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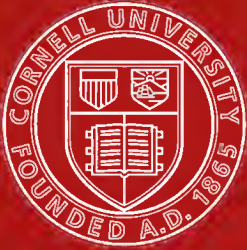
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Chas Willis Ward

THE AMERICAN CARNATION

HOW TO GROW IT

ILLUSTRATED

BY

CHARLES WILLIS WARD

Of The Cottage Gardens, Queens, N. Y.

NEW YORK

A. T. DE LA MARE PRINTING AND PUBLISHING COMPANY

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V_i

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New York

Dedication

TO THAT WORTHY BODY OF ENTHUSIASTS

MY FELLOW MEMBERS OF
THE AMERICAN CARNATION SOCIETY

WHOSE LOVE OF AND DEVOTION TO THE
DIVINE FLOWER HAVE ENABLED THEM
TO ACCOMPLISH SO MUCH IN SO SHORT
A PERIOD OF TIME, THIS VOLUME IS
RESPECTFULLY DEDICATED

PREFACE



SOME five or six years since, in an unguarded moment, I promised my friend, Mr. A. T. De La Mare, President of the publishing firm which bears his name, that I would write a work upon the American Carnation. I scarcely knew at the time the magnitude of the task which I had so lightly agreed to undertake, and did not recognize it until the work was under way. While keenly appreciating my unfitness, through lack of the necessary early training which every florist should have, to impart practical knowledge to my fellow carnation growers, the work was, nevertheless, undertaken with an earnest desire to do the carnation fraternity some good, as well as to increase the interest of the general public in the Divine Flower. During the twelve years in which I have been trying to learn successful carnation culture, large numbers of plants and flowers have been grown, and a small fortune expended in experimental work. While meeting with a measure of success that has at times been very encouraging, there have been still enough serious failures to rob the work of much of its pleasures.

The growing of carnations was commenced merely as an occupation by means of which to while away time which hung heavily upon my hands, as a consequence of being ordered out of business for the purpose of recuperating impaired health, and at first little thought was had of continuing it as a permanent employment. However, as the work progressed it became more and more interesting, which interest was especially increased by the delightful occupation of hybridizing and producing new varieties; and I am now quite satisfied that the venture has contributed largely to the recovery of my health, and if nothing more had been accomplished, the time, energy and capital expended have been well repaid. But I make free to believe that my efforts in assisting in the development of American carnation culture have been of material aid to the craft. It is unquestionably true that many carnations are now grown where one was grown before, and larger and finer blooms are produced and sold at higher prices than was the case twelve years ago; and, in addition, the general public now hold the Divine Flower in greater esteem, and to this result I am proud to believe that my quota of assistance has contributed.

Preface

This book has been prepared under somewhat unfavorable and discouraging circumstances, as during the period of work much unexpected additional labor has fallen upon my shoulders, materially hindering the writing of the volume and doubtless impairing its value.

To Mr. Alex. Wallace, Editor of *The Florists' Exchange*, New York, my thanks and the gratitude of the readers of the book are due for his efficient aid in editing the original manuscript and revising proofs; also for his researches into the early history of the carnation, and his compilation and correction of the matters contained in Chapter I.

To Mr. Charles L. Allen, of Floral Park, N. Y., who kindly placed at my disposal his peerless horticultural library, as well as lending generous aid in assisting my researches, I am greatly indebted for much information regarding the ancient culture of carnations.

I am also similarly indebted to "The Carnation," by Thomas Hogg, published in 1830; to Don's Gardeners' Dictionary, to Nicholson's Dictionary of Gardening, and to the Cyclopedia of American Horticulture.

To Mr. Fred Dorner, of Lafayette, Ind., the Father of the Carnation in the West; to that good old horticulturist, Mr. Charles Zeller, of Flatbush, Long Island; to Mr. Eugene Dailedouze, son of Mr. John Dailedouze, of the old-time firm of Dailedouze, Zeller & Gard, of Flatbush, N. Y.; to Mr. Sewell Fisher, of Framingham, Mass., and Mr. William Swayne, of Kennett Square, Pa., I am indebted for information and assistance in ascertaining the early history of carnation culture in America, and for many valuable suggestions given me during past years. I am also particularly indebted to the following gentlemen, who have so kindly contributed the chapters upon cultural methods as practiced in their immediate localities: Mr. Peter Fisher, Ellis, Mass.; Mr. Richard Witterstetter, Sedamsville, O.; Mr. E. G. Hill, Richmond, Ind.; Mr. Henry Weber, Oakland, Md.; Mr. John H. Sievers, San Francisco, Cal.; Mr. W. R. Shelmire, Atlanta, Ga.; Mr. Fred Dorner, Lafayette, Ind.; and Mr. John H. Dunlop, Toronto, Ontario.

If by means of this humble effort I shall have succeeded in rendering my brother carnationists material aid, and shall have lightened the pathway of those enthusiasts who are now springing up and becoming lovers of and ardent devotees to the culture of the Divine Flower, I shall be satisfied that the volume has not been written in vain.

Chas. Willis Ward.

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CHAPTER I

The Origin and Early History of the Carnation

THE carnation, *Dianthus Caryophyllus*, erroneously called "Pink" by many people, is a native of southern Europe. As found in its wild state, it is a half hardy herbaceous perennial, growing about two feet in height. The original flower was either of flesh color or a shade of pinkish mauve. It was a single bloom, about one inch in diameter, composed of five broad petals. Its natural period of blooming in the feral state is from June to August.

The carnation is abundant in Normandy, France, and it is believed by some writers that it was introduced into Great Britain from that country. So recently as 1874, Ellacombe found it covering the old castle of Falaise, in which William the Conqueror was born. It is found in England on many of the old castles of Norman construction; and the same writer is of the belief that it was introduced there "by the Norman builders, perhaps, as a pleasant memory of their Norman houses; though it may have been accidentally introduced with the Normandy (Caen) stone, of which part of the castles are built."

The history of the carnation antedates the time of Christ, as it was mentioned and described by Theophrastus as long ago as 300 years B. C. Theophrastus gave the genus the name of *Dianthus*, from the Greek *dios*, divine, and *anthos*, flower. The specific name, *Caryophyllus*, from the Greek *Caryon*, meaning nut, and *Phyllon*, meaning leaf, was undoubtedly taken from the name of the clove tree (*Caryophyllus aromaticus*), and applied to the species because of the clove-like fragrance of its blooms. The common name, carnation, is generally supposed to be derived from the Latin *carnis*, flesh, and refers to the flesh-colored flowers of the original type. Old writers, however, particularly those of the sixteenth century, allude to the plant as the "Coronation," having reference to the employment of the flowers in the classic coronæ, or chaplets; or, as Lyte has it, from "the flowers dented, or toothed above—like to a littell crownet."

The Origin and Early History of the Carnation

Spencer, in his *Shepherd's Calendar*, says :

“Bring hither the pink and purple columbine with gilliflowers ;
Bring coronations and soppes-in-wine, worn of paramours.”

In Chaucer's time, the flower was named clove gill-flower, and it is believed the plant was in cultivation in England in the reign of Edward III., and at that period was commonly used to give a spicy flavor to ale and wine. In Chaucer's works occurs the following :

“There springen herbes, grete and smale ;
The licoris and the set-wale,
And many a clove gelofre and notemuge to put in ale,
Whether it be moist or stale.”

Turner names the plant “*Incarnacyon*,” and Gerarde identifies the appellation with the color carnation.

In more modern times, Dr. Prior takes “*Coronation*” as the original form, and Britton and Holland think his opinion probably correct. Stevens says that before the time of Shakespeare, “*Carnardine*” was the familiar name of the flower. In an old play of that era appears the couplet :

“Gograms, sattins, velvet fine ;
The rosy-coloured carnardine.”

Shakespeare wrote about it in “*A Winter's Tale*,” and makes Perdita say, “The fairest flowers o' the season are our carnations.” This was in the year 1601, and from that date on the name carnation appears to have been attached to the plant.

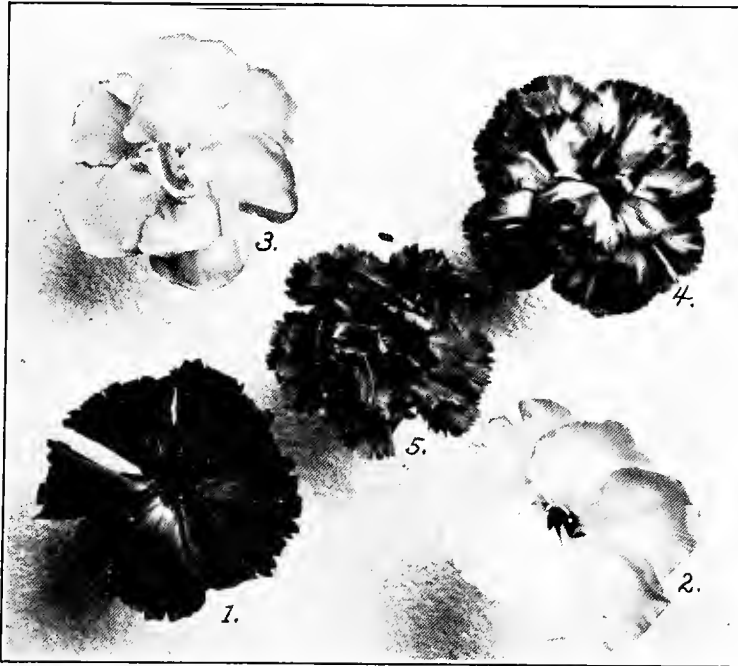
The name gillyflower—formerly called gillyvor, gyllofer and gilofre—is said to be a corruption of the Latin *caryophyllum*, a clove (Greek *karnophyllum*). By others it is thought to be a corruption of July flower. Drayton gives warrant for the latter interpretation in the following :

“The brave carnation then, with sweet and sovereign power ;
So of his color called although a July flower.”

In addition to its utility in the flavoring of dainty dishes as well as liquors, for which purpose it was doubtless used as a substitute for the more costly Indian cloves, the gillyflower was thought to possess medicinal properties. Gerarde assures us that “the conserve made of the flowers of the clove gillflower and sugar is exceeding cordiall, and wonderfully above measure doth comfort the heart, being eaten now and then.” It was also thought good against pestilential fevers.

The Origin and Early History of the Carnation

When the carnation became a "florists' flower" in England it is difficult to state, but it must have been prior to Shakespeare's time, because Gerarde says, of the sorts of cloves, carnations and pinks: "A large volume would not suffice to write of every one . . . particularly considering how every year and every climate and country bringeth forth new sorts, and such as



The original single Carnation and its development into a double flower

- | | |
|--|---------------------------------|
| <i>1—Original 5-petaled flower</i> | <i>2—One petal added</i> |
| <i>3—Several petals added</i> | <i>4—A nearly double flower</i> |
| <i>5—Flower fully double but not increased in size</i> | |

have not heretofore been written of;" a remark which will well apply to modern conditions.

The carnation has been in cultivation for more than 2,000 years, and in early Greek history was also mentioned under the name of gilliflower. Theophrastus, in his history of plants, says: "The Greeks cultivated roses, gilliflowers, violets, narcissi and iris;" the gilliflower, as has been shown, being the

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History of the Development of the Carnation

esteemed as a strange and remarkable plant. It was named Mrs. Degraw, in honor of the wife of the then president of the Brooklyn Horticultural Society. At the same time another white variety named Flatbush was produced; these being introduced to the trade about 1864. Between the years 1866 and 1872 several varieties were produced by Mr. Zeller, which were grown a number of years chiefly as pot plants, among them a pure white of fine habit and long, rigid stem, which was named and introduced as Louise Zeller.

The firm of Dailedouze & Zeller issued a catalogue between 1862 and 1872, but as this catalogue is not dated, the exact period of its publication is not known to the writer. The firm offered for sale plants of fifty-four varieties of carnations, which were described in this list, at prices ranging from seventy-five cents to three dollars each. In this catalogue were listed the varieties, Mrs. Degraw, Flatbush, General Grant and Mrs. Zeller.

During this period another seedling, which was called Victor Emanuel, synonym Astoria, was raised by Donati, a French florist, then living in Astoria, L. I. The ground color of this variety was yellow, flaked and striped with red. This became one of the most famous of the early American carnations, and remained under cultivation for a number of years, being probably the ancestor of most of the yellow American carnations which are in existence to-day.

Thus it appears that nearly a half century ago the development of the American carnation was begun on Long Island, where its culture has been continued and expanded until that section has become one of the chief centers of the carnation industry of this country.

In the beginning of the 19th century, a form of carnation craze overran England, and during this period carnation culture was brought to great perfection; blooms, three and four inches in diameter, held upon erect, stiff stems thirty to forty inches in length, being considered the criterion of a perfect carnation. The following description of carnations grown at that time, taken from "Don's Gardeners' Dictionary," published in 1830, will give a fair idea of what the English carnation exhibitor was expected to produce:

"Criterion of a fine double carnation. The stem should be strong, tall, and straight; not less than 30 inches or more than 45 inches high; the footstalks supporting the flowers should be strong, elastic, and of a proportionate length. The flower should be at least 3 inches in diameter, consisting of a great number of large, well-formed petals, but neither so many as to give it too full and crowded an appearance, nor so few as to make it appear thin and empty. The petals should be long, broad and substantial, particularly those of the lower and outer circle, commonly called the guard leaves; these should rise perpendicular about half an inch above the calyx, and then turn off

History of the Development of the Carnation

gracefully in a horizontal direction, supporting the interior petals, and altogether forming a convex and nearly hemispherical corolla. The interior petals should rather decrease in size as they approach the center of the flower, which should be well filled with them. The petals should be regularly disposed alike on every side, imbricating



*An English Bizarre
Carnation*

*From "The Carnation," by
Thos. Hogg, published
in 1839*

each other in such a manner that both their respective and united beauties may captivate the eye at the same instant; they should be nearly flat, however, a small degree of concavity, or inflection, at the broad end is allowable, but their edges should be perfectly entire, that is to say, free from fringe or indenture. The calyx should be at least one inch in length, terminating in broad points sufficiently strong to hold the narrow

History of the Development of the Carnation

bases of the petals, in a close and circular body. Whatever colors the flowers may be possessed of, they should be perfectly distinct, and disposed in long, regular stripes, broadest at the edge of the lamina, and gradually becoming narrower as they approach the unguis, or base of the petal, there terminating in a fine point. Each petal should have a due proportion of white; i. e., one-half or nearly so, which should be perfectly clear and free from spots."

It will be noticed that the English grower strictly barred all carnations with fringed petals. This is in direct contradiction to the American idea of a fine carnation, for here the fringed petal is rather preferred. My own experience with American-bred carnations is that those varieties with fringed petals are more easily grown under our conditions, and the blooms are also better keepers than the shell-petaled varieties.

The noted English horticulturist, Thomas Hogg, in his treatise on carnation culture, published in 1839, emphasizes the cardinal points of a fine carnation as follows:

"The excellence of a carnation is judged and estimated by the brightness and distinctness of its various tints and hues, and by the formation or construction of the flower leaves or petals: the ground color should be of a clear white, and the flakes or stripes must run longitudinally through the leaves, not breaking off abruptly. In a perfect flower, or one that approaches nearest to perfection, every leaf should be striped according to its class, whether flake or bizarre: plain or self-colored leaves are accounted a great defect. The calyx, or cup, after the petals are unfolded, must remain entire or unburst, and the large external petals, or guard leaves, must be without crack or blemish, and the diameter of a show flower should never be less than three inches. It is also considered a great defect when the corolla is overcharged with petals, for the blossom in expanding generally bursts the cup; and it is no less so, when it contains too few, though possessing the most brilliant and distinct colors.

"The flower must be sufficiently double to form a kind of crown in the center, the petals rising one above another in regular order; the guard leaves in particular should be broad and long, and of a stout texture to support the rest, the edges of which must not be indented or fringed; but plain and circular, like the leaves of a Provence rose. A flower whose corolla, or pod, is long, generally shoots forth the finest flower, and occasions the least trouble in attending to it. The stem, or foot stalk, must be straight and elastic, to support the blossoms firmly and gracefully, notwithstanding the stick which is applied to sustain it; the height of the stalk varies from 2 feet 6 inches to 4 feet 6 inches, according to the habit of their growth.

"The value of a flower is also greatly enhanced when it exhales a sweet and fragrant perfume. All carnations possess this quality, but in very different degrees; in some it is scarcely perceptible, while in others it is strikingly powerful. Odour seems to prevail most strongly in bizarred scarlets where there is a frequent recurrence of the clove stripe in the petals.

History of the Development of the Carnation

"The preference which one class of flowers at times is said to obtain over another, depends entirely on the taste and fancy of the person who gives that preference. The scarlet bizarre is a favorite with one, the crimson with another, the purple flake with another, and so on in like manner with the rest.

"There can be no certain or fixed rule why one is to be judged in this respect superior to another, where taste is the only criterion to go by. A flower possessed of all the properties called for by the rules and regulations laid down in the societies, where they are exhibited for prizes, is seldom or never met with."

From the above it would appear that in Thomas Hogg's time only flakes, bizarres and picotees were considered good carnations, while at present the self colors are considered preferable in America.

From these descriptions it would seem that we have as yet by no means reached the full development of this magnificent flower. But, as stated, the English variety is an entirely different race from that which has come to be known as the American carnation. It is not a perpetual bloomer, either in the open ground or upon stages, giving one large crop of flowers during the months of June and July, or August, according to the earliness of the variety. But little of the blood of the English carnation has been used by American hybridizers in the development of the American race, although the author secured some of the most perpetual blooming varieties of carnations that we have; namely, General Maceo, General Gomez, Governor Roosevelt, and their progeny, by hybridizing American sorts with the pollen of the English variety Winter Cheer.

About 1876, Mr. Rudolph Heintz, of Detroit, raised Heintz's White, one of the best-known varieties of American origin, which remained in general cultivation until 1895, or nearly 20 years. This variety passed into the hands of John Breitmeyer & Sons, of Detroit, Mich., and was disseminated by that firm. Mr. Heintz also originated another variety—Heintz's Red.

Following the work of Dailedouze, Zeller and Donati comes that of Mr. Charles T. Starr, of Avondale, Pa. (who commenced as a florist about 1870), and Mr. John Thorpe, of Queens, N. Y. In 1878, Starr began offering to the trade seedling carnations of his own raising, his first offerings being the varieties Lord Clyde and Lydia. There is no record extant of the varieties he offered between the years 1878 and 1884, but, in 1884, he introduced the famous Buttercup, also Dawn, Century, Scarlet King, Field of Gold, Lady Emma, Philadelphia, Avondale, Mrs. Garfield, and a number of others. He continued the growing and introduction of seedling carnations until his death, which occurred in 1891. There is very little known of his

History of the Development of the Carnation

methods and theories, or of the pedigrees of his seedlings. He once stated that Buttercup, Field of Gold, Venus, and Duke of York were all from one seed pod of *Edwardsii*, which was fertilized with the pollen of *Astoria*,



Governor Roosevelt

synonym *Victor Emanuel*; and from this statement we are led to infer that *Astoria* was the ancestor of the yellow varieties of American carnations.

History of the Development of the Carnation

Many of Mr. Starr's productions possessed great merit; but owing to his moderate methods of advertising, few of the varieties reached the commercial importance which has been attained by the more recent introductions.

The veteran horticulturist, Mr. John Thorpe, came next into the carnation field, and contributed some of the most celebrated varieties of carnations, which were sent out from the year 1883 to 1890. Mr. Thorpe commenced his work on carnations about the year 1881. Among his most celebrated productions were Portia, Rosalind, Miranda, Isabel and Imogene, which were sold to Mr. B. K. Bliss in the year 1885. He also originated May Queen, Charles Henderson, Maggie Thorpe, all of which were rose-pink varieties; Sensation, a good yellow; E. G. Hill, a brilliant scarlet; W. W. Coles, a scarlet, and Jas. Y. Murkland, which he describes as the most perfect carnation he had ever seen, and which he states was the beginning of the non-bursting race of carnations; it was a shy bloomer, but of good color.

Following close upon Mr. Thorpe's work comes that of Mr. William Swayne, of Kennett Square, Pa., who introduced his first varieties, Wm. Swayne and L. L. Lamborn, in the spring of 1888. Both of these varieties achieved considerable commercial importance, and were largely grown for a number of years.

Contemporaneous with Mr. Thorpe's was the work of Mr. W. P. Simmons, who originated Daybreak, Tidal Wave and Silver Spray. Mr. Thorpe states that Daybreak was a seedling from a variety named August Rölker, which was a seedling raised by himself. All of these varieties, I am informed by Mr. Thorpe, were hybridized from the sorts originated by him at Queens, Long Island.

Also coeval with the work of Mr. Thorpe was that of Mr. Sewell Fisher, of Framingham, Mass. The latter gentleman commenced his work as early as the year 1876, his first seed being obtained from a seed pod from Zeller's variety, President Degraw. From this, in 1877, he produced two varieties, Sea Foam and Fascination, both of which were introduced by Messrs. V. H. Hallock & Son and Mr. Thorpe; in 1882, Anna Webb; in 1883, Silver Lake, and in 1884, Florence, which was sent out by Mr. Denys Zirngiebel. The variety, Mrs. Fisher, which probably attained the most prominence of any of Mr. Fisher's productions, was raised in 1886. It was sent out and introduced to commerce in 1890. Crystal, a pure white, was produced in 1889; in 1892, Sebec, a crimson; in 1893, Servia, a white, and in 1896, Saxon, a scarlet. Mr. Fisher seems to have followed a system of careful hybridizing, as he states that he produced from 300 to 600 seedling

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plants each year. He has also stated that he grew seedling carnations rather as a source of pleasure than profit, although he got some returns for his work.

In 1890, Mr. John McGowan, of Orange, N. J., in connection with Mr. H. E. Chitty, of Paterson, N. J., introduced the famous variety, *Lizzie McGowan*, which for a period of ten years was grown to a greater extent than any other white carnation. This variety was a cross between Peter Henderson and Heintz's White, and was originated by Mr. Carl Schaeffer, then gardener for Mr. T. B. Peddie, Llewellyn Park, and subsequently to Hon. Samuel Colgate, of Orange, N. J., to which latter place he took the variety, and eventually sold the stock to Mr. McGowan.

In 1876, Joseph Tailby, of Wellesley, Mass., raised the variety which was introduced under the name of *Grace Wilder*. It was the result of a cross between *La Purité* and *Boule de Neige*, the latter variety being known by some as *Smith's White*. It remained in cultivation for a long period of years, and was considered the leading commercial pink carnation. It stood against all competitors until the introduction of Mr. Dorner's *William Scott* rapidly supplanted it. Mr. Tailby also raised a number of other seedlings; among them, *Fred. Johnson*, *Dr. Whitney*, *Mrs. Priest*, and others.

About the year 1889, Mr. Frederick Dorner, of Lafayette, Ind., began the growing of hybrid carnations. Mr. Dorner has undoubtedly done for the American carnation as much as, if not more than, any other grower of hybrid seedlings. He carried on his work thoroughly and persistently. The first results he achieved were sold to the E. G. Hill Co., and that firm disseminated 17 varieties of the seedlings obtained. From 1890 to date, Mr. Dorner and his firm have introduced the following list of varieties: In 1893, *Mrs. E. Reynolds*, *Mme. Diaz Albertini*, *Richmond*, *Blanche*, *Wm. Scott*, *Spartan*, *Purdue*, *Dr. Smart*, *Western Pride* and *Wabash*; in 1894, *Uncle John*, *E. A. Wood*, *The Stuart* and *Goldfinch*; in 1895, *Bridesmaid*, *Meteor* and *Storm King*, by Mr. Ward; in 1896, *Dazzle*; in 1897, *Mrs. Duhme* and *Mrs. George M. Bradt*, *Mary Wood* and *C. A. Dana*, by Mr. Ward; in 1898, *White Cloud* and *Gold Nugget*; in 1899, *G. H. Crane*; in 1900, *Morning Glory*; in 1901, *Lorna* and *Mermaid*; and in 1902, *Alba*, *Stella*, *Dorothy Whitney* and *Apollo*.

The variety *William Scott* became as famous as its ancestor, *Grace Wilder*, and at the present time is probably more largely grown than any other pink carnation.

History of the Development of the Carnation

Mr. W. R. Shelmire, of Avondale, Pa., also contributed a number of valuable varieties, among them Eldorado and Cæsar.

In 1890, Mr. E. G. Hill became interested in the growing of seedling carnations, through purchasing a number of seedlings from Mr. Dorner. A number of these varieties were introduced; in fact, the following set was sent out: Edna Craig, Fred Dorner, Edwin Lonsdale, Christine, Hoosier, Indiana, Creole, Red Cross, San Mateo, Canada, Cherry Lips, Sea Gull and Ben Hur. Many of these varieties, which were producing extremely fine flowers, were not sufficiently free in bloom to make them a commercial success; consequently, they have passed out of existence. With the stock purchased from Mr. Dorner as a basis, Mr. Hill began the raising of seedlings, and in 1896 introduced Triumph, Armazindy, Abundance, together with the variety Jubilee, which was purchased from Mr. John Hartje, of Indianapolis. In 1897, Flora Hill, which was undoubtedly the best of Mr. Hill's productions, and Mrs. McBurney were introduced; in 1898, Painted Lady and Psyche, and in 1899, America.

Mr. Peter Fisher, of Ellis, Mass., quickly sprang into fame through the raising, and particularly the selling, of the variety which was named Mrs. Thos. W. Lawson, and which was grown in 1895, the variety being the result of a cross between Daybreak and Van Leeuwen. This variety was given a world-wide reputation by its sale to Mr. Thomas W. Lawson, for the seemingly fabulous sum of thirty thousand dollars. One-half of this sum is said to have gone to Mr. Fisher, and the remaining half to Mr. Thomas Galvin, the Boston florist and friend of Mr. Lawson, who negotiated the sale. Others of Mr. Fisher's later productions are, Enchantress and Governor Wolcott.

Mr. Richard Witterstættter, of Sedamsville, Ohio, commenced the hybridization of carnations in 1890, with Degraw and La Purité as a basis. Mr. Witterstættter's work has evidently been very carefully done. The varieties introduced by him are few; namely, Emma Woche, light pink; Evelina, white; Estelle, scarlet; Enquirer, bright pink, and Adonis. The latter, his most brilliant production, was sold to Messrs. E. G. Hill and Robert Craig, in the year 1901, for the sum of five thousand dollars.

The author commenced the growing of hybrid carnations in the year 1890. The varieties with which he had to work were Wm. Swayne, L. L. Lamborn, Portia, Rosalind, Buttercup, Philadelphia; and, later on, to this list was added Lizzie McGowan, also Wm. Scott, Richmond, Elizabeth Reynolds and Mme. Diaz Albertini, of the productions of Mr. Frederick

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Dorner. The first variety he introduced to commerce was Ethel, a seedling of Portia, crossed with the pollen of L. L. Lamborn ; it was chiefly valuable as a summer bloomer.

In 1898 or 1899, General Gomez, General Maceo, Mrs. James Dean and John Young were introduced, all of which were largely cultivated for a number of years by commercial growers. Next followed Glacier, in 1900, and Governor Roosevelt, Golden Beauty and Novelty, which were introduced in 1901. Viola Allen, Harry Fenn and J. H. Manley were introduced in 1902, Mrs. Theodore Roosevelt, Governor Bliss and Alpin Glow in 1903.



Carrying the Plants to the Greenhouse

CHAPTER II

The Carnation in America

THE commercial importance of the carnation as a florists' flower has been developed since the introduction of the French or remontant varieties into America, which occurred about the year 1852. The commencement of the raising of seedlings by Dailedouze & Zeller, of Flatbush, Long Island, in 1866, may be stated as the beginning, or as laying the foundation of the American carnation, which may be classed as a distinct or modified species, the product of acclimatization and hybridization. The superiority of the American-bred carnation for the purpose of winter forcing is now acknowledged throughout the world and its importance as a florists' flower is constantly on the increase.

No other flower possesses more intrinsic value than the carnation. It has become, perhaps, the greatest staple commercial flower in existence, a serious rival to the rose, destined to supersede the Queen of Flowers, to some extent, in popularity, and to remain in greenhouse culture as long as the love of flowers or the use of them exists. The improvement in the quality and perfection of the bloom now grown, and the superior methods of marketing the flowers, have brought about a constantly increasing use of the carnation, as well as substantial advancements in price.

The carnation is a flower that awakens the love of almost every person, and as the average blooms are sold at much more reasonable prices than many other flowers, they come within the reach of a larger class of people than do roses and orchids; consequently, the consumption is greater, and the use of the carnation by rich and poor alike is rapidly extending.

There is no purpose to which flowers can be put for which the carnation is not fitted. It aptly lends itself to almost every scheme of decoration. Its delicious, clean, pungent, aromatic fragrance admits it to almost every sick room. It is probably one of the most satisfactory and one of the most durable vase flowers known. It is unsurpassed for dinner or center-table decoration. It is universally employed in the making up of set pieces. It is also one of the best flowers for boutonnières that the florist has at his command; and, finally, its wide range of pleasing colors, its lasting qualities,

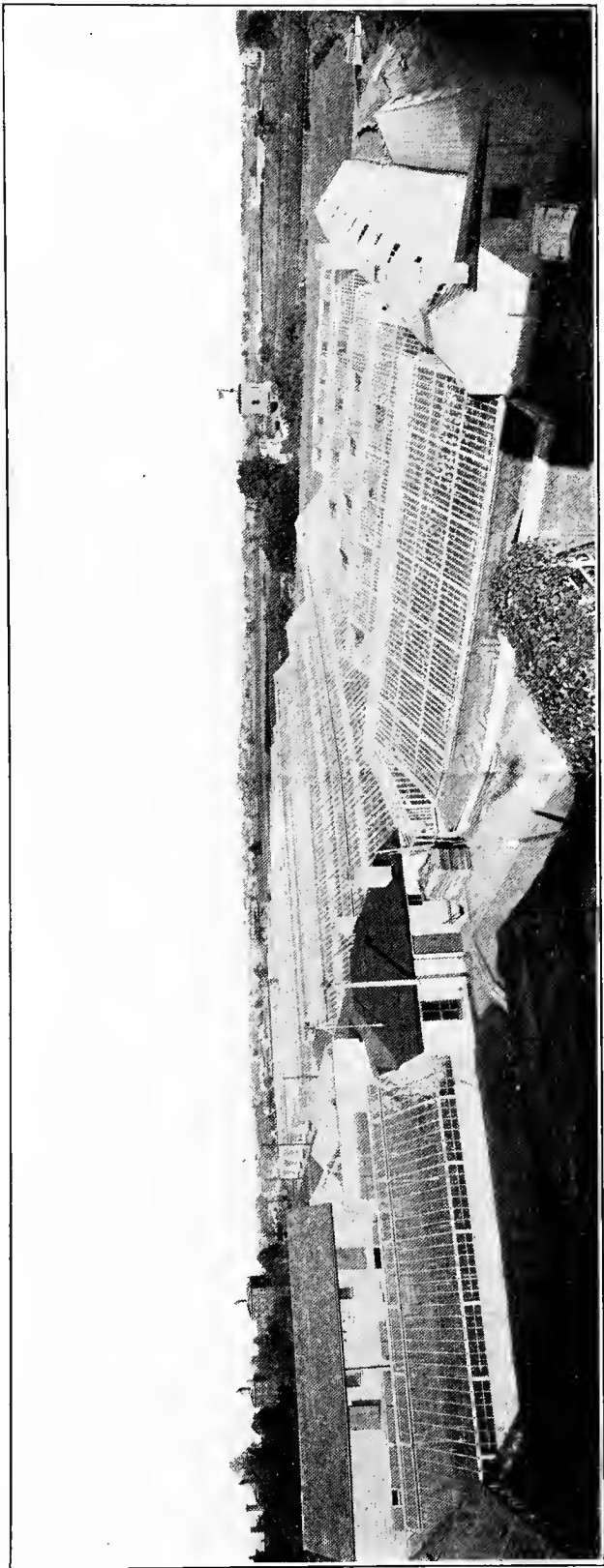
The Carnation in America

its fresh, rich clove fragrance, combine to make it one of the most favored, as well as one of the most sought for and profitable of florist's flowers.



An Artistic Decoration with Carnations

The amount of glass devoted to carnation culture is increasing each year by the erection of immense establishments, covering in some instances one to



Establishment of Dailedouze Bros.—A Flatbush (N.Y.) Carnation Range

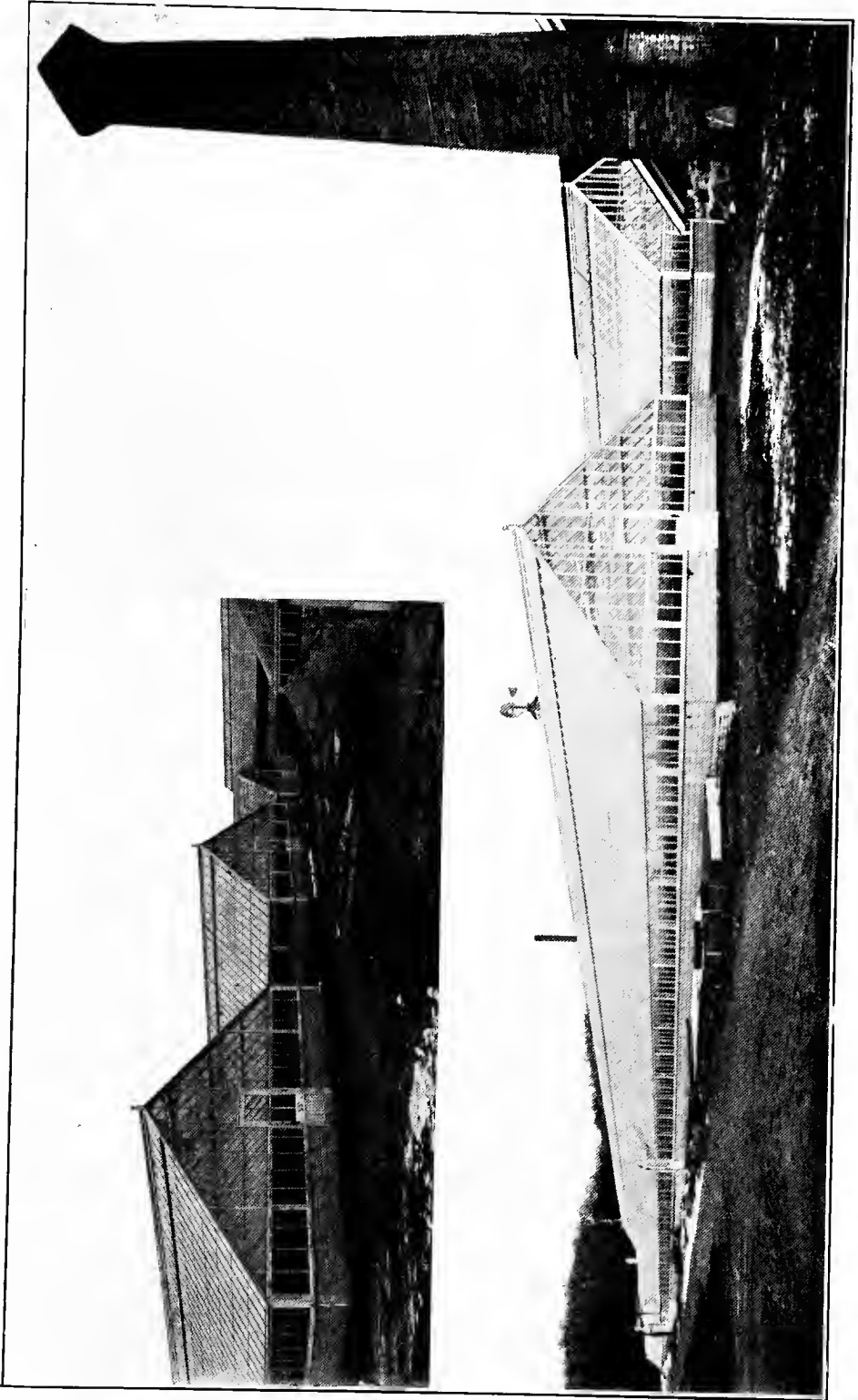
The Carnation in America

three acres of ground, for the specific purpose of forcing carnations for the winter market, and it may now be safely estimated that between seven and eight million square feet of glass are devoted solely to carnation culture in America. The number of establishments which may be classed as given up principally to carnation growing is probably not less than two thousand. These employ between five and six thousand people, who are paid wages ranging from thirty-five to fifty dollars per month for ordinary hands and growers, to seventy-five to eighty dollars per month for growers sufficiently skilled to manage establishments.

From seven to eight million carnation plants are annually grown, producing upward of one hundred million carnation blooms per annum, cut and sold in the various markets of the United States and Canada. These flowers are estimated as selling at an average of four dollars per hundred, or four millions of dollars for the entire annual output. About the year 1890, the retail prices of carnations ranged from twenty-five to fifty, and, at occasional times, seventy-five cents per dozen. At the present time the average retail prices in the larger cities of the United States stand at from seventy-five cents to five dollars per dozen, and, in rare instances, especially fine blooms are sold at as high as eight to twelve dollars per dozen. In some of the factory and smaller towns, carnations are still sold as low as thirty-five to fifty cents per dozen, but these prices are due to a foolish competition among local florists, and cannot be said to have been established by the legitimate law of supply and demand. Properly grown carnation flowers should command at least fifty cents to one dollar per dozen at retail.

The largest American carnation establishments are located in the vicinity of New York and Chicago. Probably more carnation blooms are grown and shipped to the New York market than to any other in the United States. Several very large, as well as many moderate-sized, establishments, devoted exclusively to carnation culture, are located mainly upon the western portion of Long Island. New Jersey boasts of a number of large establishments, as well as a great number of smaller ones. There are also many establishments of varying size located upon the railroads leading from New York to Boston, and along the line of the Hudson River and the New York Central Railroad a large area of glass pours its flowers into the New York market.

Chicago stands next in importance in the area of glass devoted to carnation culture. Enormous establishments are located at Joilet, Hinsdale, and in the immediate suburbs of Chicago, while as far south as Richmond and Lafayette, Ind., large areas of glass are given up to carnation culture, a part of their product being shipped into the Chicago market. But many of



*Views at the Cottage Gardens Range, Queens, N. Y.
Illustrating different types of Iron Frame Houses erected by the Lord & Burnham Co.*

The Carnation in America

the larger establishments, such as those located at Joilet and Hinsdale, also consign a considerable portion of their flowers to the smaller towns in Wisconsin and farther west.

California produces quantities of carnation flowers, but they are mostly raised out-of-doors, comparatively few being cultivated under glass. Carnations are grown as far north as Quebec, and as far south as Florida. Canada produces her full quota, large establishments being situated in the vicinity of Toronto and London, and the flowers are consumed, to some extent, in Montreal. Carnations are also largely grown in Pennsylvania, in the neigh-



A California Carnation Field

E. J. Yawter, Ocean Park, South Santa Monica, Cal.

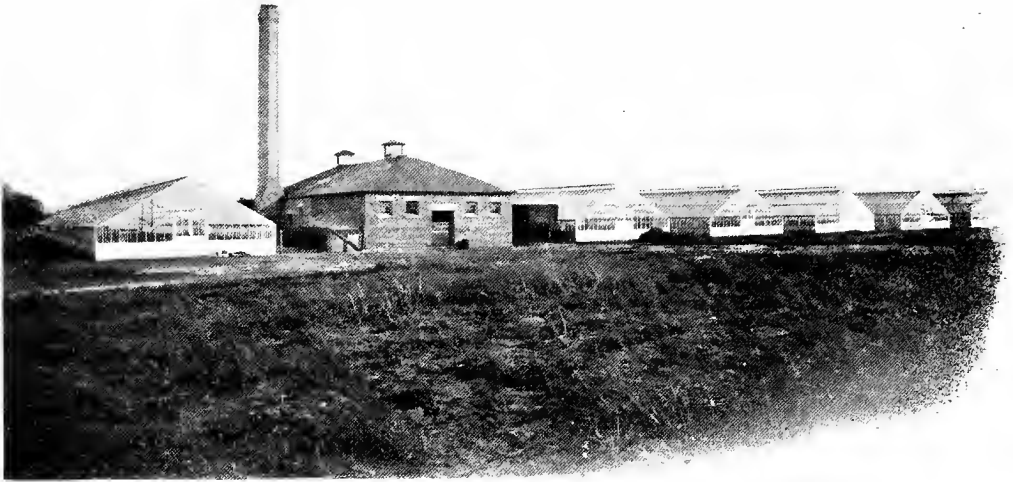
borhood of Pittsburg and Philadelphia; at one time so many were cultivated in Chester County, Pa., that a portion of that country was dubbed the "Carnation Belt."

Boston, Washington, Buffalo, Cleveland, Detroit and Cincinnati all support large and important ranges of glass, devoted to carnation culture. Extensive establishments also exist near Denver, Milwaukee, St. Paul, and many other large American cities, and it may be truly stated that the culture and consumption of carnations are spreading steadily over the entire temperate America.

Cultivation of the American carnation is rapidly extending to Europe.

The Carnation in America

Large establishments in the vicinity of London are now forcing it in quantity during the winter months, the blooms being sold at the Covent Garden flower market, in London. Belgian and German florists are also undertaking its culture upon an extensive scale, and many of the sons of German florists now visit the United States to serve apprenticeships in the leading carnation establishments, returning in a year or two to their native land to



*The J. D. Thompson Carnation Co. Range, Joliet, Ill.
A Western Carnation Establishment*

engage in the winter culture of the American carnation. Thus the utility of the American race of *Dianthus Caryophyllus* for winter forcing is being universally recognized, and within the next generation we may expect to see it in general cultivation throughout the horticultural world, wherever climatic conditions permit.

CHAPTER III

General Greenhouse Culture

Raising Plants from Seed

ONE of the most interesting methods of raising carnation plants is from seed. By this means, new varieties, and in some instances a practical reproduction of older varieties, with renewed and more vigorous constitutions, are produced. In the propagation of plants from cuttings comparatively little variation is secured, the entire stock propagated being a practical reproduction of the original variety. But in raising plants from seed, and particularly from seed taken from carefully cross-fertilized blooms, the varieties produced vary to such an extent that the grower can scarcely prognosticate the result. Great variations in habit, color, form, fragrance, time of blooming, size of flower, quantity of bloom produced and vigor of constitution are secured. Practically all of the new varieties that come into existence are originated from plants grown from cross-fertilized seed. In Chapter XIX, such detailed instructions upon cross fertilization are recorded that anyone able to grow a carnation plant may produce new varieties. Full instructions as to sowing of seed and treating the young carnation plants are also given.

Propagation from Cuttings

In growing carnations for cut flowers, the only practical method of producing large quantities of stock is by propagation from cuttings. It is sufficient to state that the best results will be gained by propagating from plants rigidly selected, and showing the desired habits, as well as by selecting wood which is in perfect condition when taken. Cuttings taken the latter part of January and during the months of February and March, even up to the 15th of April, will produce excellent results for winter blooming. Cuttings taken in February will give larger plants, which may be lifted earlier, and which will come into flower sooner and produce larger crops at Christmas and in the fore part of the winter. Throughout my experience, cuttings taken in late

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February and early March have, upon the whole, given rather the best results during the entire season; however, some of the finest crops of carnations I have grown were from cuttings taken during the month of April. These were taken from April 1 to 15; were potted up in two-inch pots about the 1st to the 10th of May; set in the open ground from the 1st to the 10th of June, and lifted and planted on the benches during the month of September. While the crop of flowers from such cuttings was not quite as abundant as that from the earlier stock, the stems were stronger and longer, and the flowers larger and of better substance. Each grower will have to determine from actual experience the best time to take his cuttings. With varieties which are rampant growers, and which do not lift well, we have not secured as good results with very early cuttings as with those taken the latter part of March up to the middle of April. If a carnation plant is too large it does not lift as well, as it suffers more severely; and the quantity, as well as the quality, of the flowers is somewhat impaired; while with the late blooming varieties it is necessary to take earlier cuttings in order to secure the crop at the proper time.

I have formed the opinion that a carnation plant lifted with the least possible check, and kept in vigorous growth, will produce the best results, such as length and stiffness of stems, size of bloom, substance of flowers and keeping qualities. I believe that every check to a carnation plant is a detriment. We all know that in the growing of specimen chrysanthemum blooms any serious check impairs the quality of the flower, and I have never seen any tangible evidence, or reason, why this should not also be true with the carnation.

Potting Young Carnation Stock

The potting of young carnation plants from the cutting bench is one of the most important operations, and should only be done with care and judgment by experienced men. Too many young carnation plants are potted deeply; that is, the root crown is buried from three-quarters to an inch beneath the surface of the soil. This is wrong. The root crown should not be more than a quarter of an inch beneath the surface of the soil. In the case of deeply-potted cuttings, many of them are apt to die off, especially if the plant should happen to be over-watered. Great care should be taken in watering young stock. The young plants should not be allowed to become too dry, nor should they be kept constantly soaked, or so heavily watered as to compact the soil and render it sour. They should be shifted as soon as they have made their growth, and should not be allowed to become pot-

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bound. A carnation plant turned out of a pot in a healthy, vigorous growing condition is, for the purpose of growing on for forcing, worth double one that is pot-bound or growing in a sour and sodden soil. I will venture the statement that a well-grown carnation plant suitable for forcing should never have been subjected to a serious check in its growth if it is expected to produce the best results.

Planting Carnations in the Field

The usual method of treating carnations in the summer time is to plant them in the field. There are advocates of different methods of planting. One recommends planting in beds, in rows eighteen inches apart, the plants a foot or so apart in the row, cultivation being by wheel or scuffle hoe and the ordinary hoeing. Another recommends field culture, so-called; that is, planting in rows from two to three feet apart, and the plants ten to twelve inches apart in the row, using a horse hoe for cultivation, supplemented with hand hoeing. Where the grower has unlimited ground, I prefer the field cultivation; but where the ground for growing plants is restricted, about as good results are secured from planting in beds.

In soils producing a rank, strong growth, the plants should be set rather farther apart than in soils where the growth is moderate. In rich soils, a good rule is to have the rows twenty inches apart, and the plants twelve to fourteen inches apart in the row. Any standard hand-wheel hoe that stirs the soil thoroughly, but not deeply, may be used in cultivating between the rows.

Preparing Field Soils

Of the several methods in vogue of preparing the soil for field culture, nothing is more practicable nor better than thoroughly manuring with well-rotted stable manure, ploughing it in and harrowing thoroughly. (See chapter on preparation of soils for field culture.)

Cutting Back or Stopping

During the summer time, blooming shoots should be cut back at least as often as every two weeks. The best results, and the most even and continuous blooming in winter, are obtained by going over the plants once each week and cutting back only those shoots that are pushing well forward into bud. Varieties that are inclined to come into bud late, such as Prosperity and others of like character, should not be topped after the 1st to the middle of July. But very early blooming varieties, such as Alpine Glow, William

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Scott, Harry Fenn and Mrs. Thomas W. Lawson, may be topped as late as the 1st of September.

Preparation of Soil for Greenhouse Culture

The English Method

The better soil we afford our carnations the better will be the result. The old English method of paring off sods from an old pasture field and piling them up in alternate layers of sods and manure, in the proportion of about one-fifth manure to four-fifths sod, cannot be very well improved upon; but it is an expensive method, and in the large American establishments is not very often practiced.

The Field Method—With the Plough

A preparation of the soil, almost as good as the foregoing, is to spread the manure evenly upon the sod ground early in September, and plough it under, running the plough about five inches deep, following that by breaking up the soil thoroughly with the disk harrow. Another light coat of manure may be spread on the ploughed ground late in November, and turned under, the ground being left rough and in ridges, so that it will get a thorough freezing. In the spring the ground should be ploughed as early as possible, and again two or three times, finally throwing the soil together in long ridges, so that when removing it from the field to the benches, carts may be driven in the alley-ways between the ridges, and the soil will not be tramped upon nor compacted by driving over it.

Fillink Benches

In filling the benches, care should be taken to get the soil evenly firmed throughout the bench. The best manner of doing this is for a man with a shovel to turn over all of the soil as it is thrown upon the bench, and to carefully pack it so that the entire mass will be of an equal degree of density. If the benches are filled evenly and the soil is of uniform texture and density, watering the carnation plants is much more simple, and can be more effectively done than where the bench is improperly filled. Light loams and sandy soils are benefited by tramping, or compacting, the bench after filling, but such is not the case with heavy, stiff clay soils.

Benching Carnations

The proper time for lifting and benching will vary in different localities according to climatic conditions. Where the carnation plant attains an early matured growth, and where the temperature conditions are moderate,

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lifting may begin immediately after the 5th of July. In other localities where the plants make the most of their growth in the later summer months, and are subject to extreme hot spells during July, August and September, lifting may be deferred until well into the latter month.

Early versus Late Lifting

There is quite a variation of opinion between the advocates of early lifting and those of late lifting. Each individual grower must decide, by prac-



House of Carnation Governor Roosevelt just planted—latter part of August

tical experience, the best date for him to lift and plant his carnations. In our experience the most satisfactory average results have been obtained from plants lifted prior to the 20th of August; and many of the later blooming

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kinds are lifted as early as the 10th to the 15th of July. We have, however, secured magnificent crops from many varieties of carnations by lifting as late as the 1st of October. Late lifted plants are apt to give a large crop of comparatively short-stemmed flowers, while in the case of the earlier lifted stock, though not producing as abundantly, the blooms will be of better quality, the stems being longer and stronger, and the product will bring a sufficiently advanced price to practically make up the difference in the yield.

Digging Plants from Field

In lifting plants great care should be exercised in digging and carrying them into the greenhouses. The digging should be done by careful men, and all of the root possible taken in with the plant. As soon as plants are dug they should be placed in trays and carried at once into the greenhouses, or into a shed where they can be shaded and kept as cool as possible, and should never be allowed to lie around in the sun to become dried out and wilted, as such treatment is decidedly detrimental. In some soils a slight ball of earth may be taken up with the roots. In hard, stiff clay soils that are inclined to bake, it is frequently essential to take in a considerable ball of earth; otherwise a large portion of the root system is lost. In our soil at Queens, a light ball of earth, about four to four and a half inches in diameter, filled with fibrous roots, is generally secured with plants that are planted in the field from pots. But where planted from flats, or in the case of cuttings planted direct from the sand to the field, it is not possible to get such balls of earth, the soil shaking off the roots entirely without doing material damage.

Selection of Stock in Digging

In digging plants they should be carefully selected; that is, the digger should go over the field and select those of even size. A second selection should also be made, and even a third. In case the plants are small, they may be doubled up in order to fill the spaces. The object of this selection is to get a more even stand of growth and bloom upon the benches.

Planting on Benches

Planting upon the bench is one of the most important of all the operations connected with carnation growing. If it is not properly done, a great variation and diminution of the crop may be expected. Care should be taken not to plant too deeply. The plant should stand no deeper in the soil upon the bench than it does in the field. The soil should be thoroughly well

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firmed around the roots, so that the plant will remain erect after setting. In light soils, the best planters use their fists for firming, pounding the earth lightly around the neck of the plant, and especially around the roots. A broad, shallow hole should be made, and the roots of the plant spread out so that they occupy about the same relative position to the top as was occupied when growing in the field.

Watering the Bench After Planting

After planting comes another most important operation—that of watering. Some writers have recommended soaking the bench thoroughly in order to set the soil, putting the water on so heavily that it will run through the bottom of the bench. I have found this method to be seriously objectionable, and many plants have been lost by stem rot whenever it was practiced. When planting, I much prefer to depend on firming the soil with the hand and fist to firming it by soaking with water. We have found that the best results have been secured when a light watering was given immediately after planting in. As soon as the soil has properly assimilated and distributed this water, another light watering is afforded, which is followed up during the daytime until the bench is nicely moistened throughout; but the soil is not sodden, nor has it been so compacted by a sudden drenching of water as to render it muddy and impervious to aeration.

Shading

Previous to planting, the greenhouses should be shaded sufficiently to modify the action of the sun to such an extent as to prevent the wilting of the plants. This shading should not be too dense, as if the plants are shaded too much they will be considerably softened and will withstand the sun much less effectively when the shading is removed. We have practiced using a shade that will wash off during rain storms and leave the houses light and clean during cloudy weather. Fire-clay, or any ordinary clean clay, has been employed with great success. It can be easily applied at the end of cloudy weather by spraying it upon the glass with a syringe, and thus the shading may be renewed and kept on until the plants have become established, when it should be allowed to wear off gradually. There should be no shade upon the houses in the early part of October, but the glass should be thoroughly clean and bright, so that the plants will have all the light possible during the short days of the fall and winter. After planting, when the bench soil has become nicely moist throughout, water should be withheld, a slight spraying only being necessary until root action has set in and the

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foliage straightens up and becomes plump. This is an indication that the plants have taken hold of the soil and are ready to grow. Care must be taken to keep the plants properly moist as soon as they have commenced growth, for more depends upon watering the benches and keeping the soil in proper condition during the fall and early winter months than upon almost any other feature of carnation growing. If fancy flowers are to be grown, care must be used that the benches shall not dry out to such an ex-



Carnation Governor Roosevelt

The same house as shown on page 42, in November following, just coming into bloom

tent as to cause the plants to wilt. Wilting hardens the plant, shortens the stem and tends to reduce the size of the flower; and while such a check will probably produce a larger crop of flowers at a given period, the quality will be inferior, as the blooms will usually be smaller and the stems shorter. On the other hand, if the soil is kept too wet, it will in time become sour and

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sodden, the feeding roots of the plant will be destroyed, and growth will be practically suspended until such time as the plant may recover.

Cultivation of Soil in Benches

After the plants have become well established, a shallow cultivation of the soil will be beneficial. This cultivation should not be so deep as to materially injure the feeding roots. All weeds should be removed, and if a green mold forms upon the surface of the soil it should be scraped off



Bench of Carnation Governor Roosevelt, illustrating combination method of Carnation Supports

or removed by the application of some such agent as soot or a light dressing of sheep manure.

Staking and Tying

The staking and tying up of the carnation plants should be begun as soon as the blooming stems have commenced to push up, and the plant should be brought under control before it has started to run up its flowering shoots to any extent. This must be attended to promptly if straight, stiff stems are to be secured, otherwise the plant will grow ill-shapen, the stems will become

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crooked, and the selling value of the flowers be thereby impaired. The different systems of staking and tying carnation plants are described in Chapter X.

Feeding Benched Plants

In from six to eight weeks, the carnation plants will have filled the benches entirely with roots and have commenced to exhaust, to some extent, the shallow soil in which they are growing. At this time, light feeding in the way of applications of manure water or light mulches may be given. It is important that such feedings should be afforded lightly and frequently rather than in heavy doses. The food should be introduced into the soil just about as fast as the plants need it for use. If given in small quantities at regular periods, the carnation roots will be able to handle all of the available chemical ingredients, and this will tend to keep the soil fresh and sweet; whereas, if a surplus of food over and above the requirements of the plant is introduced into the soil, an acid condition will likely be produced, in which case all plant food must be withheld, and, probably, a good watering of lime water, or a dressing of air-slacked lime, be used to correct the acidity. It has been our practice during the month of October to treat the surface soil of the benches with a moderate dressing of pulverized sheep manure. This is frequently mixed with Scotch soot, the proportion being half and half, and applied so as to color the surface of the soil. This serves the purpose of fertilization as well as preventing the growth of the green scum or surface mold.

Stopping or Topping

As soon as the flowering shoots lengthen, those of a weak, spindling character should be topped, for the purpose of bringing the first crop of flowers with vigorous, long stems. Stopping the flowering shoots after planting has a tendency to throw the crop later into the winter months, and it may be practiced where it is desirable to sacrifice the early blooms in order to secure heavier crops at Christmas or during the winter months, when flowers bring a higher price.

It is of great importance to study the habits of growth of different varieties of carnations in order that each variety may be topped at the proper time. Some carnations will not give crops of bloom until late midwinter or the ensuing spring if topped after the 1st of August; others can be topped as late as the middle of September and brought into full crop during the holidays.

General Greenhouse Culture

Disbudding

Where fancy flowers are aimed at, disbudding is imperative, and it is necessary to do the work early, otherwise the size of the bloom and the strength of the stem will be reduced and the object of disbudding defeated. The lateral buds should be removed as soon as this can be done without injuring the stem or the terminal bud. In varieties that are inclined to throw their blooms late, the period of flowering may be hastened by removing the side growths, or pips, from the blooming stems.

Insects and Fumigation

Insects should never be seen in the greenhouse. Preventive measures should be put into force promptly and practiced constantly. For aphids, commonly called green fly, nothing is better than fumigating with tobacco early in the season. This should be done at least once a week, selecting cool nights for the operation. Later on, when the plants are in bloom, fumigating with tobacco is objectionable, as it impairs the odor of the flowers. During the winter time, when the plants are in full bloom, we have used the various preparations of tobacco extract to advantage. These preparations are mixed to the consistency of thin paint by the addition of water, and with them the heating pipes are painted once a week, and sometimes twice. Where the green fly has been eradicated by thorough fumigation, painting of the heating pipes with tobacco extract is generally sufficient to keep the pest in check. Thrips succumb to repeated and persistent fumigation with tobacco stems. These insects are far more persistent than green fly, much more difficult to eradicate, and their depredations are much more serious, as they usually attack the buds and destroy the flowers before they open.

Diseases

The various fungi infesting carnations will not prevail to any extent if the plants are kept in a clean, healthy, growing condition. Plants improperly cared for are always sources of disease. Any neglect, such as inattention to watering and ventilation, too violent changes of temperature, or keeping the foliage of the plants wet at night, especially if such over watering or wetting of the foliage is followed by sudden falls of temperature, will have a tendency to develop fungus. It may be safely stated that such improper treatment, and a close, dank atmosphere, are the principal causes of fungous diseases in carnations.



VIOLA ALLEN
White, Variegated Pink

GLORIOSUM
Yellow Self

A SCARLET
FLAKED FANCY

PLATE 1. SEEDLING CARNATIONS (WARD)

CHAPTER IV

Soils

THE character of the soil plays a most important part in the successful cultivation of any species of plant. Unless the soil is suited to the needs and constitutional characteristics of a plant, success in the cultivation of such plant, if attained at all, will be but indifferent. It, therefore, becomes essential to study well the soil where it is proposed to grow carnations, and to select one well suited to the needs of these plants. This will not only insure a greater measure of success, but of economy as well, for the deficiencies in soils must be made up by artificial manipulation, and the addition of such constituents as may be lacking.

Carnations succeed well in a great variety of soils of varying textures, demonstrating that a wide divergence of mechanical texture, or density (heaviness or lightness) may furnish good results. Nevertheless, there are certain textures of soil that possess material advantages over others. Extremely light, sandy soils that suffer in droughts, as well as heavy, stiff, cold soils that bake and become hardened, should in general be avoided. Good carnations may be grown on such soils, but success will be uncertain and at an additional cost of care and attention.

The best carnation soil is a good, strong, semi-sandy loam, with considerable body, one that will retain moisture well and at the same time is not so dense and compact as to become sour and sodden. A well-drained location should be selected, and soils from situations where water stands on the surface for any length of time should be avoided, unless such soils can be composted and exposed to aeration and freezing for some time before they are used.

In selecting soils for field culture, wherever possible, one well furnished with an abundance of fibrous material should be chosen. An old sod lot that has been pastured by cows or sheep makes an ideal location. In the preparation of such a field, a moderate coating of stable manure should be evenly spread over the field in August or early September. The land should then be ploughed at least ten inches deep, ploughing to be followed by a thorough cultivation with the disk harrow. During the latter part of October

Soils

it should be again ploughed and allowed to remain rough over winter, in order that frost may thoroughly penetrate all portions of the soil. Where the soil is not naturally quite fertile, an additional coating of manure may be applied and turned under with advantage as late in November as the ground can be properly ploughed. This treatment insures an abundance of fertilizing material in varying stages of decomposition and assimilation, thus placing within reach of the plant sufficient digestible plant food upon which to build its growth and constitution, and renders possible the storing up of the necessary energy to enable the carnation to respond to the trying forcing which follows during the fall and winter months.

The following spring, the field should be ploughed and harrowed as soon as the ground is in a fit condition, then allowed to stand until planting time, when it should be again ploughed and thoroughly harrowed, finishing up with the Acme harrow, just ahead of the planting gang, so that planting may always be done in freshly-prepared soil. To those who might object to so much ploughing and harrowing, it may be said that such treatment insures an ideal mechanical condition and a thorough and complete incorporation of the fertilizing materials and vegetable fiber with the soil.

The location and exposure of the carnation field are of some importance. A level piece of land that will not wash in rain storms should be selected. Soils that can be sub-irrigated, in the same manner as the celery fields in Kalamazoo and other parts of Michigan are irrigated, should make good carnation fields. Any location where the water will collect in pools and stand upon the surface during heavy rain storms should be avoided. A southerly or southeasterly exposure is to be preferred, as in such a position the sun strikes the plants early in the morning, drying off the dew. Southwesterly, as well as westerly and northwesterly exposures are not as good because in the hot dry days of July and August the plants will suffer there. If an exposure protected from heavy winds and gales can be secured, so much the better, as high winds cause much injury by whipping the plants about, breaking off branches and splitting the main stem at the collar.

Preparation of Soils for Bench Culture

Bench soil should be materially richer than that in the carnation field, and the field soil should be also sensibly richer than the one used for potting up the young plants. Care should be taken that the field soil should not be made richer than that used upon benches, as in such cases the plant will receive a check when removed from the richer to the poorer soil.

Of the methods in vogue for preparing bench soils, I will repeat that the

Soils

English method of stacking sods and manure and turning them over frequently can scarcely be improved upon so far as practical results are concerned, providing the work is properly done. But it is an expensive method, and on account of the larger amount of manual labor involved, the proper treatment of such soil heaps is apt to be neglected, in which case the center of the heaps will become sour and the value of the soil lessened. There are advocates of the system of piling sods, as well as the preparation in the field by ploughing under the sod and harrowing in the manure. It is important to have the soil used for bench culture well enriched with thoroughly decomposed manure some time before putting the soil on the benches. In the preparation of compost heaps, an old sod lot will furnish the best material. The sod may be pared off to the depth of four to five inches and built up in layers on a heap, in the proportion of a layer of soil four inches in thickness to a layer of manure one inch in thickness, building up the heap layer upon layer until it is about the height of a man's shoulder. This should be done in the early fall, previous to the season when the soil is to be used. A good plan is to make up these heaps during the months of September and October, allowing them to stand well into December, when they should be turned over in a thorough manner and the manure well incorporated with the soil. The heap should be turned once or twice during the winter, and again the first thing in the spring, with an additional turning before the time for filling the benches is at hand. In the preparation of such soils, lime and salt may be used to advantage. Lime may be applied to all such composts where the basic soil is deficient in that material. It is sometimes employed in the air-slacked state and mixed with the compost at the last turning over in the fall. In soils deficient in lime, a bushel of the latter to thirty or forty bushels of soil may be used, and five to six pounds of common salt to the same quantity of soil may be also added. Hardwood ashes can likewise be used in the preparation of such compost heaps, but I have failed to see much material benefit from the employment of such ashes. Where the soils are inclined to be too heavy, hardwood ashes will tend to produce a good mechanical condition. The chief value of hardwood ashes seems to be in the amount of potash they contain, but it is usually more expensive to purchase potash in the form of hardwood ashes than it is to buy it as sulphate or muriate of potash. Soils containing a large quantity of vegetable fiber, such as sod roots, are vastly superior for carnation culture to those which have been cultivated so long as to exhaust the vegetable fiber, and for this reason it has been our practice to seed down a certain area of land each year to be kept under sod until needed. This is done for the purpose of supplying the bench soils with an

Soils

abundance of vegetable fiber, as well as to render available for the purpose of field culture an abundant area well supplied with vegetable fiber. Where no sod lot or pasture lands are available, the only alternative is to apply a heavy coating of coarse, well-rotted manure to the field and plough under, ploughing several times as before described. Many growers have no other soil than this, and accomplish very good results. But wherever sods or pasture lots are to be had, they are to be preferred.

Preparation of Bench Soils in the Field

About the latter part of August, select a piece of ground of sufficient size to furnish all the sod required when the land is ploughed to the depth of six inches. Give this ground a covering of well-rotted stable manure, putting on sufficient to make an even coating of an inch to an inch and a half in thickness. This should be spread evenly, the ground ploughed to a depth of six inches and allowed to remain undisturbed until about the middle of October; it should then be ploughed again and thoroughly broken up with a disk harrow. A third ploughing should be done late in November, just before the land freezes up, leaving the ground rough, so that frost will more easily penetrate all the soil proposed to be removed to the benches. This thorough freezing has a tendency to kill all insects and larvæ which might otherwise exist through the winter and be taken into the greenhouses the following spring. In the spring the ground should be ploughed as early as possible; that is, as soon as the frost is out and the soil sufficiently dried to work easily, and this ploughing should be repeated two or three times, at interval of three or four weeks, finally throwing the soil together in long ridges with alley-ways between, so that when removing the soil from the field to the greenhouses, the carts may be driven in the alleys, between the ridges, and the soil will not be tramped on or compacted by driving over it.

Where carnations are grown in the same field year after year, the soil will eventually become exhausted; it is also liable to become infested with the various fungi and insect enemies of the carnation. A frequent change of location is, therefore, imperative in order to avoid the various fungous diseases that infect the roots as well as the plants. It is also important to practice a system of rotating crops upon locations where carnations are grown. Our experience has taught us to avoid planting such crops as beets of any kind, potatoes, or other root crops, the roots of which are infected with various fungi. The stem rot fungus which causes so much damage to carnations also attacks the beet, producing what is known as the beet scab, and

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where beets are grown as a crop preceding carnations, the latter are liable to suffer from the stem rot.

Some growers advocate the practice of using carnation soils on the benches for two years. We have tried this to a limited extent, but the results have not been favorable. It may be that sterilization of soils, as described in this chapter, with the addition of vegetable fiber to old bench soils, will make it possible to utilize soils two or more years in succession; in fact, recent experiments in sterilizing old bench soil and using it a second year indicate that it can be done to advantage.

In the preparation of soils for either field or bench culture, commercial fertilizers may be used in place of stable manure, but where such fertilizers are employed it is important that the mechanical condition of the soil be properly cared for by the addition of vegetable fiber. Commercial fertilizers may also be scattered in the drills where the young carnations are to be planted. Our practice has been to apply at the rate of 200 pounds of fertilizer to the acre; that is, where carnations are planted in rows twenty-four inches apart. This is sown with a fertilizer machine immediately before the carnations are planted. The machine used is one that thoroughly mixes the fertilizer as it is sown with the soil in the drill. Care must be taken that the fertilizer is spread evenly; otherwise, some plants may suffer by getting too large a quantity.

Composition of Potting Soil for Young Plants

The soil in which to pot carnation cuttings taken from the sand bench should contain very little fertilizer. One of the best compositions we have found consists of sod which has been pared off about four to five inches in thickness and composted thoroughly without any manure. When the sod is thoroughly decomposed, it should be run through a very coarse sieve. The Florists' Supply Company's Sod Crusher answers the purpose very well.

For the second potting, similar decomposed sod can be used, to which has been added a small quantity of pulverized sheep dung, or any thoroughly well-rotted manure. When shifting young carnation plants, five-sixths sod and one-sixth very old and well-decomposed manure is an excellent soil to use. If the soil from which the sod is taken is of a clayey nature, the addition of one-tenth to one-sixth, in bulk, of coarse sand will be found beneficial. In preparing soil for carnations to be flowered in pots, a compost made of three-fifths sod, one-fifth or even more of thoroughly well-rotted manure, one-tenth leaf mold and one-tenth coarse sand, will give excellent results. The quantity of sand and leaf mold should be increased or decreased according

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to the friability of the soil upon which the sod has grown; and where the basic soil is a sandy loam, the leaf mold and sand may be omitted.

Upward of seventy years ago, carnations were extensively grown in England for exhibition purposes. The different English growers brought to a state of great perfection the variety of carnation which they then grew. Flowers from three to four inches in diameter, upon stems thirty to forty-five inches in length, were grown and exhibited. (See quotations from Don and Hogg, Chapter 1.)

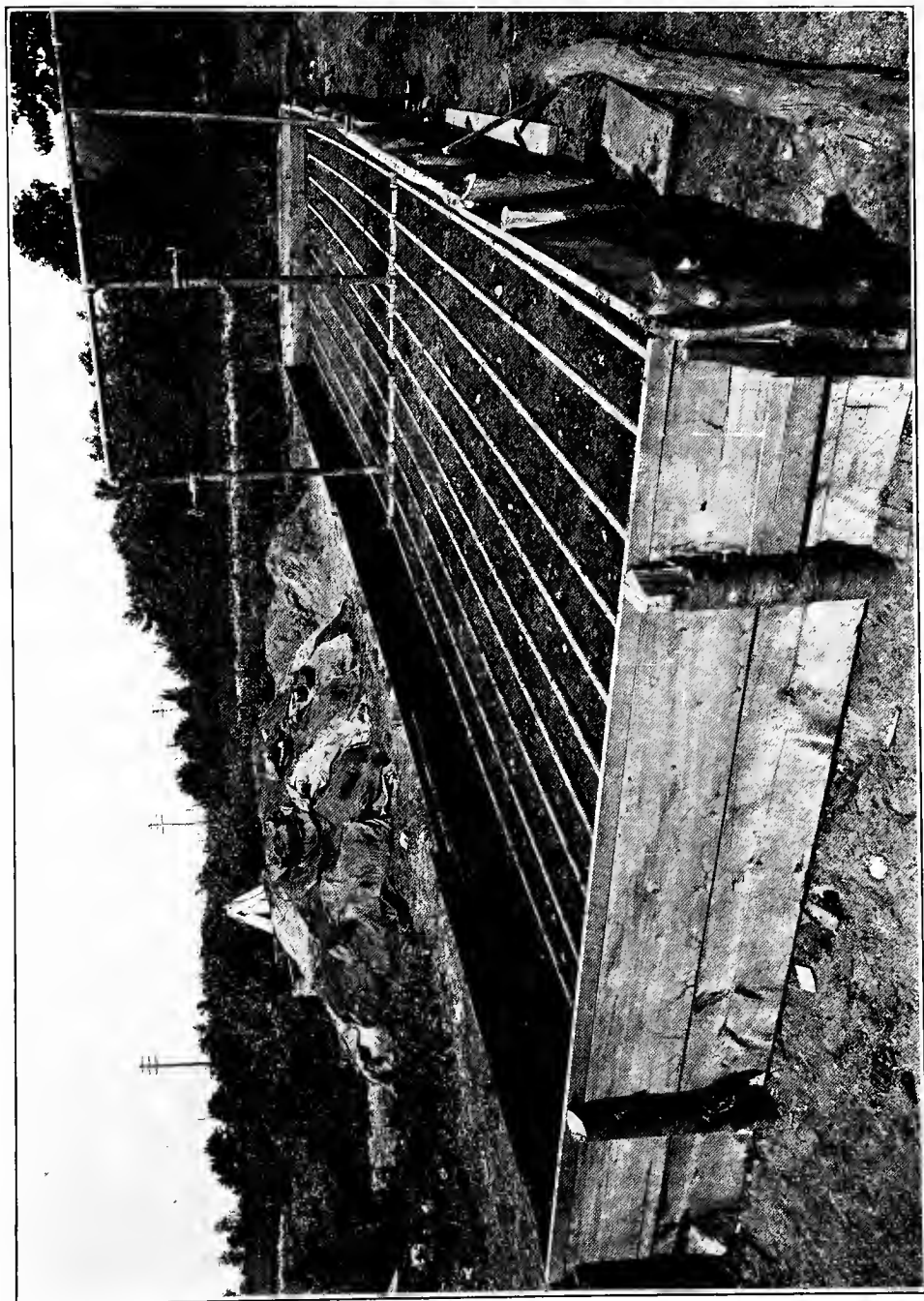
Thomas Hogg, the great carnation grower of that date, gives the following formula for the preparation of soil in which to grow carnations:

"Take three barrows of loam, one and a half barrows of garden mold, ten barrows of horse dung, one barrow of coarse sand. Let these be mixed and thrown together in a heap and turned two or three times in the winter, particularly in frosty weather, that it may be well incorporated. On a dry day towards the end of November take a barrow of fresh lime, which as soon as slack strew over while hot in turning the heap. This accelerates the rotting of the fibrous particles of the loam, lightens the soil and destroys the grub worms and slugs. If there be much rain during the winter so that the strength of the compost is reduced and the salt washed from it, take about seven pounds of damaged salt and add to the compost heap, either dissolved in water or strewed on the heap by hand. The addition of the salt will be attended with the most beneficial result upon the future health and vigor of the plants. This compost should be protected from washing rains and should be allowed to lie at least six months before it is used. For flowers that are apt to sport in color, and especially for the yellow picotees, the strength of the compost should be lowered, using three barrows of sound staple loam, two barrows of old rotten cow dung, one barrow of horse dung, one-half a barrow of sand and one-half a barrow of lime rubbish, and prepare and incorporate well as above described."

Maddock, another celebrated English carnation grower, prepared his compost as follows:

"One-half in bulk of rotten horse dung one year old; one-third fresh sound loam; one-sixth coarse sea or river sand. Mix these ingredients together in autumn, laying in a heap about three feet thick, turning three or four times during the winter, especially in frosty weather, when it should be laid out sufficiently thin that the whole mass may be thoroughly frozen. This will be fit for use in the following spring. The earth and sand may be added to it in March, and the whole should then be well mixed. Where the air is pure, experience has pointed out the propriety of using less dung and more loam; therefore, the quantity of sand, loam and dung should be in this case reversed."

From these descriptions of the soils used by the English growers of seventy years ago, the reader will gather the inference that the carnation is about as gross a feeder as any plant that we have. I mention this fact particularly, as some years ago many carnation growers throughout the United



Soil Sterilizer—Steam pipes in position ready for filling in soil

Soils

States criticised severely the introducers of new varieties, "because they grew their carnations in very rich soil." Some writers announced that carnations would not stand heavy fertilization; that the addition of large quantities of fertilizing material was detrimental. There is, however, one point to be noted in the preparation of these composts, and that is, the difference between the climates of England and America. Maddock states that where the air is pure and clear less fertilizing materials are required, and recommends a reduction in the quantity of manure. This would indicate that carnation composts for use in the United States should not be as rich as those made by the English growers of seventy years ago. Another point in the preparation of the English composts that should be noted is, the comparatively large quantity of lime employed in the constitution of these composts, which probably performed the office of neutralizing the acidity of the soil that the use of such large quantities of manure would create.

Sterilizing Soils

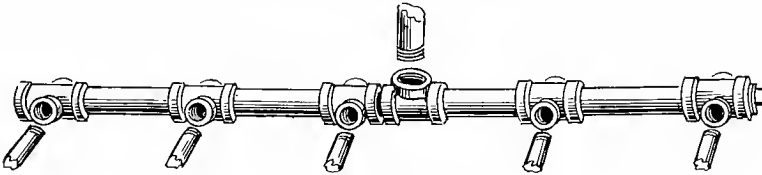
Of late years considerable experimental work has been done in the sterilization of soils with heat, for the purpose of destroying grubs and worms, insects and insects' eggs, as well as the seeds of noxious weeds; also the spores of the various fungi that prey upon the carnation plant. Very beneficial results are claimed to be secured by such sterilization, some growers stating that not only freedom from noxious insects, weeds and fungi is obtained, but the plants make a better growth and produce a more vigorous, continuous crop of flowers, of better quality. This I have not as yet proved, but have practiced sterilization to some extent with, apparently, substantial beneficial results.

The most approved method of soil sterilization is by steam. There are a number of apparatus used for this purpose, the principle of all of them being the filling of the soil with superheated steam, raising the temperature to 190 to 212 degrees, which is sufficient to destroy all animal life in the soil as well as all fungi and most seeds.

The following method of sterilization has been practiced with considerable success, and can be installed at comparatively little expense by growers who heat their houses with steam: Take one-inch pipe of even lengths—say, sixteen, eighteen or twenty feet; drill holes through this pipe at a distance of eight inches apart throughout its entire length, using a drill about three-eighths of an inch in diameter. Close up one end of each piece of pipe with a cap, through which has been drilled two similar holes; take five two-inch by one-inch

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crosses and a two-inch tee, connecting these with nipples forming a header which shall be about four inches shorter than the width of the bench in which the soil is to be sterilized; screw the one-inch pipes into this header firmly, leaving them so that the openings of the drill holes will stand at the sides of the pipe and not up and down. The object of this is to force the steam laterally through the soil, and not upward. If the hole stands upward the pressure of steam will drive an opening straight through the soil to the surface, and the steam will escape through this aperture without penetrating the soil. The accompanying drawings will show better how the header is made than can be conveyed by a description. When this apparatus is completed and



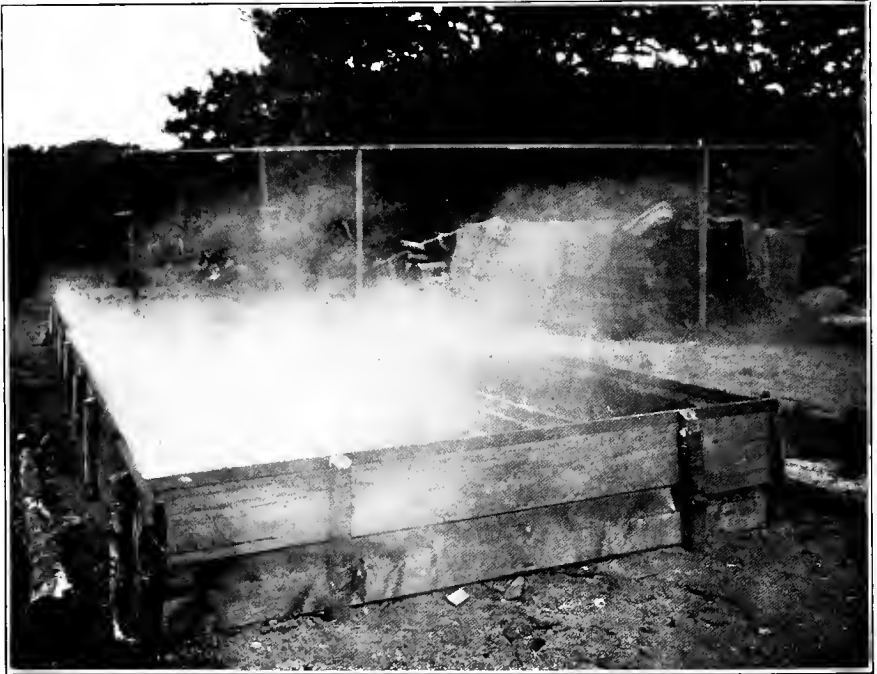
Header

placed in the bench, it should be connected with the steam main by a two-inch pipe. A right and left coupling, or a union, may be used to connect with the steam pipes. When finished, this will make an apparatus that will sterilize the soil in thirty to forty feet of bench, according to the lengths of one-inch pipe used. Place the apparatus in the bottom of the bench, and fill the remainder of the bench with soil, so that the entire machine is fully covered to a depth of six to seven inches, extending ten to twelve inches beyond the ends of the pipes. Now cover the surface of this soil with old gunny sacks, or pieces of burlap, horse blankets, or any old cloth that may be at hand. A pressure of fifty pounds of steam should be carried upon the boiler at the time of injecting the steam into the soil. Open the valves gradually, and allow the steam to run into the sterilizing machine, lightly at first, increasing the pressure so that the entire force of steam will be turned into the soil within one minute from the time the valve is opened. Let this steam blow into the soil for twenty to thirty minutes, after which time it may be turned off and the sterilizing pipes taken out, although these may be allowed to remain some considerable time if desired. If the boiler is of sufficient capacity to keep up the steam pressure of ten, fifteen or twenty pounds, it will raise the temperature in the soil to about 205 degrees. This is sufficient to kill all of the bugs, earth worms, wire worms and other insects which infest the soil, and to destroy almost all weed seeds and spores of fungi.

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After this treatment the soil will be too damp for working, and should be allowed to stand two or three days before planting is begun. The sterilizer may be removed by means of wires fastened around the header and at the farther ends of each one of the lateral pipes. It may be pulled straight up out of the soil and carried to another portion of the bench and the operation repeated.

I am somewhat of the opinion that this steaming may be beneficial in the



Soil Sterilizer in Operation

way of disintegrating the chemical constituents of the soil necessary to plant growth, rendering soluble a greater percentage than would be the case if the soil were not sterilized, but so far as my personal experience goes, I have not yet proven this to be the case. It is certain that the killing of all insect life and the destruction of the seeds of all weeds and spores of fungi in the soil are of sufficient benefit to pay the cost of sterilization, providing the soil is not damaged nor its usefulness impaired by the high heating. It is

Soils

well known that where soil is baked over a fire, or exposed to great heat, it becomes to a certain extent dead, and not as useful for plant growth as virgin soil. It has been claimed by some that exposing the soils to high temperature destroys the nitrifying bacteria which are said to be necessary to plant growth. It is possible that this may be true where temperatures are carried too high or the soil remains superheated for too long a period. If the temperature is



Soil Sterilizer in operation—Sterilizing soil on the bench

raised not higher than 195 to 212 degrees, and if the steam is not carried in the soil for more than twenty to thirty minutes, it may be possible that the beneficial bacteria will not be destroyed; whereas, if this temperature should be carried for a number of hours these bacteria might suffer. Possibly a perceptible loss of nitrogen may occur from evaporation where a high degree of heat is maintained for an extended period.

Soils

As soon as dry enough, the soil should be turned over and thoroughly shaken out. The second or third day after the soil has been sterilized it should again be turned over and thoroughly shaken, in order to break up any lumps that may have been formed in the process of steaming. It should then stand from one to two days, or until it contains only the proper degree of moisture necessary for the plant to begin growth. The treatment after this will be no different from that given to unsterilized soil.

Thomas Hogg, in ending his treatise upon the carnation, pays tribute to the necessity for good culture and rich, well-prepared soil, in the following:

“Notice Extraordinary.

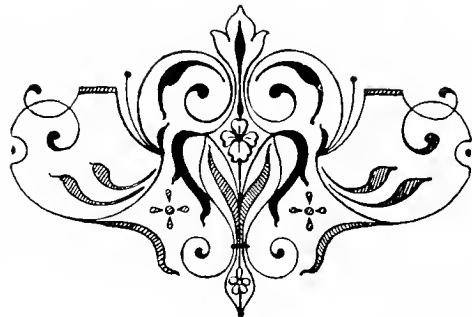
“Non Semper idem floribus est honos vernis.—*Horace.*”

“To the ladies and gentlemen who take pleasure in the flower garden, this officious intimation is hereby given, in the name and in the behalf of all the florists in Great Britain:

“That as much as the poor, sickly, half-starved, ragged, disconsolate man differs from the same man when prosperous, well fed, well clothed, in health, cheerful and at his ease, so much does the healthy, well-cultivated flower differ from the same flower when neglected, and planted in barren and improper soil. In vain will the same man exclaim, ‘I am he, I am the man;’ no one will believe him, scarce anyone will know him—he is the world’s scorn.

“So it is often the case with a flower, when in the hands of a florist, and again when in the care of some gentleman’s or lady’s bungling gardener—the flower is no longer acknowledged to be the same flower; thus reproach is very often unmeritedly incurred by the florist.

“By way of recapitulation, then, be it added, that one-third fresh loam or maiden earth, two-thirds frame dung, with one-sixth of the whole, dried road grit or sand, put together in the autumn, and frequently turned in the winter, will form a compost in which almost any plant will thrive in the spring and summer following; and whoever manages to keep his plants in health, and in a vigorous state of growth, will never fail to have a generous bloom.—*I’aleteo.*”



CHAPTER V

Manures and Fertilizers

THERE is no more important question to the carnation grower than the fertility of the soil with which he has to operate. It is not only necessary that he shall be able to grow carnations, but he must be able to produce them at a substantial, paying profit. He must not only produce flowers that will sell for more than their cost in the way of labor, manures, interest on capital invested, and cost of keeping his plant in repair, but he must produce them at a profit sufficient to cover the reduction in the future fertility of his soil, or the cost of replenishing it. If he can produce crops and sell them at a profitable margin, and at the same time maintain and increase the productiveness of his soil, he will have become a successful business florist. In order to do this, it is necessary to acquire, through years of experience, a definite working knowledge of the principles involved in plant production. He must not only be able to propagate and grow carnation plants, harvest and sell his flowers at a profit, but also have a more or less definite knowledge of the use of manures and commercial fertilizers, and of what constitutes fertility of the soil, as well as a practical experience that will enable him to judge of the capacity of his soils and to maintain and increase their fertility.

By fertility is meant the total content of plant food elements in the soil that are useable or available for plant growth. It must contain those elements found in the plant, for it is axiomatic that you can take nothing from the soil which it does not contain. Experiments show that plants take up a number of chemical elements which seem to be required for their normal growth and development. Those most necessary to plant growth are stated as nitrogen, phosphoric acid, potash and lime; but magnesium, sulphur, sodium, iron, silicon and chlorine are also taken into the plant system in greater or less quantities. Nitrogen, phosphoric acid, potash and lime are more rapidly exhausted from soils, because plants contain larger amounts of these elements than of the others above mentioned.

In order to secure the best results in growing any plant, it is evident that soils must contain the maximum amount of those particular elements which

Manures and Fertilizers

the plant removes when the maximum crops are grown, as the removal of the crops exhausts the particular elements required by the plant, and eventually reduces the soil fertility to a point so low that profitable crops cannot be grown.

The productiveness of soils is also largely influenced by their physical character. Soils which resist the penetration of air and water are less fertile than those that are soft and friable and freely permit the absorption of water and atmospheric action; also, soils that are so fine and free from vegetable matter as to become compacted, hardened and impervious to heat, water and air, are less desirable than those of a coarser texture, as the latter will form an open, mellow soil in which the active resolvent agencies will freely work.

The practical fertility of soil is measured by the amount of available or soluble plant food elements which it contains. In America most of our agricultural soils contain essential plant elements in large amounts, and this natural richness is supplemented by climatic conditions that tend to the rapid conversion of these elements into crops; nevertheless, it is true that continuous profitable crops of any nature cannot be grown without the use of manures, or of commercial fertilizers, as under such continuous cropping, if the plant elements removed are not replaced, the soils eventually become exhausted of their available plant constituents. Therefore, the future success of the florist will largely depend upon how well he understands the application of the principles involved in the preservation and use of the fertile constituents contained in his soils, as well as the practical use of the elements of fertility which he is able to purchase.

As a guide to progressive florists, I would recommend the work, entitled "Fertilizers," by Edward B. Voorhees, which may be obtained from The Macmillan Company of New York. The book named covers the subject of artificial fertilizers completely, and it can be studied by every commercial florist to his great profit. The following quotation from this work may be of interest to the observant florist as pointing out a possible cause of the crop failures of which we often hear:

"What Becomes of Our Fertility?"

"Since fertility is dependent upon so many conditions, or, in other words, since the essential elements of fertility are dependent upon their utility, and since, in this sense, fertility is largely determined by natural conditions, it is pertinent to inquire, first, whether under our present systems of management, or mismanagement, of the land, it is suffering any natural loss of fertility. As already pointed out, the most important function of fertility is to furnish nitrogen, phosphoric acid and potash, and since the

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content of these in our soil, together with the knowledge we have as to their use, measures, in a sense, our prosperity as an agricultural people, the possibilities of losing them from the soil is a matter of national concern, and is of vital interest to individual farmers, who, in the aggregate, make up that part of the nation directly affected by the results of such loss. It would, perhaps, be possible, by a careful chemical survey of our soils, to determine both the actual and potential fertility of our entire country, and this knowledge, together with an accurate measure of the intelligence exercised in its use, would enable a prediction as to our future development, if present methods were continued. That is, whether our land would become barren and worthless, as has been the case in many older countries which at one time were quite as productive, or whether it would constantly increase in productiveness, even with continuous and profitable cropping."

As before stated, the principal elements necessary for plant growth are nitrogen, phosphoric acid and potash. Nitrogen, which is one of the most useful and most essential of the elements of plant food, is the most volatile of all these elements, the easiest lost and the most expensive to replace. It is not only taken up and removed from the soil by the crop, but where soils are allowed to remain uncropped, a large percentage of the nitrogen contained therein is lost by drainage; this loss, however, is practically prevented in soils which are continuously cropped. There is also a very large loss by evaporation, especially where certain classes of crops are grown upon lands that are especially rich in nitrogen. Experiments have shown that upon the very rich prairie lands of the West, where continuous crops of wheat are grown, the natural loss of nitrogen by evaporation is much greater than the quantity removed by the crop, the average crop of wheat removing about $24\frac{1}{2}$ pounds of nitrogen per acre, while 146 pounds per acre are lost by evaporation. On the contrary, where crops were grown in rotation with clover or some other nitrogenous-gathering plant, the gain in nitrogen exceeded the amount carried away by the crop, and under such culture, as there was no loss by drainage, the land so cropped gradually increased its store of nitrogen and its fertility was not impaired.

The late Professor Kedzie, of the Agricultural College of Michigan, strongly recommended the use of nitrogenous gathering plants for the purpose of permanently maintaining the fertility of land. In the production of crops, he also recommended abundant applications of nitrogenous manures until the growth of the plant is perfected, at which period liberal applications of super-phosphate or phosphoric acid result in the production of abundant crops. He gave as an example a pear orchard which had made a remarkable growth of foliage and tree for a number of years, but had borne no fruit. A liberal application of super-phosphate had produced an enormous crop of fruit, and this same orchard was maintained in profitable productive con-

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dition for a long period by the alternate application of nitrogenous manures and super-phosphate. The principal sources of nitrogen, aside from natural manures, such as horse, cow and sheep manures, which are frequently available to florists contiguous to large cities where numbers of domestic animals are stabled, are as follows :

First. Growing and ploughing under nitrogenous gathering crops, such as the various clovers, cow peas and soy beans.

Second. Nitrate of soda, which contains from 15 to 16½ per cent. of pure nitrogen and may be purchased from dealers in fertilizing materials at prices ranging from \$45.00 to \$55.00 per ton.

Third. Sulphate of ammonia, which contains 20 to 21 per cent. of nitrogen and costs from \$65.00 to \$75.00 per ton. This is the richest of all of the ammonia compounds, and when used with ground dried blood is particularly efficacious where a manure especially rich in nitrogen is desired.

Fourth. One of the best of the chemical nitrogen compounds is nitrate of potash, which contains 20 per cent. of nitrogen and 40 to 42 per cent. of potash, and costs from \$4.65 to \$6.00 per one hundred pounds.

Fifth. Ground dried blood, containing 12 to 17 per cent. of nitrogen and from a trace to 4 per cent. of phosphoric acid, costing \$37.00 to \$50.00 per ton, is also especially valuable for florists' use.

Sixth. Peruvian guano, costing \$45.00 to \$55.00 per ton, is very rich in nitrogen and is valuable for use in making liquid manures.

Seventh. Ground sheep manure, also rich in available nitrogen, and costing from \$12.00 to \$16.00 per ton, is particularly valuable for use as a liquid fertilizer, as well as for top dressing growing plants upon benches, or sowing in the drills where young plants are planted in the field.

Eighth. Tankage, which contains from 4½ to 10 per cent. of nitrogen and 10 to 45 per cent. of bone phosphate, costing from \$25.00 to \$35.00 per ton, is also an excellent fertilizing material.

Phosphoric Acid

The next most essential element for plant growth is phosphoric acid, which is contained in large quantities in most soils, but which may generally be applied to advantage in connection with potash and nitrogen. One of the principal sources from which phosphoric acid is derived is raw ground bone, containing 20 to 22 per cent. of available phosphoric acid and about 4 per cent. of nitrogen. Steamed or boiled bone, which contains more phosphoric acid and less nitrogen than raw bone, is also more variable in composition, depending upon the degree of steaming to which it has been subjected. The refuse bone from glue factories, where the chief object is to extract the nitrogenous matter from the bone, contains from 28 to 30 per cent. of phosphoric acid and but a trace of nitrogen.

Where bone is steamed at a high pressure, a favorable effect upon the

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character of the bone is secured, as the process makes the bone soft and crumbly, and reduces it to a finer state of division than is usually accomplished by grinding. As the bone is also practically free from fat, it is more useful as a source of phosphoric acid than the ground raw bone. Ground and steamed bones are sold at \$23.00 to \$27.00 per ton.

Bone black, or animal charcoal, after having been used in the sugar refineries, consists chiefly of vegetable matter and moisture. It is variable in composition, containing from 32 to 36 per cent. of phosphoric acid and a small amount of nitrogen. It decays slowly in the soil, and its action extends over a considerable period. Bone black is sold at \$18.00 to \$20.00 per ton.

Phosphoric acid, applied in the form of raw or steamed bone, gives up its nitrogen and phosphoric acid gradually, and its chemical and physical characteristics are such that during the growing season it forms no compounds in the soil more insoluble than itself. Bone is the only phosphatic material that is now used without further treatment than simply grinding.

The commercial acid phosphate, sometimes known as super-phosphate or dissolved Carolina and Florida rock, contains from 14 to 15 per cent. of available phosphoric acid. It costs from \$12.00 to \$14.00 per ton, and is probably the cheapest source of phosphoric acid that we have.

The rock sulphates existing in South Carolina and Florida, sometimes called Charleston Phosphate or Florida Phosphate, contain from 18 to as high as 40 per cent. of phosphoric acid, which in its native form is largely insoluble, and must be treated with sulphuric acid before the phosphoric acid is made available. When so treated it is nearly as valuable as the various bone phosphates above mentioned, and is sold at \$12.00 to \$14.00 per ton.

Potash

The third important constituent of plant fertilizers, potash, is considered of less relative importance to plant growth than either nitrogen or phosphoric acid, as all good soils are, naturally, much richer in potash, and a less amount is removed from the soil in plant growth than of either nitrogen or phosphoric acid. It is deemed, however, a necessary fertilizer constituent, and essential for use upon light sandy soils, or for peaty meadow lands. It is rated as particularly valuable in the building up of worn-out soils, as it is thought to contribute largely to the growth of nitrogenous gathering plants. The various sources of potash are as follows:

First. Sulphate of potash, which contains 48 to 53 per cent. of available potash and is probably the cheapest form in which potash can be secured. It can be purchased from dealers in fertilizing materials, at prices ranging from \$44.00 to \$48.00 per ton.

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Second. Muriate of potash contains from 50 to 55 per cent. of available potash, and may be purchased at prices ranging from \$40.00 to \$44.00 per ton.

Third. Nitrate of potash, containing 40 to 42 per cent. of potash and 20 per cent. of nitrogen, is one of the most valuable fertilizer constituents known. It is somewhat expensive, costing from \$4.65 to \$6.00 per 100 pounds, but, whenever it can be secured, it may be profitably used.

Fourth. Kaimit, containing about 12½ per cent. of potash, may be purchased at prices ranging from \$10.50 to \$12.00 per ton. It is considered one of the least valuable of the various potash compounds offered, as it is a crude compound and much of the potash contained therein is not available.

Fifth. Another source of potash is wood ashes, which contain from 16 to 40 per cent. of available potash, the amounts varying according to the character of the woods consumed in making the ashes, as well as the manner in which the ashes have been gathered and preserved. Ashes from hard woods such as maple, beech, hickory and oak, are richer in potash than those made from the softer woods, such as pine, hemlock, spruce, poplar, etc. Ashes that have been carefully gathered and stored in a dry place, where they are not exposed to leaching rains, are much more valuable than those not carefully protected, as they possess a much larger percentage of available potash. Leached ashes are of comparatively little value, as the greater proportion of the potash has been taken away. Wood ashes contain potash in one of its best forms, and also contain considerable quantities of lime and a small quantity of phosphoric acid. As usually offered for sale, they contain a considerable portion of moisture and dirt. The average analysis of commercial wood ashes shows them to contain less than six per cent. of potash and two per cent. of phosphoric acid, and some 32 per cent. of lime, while the leached wood ashes contain a little over one per cent. of potash, about 1½ per cent. of phosphoric acid and about 25 per cent. of lime. Where unleached ashes made from good hard woods can be obtained, they will prove one of the best sources of potash, as the potash contained in them is in a fine state of division and immediately available.

Ashes are said to have a favorable physical effect upon most soils, especially upon those that are heavy. In purchasing ashes, they should always be bought subject to analysis, and the price should be determined by the actual plant constituent contained, and it should not be greater than that at which the same constituents can be purchased in other available forms.

In carnation growing, the most profitable use that can be made of ashes is to sow them liberally upon sodded ground intended for future use as carnation soil. The ashes should be spread upon the ground in the fall of the year. During the winter season they will be dissolved and leached into the soil.

Liquid Manures

The most useful form in which chemical manures can be employed by the carnation grower is by watering his growing plants with liquid fertilizers.

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Various formulæ have been from time to time furnished by different experimenters, as well as by the Experiment Stations. The following formulæ have all been used by the writer, with success, the results thus far with any of the different formulæ not being sufficiently striking to enable him to select either one or the other as giving positively the best results:

Formula A: 250 pounds super-phosphate, 75 pounds nitrate of soda, 50 pounds sulphate of potash. This is thoroughly mixed, ground together, and dissolved in water in the proportion of one ounce to one gallon of water, and applied to the soil about once in two weeks after the plants have become well established and are growing rapidly.

Formula B: This formula has been used by one of our best chrysanthemum growers for a number of years, with great success: 50 pounds of nitrate of soda, 30 pounds nitrate of potash, 20 pounds phosphate of ammonia. This mixture is dissolved at the rate of one ounce to twelve gallons of water, and applied twice each week after the plants are growing rapidly until growth is completed; then a liberal dose of super-phosphate is given to bring the plants into bloom. The foregoing formula makes a fertilizer which is completely soluble in water, and is probably one of the best.

Formula C: 250 pounds super-phosphate, 30 pounds nitrate of potash, 20 pounds phosphate of ammonia, 50 pounds nitrate of soda. This makes a formula particularly rich in nitrogen, and is used at the rate of one ounce to twelve gallons of water when applied weekly, or one ounce to two gallons of water when applied every two weeks.

Formula D: 250 pounds super-phosphate, 100 pounds ground dried blood, 50 pounds sulphate of potash. Used at the rate of one ounce to one gallon of water, and applied once in two weeks, or at the rate of one ounce to twelve gallons of water and applied once or twice weekly.

Formula E: 300 pounds bone black, 50 pounds sulphate of potash, 75 pounds nitrate of soda. Applied in a similar manner as set forth in Formula D.

For exhausted soils the following formula has been used with considerable success: 500 pounds super-phosphate, 75 pounds sulphate of potash, 300 pounds ground sheep manure. This is sown in the drills at the rate of 300 to 500 pounds per acre, according to the character of the soil, and is thoroughly stirred in and incorporated with the soil before the drills are covered in and the ridges made upon which the young carnation plants are set.

Mr. William Stuart, of the Indiana Agricultural Experiment Station, gives the following general formula, which he recommends for use in rose

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growing: Super-phosphate containing 14 to 15 per cent. of available phosphoric acid, 130 pounds; sulphate of ammonia, 13 pounds; nitrate of soda, 31 pounds; sulphate of potash, 26 pounds. This is dissolved at the rate of one ounce to one gallon of water, and applied once each week at the rate of two quarts per square yard, for three or four weeks, until the plants have taken on a heavy growth, and then the quantity and time of application are regulated according to the needs of the plants.

It may be stated as a general principle, that in applications of liquid chemical manures the plant should have become well established before the fertilizers are applied. The first application should be rather weak, and others made at considerable intervals apart, until the plants have shown, by active growth, that they are assimilating the fertilizers, at which time the applications may be more frequent.

So far as our experiments have extended, it has been demonstrated that to get the best practical results from the use of chemical fertilizers, it is necessary to have considerable vegetable fiber incorporated with the soil. In dense mineral soils, devoid of vegetable fiber, the application of chemical fertilizers should be made with extreme caution, as the results obtained in such soils will probably be entirely different from those obtained in soils rich in vegetable fiber, under the same treatment. In applying all classes of liquid fertilizers, the condition of the soil must be carefully observed, and whenever an acid condition becomes apparent, the application of the liquid manures should be suspended and the acidity corrected by a top dressing of lime, or by a liberal application of lime water.

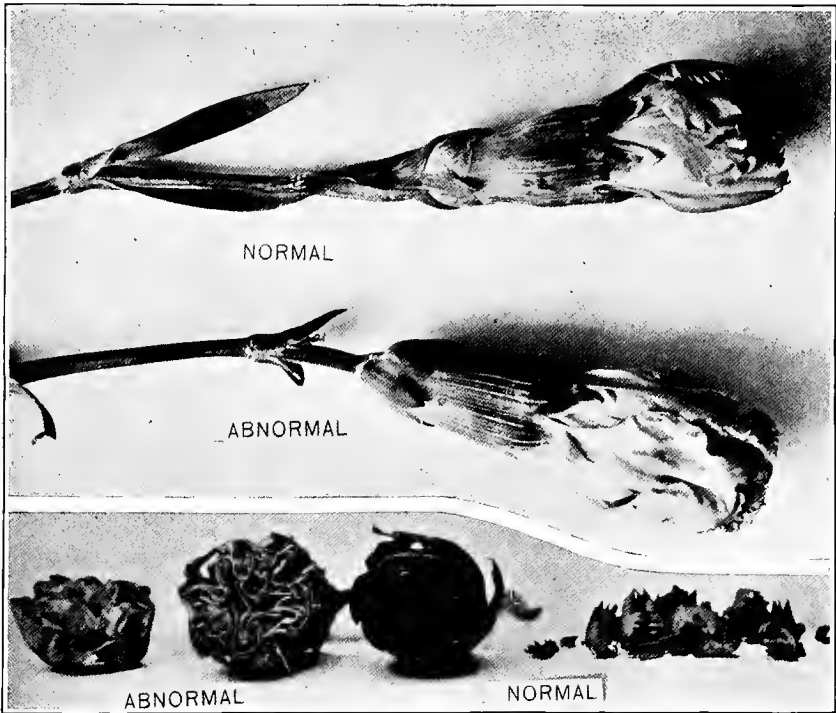
In using liquid fertilizers care must be taken not to overfeed the plants, as fatal results may be caused thereby. A curious yet serious result from overfeeding with chemical fertilizers is described in the proceedings of the American Carnation Society for 1896, by Prof. J. C. Arthur:

"A very interesting abnormal development of the flowers of the Carnation was recently brought to my attention by Mr. Fred. Dorner, who also kindly furnished me material for a preliminary study. The variation from normal habit first manifests itself by a failure of the full grown buds to expand into open flowers. The enlargement of the petals continues as usual, but they do not separate from one another. When the bud is forcibly pulled open, it is found that the petals have adhered by their surfaces so firmly that they are torn, like pieces of paper pasted together that split before the mucilage will give way. This splitting of the petals is easily seen, as the color, which gives them brilliancy, is wholly in the surface layer of cells, while the tissue within is quite colorless or white, and clearly evident when exposed.

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"It is easy to convince one's self that the adhesion of the petals is not due to the presence of a sticky substance, for any length of soaking in water or alcohol does not cause them to separate any more easily. It is evident, furthermore, that the only surfaces that adhere are on the colored, velvety parts of the petals, the colorless bases or claws being normally free.

"In the accompanying photographs a normal and an abnormal bud of Wm. Scott carnation is shown. The latter is several days older, somewhat lighter in color, and has grown to the utmost size; a normal bud would



have expanded before the petals had attained the same length. The same buds were photographed after cutting off the upper half. In the normal bud the portion cut off at once dropped apart, but in the abnormal bud it retained its form equally well with the basal half."

Natural Manures

Wherever natural manures, such as horse, cow or sheep manure, can be obtained at reasonable prices, they are unquestionably the safest for ordinary

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florists' purposes, as they may be used by persons having a much less knowledge of the action of fertilizers than is necessary in the case of fertilizer chemicals, without danger of serious adverse results. Ordinary barnyard or stable manure should be well composted before being used, and in this connection there is an old work published by the Orange Judd Company, entitled "The Bommer Method of Making Manure," which can be profitably studied by every florist. Briefly stated, this method consists of stacking the manure in a square heap upon a grated platform placed over a cement-lined excavation, the drainage from this heap being carried to a vat or cistern. This heap is made under cover, and the stable cleanings are thrown upon it each day, as taken from the stable. A pump is placed in the vat, and the drainage from the heap is pumped back upon it at intervals and allowed to percolate through and drain off again. All of the drainage from the stable is also carried into this vat, and is supplemented by the addition of water whenever the liquid drained from the heap is not sufficient for the purpose of wetting it down well. By this method stable manures are composted and rendered fit for use in a very short time, and with comparatively little loss of any of the fertilizer constituents, as by packing the manure firmly in the heap and wetting it thoroughly at stated intervals all danger of heating or firing is obviated, and the manure is decomposed with almost no loss of nitrogen.

In making such a manure heap all the refuse found about a greenhouse, such as old plants, dust, leaves, sods, muck, straw, grass, weeds, plaster, marl, as well as scraps from the dwelling house, may be put into it and decomposed together. The author has such a heap, which has been in operation for several years in connection with his stables, and he has found that the manure thus produced is much stronger and richer than anything he is able to purchase.



CHAPTER VI

Propagating and Shipping Young Stock

OF the two methods whereby young stocks of carnations may be increased, propagation by cuttings, or pippings, is almost exclusively used by the American grower. With the English carnation grower, in propagating the English varieties, layering is largely practiced; but owing to the difference in climate and the slowness with which stock can be increased, that method has not been found a practical one in America.

Like Produces Like

In the reproduction of any species of plant by the use of cuttings, layers, or grafts, it may be stated as an axiom that, with but very rare exceptions, the progeny resulting from such propagation will be practical reproductions of the parent from which the cutting, layer, or scion is taken. The tendency to perpetuate the dominant characteristics of the parent plant is strongly maintained through many generations, subject only to such modifications as may occur from environment and treatment.

Thus, cuttings from a carnation plant giving red blossoms also bear red flowers; cuttings from a vigorous plant make vigorous young plants, and vice versa; a graft, or cutting, from a plant having variegated foliage produces plants with foliage also variegated.

While the propagation of carnations by rooting cuttings is very simple, it requires not only judgment in the selection of healthy stock for propagating purposes, but also in the selection of strong shoots from the most vigorous growth of the plant, and the importance of such judicious selection should not be underestimated. Young plants grown from any stock will partake largely of the characteristics of the parent plant and of its condition at the time the cuttings were taken. If we select propagating wood from sickly plants the constitutions of which are in a debilitated condition, the tendency toward ill-health will be to some extent perpetuated in the young stock, and vice versa; if the stock is taken from healthy, vigorous growing plants at the time they are in the best condition, the tendency in the young stock will be largely toward vigorous, healthy growth.

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This tendency of like to produce like is proved by the selection of propagating wood in the case of shoots that have sported. Cuttings taken from the branch which shows the variation from the type will in most instances produce a percentage of plants in which such variation remains, and frequent selection of cuttings from these plants will finally fix the variation, although for a considerable length of time there will be occasional reversions to the original type. That is to say, if a variegated-flowered carnation



*A—Desirable cuttings as taken from the sand—Note strong root systems
B—Showing how inferior cuttings develop weak root systems
C—Desirable cuttings taken from soil after they have become established*

throws a shoot bearing a white bloom, a certain percentage of the cuttings taken from this shoot will produce white blooms, but probably some will give variegated flowers. If the propagation is continued a greater proportion of the plants propagated from the one producing the white flower will continue to throw white flowers, although now and then a plant, or even a portion of a

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plant, will produce a variegated flower. On the other hand, if the propagation of the progeny of the plant which reproduced the variegated flower is continued, the greater proportion of the young stock will produce variegated flowers, but now and then one will give a white flower. Thus, sports may become fixed by a constant selection of cuttings from parents that show the strongest tendency to maintain the variation.

This is also again proved in the case of variations in branches which produce an enormous quantity of foliage and no flowers. Cuttings taken from such branches will eventually produce a race of plants that will not bloom at all. The author has grown such types of plants two years without being able to obtain a single bloom upon them.

In propagating from a diseased plant a percentage of the progeny will also show the diseased tendency, while the other proportion will show a tendency to resume the normal or healthy growth. This healthy condition may be perpetuated by selecting the strongest plants for propagating purposes and continuing such selection. Therefore, in the perpetuation of a stock of carnations, such stock will be either poor or good according to the care used, not only in the selection of the parent plants from which to propagate, but also in the selection of the best and most vigorous wood from such plants. The axiom, "Like produces like," is particularly true in growing carnation plants from cuttings, and in propagating the golden rule should be, "Strong shoots from strong, vigorous plants in perfect health." Varieties of carnations may be split up into several distinct strains by means of this selection; therefore, the grower who aims to produce a particular type of carnation will need to select plants for propagating purposes that approximate the desired type, and to continue such selection, and if he would keep the strain pure he must avoid propagating from plants which show sensible variations from the type he desires to maintain.

In the early history of propagating carnations in America the larger proportion of the propagating wood was taken from near the base of the plant, as the grower was anxious to preserve the wood in the upper portion of the plant for flowering purposes. In those days carnation flowers were picked with short stems and every pip or bud was allowed to come into bloom, therefore the removal of any portion of the wood from the upper part of the plant was counted by the grower as a distinct loss. In some instances, where propagation was followed up for a long period by the selection of these base cuttings, varieties finally ceased to bloom and produced nothing but a large amount of grass. With the advent of growing long-stemmed carnation blooms the system of selecting the cuttings was changed,

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and at the present time the base cuttings are scarcely ever used, nor are the cuttings which grow high up in the top of the plant. Those pips growing along about six to eight inches of the center portion of the blooming stem are considered by the modern grower as the best wood for propagating purposes. (See cut showing branches of carnation used which are marked desirable cuttings and inferior cuttings.)



Propagating Wood

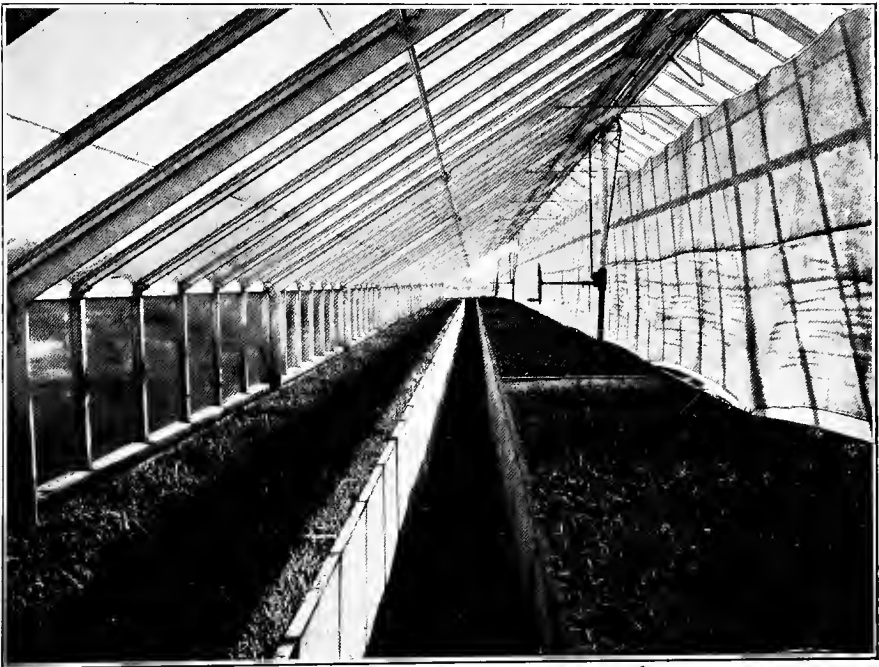
A—Desirable cuttings

B—Inferior cuttings

These cuttings are taken from the plant when in the proper condition for rooting. This varies to some extent in different varieties. As a rule, it may be said that cuttings of most varieties of carnations are in the best condition for rooting from the time the bloom begins to show color; that is, when it begins to open until the flower is ready to cut for market. There are, however, certain kinds from which cuttings taken at this period will be

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too hard, but such sorts are very rare. There are also other varieties upon which the cuttings will be too young and soft, and will not have completed their growth nor be in a proper condition for rooting at the time the flowers are cut. With this latter class, in order to get the proper quantity of propagating wood, it will be necessary to sacrifice the flowers; that is, to pinch out the buds a short time after they have extended beyond the foliage, which cutting back of the plant causes the side shoots to break, and in the course of time a large supply of strong propagating wood will be produced. In



Propagating Bench Shaded with Curtains

fact, a number of the varieties of carnations introduced in later years have the blooming tendency so strongly developed that the only practical method of obtaining stock in quantity is to cut back the plants and rely upon the new growth.

The cuttings are taken from the stem by a smart pull downward, so as to tear away a small portion of the bark from the flower stem with the heel

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of the cutting. When taken from the plant, cuttings must not be allowed to lie around and wither, but should be put in the sand with as much dispatch as is practicable. Where it is necessary to take off the cuttings some time before placing them in the sand, as is sometimes the case where large quantities of stock are propagated, they should be thoroughly sprayed with clear, cold water, and then wrapped in wet papers and placed in a cool



Short Span to South Propagating House

Width, 17 feet; height to ridge, 9 feet; width of benches, 5 feet

room out of all draughts or drying winds, and where they will not heat. This is for the purpose of preventing their withering, drying out or heating. If treated in this manner cuttings may stand from twelve to fourteen hours without serious injury.

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Propagating House

Almost any style of a greenhouse can be used for propagating purposes. Many propagators prefer one with a northerly aspect; that is, one erected on the north side of a building or wall. Such a house may be used to advantage, but in the dark days of winter we have found that cutting bench fungus will develop more rapidly in a house so placed, where it is absolutely protected from all rays of the sun upon the south side, than in a lighter house. The type of house in which we have had the best success is known as a short-span-to-the-south house, which was built after many years of experimenting with various forms of propagating houses.

This house is lightly shaded upon the south side, and in addition to this shade, in the spring and early summer months when the sun is excessively hot, the southerly side is covered with an additional shading of cheese cloth sash. In the spring, as the sun gets higher and its rays more powerful, the north side is also shaded, during bright days, with a similar sash covered with light protecting cloth. When shaded in this manner this house can be kept fully as cool as one with a northerly aspect, and it has the additional advantage of permitting us to remove all of the shade excepting the light coat of paint on the south side during dark days, and we are also able to maintain a light, airy atmosphere at all times. This has been found to be a great advantage, and since using this style of house less trouble with all sorts of fungous diseases has been experienced.

Construction of Propagating Bench

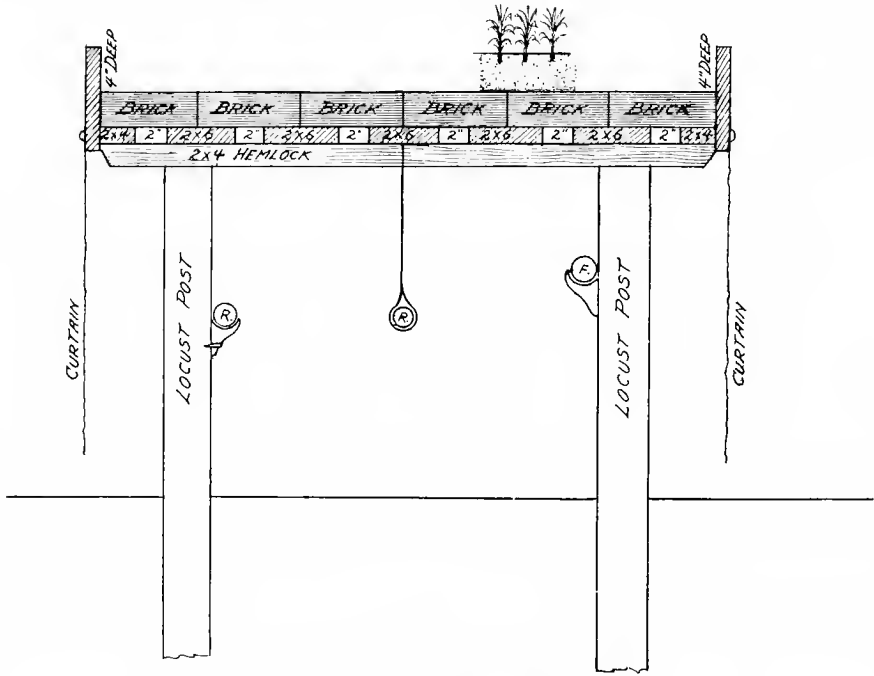
In our early experience in propagating carnations we used any ordinary greenhouse bench, cleaning off the bench thoroughly, whitewashing the inside of it, and calking the cracks with sphagnum moss in order to prevent the sand running through the bottom. From three to six inches of sand was used, and upon these benches, when new, very good results were generally obtained. But in a few years, when the wood became affected with decay, trouble with cutting bench fungus was apt to set in, and increase as the benches became older and the wood more decayed.

At the present time we are using two forms of benches—the sub-irrigation, the construction of which is described in Chapter XVI., and the brick bottom bench. While we have found the sub-irrigation bench, on the whole, the better type, almost as good a bench is made by laying porous brick upon the flat side over the entire bottom of the bench, as shown on page 77. The advantage of the terra cotta or brick bottom is that the bricks absorb

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from the sand any surplus moisture and in turn return moisture to the sand whenever it becomes drier than the brick.

This brick or terra cotta bottom should be from two and a half to four inches thick. When once warmed up this bottom gives off its heat constantly and evenly, and also acts as a shield against the intense heat from the heating pipes, preventing the baking or drying out of the sand from beneath. The heating pipes should be some distance from the bottom of



Brick Bottomed Propagating Bench

the bench; not nearer than eighteen inches at any point. While bottom heat is desirable, it should be generally and evenly diffused over the entire bottom of the benches, and it should not be allowed to become intense at any point. A very even bottom heat may be secured by tacking a curtain of light protecting cloth around the sides of the benches, allowing it to hang down to within two or three inches of the ground. This protecting cloth will keep the atmosphere under the benches a few degrees warmer than the air of the greenhouse, while at the same time it permits of the gradual diffusion of heat into the atmosphere above the benches, and tends to keep an

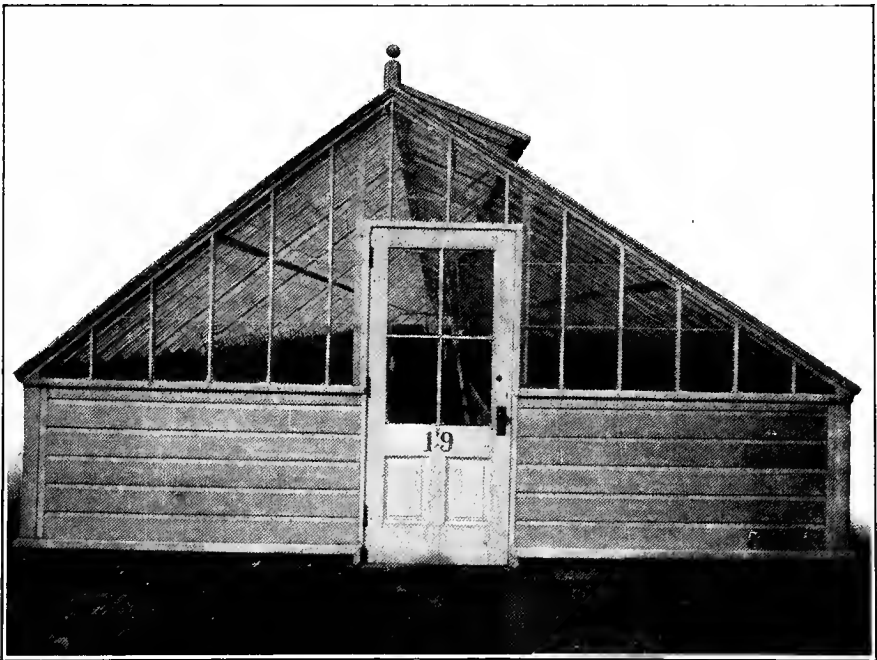
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even temperature throughout the house, underneath as well as above the benches. The temperature above the benches should be 10 to 15 degrees cooler than that under the benches.

There should be no overhead heating pipes in the propagating house, but the arrangement of piping should be such that the diffusion of heat through the cheese cloth curtains at the side of the benches will be sufficient to keep the atmosphere throughout the propagating house at the proper temperature; that is, 45 to 50 or 55 degrees.

Propagating Mediums

Many different materials can be used as media in which to strike cuttings. Sifted coal ashes or pulverized cinders mixed with sand may be



Short Span to South Propagating House

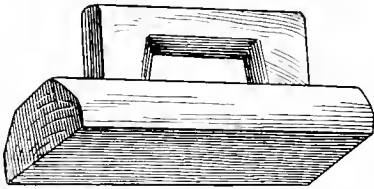
Width, 17 feet; height to ridge, 9 feet; width of benches, 5 feet

employed. Coconut fiber, also ground sphagnum moss mixed with sand, and a number of porous materials free from vegetable or fermenting or decaying matter, have been used with success.

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In the preparation of material used to fill the benches care must always be taken that it shall not be mixed with sour loam, and especially with decaying vegetable matter, as such impurities tend to develop that bane of the propagator, the cutting bench fungus. The most desirable and profitable material for propagating purposes is clean, sharp builders' sand. Many qualities and textures of sand may be employed, and each grower must put up with the best that may be available in his locality. The sand should be sharp, free from loam and all other impurities, and in preparing it for the bench it should be sifted through a fine sieve so as to remove all small stones and make it run even in texture. If it can be sterilized so much the better.

Three to four inches in depth of sand is sufficient; in fact, a bench with two and a half inches of clean sand overlying the terra cotta or brick



Tool for Firming Sand.

bottom makes one of the most successful propagating benches. In filling the bench the sand should be compacted by hammering it with a brick or a tool made for the purpose, so that it will be of an even density throughout the entire bench. The sand must be thoroughly moist throughout and compacted before the cuttings are placed in it.

In placing the cuttings in the sand they must be inserted firmly without bruising them in any manner, and the sand compacted about the base so that the cutting is held firmly and erect, and no air can get to the base to wither or dry it up.

The following method of preparing the cuttings has proved the best under our practice at Queens, after many years of experimental work, during which period upward of two and a half millions of cuttings have been rooted and either sold or grown into plants: The cuttings are taken from the plants with a short, sharp, downward pull, that tears off a little of the bark from the main stem. If the cutting is so soft that none of the bark from the main stem comes with it, it is not considered in a fit condition for striking. On the other hand, if it is so hard that a considerable portion of the wood from the main stem is removed with the cutting, forming a tail an inch or more in length, it is considered too hard and not desirable. Just sufficient of the bark of the main stem should come away with the cutting to form a little splint a quarter of an inch, or a little over, in length.

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As fast as the cuttings are removed from the plants they are taken to a cool room and laid upon a table, and immediately dampened and covered with moist paper. They are kept moistened and cool while undergoing the process of preparation, and until they are placed in the sand are not exposed to drying winds nor allowed to wilt. But when placed in the sand they are more plump and brittle, if anything, than when taken from the plant.

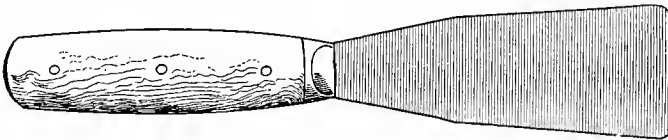
I much prefer taking the cuttings in the early part of the day when the plant is fresh and plump. I do not consider cuttings taken late in the day, when the plant may be somewhat wilted, as good for propagating purposes as when taken from the plant when in a fresh, brittle condition.

In preparing cuttings the little splint of bark at the heel is taken off just a shade below the heel with a very sharp knife. The short curled leaves at the base of the cutting, wherever they will interfere with putting it into the sand easily, are also removed, and with very long cuttings the tips of the foliage are trimmed off.

Putting the Cuttings in the Sand Bench

This is an operation which must be performed, not only with rapidity, but with such care and thoroughness as will secure the firm fixing of the cutting in the sand, and the packing of the sand about the base of the cutting so firmly that the air cannot get at the base where the callous properly forms.

The sand in the cutting bench is sprayed with a fine rose until it is thoroughly moistened to the bottom of the bench. The sand is then com-



Putty Knife.

packed with a special tool made for the purpose until the bench is firm and hard throughout. There are two simple tools used during the operation; one is the straightedge, which is made long enough to reach across the bench, and which is usually about half an inch in thickness, and one and a quarter to one and a half inches in width. The second tool is an ordinary wide-bladed putty knife, about eight inches in length. (See accompanying engraving.) The straightedge is laid upon the sand and given

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several sharp raps along its length with the butt of the knife handle. The knife is then drawn along the edge, cutting a drill in the sand from three-quarters of an inch to an inch in depth, according to the size and length of the heels of the cuttings which are being benched. The cuttings are then placed in this trench, about a half to three-quarters of an inch apart. By sharply pressing downward on the cutting the base will be fixed in the bottom of the drill so firmly that it holds the cutting perfectly erect. When the row is full the straightedge is again laid alongside of the row of cuttings and given several sharp raps with the butt of the knife handle. This compacts firmly the sand around the base of the cutting. The straightedge still lying in position, the knife is again drawn along its edge, cutting the drill as before about an inch and a half distant from the row of cuttings already set in.

This operation is repeated until the stock is in the bench. As soon as the operator finishes his batch of cuttings he takes a Boston hose nozzle and wets down the bench with sufficient thoroughness to compact the sand round the base of the cuttings and fill up all the interstices which may have been left. The cuttings are now ready for the operation of callousing and rooting, and if they have been properly selected and placed in the sand, and if they receive the correct treatment thereafter, from 95 to 98 per cent. of cuttings taken from most varieties of carnations will produce strong, well-rooted plants. ✓

The temperature of the propagating house should be maintained at certainly not higher than 50 to 55 degrees overhead; if possible to keep it as low as that. It is probably better for the health of the cuttings if the overhead temperature runs from 45 to 50 degrees, and it can be maintained as low as 40 degrees provided the bottom or sand temperature is carried from 10 to 15 degrees higher. But where the temperature is carried as low as 40 degrees the rooting process of most varieties of carnations will take an additional week.

The sand temperature should run from about 56 to 60 degrees, certainly not higher than 65 degrees, the lower temperature being much preferred.

After having been sprayed sufficiently to firm down any loose sand around the base of the cuttings, only sufficient spraying or watering should be given daily to keep the cuttings from flagging or wilting. It is decidedly deleterious to spray too much or to keep the sand surcharged with water, as such condition produces a soft growth and thereby promotes diseases, such as the cutting bench fungus and stem rot. For the same rea-

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son, a too dense shade is not desirable. Movable cloth-covered sash are preferred to permanent shading, so that on dark, cloudy days the houses may be kept in a lighter condition by removing the sash shades.

The atmosphere of the propagating house should at all times be moist, and this is best maintained by dampening the paths early in the morning, and possibly again during the middle of the day as the season advances and the sun becomes brighter.

In order to keep down green fly, aphids, thrips, etc., a moderate but constant evaporation of some tobacco preparation is desirable. One of the best means of producing this is by the use of the Lonsdale Evaporating Pan. This pan is so constructed that it can be screwed on to the heating pipes; the steam passes through a hollow chamber underneath the pan, heating the contents and driving them off into the air slowly, charging the air with tobacco-laden fumes. Where such evaporating pans are not available similar results may be attained by painting the heating pipes, once each week, with a solution of tobacco extract, of the consistency of thin paint. Insects may also be kept down and destroyed by fumigating the propagating house with either tobacco stems or tobacco dust. The tobacco extract may also be evaporated from an ordinary metal pan of any description placed upon an oil stove. Fumigation by burning tobacco stems, or tobacco dust, is not as desirable as the use of the tobacco extract. This extract can be used without any danger of injuring the cuttings; whereas, when fumigating by burning stems the cuttings may be injured in case the houses are filled with a too dense smoke.

In about ten days after the cuttings are placed in the sand they will begin to callous, which operation precedes the formation of roots. Less moisture is required at this period, and more care in ventilating. As soon as the cuttings emit roots, which will be in from eighteen to twenty-one days from the time they are put into the sand, the withholding of water and giving of more air for the purpose of hardening off the cuttings should commence.

Cuttings of different varieties of carnations require from three to five weeks to become thoroughly well rooted, according to the condition and disposition of the variety and the temperature at which the propagating house is carried. If the temperature under the benches be held at 70 to 75 degrees, and the overhead temperature at from 60 to 65 degrees, cuttings will root a few days sooner than if the temperature is carried lower; but the time gained by employing such high temperature is at the expense of the

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future constitution of the plant, and for this reason rooting cuttings in high temperatures should be avoided.

As soon as the roots have grown from one-quarter to one-half an inch in length the cuttings should be taken out of the sand and potted up. However, if they are to be shipped to a considerable distance, it will be necessary to leave them in the sand several days longer, as when the roots are so very young they are brittle and are apt to be shaken off during the process of packing and shipping. While cuttings are in a better condition for potting up when the roots are young than those that have been allowed to remain in the sand until the wood, as well as the roots, has become hardened and tough, they will not ship as well, and many rootlets will be lost. When potted, the younger cuttings will start into growth sooner after potting than the older, tougher stock.

Packing Cuttings for Shipment

Cuttings designed for shipment to any considerable distance should not be taken from the sand until the rootlets have made a growth of three-quarters of an inch to an inch in length. In removing them from the sand it should be very carefully done, so as not to destroy or break off the rootlets. When taken from the sand the cuttings should be at once placed in a cool situation, and under no circumstances should they be allowed to remain exposed to the sun's rays, or drying winds or heat, as such exposure will cause them to flag or wilt. The sand from which they are taken should be fairly moist, but not surcharged with water. In shipping long distances, and for the purposes of light packing, we frequently wash the sand from the roots by dipping them in a pail of water. If this is carefully done the roots are less liable to be broken or rubbed off in packing than if the sand is left adhering.

In packing, fine, clean sphagnum moss should be used, and this should be wetted down some time previously in order to have it equally well moistened throughout. It should not be wringing wet, but in a state to retain a fair degree of moisture for a number of days. Both moss and cuttings should be in a cool condition before packing. If kept in a temperature of 45 to 50 degrees they will be in the right condition to pack. If packed in a high temperature, it will tend to cause heating during transit, especially in the spring or warm months.

It is best to pack cuttings in bunches of twenty-five; not exceeding fifty in any case. In packing, sheets of strong, soft paper (old newspapers), cut to about nine to twelve inches in size, should be provided. Lay a small

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handful of damp sphagnum moss upon the sheet of paper, so spread out and disposed that when the cuttings are placed on the moss their roots and necks will be covered by the moss, but the tops will remain free and dry. Spread the cuttings on the moss in a thin line, roots and tops equally disposed. Commence rolling the paper so as to close in the moss and cuttings. After giving one roll fold the paper at the bottom over the roots and then roll all into a fairly compact bundle. Roll evenly and gently. Do not press hard upon the roots, or they will be bruised, and many of them break off. Tie the bundle neatly with a soft string, some raffia, or enclose with an elastic rubber band, and the cuttings are then ready to pack in the case.

Use a case just large enough to hold the quantity to be shipped. Line the case with heavy paper, using as many thicknesses as may be required to keep out the frost. Old newspapers make the best of all linings and are not expensive. In very cold weather, ten, and often fifteen, thicknesses of paper are necessary in order to protect the plants from freezing, and, in addition, the box should be wrapped upon the outside with five or six thicknesses and covered with a final wrapping of heavy manilla paper, which should be securely tied or nailed on so that no air can get through to the box. In packing large cases, excelsior should be placed between the layers so as to prevent heating. Finally, nail the cover on the box securely. When nailed, the contents of the box should be so firmly packed that they will not move or shake about.

Be sure to write the name and address of the consignee plainly upon the box, so that there will be no mistake upon the part of the shipping agents in determining its destination. Forward by such train as will insure a prompt delivery of the shipment to the consignee. Delays in transit are dangerous to carnation cuttings, and many a shipper is blamed for sending poor stock, when the real fault lies in improper packing and careless handling and delay en route.

Propagation by Layering

There is very little propagation by layering practiced among the carnation growers of the United States; so little, in fact, that we have practically no literature upon the subject. I must confess that I have done very little of it, as I found our hot, dry summers not well adapted to the operation.

The following description of layering, as practiced by the English gardener, is taken from an essay by R. Dean, which was published in the

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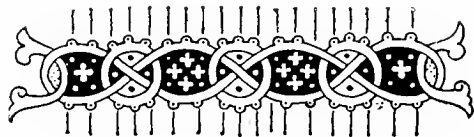
Carnation Manual, edited and issued by the National Carnation and Picotee Society, southern section of England:

"August is the month in which to layer carnations; the shoots have become firm, and can be manipulated without danger of snapping off. The first process is to trim the layers, using a pair of sharp scissors, cutting away the leaves close to the stem up to about the fourth or fifth joint from the point. Then, by means of a pointed stake, take out from the pot two inches or so of the old soil, and replace it with new, something after the nature of that recommended for cuttings. Should the soil about the roots be dry, give a good soaking of water, and allow it to drain away before filling the pot with fresh soil. The new compost should be raised up to the level of the rim, but pressed somewhat firmly as the work of filling proceeds. Pegs are necessary to fasten the layers securely down into the soil. Those made of fern are usually employed; it is also possible to obtain pegs made of flexible wire, and these, being much more durable, are cheapest in the end. Then the layerer, taking the trimmed shoot firmly between the thumb and forefinger of his left hand, thrusts his knife—the blade of which should be small, narrow, and sharpened on both sides—through the third or fourth joint, bringing it out at the back by means of a clean and rapid cut; the tongue of the layer is shortened, if necessary; it is then pressed gently down into the fresh soil, and secured by means of a peg. When the whole of the layers are laid down—and they generally are made to form a fringe around the inner rim of the pot—the surface soil should be leveled off and the surface made neat.

"Some shoots are too high up on the plant to be able to bend them low enough to layer in the ordinary way. A zinc rim, two or three inches in depth, can be fitted to the pots, filled with soil, and by this means it is brought nearer to the level of the layers.

"When all is completed, a light sprinkling overhead should be given by means of a rose watering-pot, and the pots stood out in the open until the layers have rooted, which, in good season, will happen in from a month to six weeks.

"By the end of September, and during the first two weeks in October, the layers will be sufficiently rooted to admit of potting off."



CHAPTER VII

Treatment of Young Carnation Stock Preparatory to Planting Out

AS soon as the cuttings have become well furnished with young rootlets, ranging from a quarter to half an inch in length, they are ready to be transferred to small pots (two to two-and-a-quarter-inch) or planted out in flats, and to enter upon their second period of growth. The preparation of the soil to be used in this stage of growing the young plants is fully described in Chapter IV. Such soil should be kept always on hand where it will not be exposed to heavy rainstorms and its fertility lost by leaching. When prepared for potting, the soil should be in a slightly moist condition; that is, it should feel smooth and comfortable to the hand and break up easily when rolled into a ball and pressed or crushed. The degree of moisture should not be such as to cause the ball to be permanently hardened by the operation of potting, but there should be sufficient so that the soil can be properly firmed. Two-inch pots for moderate growing varieties, and two-and-a-quarter-inch for the larger, stronger growing sorts, are the proper sizes to use. Smaller pots are disadvantageous, as they dry out rapidly and require frequent watering, while larger pots are objectionable because of the amount of bench room they occupy, as well as the danger of over-watering. If a deep pot is used, such as a rose pot, it is preferred by many and may be beneficial where light soil is employed for potting.

The operation of potting is very simple; nevertheless, it requires attention, care and a close observation of detail, in order that it may be done with rapidity and correctly. The soil, having been thoroughly broken up, and the larger lumps and clods reduced so that the mass is of an even texture throughout, is placed upon the potting bench in a heap in front of the operator. The workman takes the pot in his left hand, filling the pot about two-thirds to three-quarters full of soil. The cutting is then taken in the right hand, the roots being placed in the pot and shaken so as to be spread out in a natural manner. More soil is then placed upon the top of the roots until

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the pot is filled slightly above the rim. The pot is then given a sharp rap on the table and the soil firmed with the thumbs around the edge of the pot and over the roots.

When the operation of potting is completed the neck of the plant should be about a quarter of an inch below the top, or rim, of the pot. The work should be thoroughly done and the soil well firmed so that it will hold the cutting erect when watered. Care, however, must be taken not to pot the cuttings too deep. The root crown should be about a quarter of an inch below the surface of the soil. As each plant is potted it is placed in a flat which stands at the left of the operator, and as fast as these flats are filled a helper carries them away and places them on the benches in a well-ventilated, light house.

The first watering of freshly potted cuttings should be light, and the bench gone over perhaps twice with a light showering in order to afford to all of the plants an even supply of water. A fine Boston rose is used, which throws the water upon the plants in a gentle, misty shower, as is the case when a gentle rain is falling. Under no circumstances should the newly potted plants be soaked with a heavy deluge of water, but the watering should be done in such a manner that in the course of an hour the moisture has penetrated to the bottom of the pot and the soil is evenly moistened throughout, but not in a sodden condition. So far as I have observed, much injury is frequently done by the soaking of freshly potted plants, in many instances the young rootlets being destroyed or drowned out by the surplus water; indeed, I have seen many who profess to be expert carnation growers soaking the cuttings to such an extent that a considerable portion of them damped off. The young plant, when taken from the sand with its roots just forming, is to a certain extent in a delicate condition, and requires very favorable growing surroundings in order that it may continue growth without serious check. It needs no more moisture in the soil than its root system can absorb and the plant can evaporate through the foliage. Anything beyond this is a surplusage and a distinct detriment.

After the plants are watered they should be lightly shaded, and so long as they do not wilt they should not receive additional water until root action commences. This can be told from the appearance of the plants, which will straighten up and the foliage become plump and fresh. At this period—that is, until the plants straighten up, showing root action—the house should be kept a little close and the young plants protected from draughts. If properly treated, root action will commence within thirty-six to forty-eight hours, and it should be well established within three to four days from the

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time of potting. The shading should be removed as soon as the plants show that they have a firm hold of the soil. However, in the late spring, when the sun is exceptionally hot, the shading may be continued during the hottest part of very bright, sunshiny days, in order to prevent flagging, wilting or the soil drying out too rapidly.

Flats may be substituted for pots, and are largely used by many growers who have not sufficient bench room to hold the number of plants they require in pots, as many more plants in flats than in pots can be carried upon the same bench space. There are, however, many objections to flats, and of late years the more experienced growers are gradually abandoning their use and employing pots exclusively.

Flats should be from two and a half to three inches deep, and may be twenty-four inches long and from twelve to sixteen inches wide. A number of holes should be bored through the bottom, or the bottom should be made of slats in order to provide for drainage. A perfectly tight flat which provides for no drainage is dangerous, for the reason that the soil is liable to be over-watered and become soured, and the growth of the plants checked. Where this occurs the plants will turn a sickly, yellowish-green color. The same thing will take place if the plants are over-watered in the pots or if they are allowed to stand in pots or flats until they become root-bound and the soil exhausted. The plants may be set in flats in rows two and a half to three inches apart, and one and a half to two inches apart in the row, using the same care not to plant too deeply as is recommended to be used in potting.

Shifting

After the young plants have been growing in the small pots from four to six weeks the soil will become exhausted and so well filled with roots that the plants will need more room and additional soil in which to expand their root system and elaborate their growth. It will then be necessary to shift into a larger pot, and this should be done as soon as the ball is well filled with roots, and *before any tendency to harden* in the plant has been developed. Probably many of the important failures in carnation growing are due to improper treatment of young stock at this period. If a plant is once thoroughly checked and hardened so that growth is entirely stopped and the plant brought to an absolutely dormant condition, it will seldom, if ever, be as good a plant as if it had been kept in a healthful, vigorous, growing condition. It may give as large a crop of flowers, and in some instances a larger one, especially if the plant has been seriously checked, as after serious checks the plant will endeavor to perpetuate its species by the

Treatment of Young Carnation Stock

production of an abundant crop of flowers and the maturing of seed; but the stems will be shorter and more tough and wiry, and the blooms smaller. In order to get the best results in the way of long, stiff stems and large flowers with perfect calyces, carnation plants should not be checked in growth from the time they are taken from the cutting bench, but should be kept in a vigorous, healthy growing condition throughout the entire period of forcing and blooming.

In shifting from a two-inch pot a two-and-a-half to three-inch pot may be used, according to the vigor of the variety; and for plants growing in two-and-a-quarter-inch pots a three to three-and-a-half-inch pot is suitable. In shifting, when the young plant is turned out of the pot preparatory to repotting, the soil should be broken away from the neck of the plant and the ball lightly crushed. Sufficient soil is put into the larger pot, so that when the ball is placed in the pot the neck of the plant will stand just at the rim. Fresh soil is then filled in around the outside of the ball and packed and firmed with the thumbs, adding more soil until the top of the ball is covered, and then firming done well. The same care should here be taken that the neck of the plant be not placed too deep. Similar attention as to watering should also be used as with the first potting. Under no circumstances should the plants be deluged with water; the soil in the pots should be only sufficiently moist to carry on active growth.



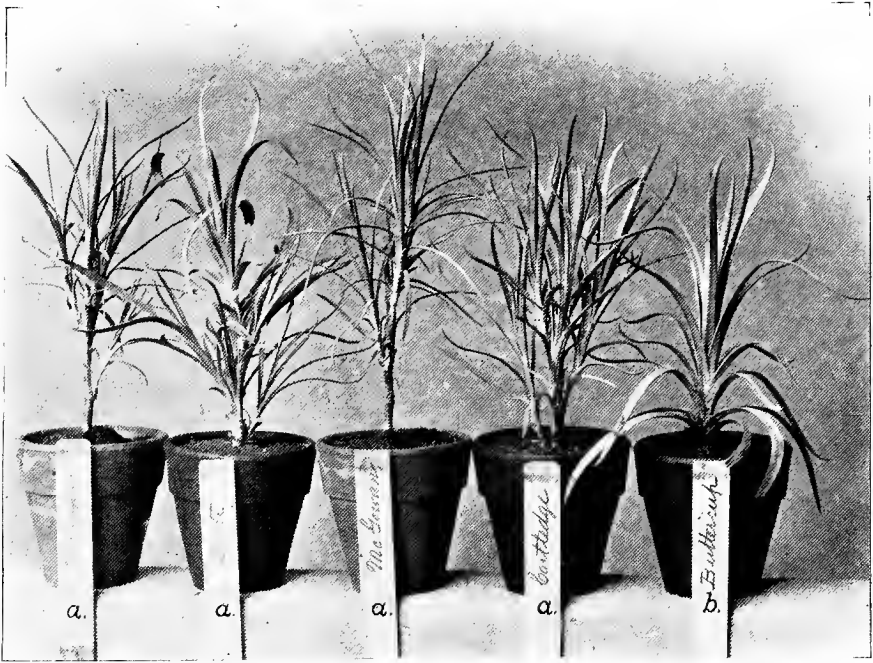
*Young Carnation Plant in 2-inch pot
ready for shifting to a larger pot
Note the active root action*

Pinching Back or Stopping

After the plants have been repotted, and with some varieties while still in the smaller pots, the center shoot will push forward and begin to form a bud. As soon as this bud has become fairly well formed, the shoot should be cut back (leaving four to six joints), for the purpose of causing the plant

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to break new growths at the joints or axils of the leaves. When ready to be set in the field, or when they are to be set upon the benches in June for culture under glass throughout the summer, all plants that have been struck in January and February should have been stopped back at least once, and each plant should have from four to five good strong breaks that are pretty well advanced in growth. It will be of no disadvantage if these growths are well advanced toward the first stages of bud formation.



Carnation Plants Ready for Planting in the Field

a—Plants that have been stopped

b—Plant not yet ready for stopping

Cuttings rooted in January and February, which are to be carried in pots until June and planted upon benches for growth under glass throughout the summer, should receive not less than two shifts after potting up; first from the two-inch to a three-inch pot, and then into a four-inch pot. Such plants should have from four to six strong breaks that are pretty well advanced toward the bud formation.

In order to get the best results from cultivation under glass throughout

Treatment of Young Carnation Stock

the summer only extra strong plants should be used. While the young plants remain growing in the pots all blooming shoots should be cut back as soon as in the proper condition. When ready to set in the field the young plants should have a strong, vigorous appearance. The stems should be brittle, and the color should be of a dark, rich green, a striking contrast to the sickly, yellowish green which is seen in plants that have been either over-potted or over-watered, or allowed to become root-bound or stood in an exhausted soil.

In preparing the young stock, before planting into the field the plants should receive sufficient water to moisten the balls through to the bottom of the pot. When turned out of the pots and placed in flats to be carried into the field, the top soil, to about a quarter of an inch in depth, should be taken off with the fingers, and the ball should receive a slight pressure to break up its dense, compact condition, for it is always desirable to have the balls of soil mellow, and very undesirable to have them in a hardened, brick-like state when planted out. When planted either on the benches or in the field, the ball of soil should be sufficiently broken up so that it will incorporate readily with and absorb moisture promptly from the surrounding mass of soil. This will not be the case if the balls have become root-bound and hardened and are planted in the field without being broken up or mellowed.

The time at which young plants should be put into the field varies with different localities. In the Southern States they might be set out as early as the 1st of March. At Queens we have occasionally set out plants as early as the middle to the 25th of March. Farther north, in Canada or the State of Maine, the time may run well into the 1st of June before planting out is done. As a general rule, throughout most sections of the country the 1st to the 15th of May should see the largest proportion of the young stock planted in the field. But in localities subject to severe late frosts the operation may well be deferred until after the danger from frost is over. This brings up the mooted question: "Are properly hardened carnation plants injured by frosts when freshly planted in the spring?" Many growers hold that they are not, but I am of the opinion that the present race of carnations, which are purely the product of hybridization under glass, and which are grown under glass at all times excepting when planted in the fields in the summer time, *are* injured by frosts, and I hold that no young carnation plant destined for winter blooming should be put into the field before all danger from serious frosts is past.

We have occasionally taken late rooted cuttings from the sand and planted them in the field during the latter part of May and early part of June with considerable success. These cuttings, if planted out in freshly

Treatment of Young Carnation Stock

worked, moist, mellow soil just before a shower, frequently commence growth at once, and in many instances have made practically as good plants as stock struck three weeks earlier and planted out at the same time from two-inch pots. But this will not hold as a rule. Young stock planted from the sand into the field is more apt to be injured by either droughts or excessively heavy rains than stock from pots, so that while we occasionally do this in order to save time and labor it cannot be recommended as a general practice.



A New York Wholesale Florist's Window

CHAPTER VIII

Field Culture of Carnations

AT the present time probably 95 per cent. of the carnations grown commercially are planted in the field, cultivated during spring and summer, and allowed to make their growth before being planted on the greenhouse benches, where they mature their crop of flowers. The preparation of soil for field planting is described in Chapter IV. All carnation plants should be planted in the field as early in the spring as the soil can be gotten into proper shape, and danger from frosts is over. This period ranges from the 1st of April to the middle of May, according to locality and latitude. In this latitude, we frequently are able to plant by the middle of April, sometimes as early as April 1, and aim to have the bulk of the planting done by the 10th to the 15th of May, although many of the later struck cuttings are planted as late as the 1st of June. These late cuttings make vigorous plants, that produce fine flowers; but such plants do not bloom as freely early in the season as the earlier rooted stock.

Assuming that the soil has been properly ploughed and harrowed, and finally finished with a pulverizing harrow so that it is in a smooth, mellow condition, the first step to determine will be the distance apart to plant. If for hand cultivation, the plants should be placed in rows not less than fifteen to eighteen inches apart, and not less than ten to twelve inches apart in the row. These rows should be laid out with a line, as it is essential that they be straight, in order to enable the hand cultivator to be used to advantage in after cultivation.

In planting for hand cultivation, a Firefly Hand Plow may be used to advantage, cutting a shallow drill not more than one and a half to two inches deep, which will be a sufficient depth to nicely hold the ball of roots of the young plants. The ground should be very soft and mellow when planting, and care should be exercised not to press the plants down too deep. The ball should be gently firmed in the soil, and loose earth drawn to the neck of the plant, so as to leave the top of the soil thoroughly mellow. The plant should not be set any deeper in the soil than it has been in the pot; that is, the neck of the plant should be just at the surface, or not to exceed an eighth

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to a quarter of an inch below the surface of the soil. Too many planters carelessly push the plant down into the soil until the neck is from three-quarters to an inch below the surface. This careless method should not be tolerated by a careful grower, as deep planting of this character has a tendency to check the growth of the plants and to cause them to rot off at the neck, especially if planting is followed by an extended period of cold, wet weather. If a small number of plants is to be set, it is a comparatively easy matter to plant them at the proper time, without much planning ahead. But where thousands are to be planted, and the number of hands is limited, the work must be well planned, and carried forward with method and rapidity, in order to get the stock into the field at the proper season.

Previous to turning the young plants out of the pots, they should be given a thorough watering, so that the balls of soil will be well moistened throughout; but these should not be in a muddy condition. If the plants are set with the balls in a muddy condition, they will dry out hard, and become brick-like, and, to a certain extent, impervious to moisture. I have seen plants dug from the field in the fall, where the balls of soil were so hard that the roots were actually choked, and had made comparatively little growth; whereas, if the soil had been of the proper degree of moisture, and the balls slightly broken up before planting, this condition would not have occurred, and the plants would have made normal growth.

As the plants are turned out of the pots they should be placed in flats, each variety by itself, with a label in every flat, in order to prevent mixing the varieties when dropping the plants. As this work is sometimes done previous to the time of planting, these flats should be set in a cool shed, out of draughts, where the plants will not wilt, and where the soil will not be dried out; and the plants should not be carried into the field much faster than it is possible to set them. If it should be necessary to carry any number of plants into the field at one time, they should be placed under shade, or covered with a light cloth of some kind, in order to protect them from the wind and sun; a large sheet made of plant-protecting cloth being very useful for this purpose.

In preparing the field for horse culture, after the ground has been thoroughly pulverized, and is in a proper mellow condition, a horse marker, set so as to make drills thirty inches apart and five to six inches deep, is used to mark off the ground. The fertilizer, if chemical fertilizers are to be used, is then sown with a machine, which thoroughly mixes the fertilizer with the soil in the drill, and immediately covered in by a coverer, which throws the soil into the drill and raises a ridge about six inches high.

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A man is then sent over the ground with an ordinary garden rake, to draw down these ridges until they are quite flat, or about ten inches across the top, which stands about an inch above the natural surface of the soil. This ridging up, and raking down the ridges, makes the soil very mellow, and puts it in a condition that renders the operation of planting easy.

A planting gang of nine men and boys may be divided up in about the following proportions: four planters, two droppers, one man to prepare the ridges ahead, and two men to bring the plants into the field, and return the empty flats to the houses (a light one-horse wagon, such as any florist has, being used for this purpose). Such a crew will set 15,000 to 16,000 plants a day, provided the plants are turned out ahead and delivered to the field as fast as the planters can handle them.

Boys do the dropping, and each dropper takes a flat and proceeds ahead of the planter to lay the plants upon the ridge at the proper distance apart for setting. As he lays down each plant, he gives it a slight squeeze, so as to break up the ball of soil. This breaking up of the soil ball is essential, as, if not slightly crushed, it may become hardened and impervious to water, and the growth of the plant be thereby seriously interfered with; but if the ball is crushed when set in the ground, it combines with the field soil, and will take up as much moisture as is absorbed by the adjoining soil, and growth will commence normally. In setting the plant, a small hole, about one and a half inches deep, is made in the top and along the center of the ridge, and the ball of the plant is placed firmly in this hole. It is further firmed in the soil by pressing upon it with the fingers, and the operation is completed by gathering a little fine, loose soil around, over the ball, sufficient to form a light mulch at the neck of the plant. I will here repeat that the neck of the plant should be at the surface of the ground, certainly not more than a quarter of an inch below, and should not be jammed down three-quarters of an inch to an inch below. Too deep planting is deleterious, often causing stem rot, and also checking the growth of the plant.

A smart boy will frequently drop plants as fast as two men can set them; but frequently it will take two droppers to three planters; and if a boy is slow, one dropper to each planter may be required. I will repeat, that great caution should be used to the end that the plants are not allowed to lie around in the flats in the sun, the balls permitted to become dried out and hard, or the plants wilted. It will be necessary to turn out a considerable number of plants before they are carried into the field, in order to keep the planters busy; but it will be easy to keep these plants in proper condition by placing them in a cool shed, or covering them with moist paper, or a protecting

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sheet. The plants should be carried from the shed, or greenhouse, to the field about as fast as the droppers can handle them, and the planters should keep close to the dropper with their work, so that no plants may lie exposed to the sun, to wither.

Care should always be taken to plant carnations in freshly cultivated soil, which should be in such a condition that it will firm down nicely around the roots. Planting should not be done in soil that is very dry, nor should it be done when the soil is pasty, or in a muddy condition. If the soil is in proper condition, and the plants are set without wilting, they will push forth their feeding roots within a day or two, and growth will commence promptly; but if the soil lacks the proper degree of moisture, or if it be too wet, or in a sodden, muddy condition, or if the plants are allowed to wither and dry out before they are planted, the growth will be checked, and the future condition of the plant will be, to that extent, impaired.

It may be repeated here, that nothing is gained by checking a carnation plant; on the contrary, a distinct damage results. If the best results are to be attained, a vigorous, healthy, normal growth must be maintained throughout the life of the plant.

Cultivation After Planting

In order to obtain the best results in growing carnations in the field, thorough and frequent cultivation must be the rule. If planted in beds, the wheel hoe should be run over these within a few days after the plants are set out, certainly immediately after the first rain, as soon as the ground is fit to work. This operation should be followed up by hand hoeing and weeding, and the soil around the neck of the plant should be pulverized so that the plant shall not be buried, or its growth impaired, by the baking of the soil about the neck, or over its roots. The wheel hoe should be run over the beds after each rain. Hand hoeing should be frequent enough to keep the soil mellow, and to prevent baking. Cultivation should be for the purpose of keeping the soil in a mellow condition, especially the top soil. Some cultivate, or hoe, only when they see weeds springing up. The best growers, however, do not wait for weeds to appear, but keep the surface of the soil constantly stirred and pulverized.

There is a great advantage in having the surface of the soil pulverized and in a mellow condition; as such soil dries out and forms a mulch over the carnation roots, preventing, to a great extent, the evaporation of moisture, and largely confining such evaporation to the moisture that transpires from the foliage, besides conserving the moisture during dry seasons; whereas,

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if the soil is allowed to become hardened, evaporation proceeds very rapidly from the soil itself, and plants will soon suffer from drought.

Where plants are set in rows, for the purpose of horse cultivation, the cultivator should be run between the rows within a few days after the plants are set. This should be followed up by hand hoeing and weeding, and pulverizing the soil around the neck of the plant. The horse hoe should be used at least once in every two weeks, and, as a rule, after each rain; while hand hoeing should be practiced frequently enough to keep the soil pulverized. No weeds should be allowed to grow to any size in the carnation field, but frequent cultivation should be attended to, so as to effectually keep down all weeds.

Cultivation around the plants should be shallow and not deep. The horse hoe should be one with small teeth, that will pulverize the soil finely, but will not run sufficiently deep to tear up or destroy the roots. The workmen should be watched when hoeing, and carefully instructed not to injure the neck of the plant by striking it with the hoe, nor to injure the roots of the plant by digging too deeply into the soil. Half an inch to an inch in depth is sufficient stirring for carnations.

There is quite a divergence of opinion among different growers as to the advantages of horse cultivation compared with hand cultivation. I have not been able to see any great difference between the two methods, excepting, possibly, a slight gain in economy with horse cultivation where an abundance of land is available. So far as I have observed, just as good carnation plants may be grown by either method, and a selection between the two simmers itself down to the quantity of ground the grower may have available. If he is limited as to land area, he should plant in beds, and practice hand cultivation; but if an abundance of land is available, he can well afford to practice horse cultivation.

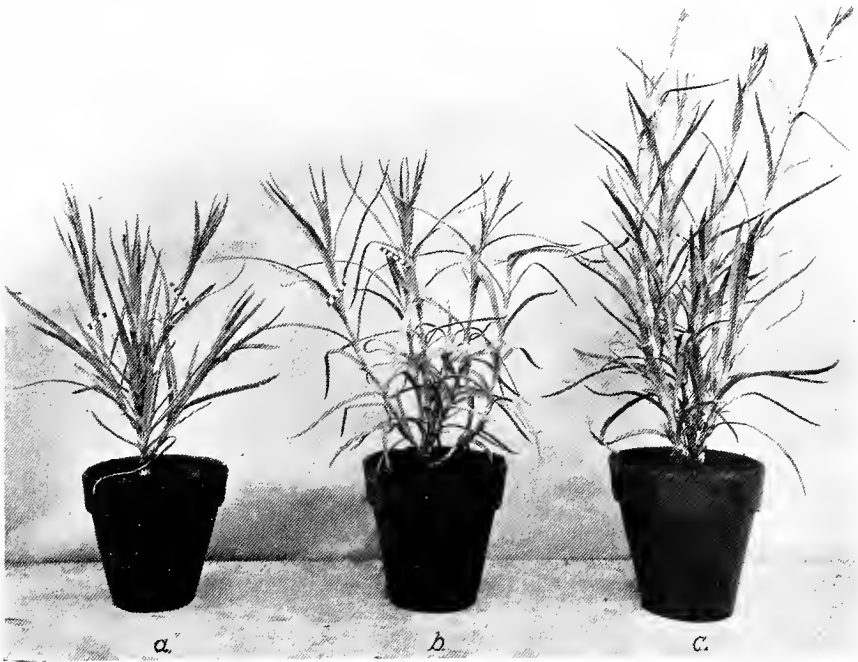
Stopping Carnations in the Field

As soon as the carnation plants have become thoroughly established, and have commenced their season's growth, flowering shoots will be pushed up, and these will soon form buds and blooms unless broken off. If it is desired to have crops of flowers during the winter time, it will be necessary to cut off these flowering shoots as fast as the buds have become well formed. It is desirable not to break off these shoots until the bud is in the condition named. Too close stopping is objectionable, as it has a tendency to dwarf the plant too much, retard the crop of bloom, and, if followed very closely, at wide periods may cause the plant to bloom in crops instead of bringing

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about a continuous blooming throughout the season. In order to secure a continuous crop of flowers during the winter season, the field should be gone over every two weeks, and preferably every week, and all shoots that are in proper condition for stopping broken off.

If the field stopping of carnations is followed up persistently, and the



*a—Plant stopped once and ready for second stopping; cut shoots at *
*b—Plant stopped twice and ready for third stopping; cut shoots at *
c—Plant coming into bloom after third stopping

shoots cut back at the proper period, and when in the proper condition, this will insure the continuous blooming of most varieties throughout the winter.

As a rule, all cutting back in the field should cease by the first to the

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middle of August, according to the variety. Many carnations should not be cut back after the 1st of August, and some varieties must not be cut back after the middle of July, otherwise the crop of bloom may be deferred into midwinter, and sometimes into the following spring. There are, however, a few kinds that may be cut back as late as the 1st of September without interfering with their blooming at or before Christmas time. Each variety must be carefully studied, and the season at which cutting back is to cease must be ascertained by practical experience.

By properly following up the cutting back of any variety of carnation, coupled with planting it upon the benches at its proper season, most modern carnations can be induced to produce a crop of flowers that will last, to a large extent, throughout the winter season. But if this cutting back is not correctly done, or is not done at the right time, the winter blooming may be seriously interfered with, and the crop of flowers obtained at a period when they are least wanted.

Before closing this chapter, I would impress upon my readers the importance of thorough, clean cultivation during the summer time, and of keeping the plants in a healthy, continuous growing condition. The success of securing a continuous crop of flowers during the winter will depend largely upon the condition of the plants when planted upon the benches. If the plant has made a strong, vigorous growth during the summer time, it will have stored up a large quantity of energy which can be successfully called upon during the winter time. But if the plant has not been properly treated, if it has been subjected to serious checks, such as droughts, lack of proper cultivation, or grown among rank weeds, where it has had to struggle for an existence, its constitution will be impaired, and it will enter the trying season of winter with strength insufficient to respond to the draughts which are made upon it in forcing. It may be laid down as a rule, that first-class results can only be expected from first-class plants; and first-class plants can only be produced by thorough, proper attention to all of the details connected with the growing of the plants, from the selection of the wood for propagating purposes, down to the time that the plants are placed upon the bench, as well as after being planted in the greenhouses. This thorough care as to the needs of the plant must not be at any time withheld. Many growers will tell you that they have good or poor luck growing carnations. I am not such a believer in the theory of luck as many, being rather of the opinion that this element of luck is largely controlled by the grower himself. If he

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neglects to give his carnations proper care at some particular time, it is easier to charge the resulting failure to "luck" than it is to blame himself for such failure. Success can only be secured by thorough, careful, constant attention to detail. Good luck smiles upon the careful, thorough grower. Bad luck is the Nemesis of the careless cultivator.



Enchantress (P. Fisher)

CHAPTER IX

Lifting and Planting Carnations from the Field

THE proper time for lifting carnations from the field, and planting under glass, will vary with the varying climatic conditions in different localities, so that each individual grower must decide by practical experiment at which time the work can be most favorably done in his locality. In some places lifting is commenced as early as the middle of July, while in other sections, according to the varying climatic conditions existing throughout the United States, the operation is extended to as late as October 1. In the latitude of New York, from the 10th of July to the 1st of September may be taken as the average time for lifting, and planting under glass.

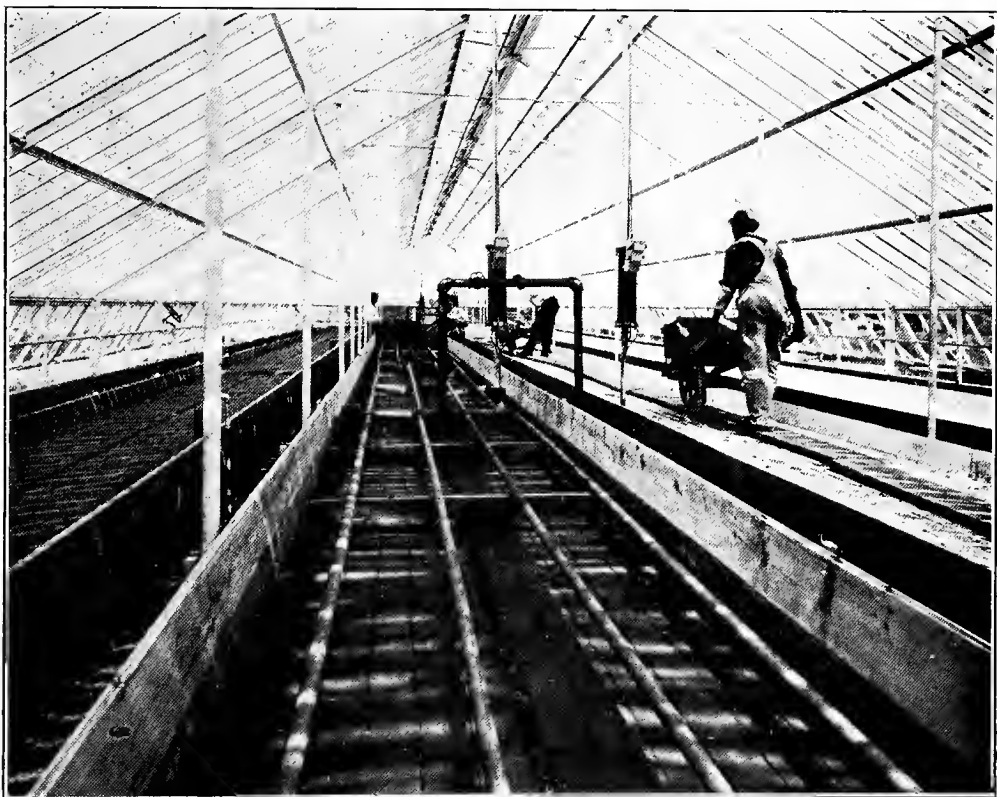
Filling the Benches

Granted that the soil heaps are in proper condition (see Preparation of Soil, Chapter IX.), it will be of considerable benefit to turn over the soil once again, about a week or ten days before the benches are to be filled. Where a small area of bench surface is to be filled, the soil may be carried into the greenhouses in light baskets, or small boxes fitted with handles. But where the quantity of soil to be handled is large, much time will be gained by using larger boxes or baskets, or wheelbarrows.

Planks are rigged up, running from the soil heap through the door at the end of the houses, and on to and down the center bench. A parallel plank is laid about every twenty-five feet, to form a turn-out, so that the wheelers may pass each other. The accompanying illustration of filling the greenhouses shows the method of arranging the planking on the benches. Three to four men are employed with wheelbarrows, and one man is stationed at the soil pile with a shovel, to help fill the empty barrows as they return. An additional shovel enables each wheeler to assist in filling his own barrow. Two men are placed at the bench where the soil is being dumped. Each of these men has a shovel, and as fast as dumped the soil is turned over and thrown back, filling the bench evenly and firming down the soil, so that there will be no holes, or soft spots, and the soil will be of an even density

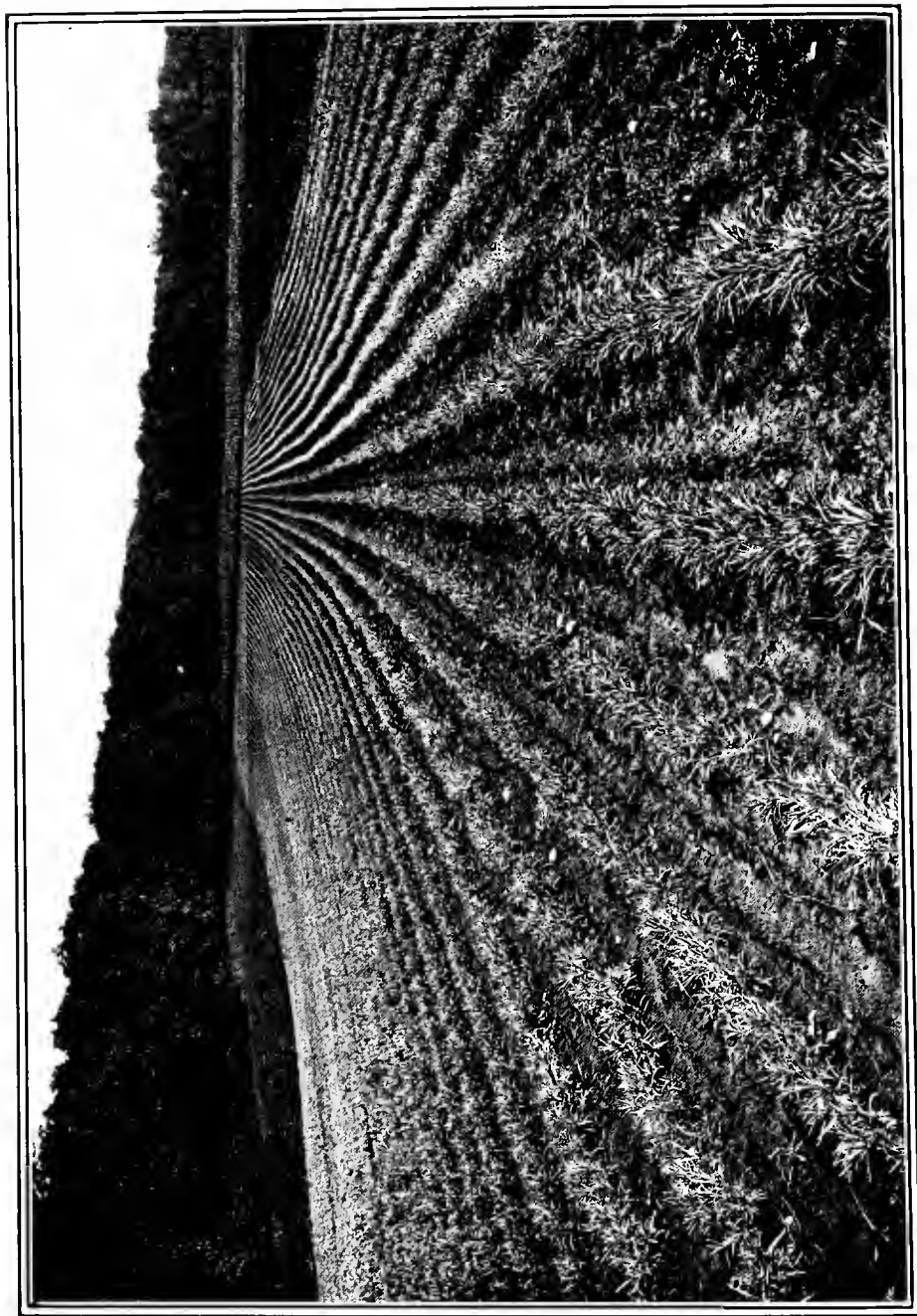
Lifting and Planting Carnations from the Field

throughout the bench. The firming is of considerable importance, particularly in the case of light soils, especially when it comes to watering, whether by the surface or sub-irrigation system. If the soil is of the same degree of compactness throughout, it will take up the moisture equally, and there will be neither sodden nor dried-out spots in the bench as would result were some



Soil Sterilizer in Position—Filling the Bench

spots dense enough to hold the moisture and became sour and sodden, and others so loose and open as to dry out rapidly, causing the contiguous plants to suffer from drought. With light soils it is often necessary to get upon the bench and tramp down the soil, in order to have it sufficiently compact, and of an even consistency throughout.



The Carnation Field—Ready for Lifting

Lifting and Planting Carnations from the Field

Marking Out the Bench

When the soil is ready for planting, it should be in a moist, mellow condition, so that the planter can easily dig holes in it with his hand. In preparing to plant, regular lines, running the full length of the bench, and spaced at even distances should be marked. Cross lines should also be marked, so that when setting out, the planter will only need to set plants at the intersection of the different lines in order to have all stand in straight rows, evenly spaced. This is important and necessary, so as to enable one to properly apply the wire supports when the plants push up their blooming shoots.

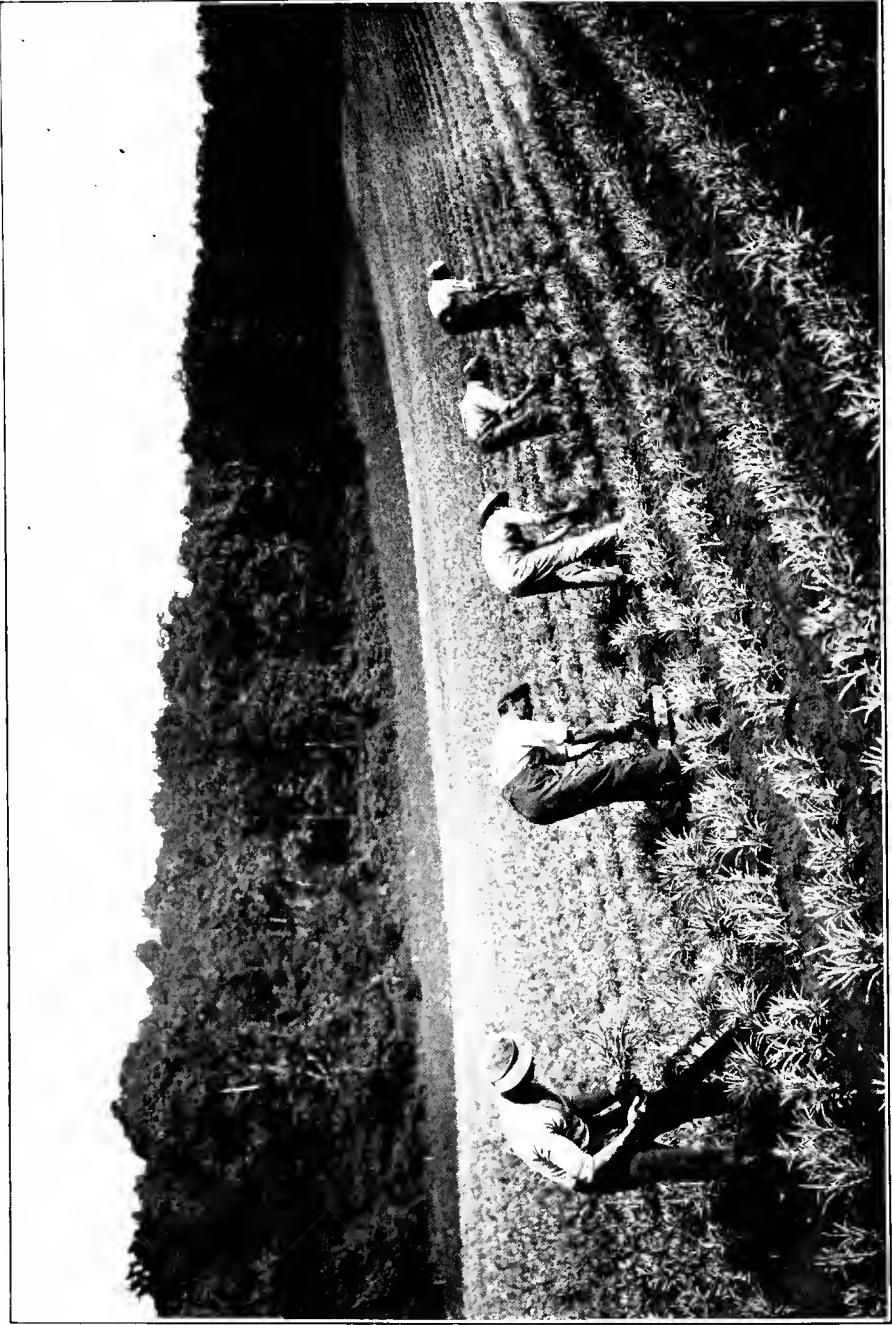
The benches thoroughly prepared, and the rows all marked out, and ready for setting, the next step to be considered will be

Digging the Plants from the Field

This work should be very carefully done by a workman of sufficient intelligence and knowledge of carnations, to enable him to select plants of even size and growth, so that when the benches are filled they will produce an equal crop throughout the entire surface. In digging the plants, all the roots possible must be preserved, especially the smaller fibrous roots. The best tool with which to dig carnations is the ordinary digging fork having four or five flat tines about three-quarters of an inch wide, these tines standing one and a half to two inches apart.

In selecting plants it is well to go over the field and select all of the larger ones that run of an even size; then go over the field a second time and select a size smaller, which will still fill the spaces fully. If you have not sufficient plants of these two sizes to fill the entire bench surface, it will then be necessary to go over the field a third time and select plants which can be doubled up; that is, two plants set as one. By such selection and doubling up of plants an even stand of bloom may be secured throughout the entire house.

After the plants are dug, they should be taken immediately under shelter, and not allowed to become wilted or the roots permitted to dry out, before planting. Too many plants must not be taken up ahead, as it is injurious to have plants lying around with the roots exposed to the wind, sun, or drying air. But the plants should be dug from the field and carried into the houses only as fast as they can be planted, and no great accumulation of dug plants should be allowed, either in the field or the greenhouses, unless it should be necessary to dig a large number prior to a rainy-day planting. If



Digging the Plants from the Field

Lifting and Planting Carnations from the Field

plants are allowed to stand around any length of time, or if shipped in from a distance, it is well to freshen them up by dipping the roots in water, and to moisten the tops, to prevent wilting.

In planting under glass, the same care not to plant too deep must be used as in planting in the field. The neck of the plant should stand just at the surface of the soil, or not to exceed a quarter of an inch below. Make



The same Carnation Field—Photograph taken ten minutes after digging was commenced

a shallow, saucer-shaped hole in the soil, at the intersection of the marks, of sufficient depth to nicely hold the entire root system; then arrange the roots therein in the same relative position that they occupied when growing in the field, spreading them out in a natural manner. Under no circumstances should the roots be rolled up, or twisted into a ball or wad. Place the plant upright, holding it with the left hand, and with the right hand work the

Lifting and Planting Carnations from the Field

soil around the roots until they are completely covered; then thoroughly firm the soil upon the roots, finishing up with a light pounding with the fist to compact the soil; at the end, working loose soil all around over the top, so that while the roots of the plant are so firmly held by the compact soil underneath that the plant will stand erect, the surface is mellow, and in a condition to form a dry mulch, which has been described in Field Culture. (See Chapter VIII.)

After the plants have been set, the next step is

Watering

Usually there are two planters in a gang, one at each side of the bench; and as soon as twenty to twenty-five feet of bench has been planted, the head planter takes the hose, and with a fine rose syringes the bench lightly and evenly, sufficient to wet the entire surface. Some growers recommend soaking the bench through at once, pouring on the water so liberally that it will run through the soil and drip from the bottom of the bench. This method we have not found advantageous, but prefer to give several light waterings during the course of the day until the moisture has penetrated through to the bottom of the bench, and the soil has become moistened throughout in a natural manner, similar to what occurs in the open ground when a gentle rain is falling.

Any close observer of soils will have noted that in seasons where very rapid, heavy rainfalls occur, when the ground becomes compacted and saturated for a considerable length of time, many kinds of vegetation suffer, and many varieties of plants are attacked with the species of fungus known as stem rot. For instance, cabbages and cauliflowers will rot off at the neck and large areas of these plants be destroyed. Muskmelons, squashes and pumpkins will rot before they are ripened. Many hardy plants, such as Sweet William, Goldenrod, Perennial Phlox, and even herbaceous Peonies, will rot off at the surface of the soil. Carnations are also seriously affected in a similar manner. The rotting of plants, under such conditions, should give the carnation grower a broad hint as to the undesirability of soaking his benches until they are in a muddy, saturated condition.

Many growers will probably have observed that when carnations are planted in the field, and the planting is followed by a gentle rain, extending perhaps over night, and falling so gently as not to compact the soil, but simply to moisten it throughout, the plants start immediately into growth without noticeable check. But where such planting out is followed by heavy beating showers, the plants are injured by the excess of moisture and the

Lifting and Planting Carnations from the Field

packing of the soil about the roots and neck. Carnation soil should be at all times in just a nicely moistened condition; that is to say, there should be sufficient moisture in the soil to keep the plants plump, and in vigorous growing condition; but there should never be an excess of water to drown out the soil or to cause it to become sodden or sour. In order to get the best possible results, what might be termed the sanitary condition of the soil should be thoroughly looked after and maintained.



Setting Carnation Plants on the Bench

Shading the Carnation Houses Before Planting

One of the necessary preliminary steps in lifting and planting in is shading, as it is desirable to protect the freshly planted plants from the rays of the sun until they have had time to strike root and commence growth; otherwise the plants will be seriously checked by wilting. A too dense shade, however, is not desirable, as that has a tendency to soften the plant and to cause it to receive an additional check when the shade is removed. Probably the best shade is one that can be easily removed during the dark weather, as the shade should not be kept on too long. When the weather is cloudy, and the sun is not shining, no shade will be necessary; but as soon as the sun

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comes out bright, shading again becomes desirable. One method of shading is to mix fire clay, or any clean clay, to the consistency of thin paint, and spray this over the glass with an ordinary greenhouse syringe. This mixture is easily removed by the first rainstorm, and may be quickly re-applied, if desired. To those who wish a comparatively permanent shade, the glass may be striped, using a mixture of white lead and kerosene oil, or naphtha, prepared as follows: Two pounds in weight of kerosene to one pound of white lead. Put on the glass in stripes three to five inches wide, leaving from two to three inches of clear glass between each stripe and the sash bars; this provides a very nice shade, which may be left upon the houses a considerable length of time. It also can be taken off easily by rubbing with a dry, stiff brush. As soon as the plants are sufficiently well established to begin active growth, the shade should be gradually removed. The glass should be in a clean, bright condition early in the month of October, and absolutely clean by the 1st of November, excepting, possibly, in the Southern States, where the sun is still sufficiently hot at that season to injure the plants or cause the blooms to fade.



Viola Allen

CHAPTER X

Treatment After Benching and Until the Plants Are in Bloom

FOR the first week after planting, ventilation should be given sparingly, and with judgment, keeping a moist atmosphere, and avoiding drying draughts. A gentle syringing once or twice a day, just sufficient to freshen up the foliage and prevent wilting, should be applied, but no heavy wetting of the soil should be done until root action has been established. As root action sets in, and the foliage straightens up, and becomes plump and crisp, ventilation should be increased and watering attended to as the plant needs moisture.

When the plants have become well established, and the bench soils fairly well filled with roots, the plants must be straightened up so that all of the shoots will stand erect. About this time weeds will begin to sprout, and the surface soil should be lightly cultivated or scratched over, and all weeds removed and destroyed.

Staking or Wiring

As soon as the growths commence straightening out, or elongating toward the bud formation, it is important that support be given promptly. This should be done before the blooming shoots start to run up. I would impress upon the reader the importance of providing support for his carnations early, otherwise the growths, if left for any considerable time without support, will run up, lop over, and fall down, causing the stems to become crooked, which is detrimental to the flower, injuring its usefulness and reducing its selling value. If the young plants are properly supported, and the body of the plants held erect, they will grow straight and sturdy, producing long, straight-stemmed blooms; but if not so supported, and allowed to fall down and become crooked, the entire plant will grow out of shape, and it can seldom be restored to as good condition as when properly supported from the start.

There are a number of methods of supporting carnations, each of which has its votaries, who prefer it to others in use; but all of these methods may

Treatment After Benching

be divided into three general classes. The first, which may be called staking, consists of driving a stout wooden stake alongside of the plant, which is then supported by being tied to this stake, either with raffia or twine. This system



Illustrating Wire Ring Supports

of support is, however, seldom used at the present time. The methods now most employed are known as wiring. That most generally in force is a round-wire support upon legs; it is made in several forms, and offered for sale by various manufacturers. Several of these forms have been patented,

Treatment After Benching

and most of them may be purchased at prices ranging from \$12 to \$25 per thousand. They are made of strong, galvanized wire, and will last for a number of years.

The second method of wiring consists of stretching wires over the bench, as is shown in the engraving. These wires are extended tightly the full length, and fastened to a framework upon each end of the bench.



Illustrating End Supports of Iron for Stretching Wire

Supports are provided at about every twenty-five feet throughout the length of the bench, and stay laths are put crosswise every ten feet in order to hold the wires a proper distance apart. A wire is stretched on the outside of the row of plants and also between each row. Ordinary twine is used for the cross tying. A man stands on each side of the bench, and the two tie the strings across, taking a wrap and half hitch around each wire so that

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the strings will not slip up and down the wires. Two strings are used between each plant, so that when the wiring and tying is finished each plant is held by itself in a square composed of wire and twine. This wiring is put on in several tiers, from two to three being used with average growing plants.

A combination of the two systems just described has been adopted by many of the most successful growers, and it seems to be nearly a perfect system of supporting carnation plants. A round wire circle having three legs is used to support the base of the plant. It stands about three inches above the ground, and holds the base of the plant firmly. Six inches above this, and then again six inches above that, and still ten to twelve inches higher, if necessary, the wire and string supports are stretched, so that the carnation plants are supported their entire height, and will grow perfectly erect in the little squares provided for them. It is not necessary nor desirable to put on all of these supports at one time, but the wiring should be added as the plants grow upward and need support. However, these supports must be put on at the proper time, as it is important to keep the young shoots constantly growing upward and straight, and not allow them to fall over and lop about.

Another system of supporting carnations is the V-shaped wire netting, supplemented by stretching the wires and string overhead. This method is shown in the adjoining cut, which illustrates it very well. This is an excellent method of supporting carnations, and has the advantage of permitting the plantsman to work between the rows without striking or injuring the plants. With varieties that are very heavy growers, however, it has a tendency to compress the plants a little too much at the base. The netting is also expensive, and since the advance in the cost of wire it has been abandoned, both on the score of expense, and also for the reason that the system of round wire supports, combined with wires and string, is considered better. Anyone, however, having the netting on hand would be able by it to support his carnations to good advantage.

Cultivation of Soil on Benches

As the season advances weeds will grow up among the plants, and with surface-watered benches the surface of the soil will become packed and hard. These weeds should be removed when young, and the hard crust be broken up by very shallow cultivation. Under no circumstances should cultivation be deep, as the root system of a plant extends to the surface of

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the soil, and if deep cultivation is practiced the plants will be injured by the disturbance of the feeding roots.

As soon as the condition of the plants shows that a considerable portion of the plant food contained in the soil is assimilated, light top dressings of decomposed manure, or sheep manure, bone dust, soot, etc., may be used; but the plants must be allowed to become thoroughly established and in full, vigorous growth, with normal root systems, before such applications are given; and when feeding begins, the food should be introduced into the soil no more rapidly than the plants consume it.



Bench of Carnation William Scott—Illustrating supporting with wire netting and wire and string

Properly prepared soil will be rich enough to carry the plants from six weeks to two months after growth has commenced, without feeding. Under ordinary culture, if plants grow vigorously, the soil will be exhausted to some extent at the end of two and a half or three months, unless it has been renewed by feeding or mulching. In such case a strong top dressing will be required to keep the plants in proper growing condition and to supply them

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with the necessary sustenance to maintain their growth and mature the crop of flowers.

The most critical time in carnation culture is during the fall and early winter months, when the natural tendency of plants is to cease growth and to rest. During this period the greatest care must be taken in watering the benches. The soil should be kept in a healthy, moist condition, but at no period should it be over-watered. It may dry out at times so that the surface appears quite dry, but this condition should not be allowed to continue any great length of time, and under no circumstances should the soil be permitted to become dry to the bottom of the bench, nor the plants to become wilted or flagged from want of moisture.

Ample provision should be made for draining all carnation benches, whether the style of bench used be sub-irrigation or surface watering. If the benches are not properly drained, serious damage may occur in case of over-watering. Sometimes, when a carnation bench has been thoroughly watered, after having been allowed to dry out a little to sweeten it up, the grower is confronted with a spell of dark, stormy, chilly weather, and if he has no means whereby to dry out this soil and remove the surplus moisture, his plants will receive a check that will be decidedly harmful, and reduce the value of his crop. Probably the most important part of the care of carnations consists in proper watering in connection with proper ventilation. At this period of the year the weather is constantly growing colder; long spells of dull, dismal weather will occur, and the grower will be constantly taxed in order to keep his plants from receiving damage. A grower who thoroughly understands the watering of his plants, and who can do the work properly, and with judgment, has mastered one of the most important secrets of carnation growing. The art of watering plants is purely a matter of personal judgment. No definite rules for it can be laid down, as conditions are constantly varying; the requirements of the soil under treatment must be ascertained by the man who has immediate charge of the growing plants, and this can be done only by practical experience and daily observation.

Disbudding

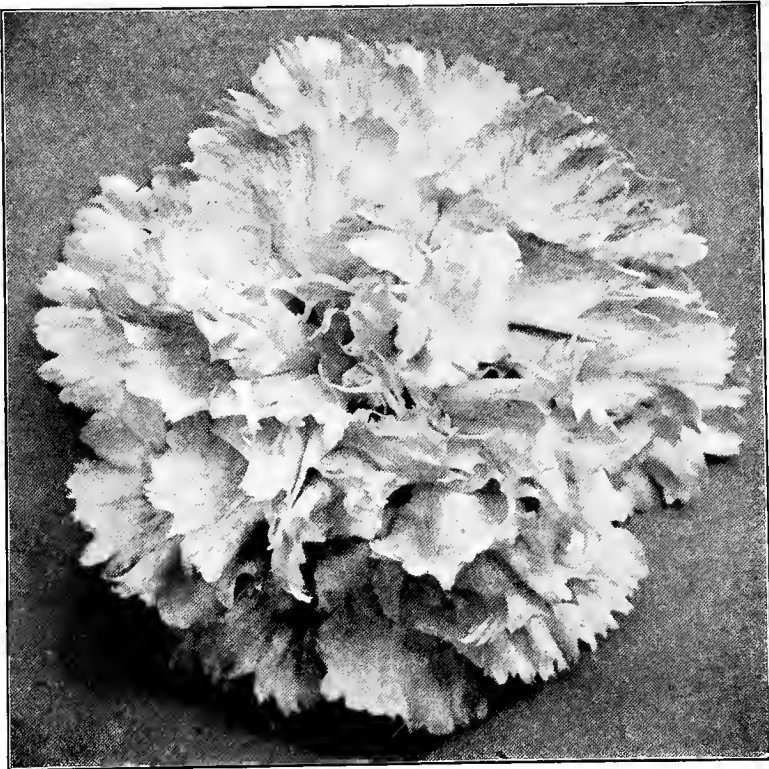
After the buds have set, and side shoots begin to elongate, disbudding should commence promptly. All buds, except the terminal, should be removed, unless that bud is deformed, in which case the terminal should be taken out and the strongest lateral from the top of the shoot allowed to grow. Disbudding should be commenced as soon as the first buds are fairly well formed, and when the laterals are sufficiently well advanced, so that they

Treatment After Benching

can be seized between the thumb and first finger and pinched out. Unless disbudding is done before the lateral buds have swelled to any great extent, it will be of little use, as the laterals will have taken some considerable strength from the terminal bud, in which case the bud left will not produce as large a flower as if the laterals had been removed early.

The benches should be gone over at least once in two weeks and the weak shoots cut back; that is, those shoots that show a tendency to produce small, weak-necked flowers. The object of this is to throw the entire strength of the plant into strong, vigorous growth, to the end that a better average quality of blooms may be secured.

The time to commence cutting the flowers varies greatly with the varieties grown, as well as with the season at which they were planted inside. In case the planting has been done in July, a few flowers may be left on the plants to be cut in the early part of September. But more profitable results may sometimes be obtained by cutting back the earliest flowers, and allowing new growths to come, which will produce blooms for November, December, and later cutting.



Prosperity

CHAPTER XI

Picking, Packing and Shipping Carnation Flowers

THE chief value of any flower consists in its being placed in the hands of the consumer in a fresh, lasting condition. This can only be accomplished by having the blooms properly handled from the time they are cut from the plant until delivered into the hands of the consuming purchaser. In order to accomplish this the flowers must be picked when in the proper condition, the stems immediately plunged in water, and the receptacle placed in a cooling room, which should be scrupulously clean, and in which the temperature is uniformly carried at from 45 to 55 degrees. The vases containing the flowers should be of sufficient size to avoid crowding or jamming the blooms together, and be deep enough to hold at least two-thirds to three-fourths of the entire length of the stem. These vases should be kept perfectly clean, and should be daily filled with fresh water. The temperature of the water in the vases may be from 10 to 15 degrees higher than the temperature of the room at the time the flowers are put into the vase. While the temperature of the cooling room should be from 48 to 50 degrees, we have found it beneficial when both the water and cool room stood at about 55 to 60 degrees when the flowers were put in, and when the morning pick was finished the room gradually cooled down to 48 to 50 degrees. The water, room and flowers cooling down together, avoids the sudden chilling of the blooms, a condition which sometimes causes them to wither, or, as the florist terms it, "go to sleep."

It is more advantageous to pick carnations in the morning, while the temperature is low, and the flowers plump and firm, than to wait until the sun has become sufficiently powerful to cause the blooms to flag. The daily picking of flowers should be finished by ten o'clock in the morning, and all blooms intended for shipment the following day should be in water by that time.

There is some difference of opinion, as well as in practice, regarding the condition in which the bloom should be when cut. Some of our best growers allow the flowers to stay upon the plant until fully developed, or, as they term it, finished. Our practice has been to pick the flower when about three-

Picking, Packing and Shipping Carnation Flowers

quarters developed. This point can be generally ascertained by observing the condition of the pistils. When the pistils have grown so that they have reached an even length with the center petals, the flower is, in the case of most varieties, about two-thirds to three-quarters full blown; and if picked at that time and placed in water, the bloom will continue to develop for several



A Wholesale Grower's Flower Room

days; whereas, if allowed to stand upon the plant until fully developed—that is, when the pistils have completed their growth, and are ready for fertilization—the flower has reached its full size, and there will be no further tendency to grow. On the contrary, the tendency to wither and go to sleep will

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be much stronger than with the flower not fully developed, and the danger of fertilization will be also much greater.

In cutting, a sharp knife should be used, and the stem should be cut in such a manner as not to place any strain upon the roots of the plant, as this has a tendency to break the fine rootlets free from the soil and to injure the plant's growth and blooming. If the flowers are broken off, the pressure on the stem should be downward, and not with an upward pull, which will start the plant from the soil.

As fast as picked the flowers should be taken into the flower room and placed immediately in the vases, which should have been prepared in advance and filled with pure, clean water. As soon as the picking is finished, the cleaning and preparing and grading of the flowers should be done. It is our practice to remove all the foliage, for about six inches, from the lower part of the stem, and to take off the cuttings while sorting the flowers into the different grades.

For the New York market three grades are made, namely, fancies, extras and firsts. The fancies are all perfect blooms, running from $2\frac{3}{4}$ to $3\frac{1}{2}$ inches in diameter, with straight stems from 16 to 24 inches and upward in length. The extras are composed of flowers which, while being perfect, are either smaller or the stems below the length required for fancies. The firsts comprise all merchantable blooms that will not pass as extras.

In grading flowers it is important that the grade should be uniform; that is to say, a fancy should be fancy at all seasons of the year. In the early part of the season, when the plants first commence blooming, there are comparatively few flowers that will grade as strictly fancy. Many of the first blooms will come imperfect in one or more respects, and the stems will generally be below the necessary length; so that at this part of the season but two grades are sent to market—the extras and firsts—the fancy grades usually putting in an appearance from a month to six weeks later.

After the stems have been properly cleaned, and the flowers separated into the different grades, the blooms are divided into bundles of twenty-five, the stems of each bundle being bound with a small rubber band. A tag upon which the name, the grade, and the number of flowers are written, is fastened to each bundle. From two to four of these bundles are put into a vase, according to the size of the blooms, as well as that of the vase, and these are placed upon a table, in a cool room, with sufficient space around each vase to admit of a free circulation of air about the flowers and to prevent them from rubbing together and bruising. The blooms remain in this cool room until the following morning, at which time they will have absorbed sufficient

Picking, Packing and Shipping Carnation Flowers

water to have stiffened the foliage and petals, so that the blooms are frequently a third larger than when first put in the cool room. At this time they will be ready for shipment, and if properly packed and handled, will reach the stores in the best possible condition.

One of the things to be avoided in picking carnations is to allow the flowers to lie around until they have become slightly wilted, or until the end of the stem has become seared to such a degree that it will not take up water readily. I would especially emphasize the importance of getting the flower stems into water as soon after they are severed from the plant as



Bunch of Carnations with Name Tag

may be possible. It is probable that many of the complaints regarding flowers going to sleep in the hands of storekeepers and consumers are due to improper usage, either at the greenhouses, before packing, in the commission house, or in the hands of the storekeeper. Carnations that are taken from the plants in the afternoon, upon a hot, bright or windy day, when the plant as well as the flower is in a somewhat wilted, flabby condition, and placed

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in a warm room and allowed to lie around half an hour or so before being put in water, are almost certain to wither and fade many hours before they would if picked at the proper time and treated properly.

Also, if blooms are taken from a warm greenhouse, plunged in ice-cold water and placed in a room a little above the freezing point, they are liable to become chilled, and to wither and shrivel up long before a properly handled carnation should show any signs of decadence. This is probably due to the sudden chill which the flower receives in the transmission from its warm quarters to the refrigerator. I am satisfied that in many stores flowers are frequently injured by being placed in ice boxes and carried at a too low temperature.

Carnation flowers may also be injured by sudden changes of temperature, or by exposing them to an atmosphere charged with noxious gases. The various gases which pervade a large city seem to be very destructive to the keeping qualities of carnations. In some instances, the cellars of florists' stores have been so permeated with gases leaking from the soil and surrounding mains, and various openings into the cellars, that carnation flowers would wither and fade away within a few hours after being placed therein. No flower grown enjoys a pure, clean, dry atmosphere more than does the carnation. The blooms should not be exposed to extremes of any kind, at any period of their growth, or of their transmission from the grower to the consumer, and the more even the temperature at which the consumer keeps the flowers, the longer will they last, and the more valuable will they be.

In shipping carnations upon the New York market there are two methods practiced, which may be termed

The Bunch Method and the Box Method

The bunch method is the oldest, and, even at the present time, probably the most practiced of any of the methods of shipping in vogue. It consists of tying the flowers into bunches of 25, 50 or 100, and packing into large cases lined with paper, and also wrapped in paper during the colder weather, in order to prevent freezing. Each bunch should have a card upon which the name, quality and number of flowers are written. While this is the cheapest method, it is also the hardest upon the flowers, as they are always more or less bruised by being packed in the bunches, and by the rubbing of the blooms against each other; further injury occurs in the stores, and especially in the commission houses, from buyers handling the bunches and throwing them about.

The box method. The finest carnations shipped upon the market are

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treated by what is known as the box method; that is, the blooms are packed singly, in layers, in shallow pasteboard boxes which are lined with soft paper, generally thin wax tissue paper. These boxes are made of various widths and lengths, in order to accommodate the size of bloom and length of stem, and will hold from 50 to 100 flowers. They range from 10 to 12 inches in width, and 36 to 42 inches in length, with an average depth of four inches.



*A case of Carnation Blooms packed for shipment to market
Illustrating the Box Method*

A box 12 inches wide and 40 inches long will hold from 50 to 75 of the finest fancy carnations, and about 25 to 30 per cent. more of the grade known as extras.

While the box method is much more expensive than the other, as it includes the cost of the boxes, as well as the case in which the pasteboard boxes are packed, and also necessitates longer time and considerably more

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labor in the process of packing, the blooms will arrive upon the market in a substantially better condition, and will generally sell for a price sufficiently advanced to cover the cost of the boxes and extra labor. These pasteboard boxes are packed in cases containing from 10 to 15 boxes. The cases are made of light half-inch pine, strongly put together, and braced so that they will stand a number of trips to the city and return, as the express companies return all empties to the shipper, either free, or for a very slight charge. An



Interior of a Wholesale Florist's Store in New York City

allowance is made to the storekeeper for the return of the pasteboard boxes, and quite a proportion of these boxes are returned, and are used over again, although of late years an increasing percentage of these are sold to go with the flowers. Upon the lid of each box a label is pasted showing names, number and quality of the flowers contained in the box.

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The blooms are packed in the early morning, usually between four and six o'clock, and are generally sold and distributed among the various retail stores by ten o'clock of the same morning, so that the carnation flower, which is cut from the plant on any given morning, is in the storekeeper's window, or cool room, by ten o'clock of the following day, and probably in the hands of the consumer, when its real use may be said to have commenced, by three to six o'clock of the same day.

Many persons have the idea that flowers freshly cut from the plant will keep the best. They frequently come to the florist with the request that blooms be picked direct from the plants as an assurance of their freshness, and carry the blooms away, with the mistaken impression that such flowers will keep better than those that have been picked and treated to the proper curing process. While such blooms frequently will last longer than many of the flowers purchased from the stores, it does not follow that it is the best method of treating the carnation flower. If such flowers can be placed at once in water, in a cool room, even for an hour only, then properly packed in a suitable box for carriage, they will keep much better than when taken directly from the plants to the purchaser's residence.

During the winter months, it is necessary to protect the flowers from frost while in transit. This is readily done where they are packed in the pasteboard boxes referred to. The shipping case is lined with several thicknesses of strong, heavy felt; and in the coldest weather each individual box may also be wrapped with paper. Packed in this manner, flowers will carry a number of hours in the coldest weather, without injury, as the pasteboard boxes protect the blooms from frost, even if it should penetrate the outer case.

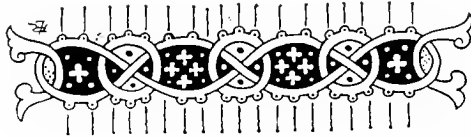
When the flowers are shipped in bundles, it is more difficult to avoid loss by freezing, as if the cold penetrates the case at any point, it rapidly spreads throughout the entire mass of flowers and injures them; whereas, when packed in the pasteboard boxes, if the cold penetrates through the outer case, it still meets with resistance from the pasteboard box and its wrapping. During an experience of ten years in shipping flowers, we have had comparatively few complaints of their being injured by frost in transit, when packed in the pasteboard boxes; in fact, it may be said, that almost all of the losses which we have incurred from flowers freezing in transit have been where the blooms were packed in bunches, and not where they were enclosed in the pasteboard boxes.

As before stated, the chief value of a flower consists in its being placed in the consumer's hands in a fresh, durable condition. Some growers won-

Picking, Packing and Shipping Carnation Flowers

der why their neighbor's blooms are usually preferred by retail dealers, at prices higher than those obtained for their own productions, reasoning to themselves, "My carnation plants are as good as my neighbor's; my flowers are as large; I grow the same varieties; I should get the same prices." All of these premises may be true, save the last, and investigation may disclose the neighbor's superior methods of handling his flowers, in picking, packing and shipping.

Superior methods of placing an article upon the market in the shape that will prove most attractive to the purchaser are sure to bring their reward in increased prices, other things being equal. In no business do cleanliness and artistic handling of goods play a more important role than in the florist's business; and the grower, commission man and retail dealer must each do his part if the greatest degree of success is to be attained.



CHAPTER XII

Insects and Preventives

IF it were not for the insects that prey upon the plant and the various diseases to which it is subject, carnation growing would be, comparatively, a pastime. But with all the care that may be taken in watering, ventilating and preparation of soils, unless the grower learn to master the various insects and diseases which attack the carnation his returns will be but meagre. There are comparatively few insects that infest the plant, but those that do are persistent, and unless met with preventive or curative measures will seriously injure, if not destroy, the crops of bloom.

Green Fly

The most prevalent of these insect enemies is the green fly, or aphides (*Rhopalosiphum dianthi*). However, this pest is more easily prevented and destroyed than any of the others infesting the carnation. The green fly is easily eradicated by several methods, the most common of which are, first, fumigating with tobacco stems, or tobacco dust; second, sprinkling tobacco dust upon the plants; third, fumigating with red pepper; fourth, painting the pipes with tobacco mixture made as follows: Dissolve one pint of rose leaf extract in one quart of pure water; paint the pipes, when cold, during the day, once or twice each week. When the steam is turned on at night the heat will evaporate the extract, filling the house with pungent fumes. This painting is efficacious only where steam is used in heating; fifth, evaporating tobacco extract from pans attached to steam pipes; sixth, evaporating tobacco extract by boiling it over an oil stove, using equal parts of the tobacco extract and water, and evaporating from four to six gallons to a house 100x20 feet, according as it seems necessary to destroy the insects.

The green fly should never be allowed to get a foothold in carnation houses, but its appearance should always be prevented by early and continuous fumigation of some sort, as soon after the plants have been housed as growth has been established. After the plants are in full growth they should be fumigated at least once each week, and this should be continued until they

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are fully in bloom. The importance of this early and continuous fumigation must not be lost sight of. The aphid having once become well established upon the plants, will frequently maintain themselves throughout the entire winter, in spite of continued fumigation. But if the first colonies that develop after the plants are brought into the houses are promptly destroyed, the succeeding colonies will diminish, and the insects will not multiply to an injurious extent, provided the houses are fumigated once each week until the plants are in bloom. At this period it is well to cease burning tobacco stems, for the reason that fumes injure the flowers, destroying the natural odor; they also impair the keeping qualities of the blooms to some extent, as well as bleach the colors.

From this period blooming plants should be kept free from aphid by using some one of the mixtures of tobacco extract. The substance employed may be applied to the steam pipes, having it of the consistency of paint and brushing it on the pipes thoroughly during the daytime while the pipes are still cool. When the steam is turned on at night the fumes of the tobacco extract will be given off, and if sufficient pipe surface is covered with the extract it proves as efficient in destroying aphides as the more objectionable method of burning tobacco stems.

The extract may also be evaporated from pans attached to the steam pipes. The extract may also be evaporated by boiling it in shallow dishes upon an ordinary oil stove.

If the grower will treat his plants to thorough fumigation once or twice a week from the time they have become well established until they are in bloom, and then follow up with a weekly fumigation with the tobacco extract, it is probable that no aphid will be seen during the winter, unless the plants when brought in from the field were thoroughly infested with the insects.

In order to guard against the stock being attacked in the field during the summer, it is essential that the young plants be treated to fumigation at least once a week, up to the time they are to be planted out. The week previous to setting the plants in the field, we follow the practice of fumigating the young stock every other night, so as to insure killing all the insects which may have escaped previous fumigation.

Red Spider

One of the most difficult insects to hold in check is the red spider (*Tetranychus telarius*). This pernicious little mite seems to be unaffected by all of the tobacco remedies which prove efficacious in the case of the aphides.



GOLDEN EAGLE

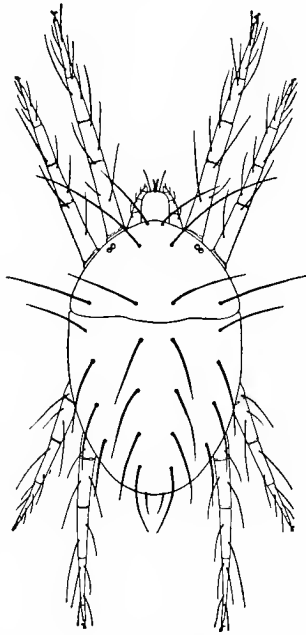
NOVELTY

Examples of Yellow Variegated

PLATE II. SEEDLING CARNATIONS (WARD)

Insects and Preventives

In fact, at the present time, I know of no method of fumigation, not injurious to the plants, that will destroy the red spider. The fumes of sulphur seem to hold this insect in check, but unless sulphur is very carefully used, the growing plants will be injured and often killed. The sulphur is usually applied as a paint to the heating pipes, being either mixed with lime to form a whitewash, or with linseed oil. It may also be mixed with the tobacco extract, and when applied in this manner the combined fumes of the sulphur and tobacco destroy the aphides, as well as check the spread of the red spider.



Red Spider

Tetranychus bimaculatus adult—Enlarged. (From Banks,
U. S. Dept. of Agriculture)

Sulphur and Lime Formula.—Slack three pounds of quick lime in a gallon of water, to which add one pound flour of sulphur, and stir till all is evenly mixed. If the wash proves too stiff to be brushed on easily, add more water. Paint three to four runs of pipe in each house. This paint should be renewed about every eight or ten days.

Sulphur and Linseed Oil Mixture.—One-quarter pound flour of sul-

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phur, to one quart of boiled linseed oil. Mix thoroughly and apply like any ordinary paint.

Sulphur and Tobacco Mixture.—Dissolve one-quarter pound flour of sulphur in one quart of rose-leaf extract, to which has been added two quarts of water. Stir thoroughly, and apply as a paint.

The usual method of keeping down the red spider is to syringe the plants, either with pure water or with a caustic preparation of soap, such as whale oil or Ivory soap.

When using pure water, the most effective manner seems to be the syringing of the plants with a fine spray under high pressure. I have become well satisfied that the mere presence of moisture in the atmosphere does not prevent the propagation and spread of red spider, but that the efficiency of water as a spray is measured by the force with which the water is driven against the insect; as in my experience the red spider seems to thrive very well, indeed, in a very moist atmosphere, unless forceful syringing is resorted to. Too much syringing, however, is deleterious to the plants, as it washes off the natural bloom which covers the foliage, and frequently results in attacks of spot and various other fungi.

Of the soap preparations, the best we have found is a solution of Ivory soap, made as follows: One-pound cake of Ivory soap, five gallons of water. Shave the soap into a kettle holding at least a gallon of water. Boil slowly until the soap is dissolved. Add to this mixture sufficient water to make five gallons, then churn the whole through a syringe until an emulsion is formed.

This emulsion should be thrown upon the plants with a fine spray, the same as is used when syringing with pure water. After the solution has remained upon the plants two hours, it should be washed off, by syringing with clear water. In the use of soap mixtures, as well as in washing them off, we have found the high pressure syringing with a very fine rose the most effective. In using any caustic preparation upon plants, the grower must remember that soft, sappy growths are frequently injured, and these solutions ought not to be applied to plants that are in such condition.

Use of Salt as a Preventive of Red Spider

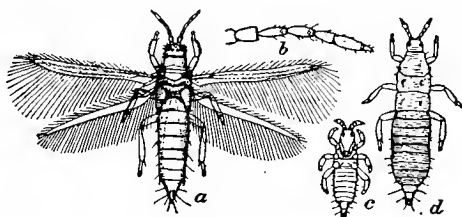
During the past three years we have been using a solution of salt, made as follows: Eight six-inch potfuls of common salt in 50 gallons of water. When using this solution, always stir from the bottom of the barrel in order to insure an even strength throughout. Give the foliage a thorough spraying, both underneath and above, using a fine rose under strong pressure. After syringing with the salt solution, this should be allowed to remain from three

Insects and Preventives

to four days in bright weather, and from one to two days in dark cloudy weather, after which the salt should be thoroughly washed off the plants by a strong syringing with clear water. Care must be taken not to syringe with the salt solution too often. The carnation plant loves a certain amount of salt, and is not injured by what will reach the soil, provided the applications are not too frequent, or the solution not too strong.

Do not spray the plants with the salt solution unless the foliage is in a firm, well-hardened condition, for if applied to plants that are in a soft state, that is to say, those that have been grown under a too high temperature, or in soil that has been kept too moist, the tender foliage will be injured or burned, and as the salt keeps the foliage constantly wet during the night time, there is some danger of developing spot upon very soft plants.

An application of salt should, generally, not be made oftener than once in two weeks; however, we occasionally syringe with the salt mixture



Thrips tabaci

*a, adult; b, antenna or same; c, young larva; d, full grown larva—
Enlarged. (From Howard, U. S., Dept. of Agriculture)*

upon alternate days, using a weaker solution of salt. The red spider does not thrive upon the carnation foliage when it is coated with the salt crystals; and after one or two thorough applications of the solution comparatively few of the insects will be found.

Thrips

While the red spider may be considered one of the worst insects attacking the carnation, I believe that the most injurious insect with which the grower has to contend is thrips (*Heliothrips tabaci*). This, like the red spider, is an insect which it is difficult to see with the naked eye, especially in its young state. It does the principal damage to the flowers while yet in the bud form. Unlike the red spider, which confines its attacks to the epidermis of the foliage, and principally the lower or harder foliage, the thrips attacks the tender, terminal shoots, or the tender petals of the ex-

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panding flower buds. It feeds upon the plant, by piercing the tissue and sucking the contents of the cells. Its presence may be discovered by the twisted and curled condition of the young growths, and also by the marring of the petals as the flower is opened. Sometimes thrips injures the buds so seriously that the petals are glued together, and the blooms fail to open.

The thrips seems to have become more prevalent each year during the past five seasons, and in some places has increased to such an extent as to almost destroy crops of carnations at certain periods. Its increase in the Eastern States has been such, that in certain localities it is impossible to grow marketable carnation flowers in the open ground. It can, however, be kept under control in the greenhouses, the principal remedy being heavy fumigation with tobacco stems. Some growers have recommended fumigating with red pepper, but so far as I have experimented with this substance it does not seem to be very efficient. Repeated, heavy fumigations with tobacco stems will keep the thrips in check to some extent, but owing to the fact that this pest is generally concealed in the enfolded bud, it is impossible to reach all of the insects by one fumigation, or even by several; therefore, it is much more difficult to eradicate than red spider.

A patented compound, manufactured in England and sold under the name of "X L All," has been successfully used in destroying thrips, and has proved more efficient than the ordinary fumigation with tobacco. It is, however, very expensive at the present time; in fact, so costly as to be beyond the reach of the ordinary carnation grower. It is furnished in small cakes, each cake being sufficient for one thousand cubic feet of space. It is used by vaporizing the cakes, either by means of a special lamp made for the purpose, or upon an ordinary tin pan placed over an alcohol lamp. This vaporizing is done just at night, and the houses closed and locked for the night. In order to get the best results with the employment of this compound, it is necessary to use it several times consecutively; that is, vaporizing the house upon one night and following with another vaporization, either the succeeding night or the second night after. If this be repeated once in two weeks, the thrips will be held in check, and the damage therefrom much reduced.

Cut Worms

Ordinary black or variegated cut worms occasionally injure young carnation plants in the field, cutting off the foliage or gnawing out the terminal shoot immediately after the plants are set out. The injury done by cut worms to young plants is, however, of comparatively little moment. These do

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the most serious damage by boring into the flower buds just before the blooms open. The worms usually attack the flowers after the plants are in the greenhouses and during the early fall and winter; they are generally brought into the greenhouses, either upon the plants when dug from the field, or in the soil where fresh sod is used in the compost heaps, and in the latter case, the damage done is sometimes serious. Usually, they appear in such small numbers as to cause the grower little annoyance, but may become a serious pest if fresh sods are used in making up the compost pile, or if weeds are allowed to grow upon the carnation soil heaps during the summer time.

When cut worms are once brought into the greenhouses, the only remedy is to hunt them during the night with a lantern. They feed upon the buds during the night, and hide either under the foliage or conceal themselves by boring into the earth at the base of the plant. With the aid of a bright lantern, they will be detected upon the flower buds in the act of feeding, and can easily be destroyed; or they may be dug from the earth during the day time.

Carnation Stalk Borer

This insect is usually present in all carnation fields, but except in rare instances it is not a serious pest. It injures the plant by boring into the pith of the stalk, and in some cases will kill very young plants. Upon mature plants this borer generally injures but one branch, and the damage in the majority of cases is done before the insect is discovered. When carnations are planted upon newly-ploughed ground, the stalk borer may become sufficiently numerous to do considerable harm; but under ordinary circumstances it injures so few plants as to cause the grower no concern. If the carnation fields are properly prepared, by ploughing under the sod in early August of the preceding year, and frequently ploughing during the fall, the ground being left in a roughened condition at the last ploughing, so that frost will thoroughly act upon all of the soil that has been stirred, very little damage will be done by either the stalk borer or the cut worm, as by this treatment of the land almost all of these insects contained therein will be destroyed.

In conclusion, it may be well stated that the best method of fighting insect pests is by preventive measures. No insect injurious to the carnation should ever be allowed to take possession of the plants. It is far more easy to prevent the propagation of insect pests than it is to destroy them, once the plants are thoroughly infected with them.

CHAPTER XIII

Diseases and Injuries

UP to a certain period, the carnation had been considered among the flowers least subject to disease, and for many years after the plant was brought into general cultivation, very little was heard of carnation diseases. Sometimes plants did not seem to do well. In such cases, it was said they needed different soils, or less water, less heat, or more ventilation, but clearly defined diseases were practically unknown to the carnation grower.

About the year 1889, Professor Seymour of Massachusetts described the disease of the carnation called Spot (*Septoria Dianthi*), which aroused the attention of florists to the fact that the plant was subject to disease. However, Professor Seymour's publication raised no particular apprehension in the minds of growers, as comparatively little damage had yet been done.

Three years later, the advent of Carnation Rust caused a great deal of concern among growers, many of whom thought that this disease would eventually prove fatal to successful carnation culture. The appearance of this disease caused a considerable disturbance to trade, and loss of confidence between dealers in carnation plants; many being unable to definitely recognize the disease, suspected every little defect in carnation foliage to be the Rust.

In 1889, Wm. Falconer wrote regarding Professor Seymour's article :

"This whole question of plant disease is one of vast importance to us, but practical men like myself are absolutely unfit to grapple with the subject; it is a matter for the scientist. We can understand fairly well anything we can see plainly, but obscure diseases bother us. It is not enough for us to say, 'Oh, it's some sort of a fungus.' Be precise, know for a certainty whether it is a fungus or not, and, if a fungus, what fungus it is; also, whether the fungus is the cause or the effect."

The manifest wisdom of Mr. Falconer's suggestion impressed many leading carnation growers, who promptly accepted his advice, and called upon the various scientists whose positions warranted their being competent advisors upon the subject. The American Carnation Society was favored with well written papers, profusely illustrated with the details

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demonstrating the various mycelia which attack the carnation. As the result of these papers and the discussions ensuing thereon, the carnation diseases became familiar to those engaged in growing the divine flower, so that, at the present time, practical growers have little trouble in diagnosing the different forms of fungi which infect the carnation plant.

Carnation Rust (*Uromyces caryophyllinus*)

When this disease was first introduced, about the year 1892, in some localities it spread so rapidly over the carnation stocks, and caused so much damage, as to excite the gravest fear among many that it would ultimately destroy the industry. Happily, this fear was not well founded, and, at the present time, this disease is not considered a serious ailment in most of the establishments where the plants receive proper treatment.

The presence of this fungus is first indicated in the plant by a slight swelling, either on the stem or leaf. The surface of these swellings soon becomes pale, or nearly colorless, as the green coloring matter is destroyed and obscured by the fruiting threads and young spores of the fungus. As the fungus matures, these spores become brownish in color, and the mass lying so closely together, imparts a dark brown color to the colony of fruiting spores. As growth proceeds, the pressure from within ruptures the epidermis, exposing the mass of spores. When the plant is thoroughly infected, the foliage presents the appearance of being thickly covered with dark brown powdery spots.

Rust reproduces itself from two classes of spores. The first, called "uredo spores," germinate readily in a moist atmosphere as soon as they are set free; and as these spores are easily scattered about and over the plants, by winds or draughts, the disease spreads rapidly if conditions favor the growth of the fungus.

A short time after the development of the uredo spores, a second kind of spore is produced, termed the "teleuto spore." These later spores will not germinate immediately after development, but must first pass through a period of rest, serving the purpose of tiding the parasite over any unfavorable periods when the uredo spores might fail to vegetate.

The Rust attacks the carnation in every stage of growth, from the seed leaf to the mature plants, cuttings in the sand bench being particularly affected wherever they are taken from an infected plant. Frequently the plant shows no external evidence of the disease for some considerable time, but contains the threads within its tissues. In such case, the disease develops

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very rapidly among the cuttings, as soon as the roots are formed in the cutting bench.

Many remedies have been advised and elaborately described; but after a thorough trial of most everything that has been put forward as a cure for Rust, I have come to the conclusion that a plant once thoroughly infected cannot be absolutely freed from the disease until it has run a certain course through the tissue of the plant, and exhausted itself.

In an article read before the American Carnation Society, at its annual meeting in 1893, the author recommended spraying the plants with Bordeaux Mixture, or the ammoniacal solution of carbonate of copper. At that time, when Rust first appeared, I had apparently cleared it from the plants, by spraying with Bordeaux Mixture; but subsequent tests, under different conditions, prove the spraying to have but little effect, and, at the present time, I am satisfied that these plants would have recovered from the disease in a natural manner, had they been left unsprayed until the disease had run its course.

Recent experiments by the United States Department of Agriculture seem to demonstrate that, where a fungus infects a certain family of plants, the disease may be wholly got rid of, by allowing it to exhaust itself. It will generally be found that, when the cycle of fungoid growth is complete, there will remain a certain percentage of unaffected plants. By propagating from these, a strain will be produced which is capable of resisting, or overcoming, the attacks of the disease. I am inclined to the opinion, that more benefit will be derived from pursuing this course in propagating carnation stocks, than by any treatment in the way of spraying with different mixtures that has yet come under my observation.

Of late years, we have dispensed entirely with spraying the plants for the purpose of curing them from attacks of Carnation Rust. The disease is located within the tissue of the plant, and the brownish powder given off is but the fruiting spores; so that while we may reach these spores by the different sprays recommended, the fungus itself retains its vitality, and continues to give off these fruiting spores until it is exhausted.

I have never yet seen a healthy carnation plant killed when attacked by the Carnation Rust, although I have frequently seen the strongest and most vigorous plants affected by the disease to such an extent that for a time growth was largely arrested. Nevertheless, after the disease had fruited for a certain period, the plants seemed to recover from the attack, and grew as vigorously as before.

So far as spraying has been tried, I believe that the salt solution,

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which has been recommended in Chapter XII to be used for the destruction of red spider, has a greater effect in the prevention or curing of Rust than any of the other mixtures I have tried.

As a preventive against this disease, the following conditions should be observed: The foliage should be free from any moisture, or condensation, during the night time. A free circulation of air about the plants at all times should be provided. The plants should be kept in a vigorous, growing condition. A close, damp atmosphere, with an abnormally high temperature, favors the development of Rust and other fungi. Probably the most essential feature in preventing these diseases is to maintain a pure atmosphere, as cool and dry as is compatible with healthy growth.

Spraying Formulas Which Have Been Recommended as Curative Agencies for Rust

Bordeaux Mixture.—Take six pounds of copper sulphate, four pounds of quick lime and twenty-two gallons of water. Dissolve the copper sulphate in part of the water; then make a thin whitewash with the lime, to which add the copper sulphate solution; then add the remainder of the water, mixing thoroughly. When using this mixture, it must be thoroughly agitated, so as to prevent the precipitation of the lime and copper sulphate.

Ammoniacal Solution of Carbonate of Copper.—Dissolve six ounces of pulverized ammonia carbonate and one ounce of copper carbonate in ten gallons of water. This should be prepared as it is needed, and should be thoroughly agitated during the operation of spraying.

The following solution has also been used with good results: Dissolve one pound of sulphate of copper in two quarts of ammonia; dilute this with thirty gallons of water, and use as before described.

Carnation Spot (*Septoria Dianthi*)

This is one of the oldest carnation diseases, and possesses certain characteristics by which it is easily distinguished from the other fungi that attack the plant. The Spot is characterized by a circular, or oblong, brownish center, bordered by a dark band, purplish in color. The whitish center of the spot is dotted with minute, black points, which are portions of the fruiting spores projecting through the epidermis to the surface. Whenever the spot is on the margin of the leaf, it will be semi-circular in form. When the spot extends across the larger part of the leaf, the outer portion will die. On the stem, the spot appears as an oblong patch on one side, the border

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not usually so well marked as on the leaf. As a rule, this disease is developed by improper treatment of plants. It also frequently develops upon plants in the open field, when a hot, dry season is followed by a continuous spell of wet, cold weather; and, then again, by periods of intense heat. It may also be easily developed upon freshly transplanted plants, by over-watering and over-spraying the plants before root action is fully established, and by leaving the foliage wet over night, especially where the night temperature is allowed to fall considerably below 45 degrees.

As a rule, where carnation plants are properly watered and abundantly ventilated, this disease will not prove serious. The same spraying which has been recommended for Rust will usually arrest, or prevent, the spread of the Spot; and the same treatment as to keeping the plants in vigorous growth, and also the atmosphere in a pure condition, is recommended.

Fairy Ring Spot (*Heterosporium echinulatum*)

This fungus, which was imported from Europe about the year 1892 or 1893, has been known for nearly a quarter of a century in England. In appearance, it differs from *Septoria Dianthi* in that the vegetable threads, growing within the leaf tissue, exhaust the substance at certain points, so that there appears a nearly circular, light-colored spot. The spores are brown in color, and when produced in great numbers, with the threads, darken the spot. At this stage, the spot possesses different shades of color, according to the number of spores produced. The growth of the fungus from the center of the spot is centrifugal, and the darker color is apt to be arranged in concentric lines, or rings, representing a miniature fairy ring—hence the name.

This fungus is much more injurious to the carnation than the *Septoria Dianthi*, as it spreads more rapidly and destroys the foliage to a greater extent; in fact, I have many times seen the greater part of the foliage taken from plants by this disease.

The same conditions that bring on attacks of *Septoria* will favor the development of the Fairy Ring, and the same remedies are also recommended.

Stem Rot (*Rhizoctonia*)

Probably the most insidious and destructive of the various fungus diseases known to carnation growers is Stem Rot (*Rhizoctonia*). This disease has been known to the American grower for many years, but until within a recent period, it appeared in its destructive form only at rare intervals.

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During some unfavorable seasons, it has destroyed almost the entire stock of several growers. It is caused by a fungus, the spores of which exist in the soil, and it apparently attacks a number of other plants besides the carnation. It frequently attacks plants in the field, causing large loss, but is usually the most destructive shortly after the plants are brought into the houses—in August and September. Thus far, comparatively little is known about the disease, and probably less about preventing it. In my opinion, it may be largely brought about by improper treatment of the cuttings in the sand; also improper potting of young stock; that is, potting the plants too deep; also by planting the young plants too deep in the open ground. It may be also increased by over-watering the plants, and by keeping them in a close, warm, dank atmosphere.

Applications of lime to the soil seem to have a tendency to reduce this fungus, but thus far have not proved a positive preventive. The sterilization of the bench soil also tends largely to reduce the ravages of the fungus; but where the infected plants are taken from the open ground and planted in sterilized soil, the disease continues its course, and the plants are destroyed. In my opinion, if cuttings are taken from healthy stock, and rooted in sterilized sand, then potted up in sterilized soil, and afterward shifted into larger pots, say four to five inches, and held in a frame until June or July, then planted upon benches filled with sterilized soil, these cuttings will remain practically free from the Stem Rot.

I also believe that propagating young stock from exhausted plants has a tendency to increase this trouble, as such stock is deficient in strength, and succumbs much more readily to the attacks of fungi than stock propagated from cuttings taken from plants which are growing vigorously.

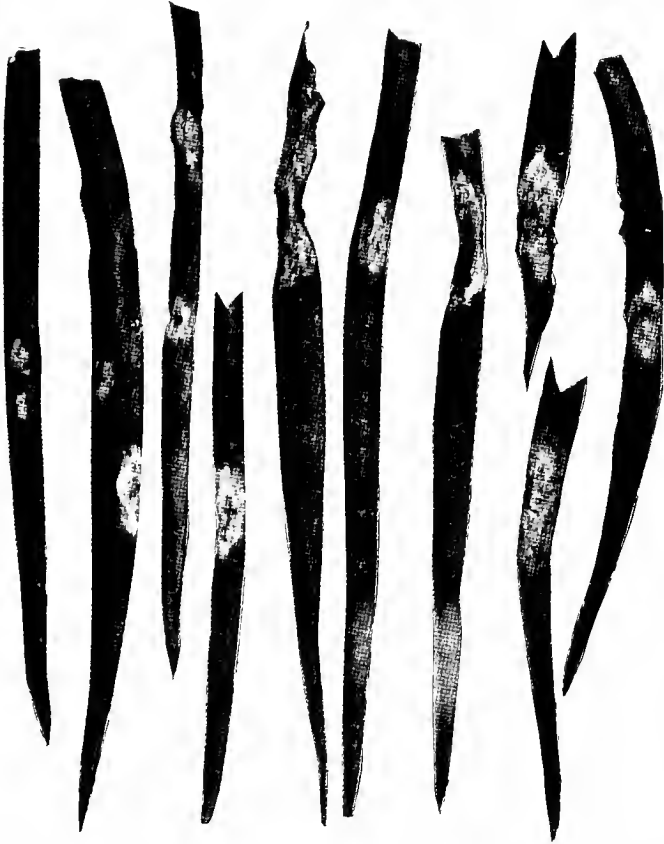
Some varieties are more inclined to Stem Rot than others, and the experiments of the United States Department of Agriculture with disease-resisting cotton plants would seem to indicate that rot-resisting varieties of carnations could also be developed.

There are two kinds of Stem Rot. The first is where the plant dies off at the collar, and the entire plant is lost. This disease attacks the plant very rapidly, and frequently carries it off in a single night. When a bench becomes affected, the mycelium apparently travels through the soil from plant to plant, causing great destruction. Sometimes as much as 90 per cent. of an entire bench of plants has been destroyed by this disease.

The second form of the Stem Rot might more properly be termed "branch rot," as usually some branch, or only a portion of a plant dies. This disease proceeds slowly, and may be usually noted by a single branch grad-

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ually drying up and turning a whitish brown. While at times the branch rot causes much damage, it is not so disastrous as the stem rot.



Carnation Leaves Affected with Fusarium Leaf-Spot

EXTRACT FROM BULLETIN NO. 164, DEC., 1899, OF NEW YORK AGRICULTURAL
EXPERIMENT STATION.

A FUSARIUM LEAF-SPOT OF CARNATIONS, BY PROF. F. C. STEWART.

A very unusual case of *Fusarium* attacking carnation foliage was observed in a greenhouse at Syracuse last November. A bench of carnations of the variety *Emily Pierson* was quite seriously affected with a peculiar leaf spot. The spots varied in length from one-eighth of an inch to one inch. The smaller ones were elliptical, but the larger ones occupied the entire width of the leaf and were irregular at the ends. They were covered with a pinkish gray mold and irregularly dotted at the center with the light yellow spore

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masses of a species of *Fusarium*. Many of the worst affected leaves were dying. The *Fusarium* was evidently parasitic on the leaves, but a careful examination revealed the fact that in every case the spots originated in a rust sorus. It appeared that the *Fusarium* was unable to attack the uninjured leaf, but when the epidermis was broken by rust it was able to enter and bring about decay of the leaf tissue. It is improbable that the *Fusarium* is parasitic upon the rust.

“The writer has occasionally observed *Fusarium* attacking injured leaves and stems of carnations and the spore masses of a similar *Fusarium* are common on the stems of carnations affected with that form of stem-rot commonly known as dry rot or die back ; but we have never before known *Fusarium* to produce a genuine leaf-spot of carnations. Inoculation experiments may show that this *Fusarium* is identical with the one causing carnation stem-rot.”

Remedies and Preventives for Stem Rot

The soil in which carnations are grown through the summer should be frequently changed, and under no circumstances should carnations be planted in the same soil year after year, wherever it is possible to avoid it ; but, instead, a new location should be chosen annually. Sterilizing the bench, potting soil, and propagating sand should be thoroughly done, and should be persisted in until the disease is overcome.

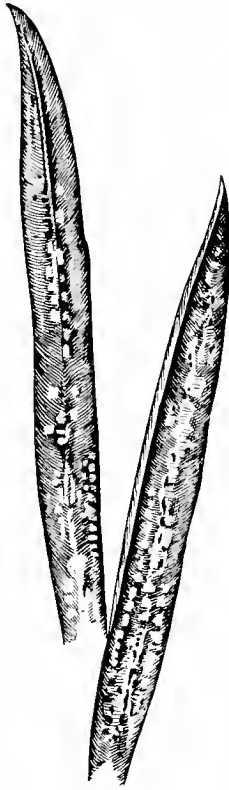
In the preparation of bench or potting soils, too much decaying nitrogenous matter should not be used ; and the soil should invariably be fresh, clean, and well decomposed. Under no circumstances should rank, fermenting manures be introduced into the soil. It is important that the soil in the benches be kept sweet, and in a friable, healthy condition, by close attention to watering. As cool a temperature as possible should be maintained after the plants are benched, and until growth is fully established. The Stem Rot usually disappears, to a large extent, upon the advent of cold weather in the fall, thus indicating that the fungus flourishes best in a high temperature.

So far as I have been able to study Stem Rot in the field, it occurs immediately after the intense heat which we usually have in July and August, and sometimes in September. When we have had a lengthy spell of extremely hot weather, with frequent thunder showers and steaming, hot cloudy days, the Stem Rot seems to have developed to its greatest extent, and caused the greatest damage. Such weather sometimes induces the rotting of potatoes, squashes and melons in the field ; also cabbages and cauliflower ; the disease being called “gangrene” by the growers of the latter crops.

In my opinion, Stem Rot may be largely avoided by propagating from strong, healthy stock plants, and by close observation of sanitary conditions when rooting cuttings ; also by proper treatment of the young stock while

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growing in pots, as well as after it is planted in the field. The disease is, however, largely caused by climatic conditions which are entirely beyond the control of the grower, and in unfavorable seasons it will prevail to a serious extent, no matter how skillfully the stock may be handled. Nevertheless,



Bacteriosis

the most skillfully handled and strongest stock will stand the best chance to grow, and will generally suffer the least.

Bacteriosis

Bacterial disease, which has been called Bacteriosis, shows readily upon leaves recently attacked, in the form of translucent dots in otherwise healthy foliage. It is best recognized by holding the leaf so that the light will shine through it. In the early stages of the disease, these dots are about the size

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of a pin point. Later on they enlarge and run together, and the leaf finally turns yellow and dries up. The presence of the disease can be detected long before there is any indication of it upon the surface, by looking at the leaf held toward the strong light. Recent observations of this disease seem to have determined that it is caused by the attacks of various insects, such as red spider, thrips, and more particularly aphid; and wherever the plants are kept free from these insects, the bacterial disease does not seem to develop. Therefore, the best remedy, or preventive, of this disease seems to be to keep down the insects, and propagate only from healthy, vigorous stock, selecting the strongest plants, which should be kept in active growth.

In general, it may be said that all diseases may be largely prevented, or modified, by keeping the plants in an active, growing condition, avoiding overwatering, overfeeding, as well as the overforcing which ensues when the temperature is carried too high. By a close observation of all these points, and, in addition, providing abundant ventilation, the grower will generally have but little serious trouble with diseases.

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CHAPTER XIV

Packing and Shipping Field-Grown Plants

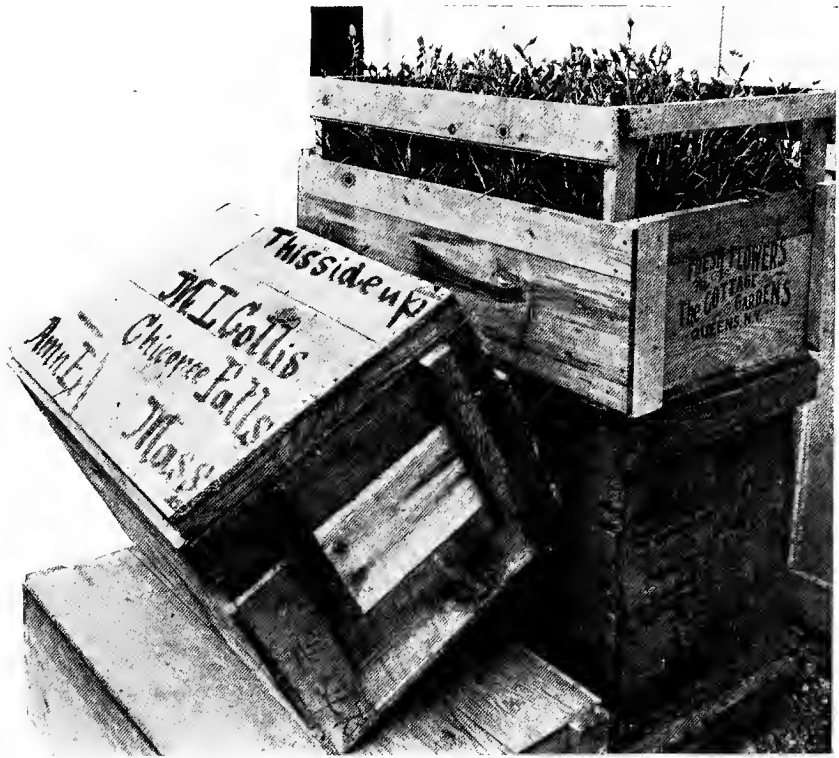
AS a rule, it is not desirable to purchase field-grown plants that must be shipped a great distance, as plants taken from a field near the greenhouses, and transferred to the benches in the shortest possible time, will suffer the least check. However, there always will be the necessity of purchasing more or less field-grown stock which must be shipped from distant growers. The uncertainties of carnation growing are such, that frequently shortages will occur, and these shortages must be made up by the purchase of field-grown plants from other growers, often located at distant points.

Success in growing plants shipped from a distance will not only largely depend upon their condition when taken from the field, but will depend equally as much upon the care taken in preparing and packing the plants for shipment, as well as the care exercised by the purchaser in properly unpacking and treating them upon their arrival, and prior to planting on the benches. Upon the part of the seller, the utmost care should be used to have the plants safely delivered to the transportation company, securely packed in a cool, dormant condition, so that they will not be injured by either heating, or growing, during transit.

Plants should be dug as early in the morning as the foliage becomes dry. They should be placed immediately in flats and carried to a cool shed, the object being to cool them down as much as possible. The roots should not be left exposed in the sun to dry, and in all cases should be covered with moist sphagnum moss; and *the plants should not be allowed to wilt*. In packing, boxes about twenty-four to thirty inches wide, and sufficiently deep to hold the plants without injury, are preferable. The flower shoots should not be bent over, but must stand erect, and free from the top of the box. They should be so packed that an abundance of air may reach the tops of the plants, which must still be protected from the drying suns and draughts. The plants should be boxed up while they are cool, so as to avoid fermenting and heating.

Packing and Shipping Field-Grown Plants

Commence the packing by placing a layer of well-moistened sphagnum moss, about three inches deep, over the bottom of the box. Tilt the box up at an angle of about 45 degrees; then, beginning at the lower end of the box, lay the plants firmly against the end, having previously lined up the end of the box, about six inches above the bottom, with a layer of moistened sphagnum. Put in a layer of plants, then work in a layer of sphag-



Carnation Plants Packed for Shipment

num around and through the roots, and up around the neck, working in about two or three layers of plants with moss, according to size. Be sure that the moss covers the roots thoroughly, so that they will not be exposed to the air; and have the moss sufficiently dampened to remain moist during the entire period of transit. Now take a cleat that will just fit in the box, so it can be nailed through at each end, and press the plants sufficiently

Packing and Shipping Field-Grown Plants

firm against the end of the box, so that, when the cleat is nailed fast, the plants cannot be moved, even when the box is roughly thrown about. Then put another layer of sphagnum moss over the roots of the last layer of plants, and fill in other plants, cleating them in as with the first layer, and continue until the box is filled.

In closing up the box, the cover should be raised from two to three inches above the sides, and should be supported by cleats nailed into the corner. When the cover is nailed on, there should be a circulation of air all around and over the tops of the plants, and every layer should be so thoroughly cleated in that the plants will not fall out, or move, even if the box be turned upside down. Mark the address of the consignee so plainly upon the top and on the end of the box that it cannot be mistaken. Do not fail to print in large letters, "Perishable Plants—No Delay." All this done, the shipment is ready for delivery to the express company.

Treatment of Field-Grown Plants When Received After a Long Shipment

The grower, upon receiving a lot of field-grown plants that have been shipped from a distance, should place the box immediately in the coolest place at hand, and unpack as quickly as possible. It will be best to retain as much of the sphagnum moss as is practicable around the roots. When unpacked, the roots of the plants should be set upon a moist surface, in a cool place, and the tops well moistened with cool water. If they are wilted to any extent, the plants should remain in the cool place until they show some evidence of recovery from the wilt. In some instances, a good soaking of the entire plant in clear water has proven beneficial. They can then be planted upon the benches.

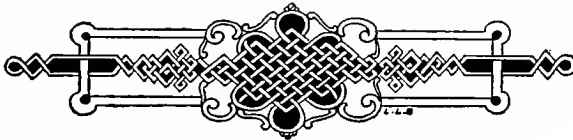
Where plants have been shipped some distance, and are, to some extent, in a delicate condition, it is best to plant them in the benches late in the afternoon, so that they may have the cool of the night in which to commence the first stage of recovery. If they are received upon a cloudy day, they can be planted at any time; but, as a general rule, we have obtained the best results by planting after three o'clock in the afternoon.

Plants received from distant points require rather more shading, and a little closer watch upon the ventilation, than those taken direct from fields near by. It will also take such stock considerably longer to recover, and the results from it will scarcely ever be as good as from the stock grown at home. Such plants are also more liable to attacks of spot, rust, stem-rot, and the other fungous diseases, especially if not properly cared for.

Packing and Shipping Field-Grown Plants

Some carnation growers who receive plants shipped from a distance will allow them to lie in the cases, unpacked, for a considerable length of time; they will also let the plants lie around, and become somewhat withered and dried out. Of course, stock treated in this way will not do well, and frequently the grower receiving it will lose a large proportion; and, having met with such losses, will lay the blame upon the shipper of the plants, instead of ascribing it to the real cause, which is improper treatment upon receipt and planting. There are also shippers of plants who will dig them from the field in a rough manner, and slash them about, breaking off many of the branches; pack them roughly into any sort of a case, and expect the purchaser to receive them without a murmur.

Growers who are obliged to purchase plants from the field in the fall, in order to fill their needs, should buy them as near at hand as possible; but in case it be necessary to obtain them from a distant source, be sure to purchase from a grower who is in the habit of packing and shipping his plants in the best possible condition; then supplement this by properly caring for the plants upon arrival, unpacking them in due season, and treating them in a proper manner during the planting time, as well as after. I have known of large consignments of plants, shipped a thousand miles or more, which have arrived in excellent condition, and have given a splendid crop of flowers; but the chances one takes in shipping field-grown carnation plants such long distances are great, and I doubt very much the desirability of procuring supplies from far distant points, provided good stock of the varieties wished can be secured nearer home.



CHAPTER XV

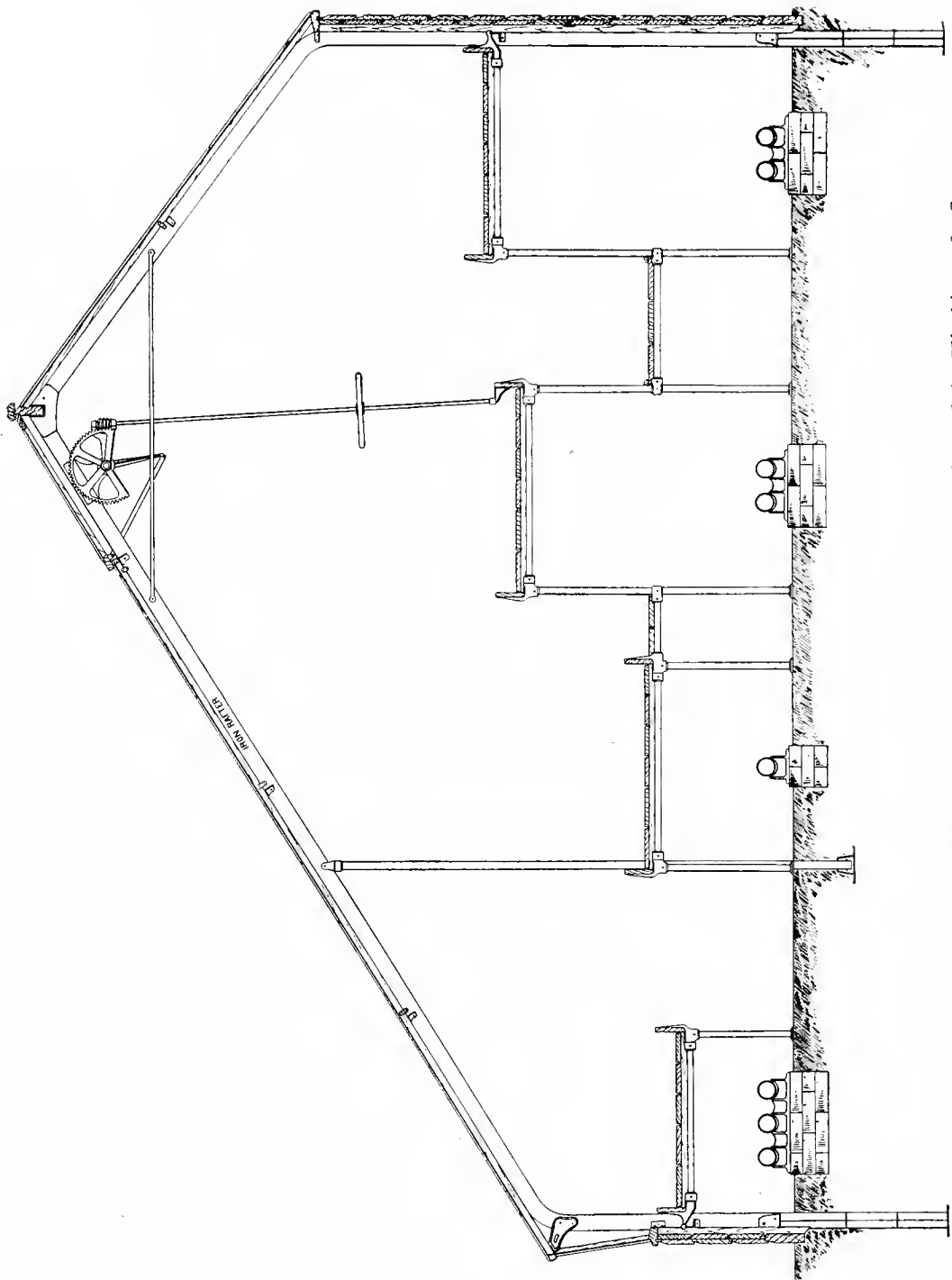
Forcing Houses for Carnations

IN the early days of carnation culture, crude structures were generally used for forcing; in fact, the carnation was treated as a sort of renegade. Almost any bench, or position, that would not grow roses, or some other more valued plant to advantage, was thought good enough for the carnation. The early structures built for forcing carnations were usually narrow, primitive houses, glazed with hot-bed sash, in which the glass



Original Type of Sash House Used for Growing Carnations

was seldom more than eight to ten inches wide. Flowers grown in such houses were naturally much inferior to the splendid specimens now produced in the modern glass structures—the evolution of the past ten years of experimental carnation growing.



Section 01. Three-quarter Span Carnation House as Erected by Hitchings & Co.

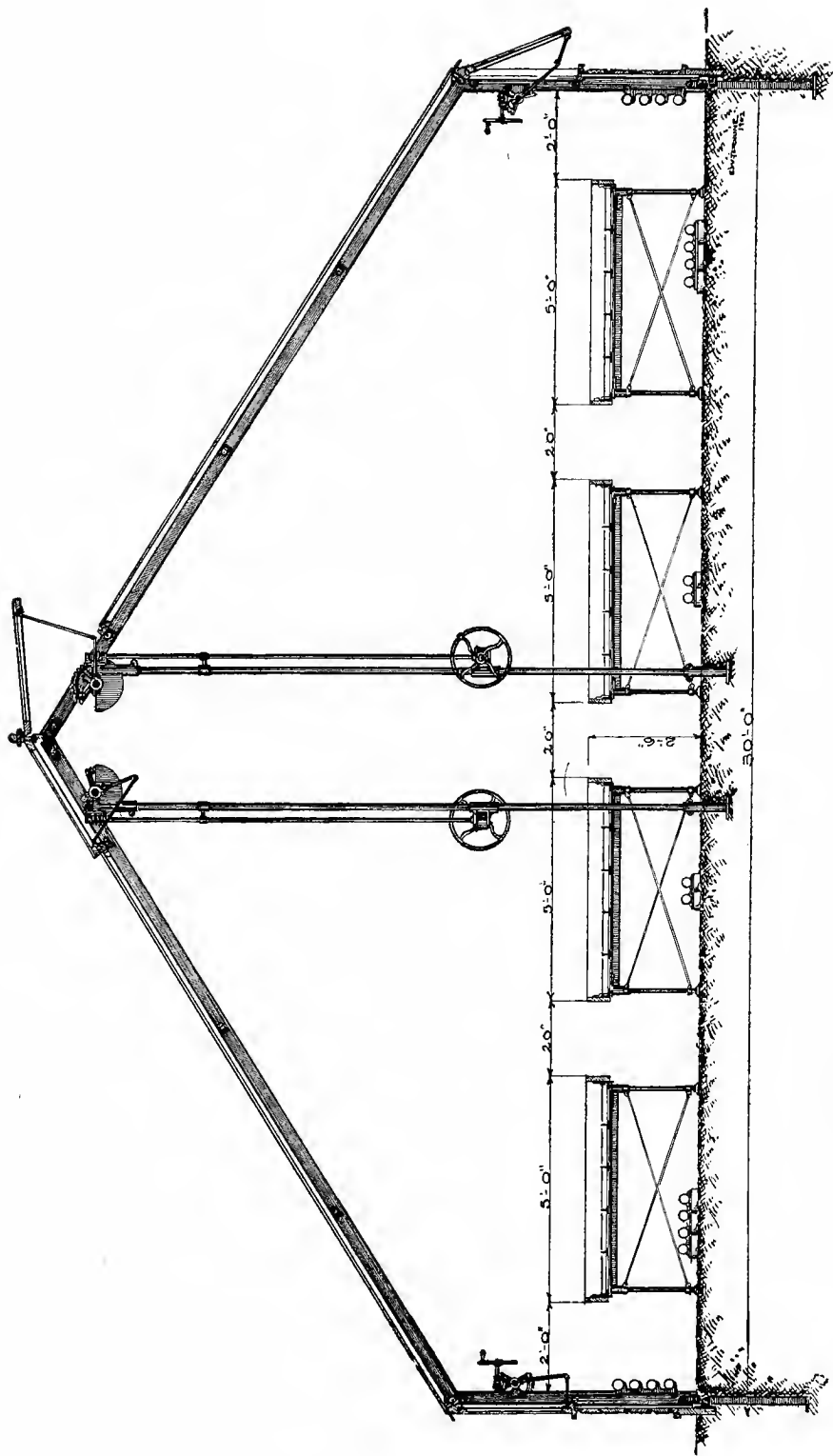
Forcing Houses for Carnations

These narrow houses were, as a rule, poorly heated, and frequently inadequately ventilated, as growers often sought to economize in coal by keeping the houses closed during cold weather. In order to produce the best results in the forcing of any flowering plant under glass during the winter months, it is essential to provide for the admission of the greatest amount of sunlight possible, as well as to furnish sufficient ventilation to keep the plants in a pure, clean, normal atmosphere.

The increasing demand for carnation blooms of larger size, with longer stems, has forced the carnation grower to constant effort and study, with a view of improving, not only his methods of growing, but the structures in which the plants are cultivated.

The various forms of carnation houses now in general use may be divided into three types: the even span, which may be built with a ridge running north and south, or with the ridge running east and west; the three-quarter, or long span to the south, which is always built with the ridge running east and west; and the short span to the south, which might be termed the long span to the north house, which is also built with the ridge running east and west.

Exhaustive trials with forcing houses have demonstrated that for forcing purposes wide houses are preferable to the narrow houses that were exclusively used up to a comparatively recent period; consequently, the most modern structures have been built from 28 ft. to 30 ft. wide and upward, instead of 16 ft. to 20 ft. The length of these houses has also been increased from 50 ft. to 100 ft., up to 300 ft., and even 400 ft. The advantages found with these wide houses are many. In the first instance, the cost of the structure per foot of bench surface covered is relatively less than is the case with the narrow house. Secondly, the cost of heating and maintaining the bench surface at the growing point is relatively no greater in the wide house than in the narrow one, and by some growers is claimed to be less. The increased volume of air contained in the larger houses maintains a more uniform temperature than is possible with a narrow house. The oscillation of temperature is sensibly less in the wider house, and the larger volume of air cools off more slowly than in the small houses. True, when cool, the larger houses require a greater expenditure of coal to raise the temperature to the proper point, but once the proper degree of heat is obtained, it is relatively easier to maintain it than is the case where a smaller body of air exists. In other words, it seems that the evaporation of heat is more nearly in proportion to the glass surface exposed, than to the volume of air contained under that glass surface. Be this as it may, it appears to have been



Section, showing the latest type of Carnation House as built by Lord & Burnham Company

The house is constructed with steel frame and wooden (cypress) capping, set on cast iron posts. Patented ice-clearing cave plates (galvanized). The roof bars secured by metal clasps. Cypress double boarding with paper, and a removable base for the sides below side sash. Furnished with galvanized steel frame plant beds, with cypress sides and porous tile bottoms. Patented ventilating machinery. L. & B. Co.'s self-rolling machinery used for operating the ridge sash. Heated by hot water with pipes hung along the sides for quickly clearing snow from roof and caves.

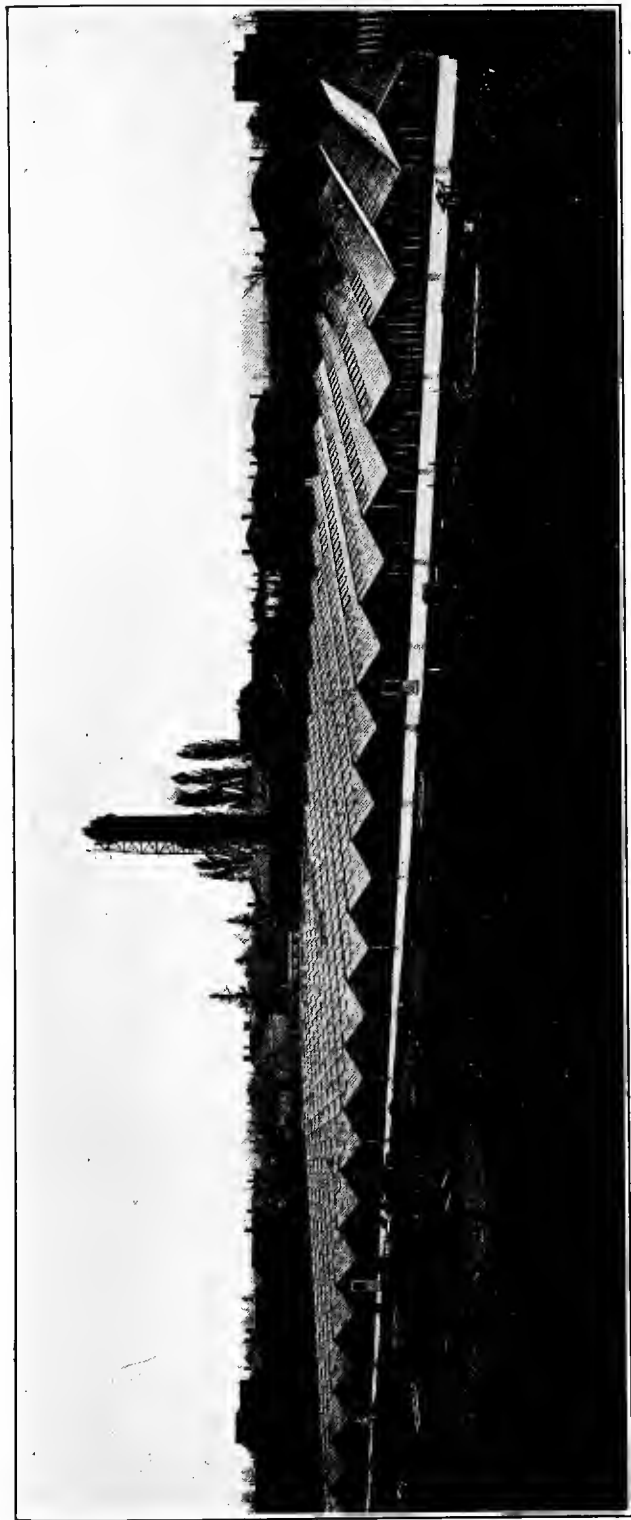
Forcing Houses for Carnations

amply proved that the larger, wider house is more desirable, not only in carnation growing, but in the forcing of many other flowers and plants as well; and at the present time a strong preference prevails among the most advanced growers of carnations and roses for the larger structures, more of which are being annually built.



A Canadian Carnation Range. J. H. Dunlop, Toronto, Can.

The lighter the house (in other words, the more nearly the light in which the carnation plant is forced approximates the normal outdoor light which obtains at the natural blooming season), the better the results obtained, not only in the quality of bloom, such as size, and length and strength of stem, but in the quantity which the plants will produce. For this reason,



A Canadian Carnation Range. The Dale Estate, Brampton, Ontario

This range consists of 21 houses, each 225 feet long by 17 feet wide. There are no divisions between the houses, it being practically a solid carnation field covered with glass. The benches are low down tile beds. The heating is by steam, there being two 1¼ inch pipes on each side of every walk. Steam is supplied by a battery of twelve boilers, the fuel supply being furnished by automatic stokers. All the handling of coal, from the time it is delivered into a chute until the ashes are dumped into a wagon, is done by machinery. The arches, gutters and posts are of iron.

One of the novel features of this range is the manner in which the water from the roofs is carried away. Each gutter support is made of heavy steam pipe and so arranged that the water from the gutter runs down each support through the legs into a drain pipe, thus keeping the roofs entirely free from snow, and taking off the water very rapidly. The roofs are trussed and the ventilators are operated by automatic ventilating machines.

Forcing Houses for Carnations

the size of glass used in carnation structures has gradually been advanced from 8 in. x 10 in., or 8 in. x 12 in., to glass uniformly 16 in. wide and from 16 in. to 24 in. in length, preference being given the 16 in. x 24 in. size, of double-thick glass.

At the present time the general consensus of opinion is that the even-span house, ranging from 28 ft. to 30 ft. in width, built with the ridge running east and west, with ample ventilation at the ridge, sides and ends, is as near the ideal type of carnation forcing house as can be attained. These houses are always glazed with double-thick glass, 16 in. wide; the height of the ridge from the floor being from 12 ft. to 14 ft., and of the eaves 5 ft. Two lines of ventilation, opening on either side at the ridge, are provided. With some growers, especially those whose greenhouses are located in sheltered localities, where the summer temperature rises high, continuous lines of ventilation are provided under the eaves, upon both sides of the house, also upon the ends. This is very desirable where houses are planted as early as July or August, or where the planting is done in the spring and the plants grown in the houses throughout the summer. When the ventilators upon the sides and ends are thrown wide open, and those at the roof are also raised to the fullest extent, a much lower temperature can be maintained than in houses where the ventilators at the sides and ends are absent.

A further reduction in temperature may be secured by liberally watering the walks and the ground underneath the benches, as evaporation of moisture will have a tendency to cool the atmosphere. In some instances, the writer has been able to maintain a temperature of two degrees lower under glass than the thermometer registered in the shade outside. This result may be more readily attained if the glass is shaded, or striped with a solution of white lead, as described in Chapter IX.

The importance of ample ventilation must not be lost sight of; nevertheless, many successful growers, and especially those whose houses are located close by the sea shore, within reach of the salt fogs, as well as those whose locations are upon high altitudes, where their structures are exposed to strong breezes, do not find side ventilation necessary; in fact, claim that it is a detriment. But at Queens we have found it decidedly beneficial and desirable.

Aspect of Forcing Houses

All forcing houses should be located in such a position as will expose the plants contained therein fully to the rays of the sun during the day-



Interior view of Carnation House, 306 feet long by 51 feet wide. Erected by Hitchings & Co., for W. W. Law, Esq., at Briarcliff Farms, Ossining, N. Y.

Forcing Houses for Carnations

time. The houses should be located away from buildings and tall trees, and from under the shadows of hills, or of any object that will shade them from the sun's rays during any portion of the day. The even-span house may be built with the ridge running north and south, but the three-quarter span, and short span to the south houses, should be built with the ridges running east and west, so that the sun's rays will fall upon



House of Carnation Enchantress in a Western Carnation Establishment

the plants during the entire day. Some growers prefer to face the house a little to east of south; others, directly south; others, again, a little west of south; but so far as my experience goes, I have found that properly-constructed houses facing south, or a few points either east or west of south, give practically the same results.

In building a range of glass, it is preferable to erect the houses some

Forcing Houses for Carnations

distance apart, so as to allow a free circulation of air around the houses and through the side ventilators, as well as to prevent the shading of one house by another. Carnation ranges may be built in solid blocks, with gutters between; but experience seems to have demonstrated that such wide blocks of houses will not give as good results, either in quality of bloom secured, or in quantity, as the individual houses situated sufficiently distant from each other to afford ample ventilation and avoid shading. This seems to be especially true where the plants are grown in the houses during the hot months.

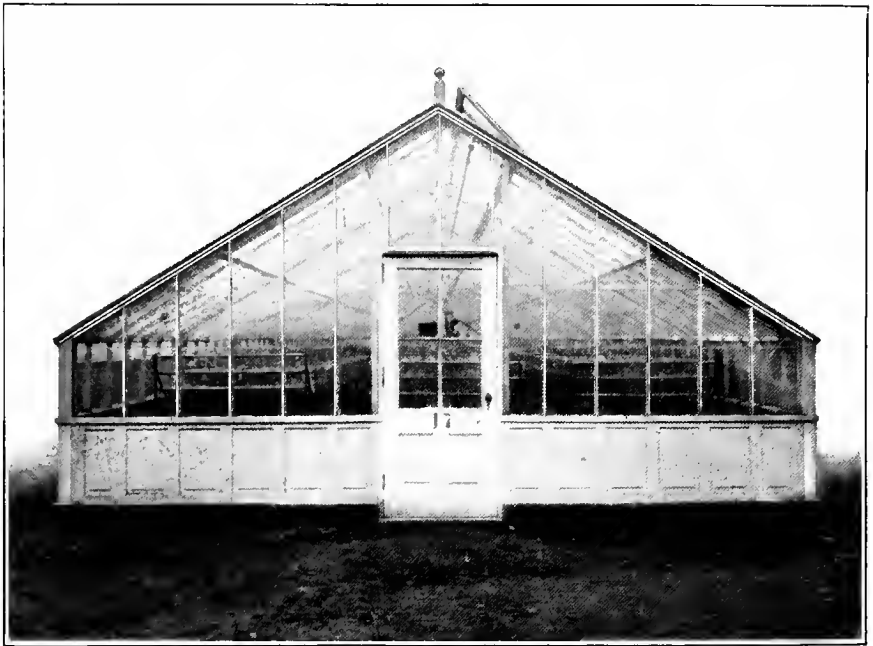
I have been asked many times to draw a plan for the best type and size of a carnation house. My preference is for a house 30 ft. wide and from 200 ft. to 400 ft. long, containing four benches from 4 ft. 4 in. to 5 ft. in width, with a double line of ventilators hinged at the ridge, and a continuous line of ventilation under the plate around both sides and at the ends. On page 151 is shown a cross-section of such a house, giving the dimensions. This house should be glazed with double-thick, first-quality glass, free from all imperfections. The material of which the house is to be built should be either first-class, clear white pine, free from sap, California redwood, or the best quality of gulf cypress, which also should be free from sap. The woodwork should be thoroughly painted with not less than three coats of a first-class quality of white lead in which is mixed a fair proportion of zinc. The priming coat should be brushed on when the wood is thoroughly dry, so that it will take up the oil and bind the paint firmly to the wood.

In building, all ends of the woodwork, wherever nailed together, or fitted into iron sockets, should be thoroughly brushed with the paint used in priming. I consider the iron framework far superior to wood, as it insures sufficient strength to withstand storms, and at the same time is light enough in structure to create the least shade, thus securing the lightest possible house. The sash bars should be as light as is consistent with sufficient strength to hold the glass firmly in place. The glass should be well bedded in first-quality greenhouse glazing putty, after the second coat of paint has been applied to the woodwork, and should be securely nailed, using preferably a glazing nail from one-half inch to three-quarters inch in length, according to the thickness of the bar.

Throughout all greenhouse structures the importance of having the greatest strength in connection with lightness and the least shade, must not be lost sight of, and these conditions are best secured with the iron construction. Furthermore, if properly built, the iron structure will far outlast

Forcing Houses for Carnations

the best wood framework. While the first cost of iron construction may be more than that of the wooden framework, the iron will, in the end, prove the cheaper, because of its superior lasting qualities. Again, the rapid destruction of the forests upon the American continent is surely leading to a steady, permanent advance in the cost of lumber, and the time is not far distant when the iron framework will be fully as cheap, if not cheaper, than that constructed of wood.

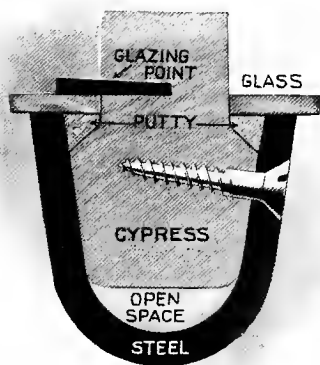


Even-span Propagating House, 20 Feet Wide

While each grower may have his individual preference as to particular styles and forms of houses, it is, nevertheless, a fact, that more depends upon the skill of the grower in the management of his plants than upon particular forms or styles of houses; but a combination of the skillful grower and the better types of glass structure will insure the greatest success in commercial carnation growing.

Forcing Houses for Carnations

New Galvanized Iron U-Bar Construction



New Galvanized Iron U-Bar

the bars being bent at that point and curved glass used. There are no rafters in the house, the entire structure being self-supporting, the U-bars and ties forming a trussed arch. The purlins can be spaced as far as 9 feet apart. The bar is very small, measuring $1\frac{1}{4}$ by $1\frac{3}{4}$ inches over all. The bars are made of steel, U-shaped, and filled with wood, which extends above the U-bar and forms a medium to which to attach the glass and prevents expansion and contraction of the metal bar. The glass is bedded in putty and rests on the edges of the U-bars, which are heavily galvanized. The sides of the house below the plate are of concrete. Practically the only wood exposed on the inside of the house is the doors, ridge and sash, while the only iron exposed on the outside of the house is the sills.

Owing to the formation at the eaves it is claimed that this type of house frees itself of ice much quicker and more thoroughly than any other type, and the claim is also made that owing to the rigid construction and the manner in which the expansion and contraction are guarded against there is practically no glass breakage. The houses present an appearance of extreme lightness, strength and durability and the effect of the whole is exceedingly handsome. The construction is apparently exceptionally durable and the cost of repairs should be reduced to a minimum.

These houses are constructed upon a principle entirely new and a radical departure from the standard type of iron frame greenhouse. The foundation consists of iron posts bedded in concrete, to which posts is bolted an angle-iron base extending entirely around the house. The bars which are bolted to this base extend to the ridge, and are there connected by iron brackets, which also support the ridge. There is no plate or gutter at the eaves,



*Type of U-Bar Semi-curvilinear Roofed Carnation House Erected by the Pierson-Sefton Co. at Briarcliff Manor, N. Y.
(See page 159.)*

CHAPTER XVI

Bench Construction

THE methods of building benches for growing carnations may be divided into four. The first type, and the one most commonly used, is

The Ordinary Wooden Bench Built Upon Posts

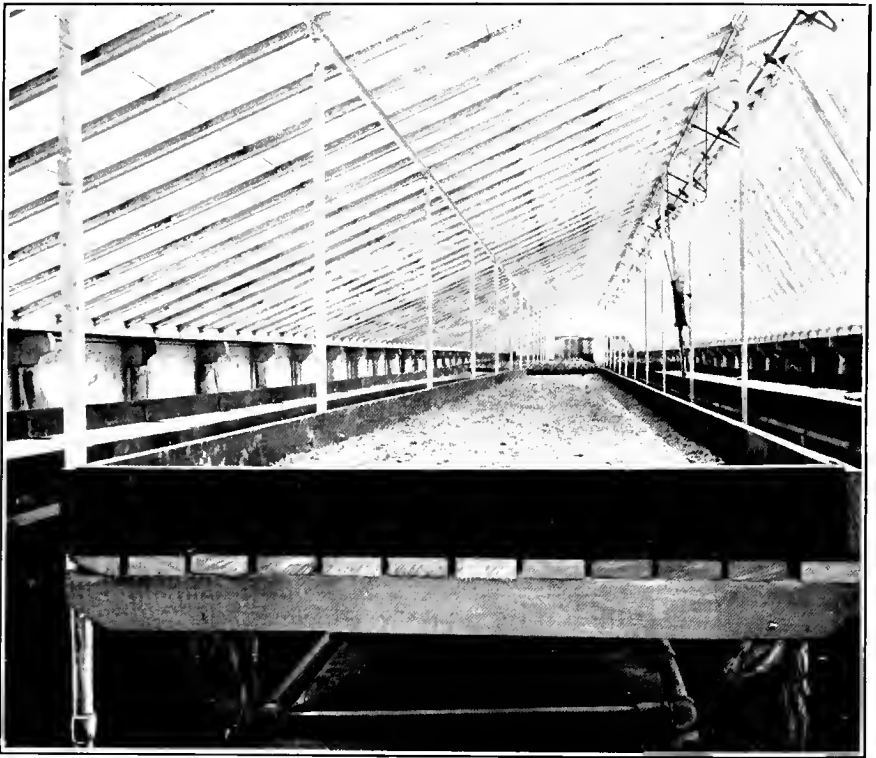
Carnation benches may be made of varying widths—from 3 to 5 or 6 feet. In our practice we have finally decided upon a bench either 4 ft. 4 in., or 4 ft. 8 in. in width. The 4 ft. 4 in. bench holds six plants in a row, and if the rows are planted twelve inches apart, the plants will have ample room and ventilation to fully develop their flowers. The 4 ft. 8 in. bench will also hold six plants in a row, and is built to accommodate varieties of extra vigorous growth. If the bench is made 5 ft. in width, six rows of plants will still fill it. If made 6 ft., another row may be added, but our experience has been that very little has been gained by adding the extra row of plants. The wide benches are also more inconvenient to handle and keep in order, and when picking the flowers. The bench, 4 ft. 4 in. to 5 ft. in width, gives practically as many flowers as the wider bench, and the blooms picked from plants in the center of the bench will be stronger stemmed, and of better quality, than those on very wide benches. The ordinary wooden bench is usually built of $\frac{7}{8}$ -in. to $1\frac{1}{4}$ -in. hemlock for the bottoms, and the sides and bearers set upon cedar, locust or chestnut posts.

Posts

The best woods for posts are the yellow locust and red cedar. Next to these are the chestnut and the white cedar. Sassafras, if the sap formation is shaved off, also makes an excellent post, which will last fully as long as white cedar, or chestnut, and probably longer. The hardy catalpa is also recommended as a lasting wood for posts. The bench should be so planned that when completed the top of the soil will be about two feet six inches above the ground. The posts should be set at least eighteen inches into the ground, and the bottom of the hole thoroughly rammed before setting the

Bench Construction

posts. It is also desirable to set the end of the post upon a good hard brick. In placing the posts, be sure and tamp the soil thoroughly about the bottom, and fill up the hole solid, so that when finished, the post stands perfectly firm. The following method of setting posts has proved very successful: Make up a rough concrete, or grouting, of broken stone, or clinkers, mixed with Rosendale cement; dig the post hole about six inches deeper than



End of Wooden Bench

usual; fill up the bottom of this with grouting to the depth of six inches, and thoroughly ram down so as to make a solid foundation. The post is then set in position, and held, while a few shovelfuls of the grouting are filled around the bottom, and again rammed. The remaining space is then filled up with soil, which is rammed until the post stands perfectly solid.

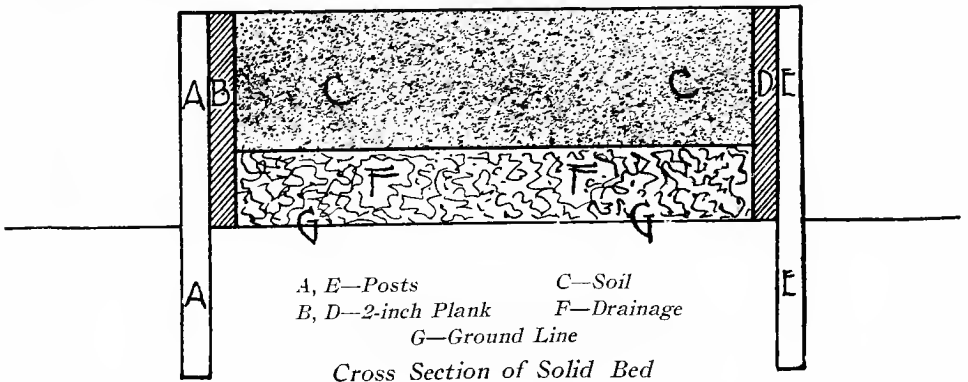
Bench Construction

When this grouting sets, the post is held firmly, and will not settle, and cannot be moved in any ordinary manner. It is desirable to set in this manner only such posts as are intended to remain permanently, as it is quite difficult to remove them in after-years. The posts should be set four feet apart from the centers, so that, when the bearers are nailed on, a 16-ft. board will just cover four sections.

We use $2\frac{1}{2} \times 4$ in. hemlock for bearers, which are sawed, as shown in cut, page 162, illustrating the manner of constructing the bench. The bottom of the bench can be made of hemlock strips, which may run from four inches to six inches in width, and one and one-quarter inches thick. These should be nailed firmly with tenpenny nails so that they will not warp, and should have spaces about a quarter of an inch in width between each strip. A $2\frac{1}{2}$ in. \times 4 in. hemlock scantling, re-sawed, makes a first-class strip for this purpose, and a $1\frac{1}{4}$ in. \times 6 in. cypress or hemlock strip may be used for sides. When this bench is finished, the bottom and sides should receive a coat of Princess Metallic Paint, and the bench should not be filled with soil until the paint is dry.

Solid Beds

An old method of growing carnations still practiced by some florists is in solid beds. While this type of bed has many disadvantages, it has the advantage of carrying the crop of carnation blooms in good condition farther into the summer months than the ordinary raised bench. But during the



winter months it is apt to be slow; that is, the flowers open slowly, and the crop comes late. For this reason solid beds have generally been abandoned. Many varieties of carnations also burst badly when grown in solid

Bench Construction

beds, that can be obtained in perfection upon raised benches. Solid beds are also more difficult to water, and the soil is more apt to become sour and soddened than is the case with the ordinary style of raised bench.

A very good solid bed may be made by setting posts the same distance apart as recommended in the case of the wooden bench; but the posts should not stand more than eighteen inches above the surface of the soil. Then nail strong hemlock planks, one and one-quarter inches in thickness upon the sides of the post, as shown in the drawing. Now put in about six inches of rough cinders and clinkers, or broken stone, for drainage, and upon this place one foot of good soil. Excellent carnations can be grown on such a bench; but, as I have formerly said, in results it has, with us, proved inferior to raised benches; consequently, it has been discarded.

The Ventilated Tile Bench

This is a style of bench which is being used with great success by many growers. It consists in making the bottom of the bench of round, porous drain tile, running from three to four inches in diameter. These tiles may be supported upon timbers, or iron bearers; or a 4-in. brick wall may be built for the sides, the space between these walls being filled with soil, thoroughly rammed down, the tile laid on top of this, and the brick wall continued above the tiles to the height necessary to secure the proper depth of soil.

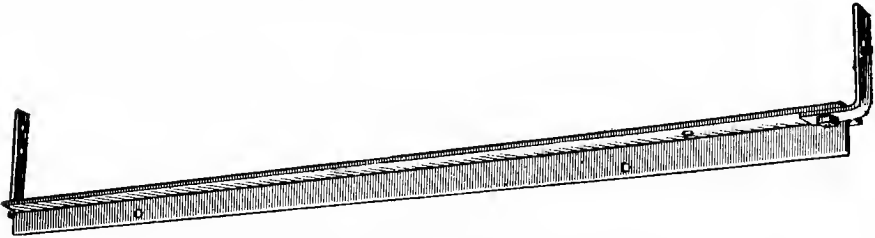
The advantages of such a bench are: First, durability, as the bench is practically indestructible, if properly constructed and used. Second, a good circulation of air is secured under the soil through the tile. This allows warm air to pass under the plants, and gives a steady, but modified, bottom heat. Another advantage in these benches is, that the tiles retain moisture to a considerable extent, and also absorb surplus moisture from the soil, so that a more even and healthful moist condition is secured throughout the entire mass of soil than is possible with the ordinary style of wooden bench.

The Sub-Irrigation Bench

Much attention has been, and will in the future, be attracted by the use of the sub-irrigation bench, which may be constructed either upon the principle of the raised bench or of the solid bed. In general, raised benches are more desirable than solid beds, and this seems to be particularly true in the case of the sub-irrigation bench. The distinguishing feature of the latter is a shallow water-tight tank, which may be constructed in various

Bench Construction

ways, and of different materials. This tank is filled to about half an inch above the sides with either specially constructed porous tile, or soft porous brick, so arranged that there are numerous canals running between the bricks over the bottom of the bench, so that when water is introduced into the bottom of the tank it will rapidly spread by means of these canals over the entire bench bottom. The bricks, or porous tile, will absorb this water



Iron Bearer for Sub-Irrigation Bench

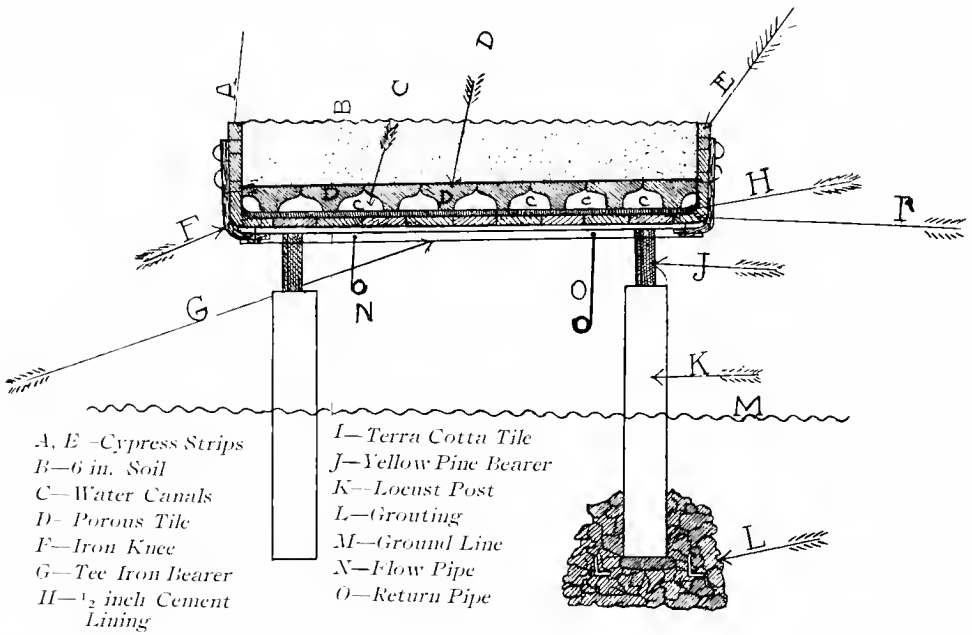
rapidly, and pass it gradually upward through the soil, and in this manner the water reaches the plants by means of capillary attraction and evaporation.

We have constructed a number of sub-irrigation benches upon the following plan: Yellow locust or red cedar posts from four inches in diameter are used. The hole is dug to a depth of a little over two feet, and about six inches of coarse grout, made of cement and clinkers, or broken stone, is thrown to the bottom and thoroughly rammed. The post is then set in the desired position, and the hole filled about half way with the coarse grouting, which is rammed as the filling proceeds. The soil is then filled to the top. A post set in this way is absolutely fixed, and there is no settling or moving. The posts are about four feet apart from center to center, and upon the top of these a yellow-pine bearer, six inches wide and two inches thick, running the full length of the bench, is set on edge and firmly nailed. Into this bearer slots are cut twenty-four inches apart, which are sufficiently wide and deep to hold the tongue of a $2\frac{1}{2}$ -in. T-iron. These T-irons are cut 4 ft. 2 in. in length for a 4 ft. 4 in. bench, and 4 ft. 6 in. for a 4 ft. 8 in. bench. Upon the end of each iron is securely bolted a knee, as shown in the drawing. These irons are placed in position, one iron in each slot. Then they are lined up so that the iron knees will stand in a perfectly straight and regular row. These irons are then securely nailed or screwed to the bearers. Terra cotta tiles, one inch in thickness, seven inches wide, and twenty-four inches long, are now laid upon the T-irons. The end of each tile will catch one and one-quarter inch upon the iron. The sides of the tank are formed by angular tiles. (The shape of

Bench Construction

these tiles can best be seen by referring to the cut on page 167.) In laying these tiles, they are bound together by cementing the ends as fast as they are laid.

A layer of Portland cement, three-quarters of an inch in thickness, is flowed over the tile, forming a complete water-tight lining. The material is made by using the best quality of Portland cement. We have preferred the Dyckerhoff Portland cement for this purpose, as we have had better results from it than from other brands thus far tested. Great care must be used in preparing this cement, the proportions being two parts of pure, clean, fine



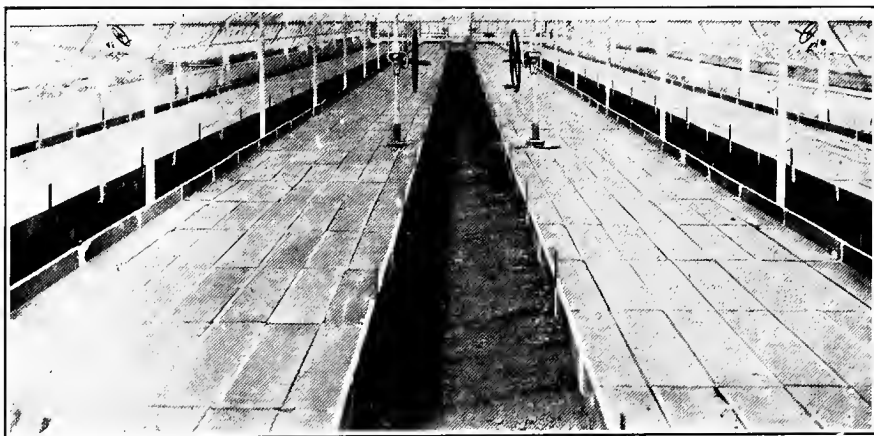
Cross Section Sub-Irrigation Bench

sharp sand to one part of cement. The sand and cement are mixed when dry, and are then moistened by the addition of water until of the proper consistency. While the cement is setting it will be necessary to "trowel it down," as masons call it; that is, to smooth over the cement several times with the trowel. This is done in order to prevent fine cracks or crevices working into the cement.

At every twenty feet an expansion joint composed of sheet lead worked into the bench is made. A cement bench will contract and expand with the

Bench Construction

variations of heat and cold in about the same proportion that iron will contract and expand. If the contraction and expansion are not provided for by means of expansion joints, many cracks will come into the benches at various points, proving a great annoyance and detriment to the successful working of sub-irrigation. By means of these expansion joints the cracks are avoided, and the bench can be maintained perfectly tight. The sides of the bench are composed of cypress strips one and one-quarter inches in thickness, and six inches wide, which are fastened firmly to the iron knees by means of round-headed tinned screws. (See drawing, which shows the construction of the



Sub-Irrigation Bench

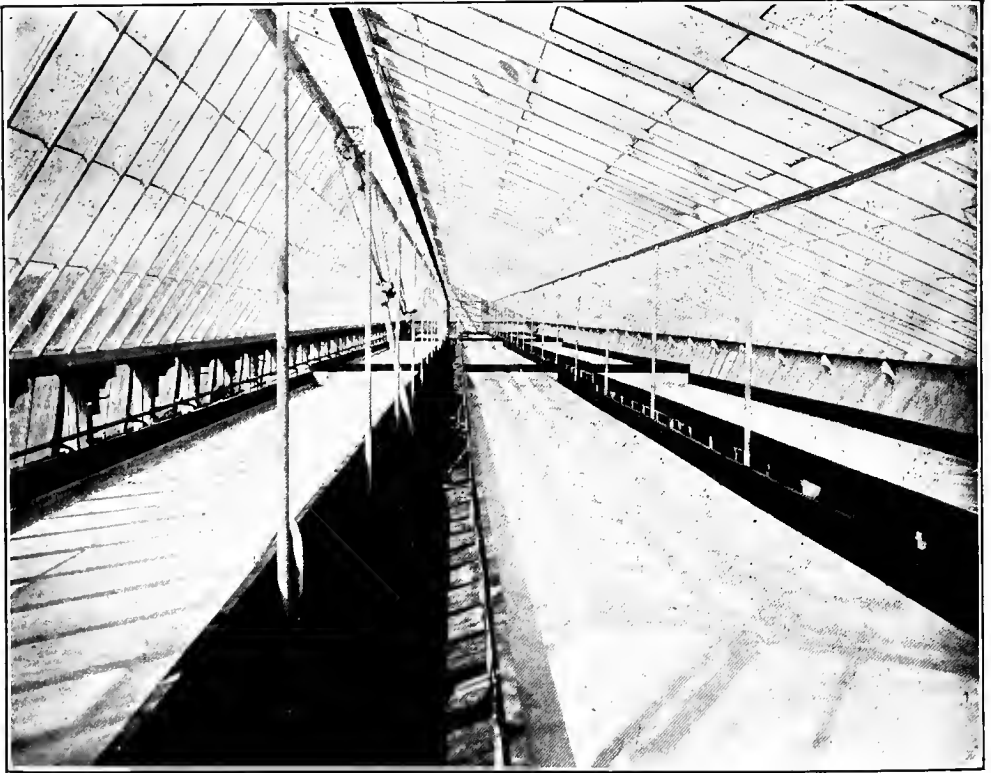
Tiles in place ready for cementing

sub-irrigation bench better than any description can convey.) It is our practice to build these benches in sections about fifty feet in length, the ends of the benches, and the division between the sections, being made by filling in with hard brick, set in the same cement as is used for the bottom. In the center of each division an inch pipe is fitted in the bottom of the bench by means of a collar. This pipe is dropped through a hole made in the terra cotta, and is held firmly in place by short lugs. In making a bench, a wooden plug is put into the end of the pipe and the cement is run around the plug and over the iron collar. When the cement hardens, this holds the pipe firmly. The wooden plug is then removed, and in troweling down, the cement is finished with a slope toward the hole, so that water will naturally drain off the bottom of the bench through the pipe. All sub-irrigation benches should be built

Bench Construction

so that they may be used either for surface watering or sub-irrigation. When used for surface watering, the valves are left open, and the soil is watered the same as with any method of surface watering. The surplus water will drain off through the valves.

Apart from any consideration of sub-irrigation, these benches have the following advantages: they are extremely durable, and will last thirty



Sub-Irrigation Benches

Ready for Irrigating Tile—Showing manner of building on sloping ground

years or more with proper care, and there will be very little expense in renewing and repairing them. If yellow locust or red cedar posts are used, they, when set as above described, will also last fully as long as the bench. The yellow-pine bearer, which is thoroughly painted on all sides and the ends, the slots in which the iron bearers rest being also painted, will likewise

Bench Construction

last as long as the other wooden parts. It will be best to paint the iron bearers, as well as the iron knees, with at least one coat of Princess Metallic Paint. If two coats can be given, so much the better. The wooden sides, composed of cypress, if painted with Princess Metallic Paint, will last several years, and can be easily renewed by taking out the screws and putting on a new piece. The iron knees should be occasionally painted; at least, whenever the sides are renewed. Ordinary stove bolts, with countersunk heads, are used in holding the iron knees to the bearers.

This bench is a better one for growing plants under the surface-watering system than is the ordinary wooden bench. It possesses one cardinal advantage, and that is the mass of moist brick which underlies the soil. This brick serves as excellent drainage, and it also holds the heat which arises from the steam pipes, giving it off to the soil in a modified condition; and when the steam pipes are shut off during the daytime this heat is still being slowly passed off and upward through the soil. Upon benches constructed in this manner we have been able to secure better average results than those obtained from any other style of bench which we have as yet used; but under the ordinary surface-watering system I am of the opinion that the ventilated tile bench first described will be practically as good. The disadvantage of this sub-irrigation bench is its first cost, as it is probably more expensive to build than any of those mentioned. Such a bench will cost from one to two dollars per running foot, according to the price which the builder must pay for his posts and iron.



CHAPTER XVII

Sub-Irrigation

ABOUT the year 1890 the attention of florists was aroused by a new method of watering greenhouse plants grown in benches, which was originated by the Ohio Experiment Station, and called "sub-irrigation." Various modifications of the original system have been evolved by other experiment stations, chiefly those of Wisconsin, New Hampshire, and Indiana. Briefly described, this system consists of introducing water under the soil, either by the use of porous tiles laid at intervals throughout the soil, or by constructing the bench so as to form a shallow, water-tight tank, in the bottom of which are placed porous tiles of various forms; the principle in each case being that these tiles form a number of canals, through which water is introduced to the bottom of the bench, under the soil, and is absorbed by the tiles, and passes upward and evaporates through the surface of the soil by capillary attraction. This method of watering plants has been used to some extent by the forcers of vegetables with considerable success. It seems to be gradually gaining ground and coming steadily into use, although its universal adoption will be very much hindered by the large expense attending the construction of practical sub-irrigation benches.

Sub-irrigation exists in a state of nature wherever water is either standing or moving underneath the soil; and it also takes place at the banks of rivers or streams by the percolation of water upward through the soil by capillary attraction. It is probable that a considerable percentage of the fertility of river bottoms, or of lands lying along, and contiguous to, constant streams of water, is due in some measure to the steady source of moisture furnished the adjoining soil by capillary attraction, herein named sub-irrigation.

The success of the growers of celery in the famous celery districts of Michigan is due in a large degree to sub-irrigation, as the best celery grounds are reclaimed swamps, or low lands lying along creek bottoms, which have within a few feet underneath the surface a constant flow of water, which

Sub-Irrigation

percolates upward through the soil, affording the roots of the plant a steady supply of moisture. It is upon such lands that the finest crops of celery are grown.

In many parts of Europe, notably in Holland, and to a small extent in the cauliflower districts near Erfurt, Germany, crops are grown largely upon sub-irrigated land. This is particularly true in the reclaimed districts of



*Sub-Irrigation Benches
Testing the Cement Tanks for leaks*

Holland, which produce such enormous crops of fine bulbs and such quantities of various plants and shrubs. In these districts, which lie beneath the sea level, and which would be overflowed were not the water kept down by a system of pumps in constant operation throwing the water over the dykes into the sea, plants never suffer from lack of moisture, as within a

Sub-Irrigation

short distance beneath the surface a continuous supply of moisture exists; the result being that in Holland many classes of bulbs, shrubs and trees are grown better and cheaper than in almost any other portion of the globe.

Sub-irrigation has been applied to the growing of carnations to a considerable extent, and has been practiced by the author at Queens for the past seven years. The results of the experiments carried on during that period have been rather in favor of the sub-irrigation bench as compared with surface-watered benches. The chief objection which has been found to the former benches has been their first cost, as they are rather too expensive for general use by florists with limited capital. This, to some extent, is largely overcome by the permanency of the structures once they are installed, as a sub-irrigation bench, properly built, will last as long as ten ordinary wooden benches, and in the end cost considerably less. The other objection is that while better results can be secured if sub-watered benches are properly handled by skillful growers who have had experience with them, the work requires more judgment and a higher degree of skill. This is largely offset by the fact that, with plants growing upon sub-irrigation benches, a grower can care for the watering of two or three times the area of bench surface that he can handle on the surface-watered bench, as much less labor is needed in watering; and growers who have once mastered the management of such benches prefer them to the surface-watered ones. It may be said, however, that in the hands of a careless grower the sub-irrigation bench is more dangerous than those surface-watered, for the reason that when once the bench is over-watered it takes a long time to dry out properly; whereas with the surface-watered bench, even if it is over-watered, the drainage from the bottom and the evaporation from the top, and the stronger degree of heat to which the bottom of the bench is subjected, cause the water to evaporate much faster and the soil to dry out in much less time than is the case with an over-watered sub-irrigation bench.

The soil in sub-irrigation benches is generally in a better mechanical condition than in a surface-watered bench, providing the watering has been done with proper skill and judgment. As before said, the danger with the sub-irrigation bench lies in over-saturating the soil with water, thereby destroying the young feeding roots. However, if the sub-irrigation bench is treated properly, the plants will not only make a generally better growth than upon the surface-watered bench, but the stems will be longer, the flowers larger and of better substance, and the crop will be increased a notable percentage. Where sub-irrigation benches are operated as they should be, the lower portion of the soil becomes filled with roots, and these

Sub-Irrigation

will even extend down through the crevices of the brick or tile, frequently partially filling the water canals. It would seem to be unnecessary to state that a sub-irrigation bench should not be intrusted to the care of a novice in growing carnations, but should always be in charge of some skilled grower who has had experience and practice in its management.

When sub-irrigation was first broached to carnation growers it was thought by some that it would prove a preventive of all diseases, and that



Section of Sub-Irrigation Bench

Showing Carnations growing under Sub-Irrigation treatment—Note how roots extend through soil to floor of bench and crawl over bench floor

we would not be troubled with such insects as red spider; but this has not been proved by actual use, for red spider, once introduced upon plants in a sub-irrigation bench, propagates there the same as upon those grown upon other types of benches. But it may be said in favor of the sub-irrigation bench that plants growing thereon are in a stronger, more healthful

Sub-Irrigation

condition, and for this reason may be better able to resist and overcome the attacks of certain classes of insects. As a rule, plants are less affected by stem-rot upon sub-irrigation benches than upon surface-watered ones, but this cannot be stated as *absolute*.

In practice, it has been found that the soil upon the sub-irrigation bench



Sub-Irrigation Tile

Showing Carnation roots growing around and attached to bottom of tile

is maintained in a more open, friable condition than upon the surface-watered bench. This is readily understood, because the water evaporating and passing upward through the soil has a tendency to lift or lighten the soil; whereas in the surface-watered bench, the water, being poured upon

Sub-Irrigation

the top of the soil generally from a hose, and in considerable quantity, passes downward and compacts the soil, so that upon a surface-watered bench that has been some months in operation the soil frequently becomes almost as hard as a brick when dried.

There are a number of systems of constructing sub-irrigation benches.



Sub-Irrigation Bench

Showing manner of laying Terra Cotta foundation and protecting supporting columns

One of them is described in Chapter XVI., which deals with bench construction. Several thousand running feet of these benches have been in operation at the Cottage Gardens for several years past, and have, as a rule, produced better average crops of flowers, both as to quantity and quality, than have been obtained upon the surface-watered bench with the same varie-

Sub-Irrigation

ties of plants, grown under approximately the same conditions. In some instances the product of the sub-irrigation bench has been nearly one-third greater in money value than was secured from the surface-watered bench, from the same variety grown in the same soil and in the same house; that is to say, as near as it is possible to obtain the same conditions.

I have not been able to determine that plants grown upon sub-irrigation benches are more exempt from disease and insects than those grown upon surface-watered benches, excepting, as before stated, that the plants may be in a more vigorous growing condition, and thereby able to withstand and throw off the attacks of insects and the various plant diseases. A better average growth will usually be secured from the sub-irrigation bench where it is properly handled, for the reason that underneath the soil there is always a mass of moist brick, which gives off the water very slowly to the soil when the bench passes to the dry side. This, of course, affords a more constant and even supply of moisture for the plant's use, and renders impossible the drying out of the bench soil from underneath, which sometimes occurs in surface-watered benches, especially in very cold weather, when high firing is necessary. One of the principal advantages that seems to arise from the use of sub-irrigation benches is that the mass of cement and tile at the bottom of the bench absorbs the heat from the steam pipes and passes it gradually upward through the soil, so that where high firing occurs this shield of brick or tile between the hot steam pipes and the roots of the plants is a decided benefit. Again, when steam is turned off, these tiles remain warm, and continue to give off a moderate heat to the soil; and, in my opinion, this even, moist condition at the bottom of the bench, and steady, modified heating of the soil, tend to a more regular and stronger growth of the plants, as well as a greater production of flowers. This is shown by the fact that plants upon sub-irrigation benches usually produce flowers with stems three to four inches longer, and from 20 to 25 per cent. stronger, than those obtained from plants growing on surface-watered benches.



FANCY FLAKED

PLATE III. CARNATION PROSPERITY (MILES)

CHAPTER XVIII

Greenhouse Heating

AS a rule, the florist should consult a practical heating engineer when installing his heating plant. Every greenhouse establishment furnishes its own problems and peculiarities in heating. These can be best studied out and provided for by a practical man experienced in heating problems. For this reason I will not attempt to give advice as to laying out and installing heating apparatus, but will briefly describe the most important systems in general use among florists. In writing this chapter I have been ably assisted by Mr. E. S. Titus, of Hempstead, Long Island, who has had ample experience in installing greenhouse heating apparatus, and who erected the one in operation at the Cottage Gardens.

Modern greenhouse heating is accomplished by two systems, *steam* and *hot-water*, and these are varied in several ways.

Hot Water Systems

There are a number of hot-water systems which are more or less distinct in character. Three of these are widely used among florists.

The Open Expansion Tank Method

The first to be described is the old system, with open expansion tanks, which is operated under low pressure. In the beginning, a type of heater made of cast iron, technically called a one-piece boiler, was almost universally used. This type of heater, although somewhat crude in design, was fairly efficient. The radiating surface employed was made of a four-inch heavy cast-iron pipe. The expansion of water was taken care of by numerous open cast-iron tanks connected to the highest and most distant points of the heating pipes. These tanks also formed a medium for the liberation of air from the water contained in the apparatus.

On account of the low expansion tanks this system necessarily required a low head of water, and correspondingly low water temperature, the actual boiling point being only slightly above the normal, or 212 degrees Fahr. In practice, a radiation temperature of 150 degrees is rarely exceeded.

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In recent years a type of heater, made of cast iron, in sections, or the so-called sectional boiler, has been employed quite largely. Notwithstanding its crudeness, and the cumbersome appearance of this system, it has enjoyed a remarkable popularity among florists, and its simplicity of operation, and general durability, have kept it in the front rank for heating florists' establishments of moderate size.

The Pressure Method

In the second, a "pressure system," with open tanks, which are set from twenty-five to forty feet above the heater, two-inch and two and one-half-inch wrought pipe is generally used. The practical working of this system differs in reality from the first only in that the expansion tank is set at a higher elevation, thus increasing the pressure and boiling point.

Assuming the water line in the expansion tank to be thirty-five feet above the top of the heater, a pressure of fifteen pounds per square inch in the boiler would be obtained, thereby raising the boiling point to 250 degrees Fahr. While the old style of one-piece heater, in some cases, is not sufficiently strong to safely withstand this increased pressure, the sectional boilers possess ample strength to do so.

The cast-iron sectional boiler is so well known that little comment thereon is necessary. It is efficient, fairly economical and durable, and safe as well. Wrought-iron or steel tubular boilers of several different types are also largely used in the hot-water system. The two most frequently met with are the horizontal-return tubular and the firebox boiler, of locomotive or similar type.

Sectional Boilers

A sectional boiler for hot-water heating should be designed with the greatest care. If the sections are bolted together, the bolts should in no case pass through the water spaces, but through the legs, outside of the water spaces. It is very important in hot-water apparatus that friction should be reduced to the minimum. It has been found by actual experience that the efficiency of some apparatus is much impaired by these bolts. If the sections are connected together by drums and nipples, particular attention should be given to the size of these, for if the openings in the connecting drums are unduly small the circulation will be retarded, and this means a serious impairment in the efficiency of the heater. This type of boiler should have about one square inch of grate surface for every 1.3 square

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feet of radiating surface. If a fireman is on duty all night, the proportion of radiating surface can be somewhat increased.

Firebox or Locomotive Boiler

The "firebox boiler" has many friends among florists. Its efficiency is fair. It is easy to fire, and is safe. It has, however, some weak points. The legs of a locomotive firebox have much surface exposed to the atmosphere, and, in consequence, are very vulnerable to corrosive effects. A greenhouse boiler is out of commission about half the year. During this period of rest the firebox is in a condition of extreme exposure. If the grates are left in, with an accumulation of ashes either on the grate or in the pit, in contact with the boiler legs, they will absorb moisture from the air and incite active corrosion wherever they touch the boiler. A little care would practically obviate these defects, but the average florist stops firing as soon as warm weather renders it unnecessary, and probably does not look at his heating apparatus again until the approach of winter. He who neglects a locomotive firebox boiler in this manner will soon find in it numerous holes.

While the circulation of water in the locomotive type of boiler is not ideal, it is, however, fairly good. In this type of boiler there should be not less than three openings, or inlets, for return water; that is, one inlet in each of the three sides of the firebox, which openings should be near the bottom, or below the grate. It will improve the circulation if these openings are connected into one trunk.

Horizontal Tubular Boilers

The horizontal tubular boiler is probably the most efficient, and the safest heater for general florists' use. It should be set higher at the front than at the back. This elevation should be not less than twelve nor more than twenty-four inches. The boiler should be built longer than the regular type. It should have no drum on top. The tubes should be of iron, and not steel. The shell would undoubtedly last longer if made of iron rather than steel, but it is now practically impossible to build boiler shells of iron, as iron plates cannot be had except after months of waiting, and then at a prohibitory cost.

During the inactive season steel tubes corrode much faster than iron, for which reason the increased cost of iron tubes may well be afforded. This type of boiler, which is the ideal one for hot-water circulation, is effi-

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cient, safe, and economical. The inlet should be in the bottom, at the rear end. The hole should be large, and reinforced with a wrought flange, riveted on. The outlet should be of the same size as the inlet, and situated in the top, as close to the front end as practicable. In this case there is a natural flow of water from the inlet at the lower end of the boiler to the outlet at the upper end; a natural rising of the expanding water through an unobstructed space, with an easy flow, like the current of a river. In all the other types this flow is more or less obstructed.

Practical tests made to ascertain the amount of friction in different types of boilers have demonstrated that the horizontal tubular boiler, set as above described, with a carefully-designed radiating system, will respond readily to hard firing, and show at high temperature a difference of not more than three degrees Fahr. between the outward flow and the return. The writer has never been able to get anywhere near as good a result in any sectional or firebox boiler. The florist seeking a hot-water heater can make no serious mistake in selecting any one of the three boilers described, as all do good work.

The Closed or Perkins Method

We will now consider the third system of hot-water heating, namely, the so-called closed, or Perkins method. This differs from the other two alluded to above by having an increased pressure. In this system, which is sealed tight, the usual installation includes an expansion tank filled with air. After the apparatus has been fired sufficiently to expel all the air from the water, the entire apparatus is sealed air-tight. The air in the expansion tank provides an elastic medium which allows for expansion of the water contained, when heated. There is but one point gained—if it be a gain—and that is, the increased pressure will allow of a higher water temperature in the radiating coils. The entire apparatus is vulnerable to leaks, and in practice is very complicated, and there would seem to be no excuse, or reason, for its employment by florists. The second system described will allow of a water temperature of 212 degrees and over. Few florists care for more.

The Pump Method

Before passing the subject of hot-water heating it may be interesting to mention another type of apparatus which may be adapted to such installations. I allude to a system in which the circulation of hot water is impelled by mechanical force, such as a steam or belt-driven pump, which may be operated either by an engine, an electric motor, or a water motor. In the

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writer's opinion there are many features about a hot-water apparatus of this type which especially commend it for the heating of large greenhouse establishments. Inasmuch as the factor of friction in the boiler and pipe circulation is overcome by mechanical force, there will be no longer the necessity to hold fast to the large water mains and runs which are absolutely essential to every hot-water heating apparatus in which the circulation is impelled by heat and the resulting expansion of water. If we assume that the difference in temperature between the outflow and the inflow of the boiler is less than 19 degrees Fahr., say, outflow 180 degrees and inflow 170 degrees, a cubic foot of water would increase in weight 22-100, or an increase of .0036 per cent. per pound. Assuming the apparatus to contain one ton of water at the point of entrance to the boiler, this ton would be increased by 7.2 pounds. Allow a fall of six feet in the apparatus, and we have a power of 43.2 pounds to keep one ton of water in motion, to overcome the friction in the heater and a long run of pipe containing many short bends.

It is this small and insignificant force which the engineer has to husband so carefully in order to make the hot-water job efficient and successful. The pump, as a compelling force, does away with all this refinement of calculation, and he is free to use such small radiating pipes as one and one-quarter-inch, one and one-half-inch, or two-inch, if he so elects. The mains may be materially reduced in size. In short, we have now an apparatus as compact and neat in appearance as any steam system can be; a system absolutely noiseless, and under almost perfect control. The heater might be managed to maintain automatically a boiler temperature proportioned to the requirements caused by variations in the outdoor temperature. The operator controls the heat in a block of houses by regulating the speed of the pump. The heat in each individual house, or side of a house, is regulated by opening or closing the valves on the runs, which should be gate valves.

In a layout on this system, pipes could be run practically regardless of height in pitch in relation to boiler, which in the other three systems must be carefully considered. It must, however, be admitted that such a system leads slightly away from the highest economy, for having started out to overcome friction by mechanical force, one must consider that this increase of friction means an absorption of heat units from the furnace; that is to say, whatever excess of friction there is must be measured by its equivalent in coal. In the opinion of the writer this loss is so slight, and

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the general efficiency and easy control of the plant would be so much increased, that such loss should not be considered as a bar to its use.

Such a plant could be made a combination steam and water installation, using steam in cold weather and water in mild weather. As a temperature of 200 to 230 degrees Fahr. could be readily maintained throughout the entire radiation surface by water, there seems to be little reason for making steam a factor in it. There would, theoretically, be less friction in the steam, though air valves and joints would bring the two systems about on a level as to economy.

With care and watchfulness, a temperature of 280 degrees would be entirely practicable at fifty pounds pressure. Given an installation of this design, to start with you have an apparatus perfectly adapted to all weathers; in mild weather, a slow fire and a slow movement of the pump; in cold weather, a rapid fire and a more rapid movement of the pump.

In this installation the pipes could be of the same size throughout as with the steam system, with the material advantage that the mains could be run practically at will, and with less regard to location, than with the usual gravity system. With the usual valves, the fireman would have perfect control over his entire system. The loss of heat units in the power required to move the water through the apparatus would probably be no more than is absorbed by the pump in lifting and returning the water of condensation in the positive return steam apparatus.

Steam Heating Systems

There are three systems of steam heating which are common among florists: *First, the Gravity System; second, the Positive Return System; third, the Vacuum System.*

The Gravity Method

The gravity system, as its name implies, is dependent on the weight of its condensed steam, or water, for the proper return of such condensation to the boiler, and is, perhaps, the most desirable of all systems for the average florist. Indeed, this is the only steam-heating system which fully meets the necessities and numerous exactions of the florist who does not employ a night fireman, his requirement being a simple apparatus which needs comparatively little attention, and which should, in a measure, be automatic in action. The radiating surface should be readily controlled by the operator. The boiler should be easy to fire, and the entire apparatus durable, with no features in construction likely to need frequent or costly

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repairs. The gravity system of steam heating fully meets the above-mentioned requirements. The apparatus is made automatic by draft regulators, which are controlled by steam pressure. The regulators are adjusted to different pressures, allowing a change of steam temperature to suit the weather. Here the automatic feature ends. The fireman must do the rest, keeping a clean fire, and replenishing with coal at the proper intervals. The proper distribution of heat must be controlled by opening or closing the valves until the required temperature is obtained.

The installation of such a plant is comparatively simple, and does not require more than ordinary mechanical knowledge. The constructor should carefully consider the following salient points in making his layout for the job: The boilers should be set with care, on solid foundations. A substantial chimney, with dimensions in proportion to the size of the grate, should be provided. A good draught is of the utmost importance, as no efficient heating apparatus can be maintained with a poor draught. The steam mains should rise directly from the boiler, and pitch away from it, and the size of the mains should be in proportion to the amount of radiating surface carried in the coils.

There should be no deviation from the rule which disallows any opposition of steam and water currents. All water of condensation should travel in the same direction as the steam, and never against it. The lowest parts, or ends, of the steam runs should not be less than twenty-four inches above the water line of the boiler. If forty-eight inches can be obtained, so much the better. The check valve on the return main at the boiler should be of the best construction, and easy of operation, be kept properly cleaned and in order. The radiation pipes are usually one and one-quarter inch or one and one-half inch. The steamfitter should be careful to allow for expansion of the pipes by heat; otherwise, frequent leaks will occur at points where this expansive strain exerts itself most.

The Positive Return Method

The second, or positive return system, differs from the first in that the water of condensation is returned to the boiler by positive means, such as a steam pump or injector. This system does not differ materially in layout from the first, except that the factor of friction is not so important, and the size of the steam mains is not so arbitrary. The steam mains may be considerably smaller than in the ordinary gravity system.

There are a number of plans employed in the installation of this system. One plan is to carry a boiler pressure of one and one-half to ten

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pounds, and also some other power, such as an auxiliary boiler at higher pressure, or electricity, to drive the pump which returns the water of condensation. In some cases the water of condensation is conveyed to an open well, or reservoir, and from there into the boiler. Another plan, and a more common one, is to carry the return water directly into a receiver at the suction end of the pump. If a steam pump is used, it is of a special construction for this purpose, and works automatically, forcing a constant stream of return water into the boiler, the volume of which will vary with the weather. This water is frequently made to return into the receiver of the pump relieved of pressure; that is, after the water reaches the receiver, any steam vapor which collects in the receiver is allowed to escape. This plan makes a return water temperature of more than 212 degrees Fahr. impossible, and the usual temperature is much below this. For reasons which will be given further on, any plan which reduces the pressure on return water, between the radiation pipes and the boiler, is not favored by the writer.

A higher boiler pressure, viz., from twenty-five to fifty pounds, is more commonly employed in operating the positive return system. The boiler pressure must be sufficient to properly work the steam pump. If a lower pressure is desired, the steam cylinder of the pump must be made larger.

With this increased pressure, an auxiliary boiler is not required. The return pump is connected direct to the boiler. It is not desirable to carry this high pressure into the radiation pipe. A reducing valve is a necessary adjunct to the boiler in this system. This valve is entirely automatic, and can be adjusted to any pressure from one to ten pounds, or more, at the will of the operator, to suit the requirements of the weather.

This method of positive return, as applied to steam heating, is adapted to large plants only. It is not contended that it is the equal in economy to the so-called gravity system. There are inherent in the system certain features which, in spite of the best efforts of the engineer to prevent it, absorb a considerable number of heat units, which the gravity system is not guilty of. To start with, there is a slight friction loss in the reducing valve; then, after the return water reaches the pump, there is still another loss, for power is required to drive this pump. Notwithstanding this slight loss, which cannot be entirely eliminated, the positive system is quite popular with florists. It is not within the writer's knowledge that any florist who has used it has condemned it on account of poor economy. To attain the best results from this method the return water should be conveyed direct to the receiver of the pump without any diminution of pressure; that is,

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there should be no relief of pressure in the receiver, but full pressure of the radiation pipes should be maintained, less such slight loss as may occur from friction in the radiation pipes. Assuming that in zero weather a pressure of ten pounds of steam is being carried in the radiation pipes, the return water, if conveyed to the receiver of the pump at that pressure, will have a temperature of about 240 degrees Fahr.

If, in an emergency, a pressure of twenty pounds is used, there will be in the receiver a temperature of about 259 degrees. Take off this pressure in the receiver and the temperature drops to 212 degrees. This entails a loss of heat which is too great to be permitted. Therefore, no florist can afford to return the water of condensation into the receiver at any reduction of the normal radiation pressure. Inasmuch as heating plants of this design cannot be safely installed without the advice and superintendence of a competent engineer, there is no reason why this problem should not be properly taken care of. The temperature of either of the pressures considered, ten pounds or twenty pounds, is too high for anything but a metal-packed pump. The water end of such pump should be bronze or brass-fitted throughout. Rubber valves will not do. The water end must be all metal. The pumping of water at such high temperature involves upon the engineer more than ordinary care, and, perhaps, more than ordinary experience and skill. It is, however, the writer's experience that when the necessary conditions are properly met and provided for, returning the water at the temperature here named is just as reliable, and the pump will work just as well, as when pumping water at 200 degrees, or less. We have never noticed but what the ordinary greenhouse fireman handled either pump—the high or low temperature—equally well.

Pump Exhaust

The exhaust of the steam pump should be directed into the steam main which supplies the radiation pipes. This is a material saving, and should not be neglected. The pump exhaust should have an outlet to the atmosphere. A valve on each pipe will give the operator control, enabling him to turn the exhaust either way. In practice, the exhaust will very rarely be turned into the atmosphere.

The Vacuum Method

The third system is that which has been aptly named the vacuum system. It possesses many features which commend it in a special way to the florist. In this system all air valves are eliminated from the entire

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apparatus. As is well known, these air valves are more or less complicated, requiring considerable attention, and the greenhouse operator never feels sure that they are operating properly until he goes around and examines and tests them.

In the vacuum system the operator would not have this trouble, for the purpose of one of the pumps, which we call the vacuum pump, is to exhaust all air from the apparatus, which must be effectively done. The operator having accomplished this before turning on the steam, knows that the pressure of his boiler must fill the most remote part of the radiation surface.

There is another advantage in this system which is most commendable. Steam at a very low pressure, a mere vapor, in fact, without pressure, can be admitted into the radiation pipes and the quantity throttled at the valve, a feature which makes the heat as controllable as hot water, as in either case the controlling power of the valve is practically the same. The water of condensation is returned in practically the same manner as described in the positive system. In fact, the vacuum system may be termed a positive system without air valves. There are numerous modifications of the vacuum system. A description of them will, however, have but little interest for florists. This method of steam heating probably more efficiently meets the requirements of large florists' establishments than any other.

The Single-Pipe Method

The so-called single-pipe system is largely used in the heating of buildings. It is not very popular among florists. We think it possesses so few features commending it to the florist that it is not worth while to devote space to a description of it here.

Types of Steam Boilers

The type of boiler which is adapted for steam use should differ in construction from the hot-water boiler; that is, a boiler which may give excellent results in hot-water practice is not necessarily as efficient in steam practice. The circulation of a hot-water boiler is entirely, or should be entirely, a continuous flow from the bottom toward the top. There should be no return current in the interior of the hot-water boiler. The steam boiler has a circulation almost entirely within itself. The water should be in constant motion, rising upward in the hottest part and returning down the coolest portions. This gives the steam bubbles a chance to escape

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into the steam space without causing violent ebullition in the interior of the boiler. The return tubular, the locomotive, the cast-iron sectional, and some marine types of boilers, are used for greenhouse heating. Many adherents of each type are to be found.

Fuels

The leading fuels that may be considered within reach of the florist are: Bituminous Coal, Coke, Anthracite, and Crude Petroleum, known as Fuel Oil.

Bituminous Coal

A good grade of bituminous coal, skillfully stoked, is probably the cheapest fuel available for greenhouse heating. It has the disadvantage of creating a lot of dirt and soot, which clouds the greenhouse glass and reduces its efficiency to some extent where flowers are desired.

For greenhouse heating purposes the free-burning grades of bituminous coals, known as coking coals, that produce the minimum of smoke when burned, are superior to the block, or hard bituminous splint coals. The coals now being mined in West Virginia are, many of them, especially adapted for greenhouse heating purposes, notably those known as the New River (or Fire Creek vein) and the Pocahontas vein. The Kanawha River coals mined from the Cedar Grove seam, the Kelly's Creek, or No. 5 seam, and the Blacksburg seam, are superior coals for steam-heating purposes. They are free-burning, leave but little ash and clinker, produce relatively little smoke, are rich in carbon, being also comparatively free from sulphur and phosphorus, the presence of which in a fuel shortens the life of the boiler tubes and rapidly disintegrates the grate bars of furnaces.

Anthracite

Anthracite is next in economy to the free-burning West Virginia bituminous coals, and when it can be procured at reasonable prices is much superior for florists' use on account of its cleanliness and the ease with which it may be handled and fired. It is delivered in several sizes suitable for steam purposes. Where a high steam pressure is carried, and a fireman constantly in attendance, the smaller sizes, such as rice, buckwheat and pea, are more economical than the larger sizes, known as egg and broken; but in low-pressure steam plants, and in hot-water plants, egg and broken coal are more desirable. The smaller sizes give best results when the fire is carried thinly, and is evenly spread over the grate, keeping a clean grate and a lively draught. The larger sizes are suitable for plants where a

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fireman is not in constant attendance, as heavy, thick fires may be carried, which endure for a long period without attention. Thick fires cannot be considered economical, as they exist by slow combustion, which allows much of the gases contained in the coal to escape without being burned. Quick combustion is productive of the greatest economy. Anthracite, when burned, produces very little smoke, for which reason it is superior to bituminous coals for the florist's use.

Coke

When it can be procured at reasonable prices, coke may be ranked with anthracite; but it is not largely used in greenhouse heating, probably on account of its cost.

Crude Petroleum, or Fuel Oil

At frequent intervals the announcement is made in the public press that fuel oil is about to displace coal for boiler-heating purposes; but for some reason the claim is never made good, and coal remains practically in possession of the field. Some nine years ago I made an exhaustive test of burning fuel oil, comparing the results obtained with those secured by using coal, in the same boilers. The result in economy was so overwhelmingly in favor of coal that I abandoned the use of the oil at once; and I make bold to declare it as my opinion that but little economy will be found in burning fuel oil for greenhouse heating whenever coal may be procured at a cost not exceeding six dollars per ton.

In conclusion, I would again advise every florist to consult a practical engineer when installing his heating apparatus.

CHAPTER XIX

Carnations for Summer Blooming and Pot Culture

AS a general rule, the carnation, when grown for Summer blooming, does not do well in our dry climate. While crops of very fair flowers may be secured during the months of June and September, and, at times, extending through the month of October and even into November, the droughts which usually occur in July and August are a serious detriment, as during these dry spells thrips and red spider frequently destroy the blooms, and seriously injure the plants. Probably in more northern parts of the country, and in locations contiguous to the Great Lakes or other large bodies of water, which modify and moisten the climate, the carnation will do well when grown as a Summer flowering plant.

In order to secure good crops of flowers in the open ground, plants grown from early struck cuttings, taken from early blooming varieties, must be used. While many of the early flowering sorts do well outside as Summer bloomers, but comparatively few of the late varieties will prove at all satisfactory in this respect, excepting in localities where climatic conditions during the months of September and October are favorable.

The best time to strike cuttings for this purpose is generally in October, November, and the early part of December. These cuttings should be potted up when well rooted, and kept in cool houses during the winter, shifting the plants whenever the pots have become well filled with roots. It is essential that this shifting should be done at the proper time in order to keep the plants in growing condition; for if neglected, and allowed to become potbound and stunted at any period, the plants will give inferior results.

From the middle of April to the 1st of May, the plants should be set into the open ground. At this time, if proper growth has been made, they will be in four to five-inch pots, according to the vigor of the variety; and should have been pinched back at least once, and preferably twice. Each shoot should be pinched back as soon as it shows a disposition to develop a bud.

In planting out, the balls of earth should be disturbed no more than is necessary to soften them up in order to prevent hardening, so that growth

Carnations for Summer Blooming

may not be materially checked. Commercial growers would do well to plant their Summer blooming carnations in beds not exceeding four feet in width, with two-foot paths between the beds. The summer treatment is the same as that for carnations intended for winter flowering, except that stopping, or pinching out the flower buds should be omitted.

During the hot, dry months of July and August, both red spider and thrips are apt to seriously damage the flowers. Of late years, the thrips has become such a serious pest in the Eastern States that attempts at flowering carnations in the open ground are liable to be comparative failures. There seems to be no effective remedy for this insect that can be practically applied to plants growing in the open ground. If the thrips or red spider once gets possession of the field, the crop will frequently be ruined.

While the following list of varieties will be found suitable for outdoor blooming, many other sorts may do as well, or even better in some places, each grower determining by practical experiment the kinds best suited for his locality :

Pink—William Scott, Morning Glory, Floriana, Mrs. Roosevelt, Mrs. Thomas W. Lawson, and Genevieve Lord.

White—Alaska, Mrs. Fisher, and Lizzie McGowan.

Scarlet—Portia, J. H. Manley, and G. H. Crane.

Crimson—General Maceo, General Gomez, Governor Roosevelt, and Harry Fenn.

Yellow—Golden Beauty, and Eldorado.

Variegated—Stella, Mrs. George M. Bradt, and Viola Allen.

Bedding Carnations

While the American climate is not generally favorable for flowering carnations in summer, some very nice effects in bedding may be secured by a judicious selection of varieties. Planting moderate-sized beds of one variety usually produces the best results.

The propagation and treatment of bedding carnations are as already described. But few varieties are suitable for bedding. Portia and J. H. Manley are probably the best scarlets for that purpose; the best whites being Alaska and Mrs. Fisher; Governor Roosevelt and General Gomez for crimson; Stella for variegated; William Scott and Floriana for pink. Most of the yellows are not suitable for bedding purposes, unless one is willing to wait for flowers until the months of September and October.

Carnations for Summer Blooming and Pot Culture

Hardy Carnations

Comparatively few hardy carnations are grown in this country, except upon the Pacific slope, where they seem to do very well. The attacks of red spider and thrips, in connection with the high temperature prevailing during July and August, render success in growing this section of the Dianthus family very precarious in the United States. Frequently, during extreme cold winters, and especially where much freezing and thawing occur, the plants will be heaved out of the ground and so seriously injured as to produce few blooms the season following. Probably a hardy race might be bred from our winter blooming carnations by leaving large numbers of seedlings to stand over winter in the field, and propagating stock from such plants as survived.

Carnation plants that are to stand in the open ground throughout the winter should be protected with a light mulch, which may consist of Autumn leaves, chopped straw, or very coarse manure that may also be mixed with the leaves or straw. This will serve to enrich the ground, and to promote a stronger growth the following spring. The soil in which carnations for summer blooming are grown should be made rich, and at least eighteen inches deep; and provision should be made so that the beds may receive an ample supply of water during the heated months, when droughts prevail.

Carnations for Pot Culture

It is with considerable diffidence that I undertake to give information on this subject, having had but meagre experience in growing carnations in pots. As a rule, my efforts in this line of culture have met with but moderate success, owing, perhaps, to the fact that I have been more interested in the growing of seedlings, and the improvement of the bench culture of carnations, than in pot culture. I can do no better than to supplement my limited knowledge by quotations from English authors who have fully treated the subject.

In the treatise upon the carnation, published in 1839 by the veteran, Thomas Hogg, of Paddington Green, England, the pot culture of carnations is dealt with at length. Mr. Hogg gives the preparation of soil much importance, the following formula being supplied for preparing a compost heap of sufficient size to furnish soil for blooming five hundred pots of carnations:

“One load of fresh yellow loam; half a load of common black earth, or garden mould; two loads of rotten horse dung; four large barrows of coarse sand from some

Carnations for Pot Culture

wash or pond by the highroad side, or dry road grit in lieu thereof, laid up to dry and run through a sieve.

"For an abridged quantity take: Five barrows of loam or maiden earth; eight to nine barrows of horse dung from frames (i. e., well rotted); one barrow of coarse sand, or more, according to the nature of the loam, stiff soils requiring more sand. Mix thoroughly and throw together on a heap, or ridge, and turn two or three times during the winter, especially in frosty weather, that the ingredients may be well and evenly incorporated.

"On a dry day, towards the end of November, take a barrowful of fresh lime, which, as soon as slacked, strew over the heap while hot, meanwhile turning the heap; this accelerates the rotting of the fibrous materials, lightens the soil and destroys grubs, worms and slugs."

I would further recommend that this soil be sterilized about a month previous to using. Sterilization further accelerates the rotting of fibrous materials, tends to increase the available content of plant food, and also destroys weed seeds, spores of fungi and all insect pests, or their eggs. Hogg further says:

"If any objection be stated that the quantity of dung is too great in proportion to that of loam, I answer that such an objection might be well founded if the compost were to be used immediately on its being mixed together; but as it has to lie six months before it is used, I am decidedly of the opinion that the quantity is not more than is necessary, in order to insure a luxuriant growth and a generous bloom.

"The thoroughbred florist, who derives pleasure from the pursuit, and who has always the flower-fever strong upon him; who has rivals to contend with; who is incited by the love of fame, and the hope of winning the first splendid prize at some exhibition; who will walk fifty miles to catch a glimpse of some new, celebrated flower, and who, if it meets his fancy, will sooner pawn the coat from off his back than not to obtain it; who will leave his warm and comfortable bed at midnight to rise and destroy the cursed earwigs that shall dare to attack his favorite blossom; will begrudge no labor, and neglect no pains, to perform this part well, on which he knows his chance of success principally depends. With the latter, especially if he be young in the fancy, my only fear is, lest he overdo the part. To such a one, if you give a receipt for any particular composition, and recommend one peck of soot, most probably he will put two; if two pounds of salt, he will put four; if three pails of blood, he will put six; if four barrows of sugar-baker's scum, he will put eight; and so on.

"Removing the plants into large pots to bloom.

"In our variable climate, the first week in April is the safest and best time to perform this; the pots generally made use of for this purpose are those of twelve or sixteen to a cast.

"A twelve-size pot will contain three or four plants, according to their habit of growth; a sixteen, two or three, according to the same rule. Be careful to put two or three large bits of tile at the bottom, or the hollow part of a large oyster-shell, resting upon a tile, to preserve drainage for the water. Stagnant water, whether in pots, or in the open fields, is alike prejudicial to all plants, except aquatics.

"The pots to be filled three parts full with compost, in its rough, or coarse, state

Carnations for Pot Culture

from the heap, using fine, or sifted, mould only at the top, around the roots of the plants, which must not be planted deeper than they were before.

“The mould to be well shaken down, to prevent its settling after. The coarse parts, or riddlings that would not pass through the sieve, may also be put at the bottom, filling each pot about three inches deep with them.

“At this season of the year, when they want water, let it be given in the morning, rather than in the evening, till about the middle of May, on account of the frosts which will often recur at that time.

“When the plants begin to spindle, or shoot up for bloom, they require to be supported by sticks, about four feet in length; some of tall growth, as Humphrey’s Clarence, Snook’s Defiance, Fulbrook’s Grenadier, Wood’s Ambassador, etc., require sticks five feet long.”

To keep down aphid, strew pungent, fine tobacco dust, or Scotch snuff, over the plants immediately after syringing. A weak solution of tobacco extract, or tobacco water, may be sprayed upon the foliage with an atomizer, and repeated at intervals of two days until the aphid disappears entirely.

Top Dressing

Frequent watering of the plants in our dry, hot seasons exhausts the compost, and tends to weaken the growth of the plants. This may be remedied by top dressing the pot soil in the early part of June. Well-rotted horse, or cow dung, passed through a sieve, may be used, covering the soil surface to the depth of half an inch. A few handfuls of pulverized sheep manure, and a dash of Scotch soot, may be added, with good results.

Top dressings of hot manures, such as night soil, sugar-baker’s scum, nitrate of soda, dried blood, should be avoided. Weak solutions of nitrate of soda, as well as the chemical fertilizers mentioned in Chapter V., may be used, but must be afforded conservatively, and with judgment.

It should never be lost sight of, that “an immoderate use of strong manures to most plants is like the immoderate use of hot spirituous liquors to the human frame; they force and excite for a time, only to weaken and destroy.”

In my opinion, manures and fertilizers should be used as foods and, except in rare instances, not as stimulants. Plants that must complete their growth the year round, in pots, are generally much benefited by surface dressings of the soil at reasonable periods. The beneficial effects of such dressings may be made apparent by experimenting with one or two pots, and comparing them with others untreated. The improved health and vigor of the plants will be evidenced by improved color of foliage and strength of growth. The blossoms will be larger, the substance of the petals firmer, the stems longer and stronger, and the blooms of much better color. If,

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however, such fertilization is over done, a soft, sappy growth, with washy colored blooms, will be the result. A late English essayist says:

"A proper compost should be composed of good yellow loam, plenty of well-rotted manure, a little peat, and some coarse sand. In potting plants, the roots should have plenty of room. The period of growth and blooming while in the pots is very long, and to allow the roots to become potbound at any time is bad practice. In favorable seasons, it is best to plant in the open ground in May, and lift and repot in early September. The leading shoots should be stopped twice while the plants are in the open ground. After potting, the plants should stand in a shaded situation for a week or ten days, or until well established."

Air must be freely given upon all favorable opportunities, maintaining a winter temperature of about 60 degrees, with some 10 degrees less at night.

More attention will be necessary in watering plants grown in pots than is required in bench culture. The carnation needs a liberal supply of moisture, and plants growing in pots are subject to loss of moisture from evaporation from the sides of the pots, as well as surface and foliage evaporation. The soil must be moist, not only on the surface, but clean through to the bottom of the pot. When watering, be sure that a good soaking is given, thus insuring an even moisture throughout the soil. When the plants are coming into flower, a weak solution of manure water, made from fresh cow dung, to which may be added a little Scotch, or soft coal soot, may be used to advantage.

Green fly is destroyed by fumigating with tobacco smoke, or the burning of tobacco dust or snuff; or by dipping the plants in a solution made by dissolving four ounces of Ivory soap to a gallon of water, adding a half pint of tobacco juice, and churning with a syringe until thoroughly mixed.

Cuttings for pot culture should be taken in January and early February. When rooted, pot into two-inch pots, and place in a temperature of 60 degrees. As soon as the plants are well rooted, place the pots in a cooler house, where the temperature is maintained at 50 to 55 degrees during the day, and 45 to 48 degrees at night. This cooler treatment will produce a shorter, more vigorous growth.

By the end of March the plants will need shifting into two and one-half or three-inch pots, at which time a little pulverized sheep manure, or dry cow manure rubbed through a sieve, may be advantageously added to the soil. After shifting, the plants should not be watered for a few days, as the soil should contain enough moisture to promote root action, if the plants are properly shaded.

Young plants do best when kept in a low house, close to the glass, and

Carnations for Pot Culture

given an abundance of air night and day. The carnation never takes kindly to a close atmosphere. This matter of ventilation and watering is undoubtedly the keynote to success in flowering carnations in pots.

When the shoots lengthen to five or six inches, they should be stopped. There are no set rules as to this operation, as each variety must be observed and treated according to its growth. Some may require pinching twice or thrice; others only once. During a cold season, less pinching will be required than during a warm, moist period, when growth is more rapid.

By the end of June, plants will be ready for the final shift, using the same compost, to which add coarse ground bone; also a sprinkling of soot over the drainage crocks. Six to eight-inch pots may be used, three or four plants being put into the larger pots. When potted, the plants should be staked, and then placed in frames, on beds of coal ashes, to keep worms out of the pots. By the middle of August, the pots will become filled with roots, and the plants may be occasionally fed with manure water, or mulched with a compost, as hereinbefore stated. Careful attention to watering is required during the summer months. A syringing twice each day during bright weather will promote a fresh, vigorous growth, and help to keep down red spider and green fly. From the 1st to the 15th of October should see the plants in winter quarters, which should be a clean, bright, airy house, with top and side ventilation, that should be kept on at all favorable times. Carnations should never be kept in a close atmosphere. They need a constant circulation of air. As soon as housed, fumigate the plants with tobacco smoke, or XL-All, and repeat the fumigation every week, until the flower buds show color. If large blooms are desired, all buds, save terminals, should be removed; but a better plan is to take out the terminal and pinch off all but the strongest three buds on each shoot. By this treatment, thirty to fifty blooms may be grown to a pot, in the case of some varieties. A temperature of 45 to 48 degrees at night, and 55 to 60 degrees during the day, will maintain the plants in a hardy, growing condition, and keep them longer in flower than warmer treatment.

Painting the steam pipes twice each week with a solution of Rose Leaf Extract, Nicotocide, or some other of the various concentrated tobacco extracts, will prove efficient in keeping down green fly and also largely hold thrips in check. Add enough water to the extract to reduce it to the consistency of thin paint, then brush all the pipes with the solution. The more pipe surface that is covered with the extract, the sooner will the insects be destroyed.

CHAPTER XX

Raising Carnations from Seed—Cross-Breeding and Fertilizing

PERHAPS the most interesting part of carnation growing, especially to the flower lover, is the production of new varieties from seed. This is accomplished by hybridization and cross-fertilization. When the grower desires to produce a new variety, plants are selected which seem to combine the greatest number of characteristics to be perpetuated or increased.



E. Flower ready for pollinating *A. Petals closing after fertilization*
D. Flower dissected, showing pistil *B. Ovary beginning to swell*
C. Seed ripening

If a large flower, of a beautiful pink color, upon a free habit is sought, plants whose combined characteristics will equal or approximate those wanted are

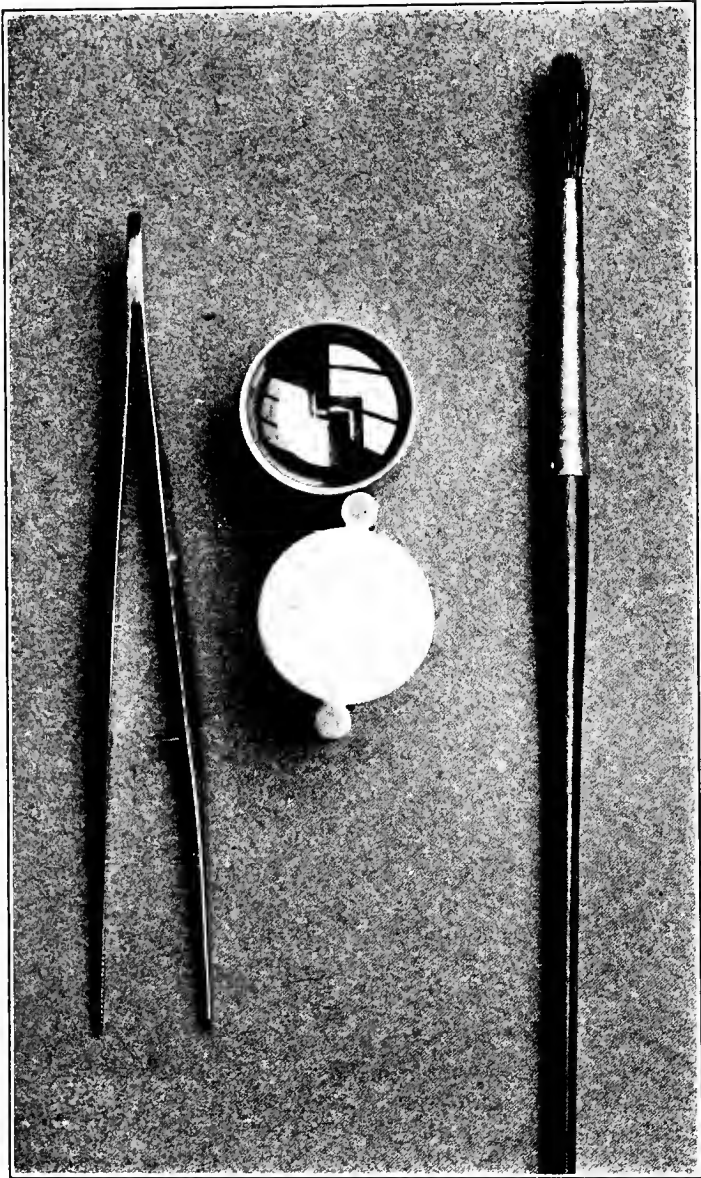
Raising Carnations from Seed

chosen. For instance, if there are two varieties, one of which possesses the ideal habit and a flower of the ideal size, form and shape, but lacking in color, and the other variety, while deficient in some of the above characteristics possesses the desired color, the flower of the variety having the wished-for habit, form and size will be fertilized with pollen from the variety possessing the color wanted. The result may be that a variety will be produced which not only combines the habit, size, form and freedom of bloom sought, but the ideal color as well, and in many instances improvements in all those points.

The operator's tools are few, indeed. A pair of tweezers, a pocket microscope, a few tight-stoppered glass phials in which to preserve pollen, and a delicate camel's hair brush comprise the list, and frequently the latter is dispensed with, the tweezers alone being relied upon to transfer the pollen to the pistils.

The operation of pollinating the flower is very simple. It consists of applying the pollen, when it is in the right condition, to the stigma of the flower desired to be pollinated, at the proper time. The only way to learn at which time this should be done is by practical experiment. The pollen is produced upon the anthers. As these anthers burst, the pollen is released in the form of a dry powder, and when in this condition it should be applied. While the pollen will stand for a considerable time and retain its vitality, the best results are obtained if it is used as soon after ripening as possible. Tiny, hair-like growths standing along the entire length of the upper surface of the stigma will be noted. When these hair-like growths are well developed, and especially when they assume a transparent appearance and seem to be covered with tiny dew drops, the stigma is ready for pollination. The operation should be done just as soon as the stigma is in condition; otherwise some foreign pollen may alight thereon and the flower be pollinated before the pollen desired to be applied has had time to act.

Fertilization takes place with the germination of the pollen, which sends very minute root-like growths down and makes connection with the ovules. As soon as these growths reach the ovules they commence to swell, the petals of the flower wither, and the bloom closes up, or "goes to sleep," as the florist expresses it, and fertilization is complete. In the illustration on page 196, A shows the flower closing up immediately after fertilization; B the seed pod swelling after fertilization, and C the ripened pod. It takes from six to eight, and sometimes ten weeks after the flower is fertilized before the seeds are ripened. This ripened condition will be indicated by the



The Hybridizing Tools are Simple Indeed

"A pair of tweezers, a magnifying glass, and a delicate camel's hair brush"

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Pods shriveling up and turning brown on top. The seed pods must be watched and not allowed to stand too long before they are gathered, as sometimes the pods burst open, scattering the seed, and it is lost; but it should be gathered as soon as thoroughly ripe.

The stem should be broken off about four inches in length, and the pod and stem placed together in an envelope and put in a dry place, to remain until thoroughly cured, after which the pods should be broken open and the seed cleaned and placed in small envelopes, upon which the name of the cross, the date on which it was made, and the time the seed was gathered, should be plainly written.

The best time of the year to pollinate carnations is either in the months of October or November, or in January or February and early March. As a rule, I have secured a greater number of good varieties from flowers that were pollinated in October or November than from those which were pollinated in the spring. Possibly, the reason is that in the fall months there is less pollen floating about in the air, and the hybridizing is not interfered with by foreign pollen being introduced to the pistil. If the blooms were protected by gauze covers both before and after pollination, it might insure better results during the spring months.

We aim to sow as much of our carnation seed as is ripened by the 1st of February. A second sowing is made on the 1st of March, and a third sowing about the 1st of April. Seeds which do not ripen by the 1st of April are not then sown, but carried over and sown in February of the following year.

The seeds are sown in shallow flats, not more than an inch and a half to two inches in depth, or in shallow fern pans. These flats, or pans, have sufficient drainage so that the soil will not become sour. The soil should be of a light, friable nature, but with sufficient body to hold the proper degree of moisture; it should be thoroughly sifted, and the flats filled evenly and firmed. Shallow drills, one and a half inches apart and an eighth of an inch deep, are made by pressing a slat about a quarter of an inch wide into the soil. The seed is sown in the drills at a distance of half an inch apart and covered with not to exceed an eighth of an inch of fine soil. The surface of the soil is then moistened with a fine spray, and the flats are placed in a light house, where the temperature is about 56 to 60 degrees at night. The soil is kept moistened by spraying with a fine spray, and if during the intense heat of bright days the sun dries out the soil too fast, shading with thin paper should be afforded, to be removed as soon as the power of the sun decreases.



*Mrs. Theodore Roosevelt
Governor Roosevelt*

*Novelty
Mayor Grant Bud*

Types of Good Calyxes

"In selecting a flower be sure of a firm, large, well-shaped calyx"

Raising Carnations from Seed

In a week or ten days the young seedlings will commence to push out of the soil, at which time great care must be exercised that they be neither allowed to wither by having too little water, nor caused to damp off by being watered too much.

No rule for watering can be given, but the proper time to apply it and the supply to be afforded must be noted by observation. As soon as the young seedlings have made three or four leaves they are pricked off into similar flats (which are filled with soil of the same character as before mentioned) in rows one and a half to two inches apart, and one inch apart in the row, where they are allowed to grow until about two inches in height, when they will begin to crowd and must be removed from the flats and potted up.

One and three-quarters to two inch pots should be used; and the same kind of soil that is employed in potting cuttings is suitable for seedlings. As soon as these seedlings have thoroughly filled the pots with roots, and if the conditions are not such that they can be planted out at once, they should be shifted into two and a half inch pots.

The care of the seedlings from the time they are shifted is similar to that given any young carnation plant. Seedlings from early-sown seed are usually planted out not later than the 1st to the 10th of May, but those from seed sown the 1st of April will not be ready to plant out much before the 1st of June.

A good method is to plant the seedlings in the field in the same manner as is done with carnation plants grown from cuttings. The care is similar during the summer months, excepting stopping or cutting back. In the case of seedlings, the first, or central shoot (which might be called the crown shoot), is cut back, and the laterals allowed to grow and flower; while with plants for winter blooming, all shoots are cut back during the growing season.

About the 1st of August the first blooms will commence to open, and then begins the task of selecting such plants as the grower deems worthy of cultivating under glass for what is known as the first year's trial. The selection of such plants is purely a matter of judgment on the part of the grower, who will naturally choose those varieties in which he sees the most promise.

As soon as a plant has been determined upon for trial, it should be marked with a label, upon which the cross number (which will identify it with the record kept of the cross) should be placed. Plants selected for trial should be lifted and planted inside, the same as plants grown from

Raising Carnations from Seed

cuttings, with the exception that seedling plants, being considerably more vigorous, should be given more room on the bench. Rows twelve inches



"If you fail to select good, firm calyces a burster may be your reward"
apart, and plants ten to twelve inches apart in the row, will afford none too much growing space.

Raising Carnations from Seed



A Vase of Selected Seedlings

"The parents should always have strong stems and large, well-formed flowers"

Seedling plants are treated in the same manner as those for ordinary winter flowering, and allowed to bloom throughout the winter, frequent notes being made as to their condition at various periods. But a small portion of

Raising Carnations from Seed

those taken in will be thought worthy of a second year's trial, and such as are selected should be immediately marked with a label to denote the selection. This label should always remain with the plant, as it identifies the pedigree, or life history, as it were, of the seedling.

In selecting a seedling for the second year's trial, be sure of a firm, large, well-formed calyx, for if you fail to select good firm calyces a crop of "bursters" may be your reward.

The seed parent should always have good strong stems and large, well-formed flowers, as the axiom that "like will produce like" will be found to hold, to some extent, in the reproduction of carnation plants from seed.

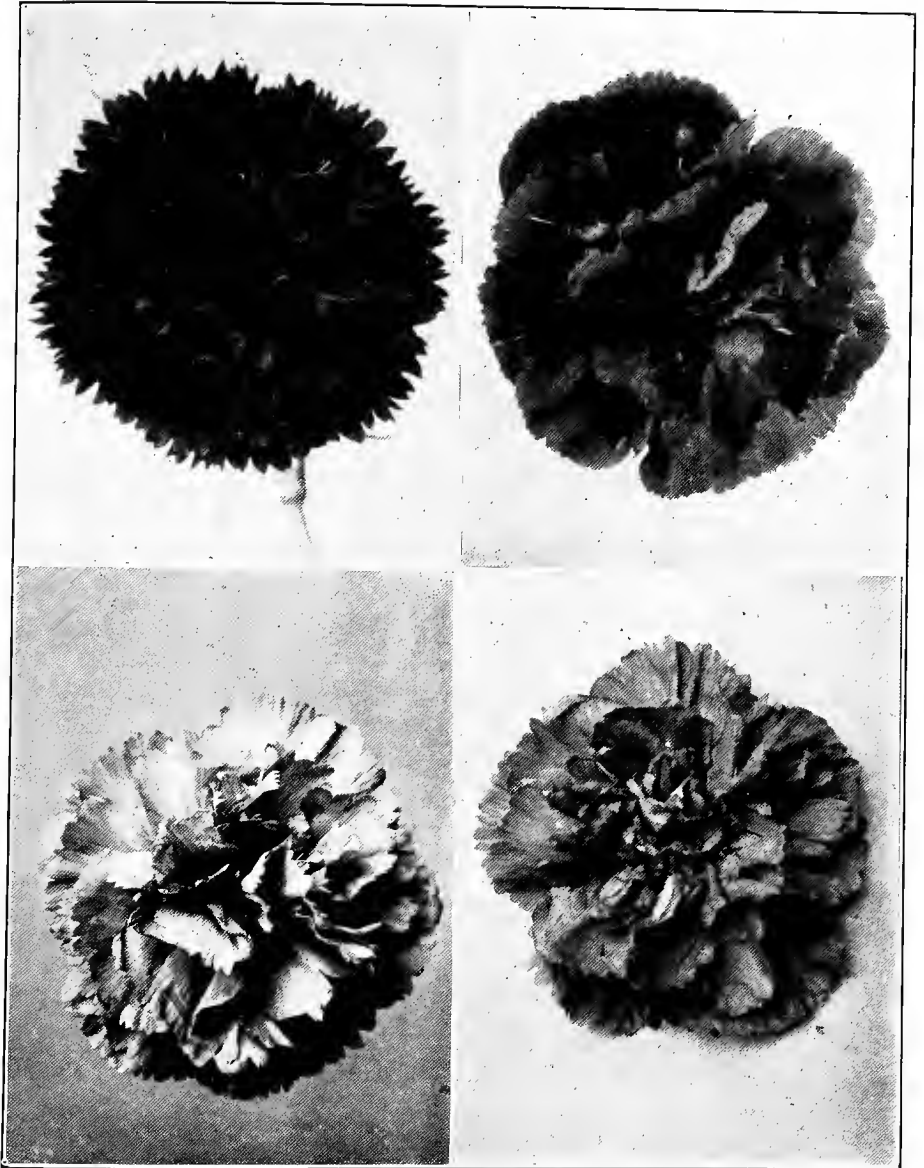
Close attention should also be paid to the habit of the seed plant selected. Such plants should possess strong, vigorous constitutions and a tendency toward rapid, free growth and early and continuous flowering. By a course of careful selection, extending over a period of years, the grower will produce a strain of plants peculiarly his own, from which by careful breeding he will be able to obtain many sorts of great merit. He will certainly secure far better results than if his work has been done in a careless, unsystematic manner and without regard to the pedigree or physical characteristics of his seed plants.

The size and form and stem of the flower, as well as the habit, having been approved, the next point to be considered is color, and in this, careful work in the selection of pure, clear tints will bear fruit fully as richly as the selection with respect to other characteristics.

Some royal beauties will fall to the lot of every careful breeder who does his work faithfully and well. The varieties Governor Roosevelt, Mrs. Thomas W. Lawson, Adonis, Mrs. Theodore Roosevelt, Prosperity, and Enchantress are likely examples of the result of careful work faithfully performed. However, Dame Carnation produces some strange freaks, and now and then the grower will discover such absurdities as the anemone-flowered carnation, the Jumbo, and the two-storied flower. These, while decidedly interesting, can seldom be perpetuated and are, as a rule, of no value, save as curiosities.

In selecting the colors, the tints should be pure and clear, and the tones pleasing to the eye. A mixture of purple and pink tones should be avoided, choosing for the pink section those tones that are clear and inclined toward the salmon, or flesh pink, rather than toward the magenta.

Among the bizarres, strange and beautiful combinations of delicate coloring will be found, and these colorings are not always disposed in regular



*Governor Roosevelt
Mrs. Theodore Roosevelt*

*Adonis
Mrs. T. W. Lawson*

*"Some royal beauties will fall to the lot of every careful Hybridizer
who does his work faithfully and well"*

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stripes or edgings. Sometimes they are laid on in dashes, flecks and bars, as if the Goddess of Flowers now and then wielded her brush carelessly.

The fancy variegated section will afford much interest and pleasure. Selections from this section should be pure in color tint, and the markings should be distinct and agreeable in tone.

The ideal white carnation is like the Will-o'-the-wisp, always before you, yet not quite in hand. In this section, the field is still open. It may be said to be almost unoccupied, and so long as carnations are grown we may expect a continued search for the ideal white. Several times has the ideal been announced, exhibited, and received the prizes and awards of the National Society, but when put to the test, a year or two after introduction it has failed to satisfy the requirements.

Of all the colors yet obtained, yellow seems the most difficult to produce. It generally comes with various types of variegation, which should be disposed in clear, distinct markings. The call for yellow carnations is not over large; nevertheless, a good yellow is always in demand in limited quantities.

On the 1st of February most of the worthy plants will have bloomed, and the selection for the second year's trial have been made. None but strong cuttings should be taken from such, and only a moderate number propagated the first year. Many seedling raisers make the mistake of growing as many cuttings as possible from the seedling plant, and the disposition of many varieties to become weak during the earlier years of propagation, may possibly be traced to the over-propagation of the seedling plant. Many times a seedling plant which shows an exceptionally strong, vigorous constitution, and, in fact, seems to be extra promising, turns out to be of little value on the second year's, and probably on the third year's trial. In fact, for the first three or four years but little is positively known of the variety under test. Frequently a variety which shows great promise during the first and second years' trials utterly fails the third year.

Four to six years after introduction seem to constitute the profitable commercial life of a carnation, although such may frequently be prolonged; and many varieties have been grown commercially with great success for ten to twelve or more years by growers who realize thoroughly the importance of general good care, good culture, and a selection of propagating wood from plants in the best of health and condition. Too much importance cannot be placed upon proper cultural methods and judicious selection of propagating wood. Nevertheless it will always be a fact, that so long as raisers of seedlings continue to produce new varieties, it will be necessary



Anemone-flowered Carnation

The two-storied Carnation

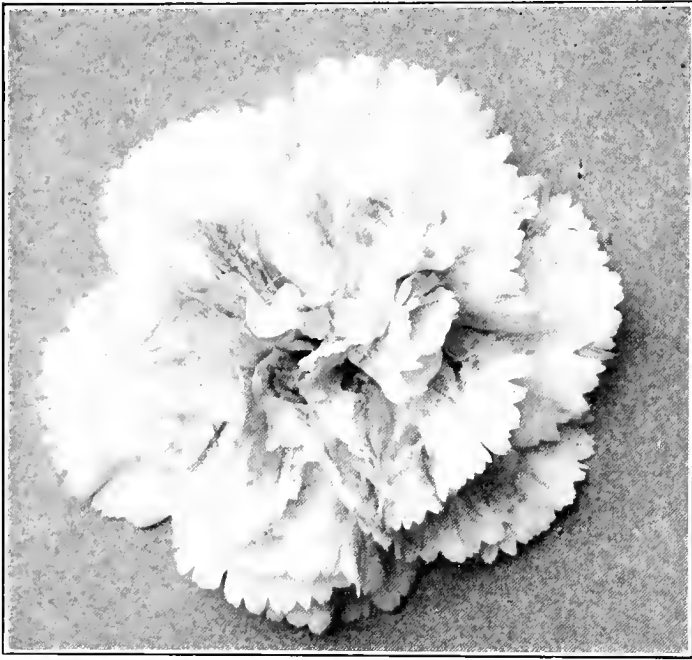
Malmaison Carnation Jumbo

"Dame Carnation produces some strange freaks"

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to replenish carnation stocks with new kinds grown from seed, in order to keep pace with the requirements of the market.

There exist two leading elements that bid fair to encourage florists to continue their efforts for the improvement of the carnation for many years to come. Lovers as well as users of flowers are constantly seeking that which is novel and rare. The progressive florist is ever on the alert to gratify such desires on the part of the flower-loving public; consequently, the call for



Bizarre Seedling

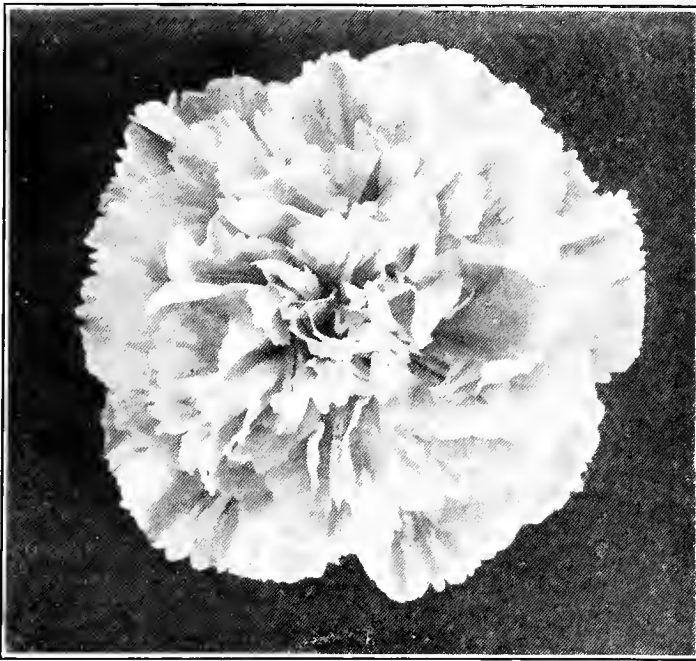
Snow-white ground with crimson scarlet shadings. The colors are not always disposed in regular stripes or edgings

new and improved carnations will be, to some extent, perpetuated by these conditions, and it may be well said that no florist who hopes to keep abreast of the times can afford to ignore this improvement in the carnation, and must of necessity keep in close touch with the newer varieties as they are introduced and maintain his stock fully up to date by the purchase of those

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better sorts which bid fair to succeed with the conditions under which he grows carnations.

Again, say what we may, it is a well-known fact, that the average variety of carnation remains in profitable cultivation but a few years and must be constantly replaced by the newer and improved and more vigorous varieties grown from seed. In other words, carnations are continually running out; therefore, the market for new and improved sorts would seem to



Bizarre Seedling

Snow-white ground overlaid with splashes of cream pink and crimson. Among the Bizarres strange and beautiful combinations of delicate coloring will be found

be a permanent one, and these elements will tend to keep open a broad field to the grower, who may rest assured that if he produces a really improved carnation he will find a profitable sale for his production.

Buyers of carnations will usually seek the best, and the various raisers of new kinds, who are devoting their time and attention to the advancement

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of the carnation, are certain to produce more or less improvements upon existing varieties, and the forehanded grower will need to purchase annually, and test such varieties, in order to determine whether he can successfully supply them at a profit.

The mere raising and selling a double seedling carnation, even though netting some profit to its grower, cannot be considered as successful improvement of the carnation. An accidental variety of merit may now and then come to the grower who miscellaneously mixes the pollen from different flowers, and plants the seed resulting therefrom; but the continued production of the best of the improved varieties will scarcely follow such work.

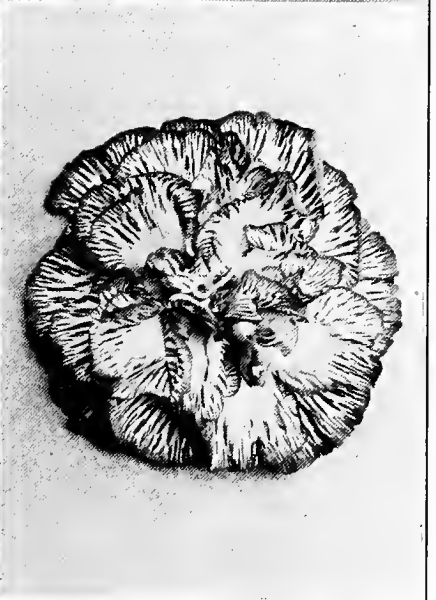
If the reader expects that hard and fast rules for producing an army of new seedlings, to perplex the whilom seeker of that which is best and most profitable to grow, will be herein laid down, he is laboring under a mistaken idea.

The ground over which a hybridizer is working becomes peculiarly his own territory, practically an unknown region which he alone is exploring, and he must not only get his knowledge as he works over his field, but he must also have the ability to take advantage of and use what knowledge it may be his fortune to garner; consequently, he cannot make rules even for his own guidance, much less for the guidance of others laboring in different, though analogous fields.

In the selection of parents, choose the best you have at hand. You will not find all the desired attributes in any one plant, or in any six plants, possibly not in any hundred plants; and after producing several thousand seedling plants, and finally reducing them by the process of selection to a half-dozen considered worthy of a third year's trial, the hybridizer will wonder at and be discouraged by the amount of dross he has to handle in order to get a little gold.

In the selection of seedlings, color stands pre-eminently above all other considerations. Size, form, fragrance, substance, strength of stem, stand on a fairly even basis of value. When these have been secured, get as much continuity of bloom as is possible, and maintain your cardinal features. Do not overlook fragrance. Its place is so close to color and size, that it was the cardinal virtue that won the Divine Flower into favor long before it had much of either color or size to boast of.

Having suited your own taste in selecting your seedling, you must investigate its selling qualities. Florists should appreciate that the discriminating buyer usually decides what he or she wishes to purchase. The retail florist, being in close touch with the consuming purchaser, quickly dis-



Viola Allen
Judge Hinsdale

Mrs. George M. Bradt
Fancy Seedling

“The fancy variegated section will afford the Hybridizer much of interest and pleasure”

Raising Carnations from Seed

cerns what is most pleasing to the greatest number. Therefore, it follows that the producer of new carnations should keep in touch with the retailer, and should avail himself of the latter's knowledge whenever possible.

Choose pure tones of color, those possessing the greatest elements of fixedness. Avoid dull, fading, or washy colors, and above all, those peculiar combinations of discordant tints that shock the optic nerve.

Every flower coming with long stiff stems, large and double, of good form and calyx, and the plant a free bloomer, will not prove commercially valuable; but a combination of size, pure tone of color, good stem, form, fragrance and calyx, with freedom of bloom, and above all not forgetting selling qualities, is what constitutes a first-class commercial carnation, and the grower who produces such a one deserves the plaudits of his fellow growers.

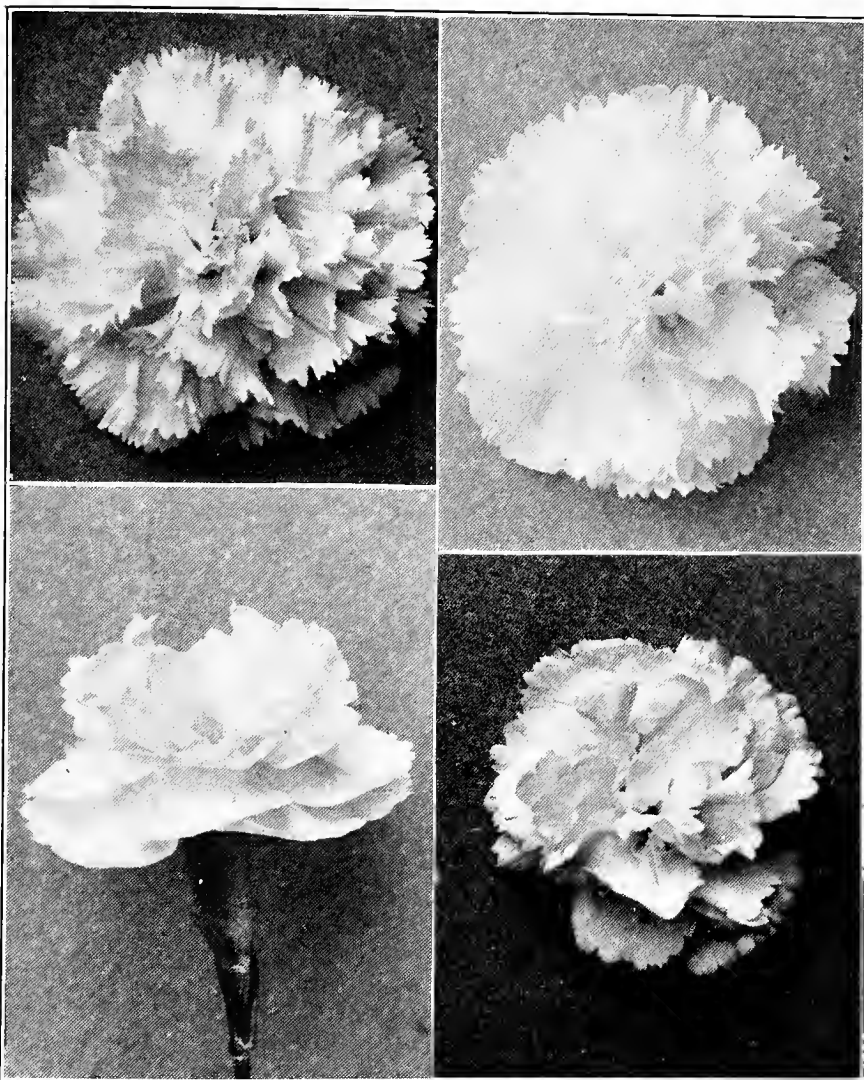
Introducing New Varieties Into Commerce

Having determined the candidate for introduction, the method of bringing it before the trade will next interest the originator. There are two methods now in use, differing to such an extent as to deserve separate descriptions. The first and possibly that most frequently employed is what we may term the "boom method," which in order to be successfully carried out needs the co-operation of several different elements, and the accumulation of a large number of stock plants.

Briefly stated, the "boom method" consists of praising and pushing the merits of the candidate for introduction in all possible ways, and advertising all its virtues, real and imaginary, constantly through all available media. Certificates of merit, special cups and prizes offered to be won by the candidate, as well as frequent exhibitions at flower shows, supplemented by well-written press notices, form the usual plan, and when cleverly carried out, result in large sales and considerable profit to the introducer during the year of introduction.

The second and perhaps the most desirable method might be termed the "business method," which, while not productive of such large sales the first year, eventually accomplishes more for the general benefit of the fraternity than the method just previously described, and may be safely adopted with a stock of 1,500 to 2,000 plants to propagate from. The varieties selected for introduction may be brought to the attention of the trade by placing the flowers in the hands of leading retailers, as well as by judicious advertising, and staging blooms at the annual exhibitions.

The descriptions given should be correct. Avoid producing impressions,



Shasta
White Seedling

Alba
Lizzie McGowan

“The ideal white Carnation is like the Will-o’the-wisp—always before you yet not quite in hand”

Raising Carnations from Seed

or arousing expectations, that cannot be fulfilled. Be satisfied with selling a fair number at a good price the first season, and endeavor to be in a position to satisfy the second season's demand, which will be large, if your selections possess merit.

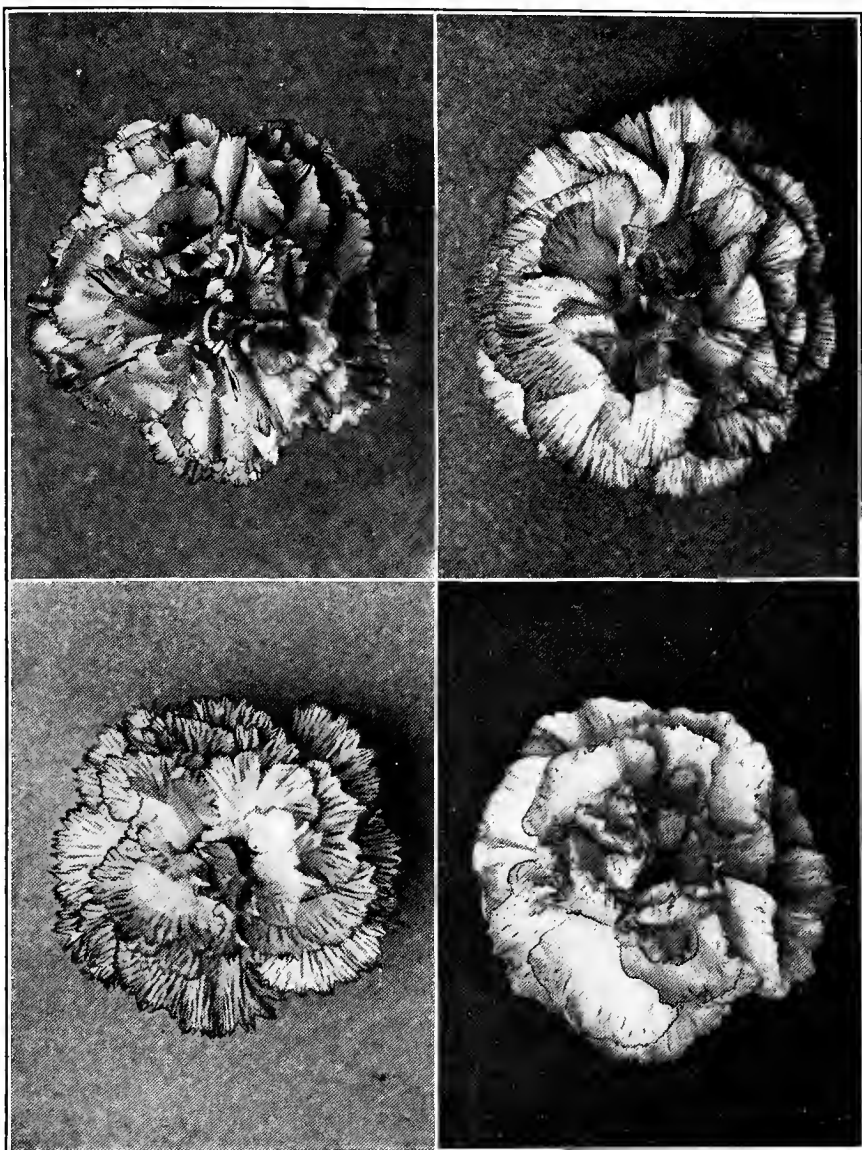
Propagate your stock carefully, selecting your propagating wood with judgment, keeping your stock in good health, and send out the young plants in a condition that will insure good growth and a successful crop of flowers in the hands of the average florist.

I do not mean to convey the impression that the introducer is limited to the two methods described. Each introducer may adopt any honorable, legitimate means whereby he can bring his production to popular notice and secure a profitable sale thereof.

If the carnation specialist can get under the wing of a Copper King and deftly twist a 30,000-dollar nugget from the plethoric purse of the monarch of metals, he may well congratulate himself, and no doubt many of the fraternity will also congratulate him. But it may be well to remember that there are as yet few Lawsons, even fewer Fishers, perhaps; while the combination of Lawson, Fisher and Galvin is the rarest of all.

It may, however, be well to comprehend that a reputation for reliable and honorable dealing may be established by the introducer of new plants equally with any other business man, and such a reputation will become a source of much profit to its possessor and a surer aid in marketing his productions, than could all the prizes and certificates he might be able to win. It therefore behooves the intending introducer of new carnations, not only to be cautious and circumspect in the selection and judging of his own seedlings, but to guard his statements well, and to let no shadow of misrepresentation linger about the descriptions with which he brings his favorite to his patrons' notice.

Remember that ten satisfied customers are far more valuable than a thousand dissatisfied ones; and the way to create satisfied customers, is to introduce only varieties which your experience teaches you will have a profitable chance of succeeding; and to deliver the stock in such a condition that the purchaser will not be handicapped in his efforts to test successfully your introductions.



Golden Beauty
Fancy Yellow Seedling

Novelty
Golden Eagle

"Of all the colors obtained, yellow seems the most difficult to produce"

Raising Carnations from Seed

The Growing of New Varieties

BY FRED DORNER.

As the growing of new varieties has been a great factor in the evolution of the carnation during the last decade, a few remarks as to how this branch is conducted at our place, at Lafayette, Ind., may be of interest.

My first seedlings were grown in 1889. The varieties which were then at my command, to obtain seed from, and which are mainly the ancestors of all I have grown since, were: President De Graw, Edwardsii, Heintz's White, and Silver Spray, white; Grace Wilder, and Mrs. Cleveland, light pink; La Purité and Tidal Wave, dark pink; E. G. Hill and President Garfield, scarlet; Ferdinand Mangold, crimson; Buttercup and Astoria, yellow; and Hinsdale and Sunrise, variegated.

Encouraged by my first effort, which proved a grand success, I concluded to make carnation culture my specialty, and the production of new varieties the head of it.

The seed for 1890 was grown mainly on the 1889 seedlings, and in the fall of 1890, a bench, 4 feet x 120 feet, was filled with plants selected out of 2,000 seedlings from the field. This branch of the business has since steadily increased; and in the fall of 1902, a whole house, containing 2,200 plants, was filled with those selected from 8,000 seedlings that had bloomed in the field. A correct record of all crossings, since 1890, has been kept. This is found to be a great help, as a seed parent is rarely selected without consulting its pedigree.

Seed is grown in January and February. The parent plants are mostly selected from the one and two-year-old seedlings. At this time, the flowers can be selected when they are at their best, and we find it the most suitable period to make a clean crossing without the interference of nature's agents to effect fertilization. By April the seed is ripe, and is sown at once; and by the latter part of May the young plants can be transferred to the field. Quite a number of plants will bloom by the latter part of July, and my experience tells me that plants which have not flowered by the 15th of October are worthless, as they are invariably shy and late bloomers. The best and most profitable varieties we have sent out were found among the early bloomers in the field.

A noticeable feature, in my experience, is, that while in 1890 fully 50 per cent. of the flowers came single, this has gradually decreased to about 20 per cent. in 1902.

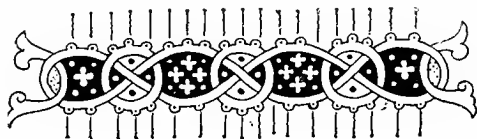
About one-eighth of the seedling plants housed are selected and num-

Raising Carnations from Seed

bered for a second year's trial; and of this number about one-fourth are selected for trial a third year. However, the weeding-out process is sometimes much faster. Of our 1899 seedlings, only one variety was left from the second year's trial. One year is not so productive of results as another.

The growing of new varieties, in the natural way of crossing and hybridizing, is a very interesting and fascinating work. It needs the aid of culture. Without this great stimulating help, our varieties would revert gradually to the primitive pink of a thousand years ago as rapidly as they have advanced at the present time.

Selection of the parent flower is largely based on calculation; but nature, with all its hereditary power, is a curb, holding fast to the stages of the evolution in the past, and thus making results very uncertain, disappointing, and almost a game of chance. If from thousands of seedlings, after three years' trial and weeding out, we return two or three varieties better than existing ones, we are well pleased with the results.



CHAPTER XXI

Various Classifications of the Carnation—Traits and Peculiarities—Sports and Variations—Seed Sports

THE various attempts at classifying the carnation have gradually been abandoned, until, at the present time, there seems to be no definite classification scheme in vogue. The French divide the carnation into three classes, namely: First, Grenadines, including those with strong perfumes, single or double flowers, medium in size, with petals deeply fringed and self-colored blooms. Second, Flamands, which include all large-flowered varieties, the blooms being round and double, rising in the center, and forming a convex surface, with smooth-edged petals. In this class the colors might be self, or striped with two or more colors. Third, Fancies, comprised of those with colors arranged in bands on light grounds. In this class the petals might or might not be fringed.

The English divide the carnation into four classes, namely: First, Selves, those possessing but one color. Second, Flakes, those having a pure ground of white, or yellow, and flaked, or striped, with another color such as crimson, scarlet, or pink. Third, Bizarres, those having the pure white, or pure yellow ground, marked in the same manner as in the Flakes, but with several different colors. Fourth, Picotees, which latter class has been regarded as a distinct race, the flowers having a pure white, or yellow ground, the same as with the Flakes, with a band of color bordering each petal at the margin.

In the early part of the 19th century much attention was given by English gardeners to the growing of large carnation flowers. In order to produce the most perfect blooms, the English growers practiced what was called the art of "dressing," which consisted of removing the superfluous petals with forceps, and arranging, in a formal manner, such petals as appeared out of place. The calyx was frequently cut partly down between the teeth, in order to prevent bursting, and to provide sufficient room for the utmost expansion of the flower. But the practice of the art of dressing seems to have wrought the downfall of the English carnation about the middle of the 19th century.

Various Classifications of the Carnation

The variety commonly grown in America, known as the perpetual flowering, or remontant, monthly, or tree carnation, may be classed as a distinct race.

As yet, there has been no organized effort to divide the American carnation into distinct classes; but, at the present time, it might be possible to revive the English classification, and apply it to our American race. Thus, such varieties as Mrs. Thomas W. Lawson, Enchantress, President Roosevelt, Mrs. Roosevelt, William Scott, Harry Fenn, and others would be classed as Selves. Varieties such as Viola Allen, Mrs. George M. Bradt, Gaiety, Marshall Field, Mrs. M. A. Patten and Prosperity, would be classed as Flakes, but now commonly called "variegated" sorts by American growers. Such varieties as Eldorado, Novelty, and others, would be classed as Picotees. At the present time, there is no representative of the Bizarre type in cultivation here, as the American public, as well as the American grower, have been but little interested in the combination of several colors in one flower. However, examples of the Bizarre class frequently appear in the stocks of the various hybridizers, and, in all probability, some of the more striking of these will, sooner or later, find a place upon the market, where they will undoubtedly meet with favor among a certain class of people.

Varieties

In breeding carnations the writer has divided his stock into the following classifications:

1. **FANCIES:** These embrace varieties with white, yellow, or other self-colored grounds, which are strikingly and peculiarly marked.
2. **THE PURPLE AND BLUE SECTION:** This covers all shades of purple, mauve, and such as might be liable to produce a blue-colored carnation.
3. **CRIMSON OR MAROON:** Most of the so-called crimson carnations are really deep scarlet grounds, which are covered with a veiling, or sheen, of maroon.

4. **SCARLET SECTION:** This needs no description.

The Pinks are divided into two sections:

5. **LIGHT PINKS:** Embracing shades of the flesh, or salmon, commonly known as the Daybreak type; and
6. **DARK PINKS:** Exemplified by William Scott, and such darker varieties as Mrs. Thomas W. Lawson, Mrs. Theodore Roosevelt, and so forth.
7. **WHITES:** Which need no description.
8. **YELLOW VARIEGATED:** These are yellow grounds which are striped, spotted, or bordered, with various colors, such as scarlet, pink, etc.



The Cottage Gardens Carnation Range in a Blizzard

The Carnation grower's life is not an easy one. In winter there are blizzards, snow-drifts and ice, entailing hard labor that rends his muscles and taxes his patience

Traits and Peculiarities

9. WHITE VARIEGATED: White ground, with various colored markings.

10. PINK VARIEGATED: This is a section which is the result of seed sports derived from crimson crosses. The ground color of the flower is usually of a deep Daybreak shade of pink, and the variegations are almost always maroon, or crimson.

11. A FANCY SECTION, which might be called *Flake*, of which class Prosperity is a good example.

There has been no particular reason for this classification, except to keep similar varieties together in order to maintain a better control in the scheme of breeding.

Traits and Peculiarities

Probably no commercial florists' flower requires more strict attention to the details of culture, in order to grow it to the best advantage, than the carnation. Undoubtedly, the florist meets with greater disappointments, and his success in cultivating this flower is probably surrounded with more uncertainties, than is connected with the culture of almost any other plant grown for cut flower purposes. The carnation possesses so many individual traits and peculiarities, that the study and patience of the grower are taxed to the utmost. Then, too, the constant introduction of new hybrids, themselves the production of a generation of hybrids, seems to be developing an increasing list of idiosyncrasies which tend to render successful culture perhaps more difficult than it has been heretofore. This uncertainty in the carnation character is so well known to hybridizers who have worked any length of time in the production of new seedlings, that they insist upon testing their new productions a number of years before coming to any definite conclusion regarding their value. A seedling will frequently give the greatest promise for one, two, or even three years, and then, even as late as the fourth year, will indulge in such pranks as refusing to bloom, developing spot, rust or some other disease to such a degree as to practically drive the variety out of cultivation; or it will develop a disposition to burst its calyx which seems impossible to overcome.

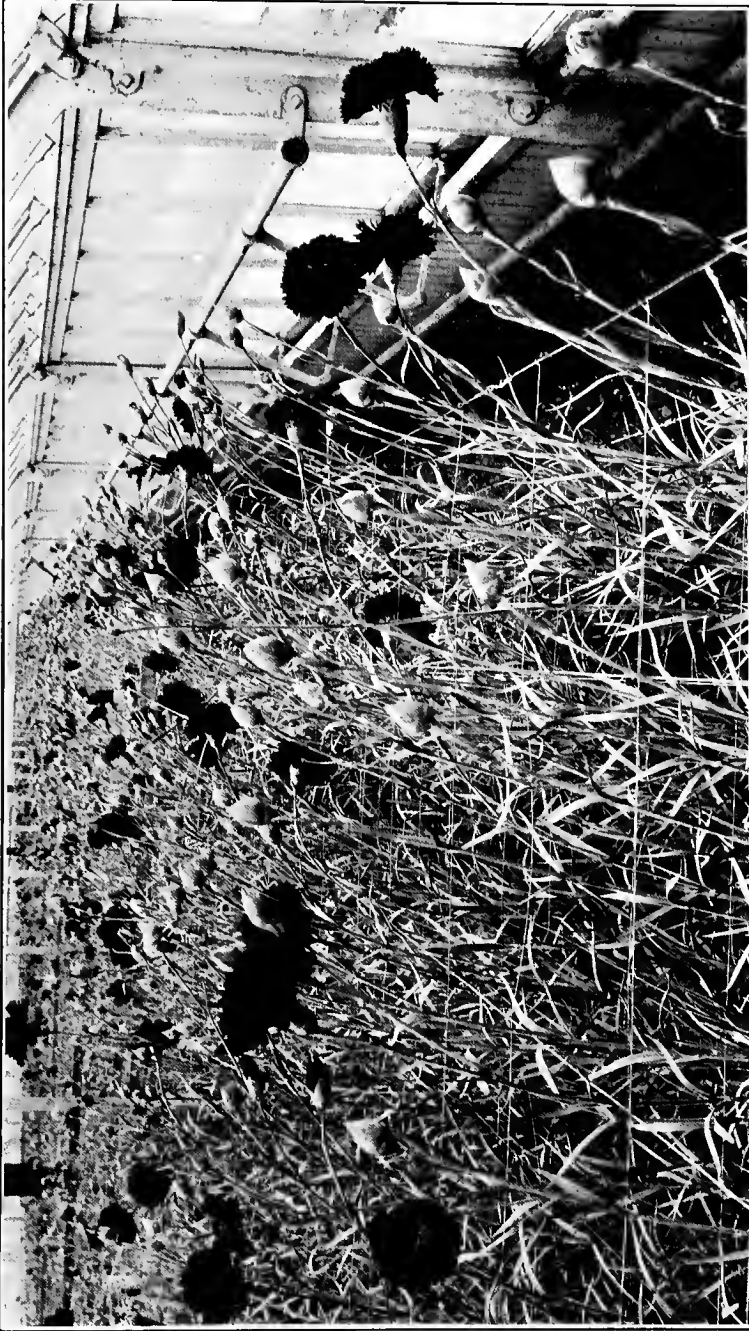
Many of the seedling carnations which produce enormous flowers during the first years afterward dwindle rapidly, until the blooms become of less than ordinary size. On the other hand, some varieties, that at first do not appear to possess particular merit, gradually increase in size and character, and in the course of three or four years are developed into valuable kinds. Of varieties with this characteristic, the well-known Mrs. G. M. Bradt is an

Traits and Peculiarities

example. When first sent out the success in the culture of this carnation was little more than nominal. The plants of it yielded but comparatively few flowers, and a very large proportion of these burst the calyx. It improved in profusion of bloom, size of flower, and strength of stem, for several years after its introduction, and, for a period, was one of the most valuable and popular carnations grown. Another example of this type of improvement is the well-known General Maceo. The original plant apparently possessed a weak constitution, and was left for some time in the field, as it was not considered to have sufficient merit to warrant a trial. It was at the last moment dug out of a frozen field, because of the depth of the color of the flowers, and the fact that they lasted an unusual length of time after opening fully. The plants propagated from the seed parent showed a sensible increase in strength and constitution, and further improvement followed the subsequent propagations. The variety also developed great freedom of flowering, and, probably, was the most profuse blooming carnation that had been introduced to American culture for a long period of time.

Some varieties are also particularly affected as to the period of flowering by the time at which the cuttings are taken for propagation. Thus, late-blooming kinds, such as Prosperity, Buttercup, Mme. Diaz Albertini, and others of that type, may be developed into early bloomers by propagating very early in the season, as early even as November and December, and stopping the plants but once or twice at the most. Such varieties as show a habit and disposition similar to those of Prosperity, should not be stopped after the month of July. A good example of the effect of early and late propagation, connected with early and late stopping, was given by a house of Prosperity grown this year, 1903. The plants that were propagated in December, and planted out from four-inch pots about the middle of April, stopped once after planting out, and lifted and planted upon the benches about the middle of July, came into full flower in the early part of October; while, upon another bench, where the plants were propagated the latter part of February, set out from two-inch pots at the same period as the earlier struck stock, but cut back once more and planted upon the benches at the same time, did not produce any blooms until Christmas, and even later; while the same plants which were stopped but once after planting came into flower a full month earlier.

Occasionally, a variety will show some peculiarity in bud development, such as opening the flower on one side only, under certain treatment. Thus, William Scott, when too highly fed with manures excessively rich in nitrogen and potash, failed to open the blooms, the petals having cohered at the



House of Carnation Harry Fenn

Yet for all that it has its compensations

“Underneath the crystal roofs all is calm and undisturbed”

Sports and Variations

edges. Daybreak and its progeny give many one-sided flowers, when grown in a very rich soil, and highly fed. Some varieties burst the calyx badly when grown in a low temperature. Mrs. Thomas W. Lawson and Eldorado are examples of this class. Other varieties burst the calyx if over-watered. Mrs. Lawson is apt to do this, and during the dark winter months should be kept a little on the dry side. Other varieties show a marked disposition to develop rust, or other fungous diseases. Such kinds should be discarded as seed or pollen parents. Breeding from disease-resisting sorts is to be preferred.

Sports and Variations

A carnation sport may be described as a distinct and definite variation from the regular type of the variety. This variation may consist of a change in color; that is, a plant bearing scarlet blooms may give a snow-white flower upon one branch. The cuttings taken from this branch will probably produce a certain proportion of plants that will reproduce the white form; but a certain number will revert toward the type, and produce scarlet blooms. Some of the plants may produce white flowers; others blooms that are parti-colored, or variegated; others will produce white blooms upon one portion of the plant, and flowers of the type upon the remainder. Continual selection from the branches producing the white blooms, and particularly from plants that reproduce all white flowers, will finally fix the sport, and it then becomes a variety. This type of sporting is called "bud variation."

"Color sports" are frequently very unreliable, especially where there is no variation in the habit of the plant; but frequently color sports are accompanied with a variation in the habit as well, and, in such cases, they are apt to be more permanent.

There are also sports in time of blooming. For instance, a very late variety may produce branches that give flowers early in the season, although the blooms may be the same as those of the type. A selection of propagating wood from these earlier flowering branches will, in time, fix a variety which will remain constant as an early bloomer.

There is also more or less variation in the habits of plants which might be termed "foliage sports;" that is, varieties with narrow foliage and rather slender, weak stems, may produce strong shoots, bearing broad foliage; this characteristic may also be fixed by the process of selecting the propagating wood.

Frequently, variegated carnations will give self-colored flowers of the same shade as the markings of the blooms which exist in the type. In such

Seed Sports

cases, these sports are not apt to be constant, as there is a tendency to revert to the type. An example of this is seen in the well-known red form of Mrs. George M. Bradt, which is produced, to a greater or less extent, wherever the variety is grown. While this form has been fixed, to some extent, I have never yet seen a stock of the so-called Red Bradt which did not produce more or less flowers of the variegated form. While in the case of the Bride rose, it seems to have been proved that a sport in a rose may be of much more value than the parent, the same cannot be claimed as true of carnation sports, for, with comparatively few exceptions, the latter are of but doubtful value.

They are, in general, a reversion toward some one of the parent types; and as the modern carnation is the product of hybridization, and as these hybrids are selected because they are improvements upon the type from which they have been produced, any reversion toward the parental type is apt to be one of decadence, rather than one of improvement.

Seed Sports

Among carnation hybrids, frequent variations in seedlings are noted, which cannot be accounted for in the pedigrees of the seedling parents. Thus, a cross between a crimson and a scarlet; or a cross between two crimsons; or a cross between two scarlets, all of the parents in the above cases having crimson and scarlet pedigrees, have produced snow-white blooms, though there be no trace of white blood for many generations in the seedling parentage. Such variations may well be termed "seed sports," and these are, in turn, apt to produce sports due to blood variation, frequently throwing strains of crimson or scarlet flowers, or blooms with white grounds and crimson or scarlet markings. I have seen some remarkable seed sports produced from crimson crosses. In some instances these have been pure white; in others, delicate salmon pink selfs, and, again, flesh pink grounds, delicately edged, or dotted, with crimson or purple. Further, the yellow and white variegated sections are apt to sport backward and forward; that is, yellow crosses will frequently produce white blooms with the same color markings existing in the parents; and, occasionally, crosses among the white variegated section will produce flowers with yellow grounds.



CHAPTER XXII

The Ideal Carnation

MUCH has been said about the Ideal Carnation, and now and then an enthusiastic seedling grower, or an admirer of the Divine Flower, gives to the world his description of what he considers an ideal carnation. Undoubtedly that Will-o'-the-wisp has bothered the minds of carnation lovers for the past three centuries, for as early as 1619 we find a good description of a method of growing carnation flowers in winter in a little work entitled "The Garden of Eden: an accurate description of all flowers and fruits now growing in England, with particular rules how to advance their nature and growth, as well as seeds and herbs, and the secret ordering of trees and plants, by that learned and great observer, Sir Hugh Plat, Knight. (Fifth Edition London, 1659)," of which the following is an extract:

"To have Roses or Carnations growing in winter, place them in a room that may "some way be kept warm, either with a dry fire or with the steam of hot water conveyed by a pipe fastened to the cover of a pot, that is kept seething over some idle "fire, now and then exposing them in a warm day, from twelve to two in the Sun, or "to the rain if it happen to rain; or if it rain not in convenient time, set your pots "having holes in the bottom in pans of rain water, and so moisten the roots.

"I have known Master Jacob of the Glassehouse to have Carnations all the winter "by the benefit of a room that was near his glass house fire; and I myself, by nipping "off the branches of Carnations when they began first to spire, and so preventing the "first bearing, have had flowers in Lent, by keeping the pots all night in a close room, "and exposing them to the Sun in the day time, out at the windows, when the wether "was temperate; this may be added to the Garden (mentioned Nu. 29) to grace it "in winter, if the room stand conveniently for the purpose.

"You shall oftentimes preserve the life of a Carnation or Gilliflower growing in "a pot, that is almost dead and withered, by breaking out the bottom of the pot, and "covering the pot in good earth, and also the old stalks that spring from the roots; "but every third or fourth year, it is good to slip and new set them."

From the above it will be seen that the winter culture of carnations was known at least 300 years ago. In the *Gardeners' Magazine of Botany* for 1850, an article, written by Mr. George Glenny, on some points of excellence in florists' flowers, gives an idea of some of the attributes that might con-

The Ideal Carnation

tribute to an ideal carnation. Mr. Glenny said: "As there is nothing more essential to the improvement of flowers than a knowledge of what would constitute perfection, it may be acceptable if we give a slight sketch of the principal features desirable in some of the more popular of our ornamental plants and florists' flowers, that those who raise from seed may be aware of the points most esteemed when they select for future cultivation. The claims which seem more or less to predominate are: First, **PERFUME**; desirable in everything, whether gay or otherwise; witness the violet, mignonette, pink, stock, carnation, wallflower, sweet pea and heliotrope among flowers; and the rose, thorn, sweetbrier, honeysuckle, magnolia, clematis, etc., among shrubs. Second, **CONTINUOUS BLOOMING**; even without perfume, as in the scarlet geranium, verbena, china rose, dahlia, convolvulus, heliotrope, calceolaria, etc. Third, **ELEGANCE OF HABIT IN THE PLANT**, as in the fuchsia, and in most evergreens, especially the holly, box, laurel, and nearly all the coniferæ. Fourth, **SPLENDOR OF THE FLOWER**; as in the camellia, pelargonium, erica, azalea, rhododendron, ranunculus, anemone, etc. All these points are desirable, and although some subjects may possess only one of these in an elemental degree, there are others which possess more than one, though perhaps not so desirable as some others may possess the individual properties."

In discussing this question, Mr. Glenny, referring to the tulip, remarks as follows: "As regards individual properties and qualities, perhaps no flower has caused more discussion than the tulip. The form alone has occupied the attention of many who have endeavored to upset those laws which were laid down in 1832, but which stand to this day as the only standard in spite of all that has been written to the contrary from that time to the present day."

In the same magazine, descriptions and cuts of perfect picotees as well as perfect carnations are given, with reproductions of the varieties of these respective flowers which growers had been able to make approach most closely the arbitrary ideal outlined. A reference to Figs. 1 and 2 will give the reader a good conception of the ideal which the carnation grower of 1850 was seeking to produce among picotees. Fig. 1 was described as the Mrs. Norman, a heavy edged picotee, raised by N. Norman, a well-known cultivator, of Woolwich, and was raised from seed saved from Headley's King James fertilized with pollen of Ely's Emperor, both heavy, red edged flowers. Comparing the two cuts, the modern carnation grower will be at once impressed with a stiff, wooden-like appearance of the illustration denoting the perfect picotee. Again referring to Figs. 3 and 4, we have what at that day was laid down as the proper dimensions of a perfect carnation, and also one of the best examples of the bloom that nearest approximated the ideal of that

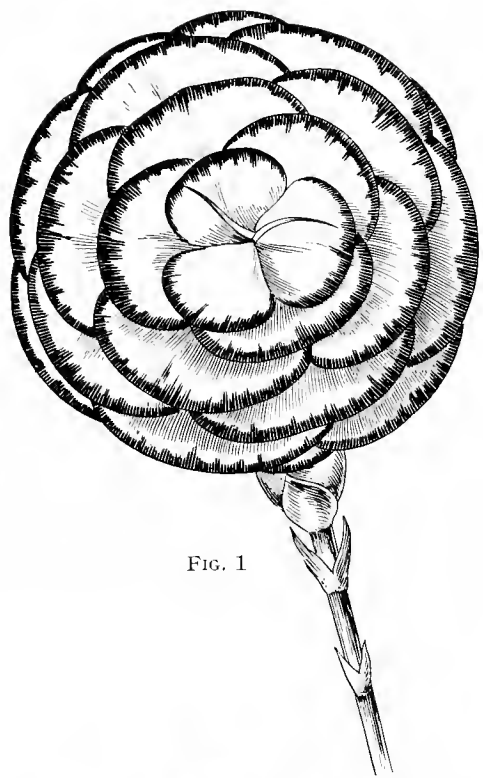


FIG. 1

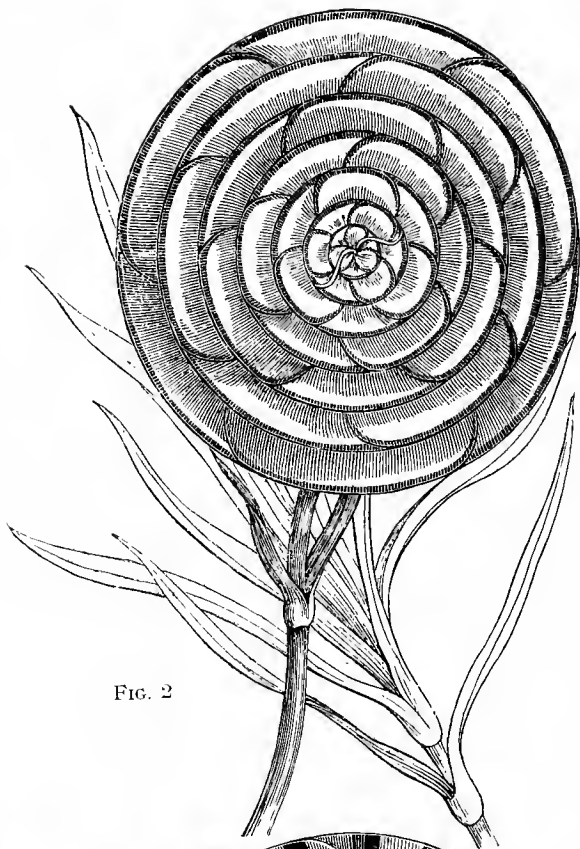


FIG. 2

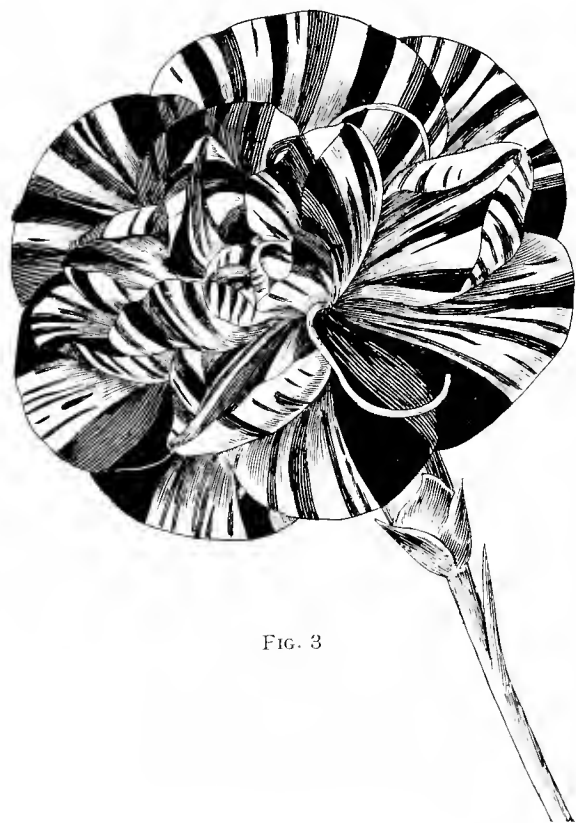


FIG. 3

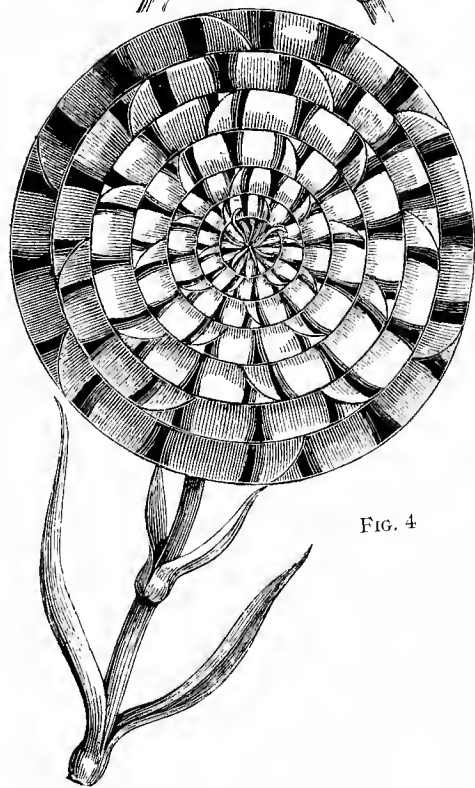


FIG. 4

The Ideal Carnation

day. Fig. 3 is described as Puxley's Emperor, a scarlet bizarre, raised by Mr. Puxley in 1848, a remarkably large and showy kind, of good habit and free growth. It is stated as a fact worth recording that Mr. Puxley, though an extensive grower, had only two kinds of carnations in his garden at that time which were not originated by himself.

Further comparing the ideal with the attainable carnation of that date, one is once more impressed with the stiffness, formality and lack of grace in the so-called ideal, or perfect carnation. In those days nothing but bizarres, flakes and picotees were grown. So far as carnation literature discloses to us, selfs were not desirable, consequently were not cultivated. At the present time the American carnation grower seems to be working in an entirely different field from that of the English cultivator of earlier days. The shell petal, so much valued by the English grower, seems to be but little liked by the American public, for the reason that in our climate during bright, sunny weather the moisture evaporates from the edges of the petals, drying them up and drawing them together toward the center in a cup-shaped manner, thus producing a sleepy appearance in the flower, which is fatal to its sale.

Among the many smooth-edged seedlings which we have raised at Queens quite a number of them develop beautifully and keep well during dark, winter weather, but as soon as exposed to the bright, sunny days of February and March they take on their sleepy character; and during the months of April and May are comparatively valueless. The laced or serrated-edged petal seems to stand far better in our climate, for even after the edge of the petal has become slightly withered and dried it does not alter the shape of the flower, consequently the bloom is still presentable in appearance; and it may be stated that invariably the flower with the lace-edged petal is far more durable and lasting than the shell-petaled bloom.

Among American seedling growers of the present day more attention is perhaps paid to form than is warranted by the tastes of our public. It has been said that the devotion of the carnation grower in England to the production of perfectly formal flowers finally wrought the downfall of the English carnation, which, in a measure, passed out of popularity. Up to the present time the American seedling grower has not been able to make so much progress toward the production of formal blooms as to rob the carnation of that great wealth of artistic variation, which probably has contributed more to the increase of the consumption of carnations in the United States than any other one point.

So far as artistic taste is concerned, there is as much to be said in favor of the ragged, yet artistic, graceful appearance of the heavily fringed carna-

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tion as there is in favor of the perfectly formal flower of the English grower. The ragged bloom gives pleasure to many who purchase it, and the formal flower gives pleasure as well, and who is to say that either shall be denied to the lover of flowers?

If I were asked to describe the perfect carnation I would reply that there could be perfect carnations of several different classes. For instance, there could be a shell-petaled bloom that would closely approach perfection; there could also be a semi-shell-petaled flower that would be a perfect one of its class; and then, again, there could be flowers the petals of which were heavily laced, which could also be considered the perfection of their type.

I will then take the ground that no single form of carnation can be adjudged as perfect or ideal; but that many variations in type may be successfully grown and will please a wider range of people than if one formal type be produced. This does not, however, prevent the fixing of a scale of virtues which all good carnations should possess. These necessary attributes might be stated as Color, Fragrance, Substance, Form, Habit, and General Appearance when the blooms are massed.

COLOR I should place at the head of the three most important qualities (FRAGRANCE and SUBSTANCE being the remaining two), and it should be of a pure, clear, pleasing tone, or combination of tones. At this date no dull or impure tints should be tolerated, and, above all, the tints should be durable and retain their pleasing tones long after the blooms are cut.

FRAGRANCE I consider one of the cardinal virtues of the carnation, for throughout its entire history its fragrance has been noted as one of its chief attractions. A carnation without fragrance always seems to me like the comb without the honey.

SUBSTANCE stands on an even footing with fragrance and color, for without substance the colors fade, the blooms quickly wither and die and pass away like a myth. Substance contributes so much to form and durability of the flower that no grower of fine carnations can afford to give it other than an important place in his scale of virtues.

FORM and HABIT and GENERAL APPEARANCE stand relatively second in importance to color, fragrance and substance, though they are all so essential that none can be properly omitted in judging the merits of any carnation.

FORM may vary to a considerable extent and be of several different types, such as the shell-petaled bloom of the English garden, the serrated-petaled flower of our American varieties, or the highly laced, or feathered-petaled blossom of the Marguerite type. The general contour of the bloom should verge toward the symmetrical; the guard petals should be broad, stand well

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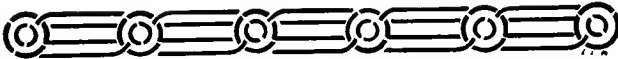
out of the calyx and turn at right angles to the stem, spreading broadly and evenly and firmly supporting the center mass of petals, which should form a semi-circular periphery. A firm calyx that does not burst is always a necessary adjunct of a good carnation.

HABIT is also all important, because it controls the stem and determines what sort of a crop of flowers we may expect. The habit should be vigorous, but not gross or coarse. The stem should be stiff, wiry and strong enough to hold the bloom erect, but not rigidly upright. The growth should be compact, grass not too coarse; and the plant should be a rapid yet firm grower and an early, free and continuous bloomer.

GENERAL APPEARANCE of the blooms should also have consideration, inasmuch as many varieties deficient in form and appearance when taken as single flowers are very useful and valuable when massed in quantities.

SIZE: You will wonder why I have not given Size a more prominent position, and why I leave it until the last. Well, the reason is just this: I fear that too much prominence has already been given to the size of carnation flowers, and that in the end we may commit the error of producing coarse blooms, deficient in fragrance and grace, and thereby impair the popularity of our carnations. Flowers two to two-and-a-half inches in diameter are large enough for ordinary carnations, and two-and-a-half to three-and-a-half inch blooms, with an occasional "Jumbo," four inches across, should satisfy the craving for large size.

I perhaps ought to refrain from naming any varieties possessing superior merit as perfect carnations, but if one wishes examples, Governor Roosevelt, for form and stem, might be cited, while Prosperity, though of a different type, possesses splendid form and is large enough to suit all requirements.



CHAPTER XXIII

The Future of the Carnation—Who Shall Grow Carnations—Profits of Carnation Growing— Does It Pay to Do Things Well?

THE rapid development in the production of carnations, which has occurred during the past ten years, has frequently caused those engaged in the business to question the probable future of the Divine Flower, and to consider whether its popularity is a passing fad, or is founded upon such intrinsic merit as will insure the flower's permanent continuance in popular favor. Judging from past history, and, again, from present indications, the latter proposition would seem to be tenable. The carnation has become one of the most important of staple florists' flowers, and is now so generally used as to be regarded as a floral necessity. Among all flowers there is none that may be considered more useful than the carnation; in fact, it is the only rival the rose has thus far met, for even at the present time its popularity is not second to that of Flora's Queen. Its consumption fully equals in numbers that of roses, and, probably, may exceed it within a few years. This increasing popularity may be readily accounted for. While the common varieties can be sold with profit at modest prices, the bountiful response of the carnation to superior cultural methods is productive of blooms of such excellence as to satisfy the most fastidious tastes, or the extravagant desires of the very rich.

While competition among growers will tend to decrease the price of the ordinary grades of carnations, this diminution will be amply counterbalanced by an attendant increase in consumption, as values are brought within the reach of people with limited means; while the better classes of blooms, especially those which may be considered the finest, or fancies, will always command prices commensurate with their quality and cost of production.

The continuing improvement in the carnation, and the introduction of new and interesting varieties, must always exercise an influence that will attract the attention of the flower buyer; and if the producers of the Divine Flower will carefully preserve that sweetest of its attributes—the rich, clove

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fragrance—and not commit the error of producing blooms solely with a view to enormous size, stiff stems, and regular form, the popularity of the carnation ought to be conceded as a permanent factor in commercial floriculture. If the clove gillyflower—*i. e.*, the clove pink, mentioned in the early history of the English carnation—so richly fragrant as to scent a whole greenhouse, were still in existence, its popularity would undoubtedly be as great as in the olden days.

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During each year the author receives a number of letters from enthusiastic lovers of the carnation, who desire to engage in its commercial culture. These letters come from and represent a varied class of people, being received not only from the aged financier, or professional man, contemplating retiring from active business life and desirous of spending his remaining years in some light, interesting employment, yet retaining enough thrift to wish the occupation to pay its way, but from the energetic lad, with his career still before him; also the middle-aged man, whose salary is beginning to be insufficient to care properly for the growing family, and who hopes, by engaging in some side employment about which he can busy himself before and after business hours, to add, in a slight measure, to his income; as well as from the spinster, who longs to support the dependent loved ones by engaging in some employment which will save her from teaching, the factory, the store counter, or, more hated still, domestic service.

These letters are always interesting, as they disclose the existence of such earnest hopes of success as would call forth all the energies of which the writers were capable; but they also disclose a lack of practical horticultural experience, and indicate that the writers have not formed any conception of the application necessary to master the commercial growing of flowers and to overcome the difficulties connected with their culture, in order to gain a fair profit and compensation for the labor entailed and capital invested. One writes that she holds a position as telegraph operator in a country town. Her home is but a few rods from the station. She has dependent upon her an aged father. She is imbued with the idea that the culture of beautiful carnations will add something to her income, and prove a pleasure as well. Then, too, she has an advantage: the aged father will be only too glad to take care of the plants during the hours she is employed in the office. She has but a hundred, or two hundred dollars at the most at her command, and has already expended, perhaps, one hundred and fifty dollars in the building of a lean-to greenhouse against the dwelling before she applied for

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advice, so that she is already committed to her project before the probability of success or failure can be discussed. The best advice is given, and she is furnished with plants in the best possible condition, replaced, perhaps, once or twice, as they are lost through improper treatment. She struggles hopefully and bravely on for, perhaps, two or three years, only to learn that the well-equipped florist, but a few blocks away, has such superior facilities for the growing, and especially the selling of flowers, that she has but a slender chance to make even a moderate margin of profit; and, finally, becoming discouraged, she gives up the venture.

Another example is the broker, who has struck it rich in Manhattan Elevated, American Iron and Steel, or reaped a colossal fortune by engineering the combination of enormous interests, and who, finding himself replete with wealth, expresses his desire to do something with his accumulations by laying out a generously planned country seat, and building thereon a sumptuous establishment, with palatial glass structures in which he designs to grow exotic flowers and fruits to gratify his new-born tastes. Within a few years, the contemplation of the large expense account, which necessarily accompanies such luxurious surroundings, awakens a vein of retrenchment and economy, and he begins considering how he can manage his estate, and make it support a portion of its financial burden. One of the first problems he is likely to tackle will be the extensive greenhouse establishment; and his faithful and enthusiastic gardener will generally be able to figure, to his employer's satisfaction, munificent profits, based upon the prices which he is obliged to pay to the Broadway or Fifth avenue florist for the selected fancy blooms bought only during the holiday season, when the supply from his own greenhouses is not sufficient to cover his requirements in the way of remembering his friends. He tarries not long in arriving at a decision. He will grow either carnations, roses, or orchids. He usually considers this question late in the season. There is no time to fill the houses with roses; and orchids must be left until the following spring, so he falls, naturally, into growing carnations, even if only for the present, until time is afforded to prepare for the other and more expensive stock. Price-lists are hurriedly sent for; a stock of field-grown plants, consisting of a wide range of varieties, is purchased from various growers; soil is hastily gathered together; the benches are filled; the plants arrive; the planting is pushed forward with energy; and within a space of perhaps six to eight weeks the place has bloomed forth into a full-fledged commercial florist's establishment. Expensive help is employed; the newest and latest fads in the way of carnation supports and other paraphernalia are purchased; and the proprietor

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is as well pleased for the time being as if he were engineering a successful corner in coal stocks. But the reckoning day is at hand. The time comes when the returns from the commission house begin to give a pointer as to what the profits bid fair to be. It is then that the floricultural novice learns that there is a wide difference in value between the flowers as they leave the handsome store of the Broadway florist, delivered in the liveried equipage drawn by expensive horses, and the price at which they leave the commission house; and this variation he finds one that cannot be overcome, unless he himself be willing to engage in the retail florist business and assume its attendant risks and expenses. His vision of handsome profits vanishes. He finds that the possession of immense wealth does not make him a successful commercial grower, and that the enthusiastic, skilled florist, who not only loves the carnation as a flower, but who couples with that love a shrewd ability to make the best out of little, and who is willing to make the many personal sacrifices necessary to produce the best results, is able to obtain better flowers, and to sell them at better prices than the whilom grower is able to get for the costly products of his expensive greenhouses, which he finds must be sold upon an unprofitable basis; and after a period of time he, too, disappears from the ranks of the commercial florist.

Another would-be carnation grower is exemplified by the following letters:

J. Kelsey Blank.
W. Atwood Blank.

Office of Blank & Co.,
Manufacturing Chemists,
469 Blank Street, Chicago, Ill.

My dear Mr. W—:

This will introduce to you my gardener, Mr. John Rowls, who has charge of my country place, Overlook Manor. You will find that Mr. Rowls is a very capable florist. Now, my dear Mr. W—, I wish to ask a little advice. I have at Overlook Manor quite an extensive greenhouse, sufficiently large to more than provide my household with such flowers as we desire. Mr. Rowls has been marketing the surplus carnations, and has always received the very highest prices for them. He thinks the climate and soil at Overlook especially well adapted for growing fine carnations. Mr. Rowls has advised me, that with the building of a few additional greenhouses the production of carnations will be increased so that enough can be sold to materially help defray the expenses of maintaining Overlook.

I have a surplus income from my business which will enable me to build the needed additional houses, and I contemplate engaging in growing carnations. Knowing you to be one of the most successful growers in the country, and one who seems to have made considerable money out of the business, I take the liberty of asking you to advise me as to their culture and the style of house I should build; also, will you kindly fur-

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nish me with a list of such varieties as you would advise me to grow—those that can be sold to the best advantage?

Any courtesy you may show Mr. Rowls will be much appreciated, and, in consideration of your advice and kindness, I will purchase the entire stock I may require from your establishment. What chances do you think I would have of succeeding in the undertaking?

Thanking you in advance for your kind consideration, I remain,

Yours sincerely,

J. KELSEY BLANK.

J. Kelsey Blank, Esq.

My dear Sir:

Replying to your esteemed favor of recent date, I have given your gardener, Mr. Rowls, whatever information he asked for. In regard to your undertaking growing carnations in a commercial way, I think you would have as good a chance of succeeding as I would, should I enter the business of manufacturing chemicals. No doubt a man of your experience and ability would succeed, provided you were able to give carnation growing the attention and study it requires. Your inquiry has awakened the suggestion in my mind: Why should I not engage in the chemical manufacturing business? I have some spare money. You could advise me in the conduct of the business as well as I could advise you in the florist business; then, too, I could purchase my stock, to start with, from your firm. What do you say to our trading business experience in this way?

Sincerely yours,

C. W. WARD.

Office of Blank & Co.,

Manufacturing Chemists,

469 Blank Street, Chicago, Ill.

My dear Mr. W—:

Many thanks for your kind letter of the 20th inst. You have opened my eyes about the florist's business. I have concluded that it is best for every shoemaker to stick to his last, and I shall not engage in growing carnations for sale.

Sincerely yours,

J. KELSEY BLANK.

But every one who essays the culture of carnations does not make a failure, and there may be individuals among any of the above-mentioned classes of people who will make a success of the undertaking. Upon general principles, it may be stated that the most successful growers of carnations will be those who combine practical cultural skill and knowledge of flowers with an inborn love for them so strong that those making the effort may be willing to make the sacrifices necessary to achieve successful results. Nevertheless, a genuine love of the business, and a determination to succeed, will frequently overcome a lack of cultural skill; and there are many cases that might be mentioned where the novice has engaged in the culture of flowers and, by dint of application, hard work and perseverance, made a success.

Would I discourage anyone who wished to enter the florist's profession? No, indeed. Only a note of warning, that "all is not gold that glitters," and

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that back of the wealth of spicy blooms there lies the same old foundation of the spade, the digging fork, the shovel and the hoe, with brawny hands and arms and stout hearts to wield them. He that would have gold must dig for it; and he who would grow flowers will get no more for the asking than would the gold digger.

Profits of Carnation Growing

It is not my purpose to embody in this work any definite estimates of the profits that may pertain to commercial carnation culture. To the theorist, there is no more agreeable occupation than estimating beforehand the probable profits of any venture he may be about to engage in. Some one has said that "figures don't lie!" I would change this axiom into: "Figures are always made to lie, when future profits are computed upon the workings of a new venture."

If you ask, "Is it a profitable business?" I will reply, "Yes, if properly conducted;" but will say further, that I know of no calling that requires closer attention, or more constant personal application, than that of the commercial florist. Like the housemaid's task, his work is never done. Week-day and Sunday, workday and holiday, by sunlight or lamplight, his factory is running every full day of twenty-four hours. His employees may gauge their day's work by ten hours, or less, or more; but his responsibilities never for a moment cease. And the florist endures all this upon a margin of profit that affords him, in a well-managed business, sufficient only to educate his family and start them on life's pathway upon but a modest footing, unless he has been fortunate enough to have located on the margin of some large city, and purchased sufficient real estate, the rise in value of which has brought him riches.

Commercial gain should not be the sole and determining factor of interest to the successful florist. The mere sordid pursuit of wealth ill befits an art in which so many possibilities are wrapped. While the carnation enthusiast's life may not be one of ease, and while in winter there are blizzards, snowdrifts and ice, entailing upon him hard labor that rends his muscles and sorely tries his patience—for all that, his calling has its compensations. Who among the craft will deny the pleasures of that most enjoyable time just before the holidays when the richness of the floral harvest is at full tide? While the fiercest gales of winter are wildly battling the drifting snows against the glass, underneath the crystal roofs there is the coloring of spring-time; and the broad expanse of royal blooms, redolent with the spicy odors of the tropics, are waving with a quiet beauty peculiarly their own, suggesting

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the bountifulness of swaying grainfields during the prairie farmer's harvest time.

The President's favorite flower may be seen growing under such an expanse of crystal roof as to suggest the appellation of "carnation ranch." Then, too, the grower may have the pleasure of knowing that his work has the appreciation and approval of those throughout the world whose eminent positions and education have fitted them to judge of his efforts from an æsthetic, as well as a practical standpoint.

The Divine Flower has received the love and praise of two of our most beloved and esteemed Presidents—Mr. McKinley and Mr. Roosevelt—and, within a recent period, His Imperial Majesty, the Emperor of Germany and His Royal Highness King Edward of England have done homage to the American carnation.

Does It Pay To Do Things Well?

This question might be answered by asking the question, "Does it pay to do them any other way than well?" When it comes to the culture of flowers, it most certainly does not pay to grow them, unless the undertaking is carried on in a most thorough and systematic manner. Organization, method and thoroughness will accomplish as much in floriculture as in any other undertaking. The successful horticulturist must be one who always has command of his business; and to accomplish this, that business must be so well organized that he will have a grasp upon all its details. In order to get the best results from his establishment, every foot of bench space needs to be cultivated in the best possible manner. He should know what particular varieties of plants can be profitably grown, and also be sufficiently well acquainted with the demands of the market to enable him to judge of what he can sell profitably. If he grows cut flowers, they should be picked and shipped to market in such condition as will enable him to secure the highest prices. If plants, they should be so well grown as to make them desirable purchases. His greenhouses ought to be models of cleanliness and neatness. There should be no accumulation of filth, or rotting material, under the benches, or stood in out-of-the-way corners, as such accumulations are but the breeding places of insects and disease. A neat, well-kept establishment exercises a favorable impression upon the visitor. Purchasers usually prefer to deal with prosperous concerns; and ill-kept florists' establishments do not convey an impression of prosperity.

CHAPTER XXIV

Calendar of Operations

January

Plants should now be in bloom. Maintain an even night temperature of about 50 to 52 degrees; not exceeding 56 degrees on any variety. Day temperature 65 to 70 degrees. Give air on all bright days. Don't hold the houses too warm or create a close, steaming atmosphere. Watch watering carefully; the plants will now begin to need more water as the days lengthen and the sun's rays become more powerful. Look out for sudden rises in temperature in the houses on bright mornings. Take cuttings of late blooming varieties. Watch carefully for green fly, and especially red spider. Fumigation with tobacco at this season is objectionable, as it ruins the blooms; preferably use XL-All, or tobacco extract painted on the pipes twice a week. Commence feeding the plants lightly with liquid manures, or afford a light mulch of sheep manure about the middle of the month.

February

Plants are now having more active growth, and will need more water and feeding as the days lengthen. As the season advances, green fly and red spider should be more carefully watched for. Thrips will now begin to develop. Propagation should be fully under way. Plants are now growing and blooming freely. Increased ventilation should be given on bright days. Cuttings taken in January should be rooted and ready for potting up. Use a two-inch pot. A soil composed of about three parts yellow loam, one part leaf mould, one part decayed stable manure, a dash of bone dust and one part fibrous peat, makes a good potting soil. (See chapter on Soils.) This soil should be thoroughly mixed and run through a coarse sieve. If the compost has been prepared six months ahead, so much the better. Pot firmly, as this soil will be very light. Cuttings potted in January will need a shift about the middle or last of this month. Don't let young plants get potbound.

March

Propagation should still be in full force. Select all cuttings carefully

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from none but healthy plants. Watch for red spider, thrips and green fly, and use proper preventive measures. Watering must be carefully attended to. Look out for sharp rises in temperature on bright mornings after heavy firing. Plants are growing more rapidly, and will need increased quantities of water. Abundant ventilation should be carried whenever possible. Syringe if any trace of red spider appears; a good syringing once each week, on a bright morning, will do no harm. Such varieties as the Mrs. Thomas W. Lawson, Mrs. Theodore Roosevelt, Daybreak, Enchantress, and any of the colors which fade in bright sunlight, should be lightly shaded by striping the glass with a thin paint made from white lead and naphtha. Make the stripes four inches wide, with three inches of clear glass between each stripe. Fumigate with extract of tobacco, or XL-All, to destroy thrips. Always cut the blooms closely before fumigating with tobacco, or syringing with salt solution. Pot all cuttings as soon as rooted. Shift all plants that need it and before they become potbound. Watch the young plants in pots closely; don't let them wilt for lack of water. Don't soak them all the time; use judgment and reason in watering. If young plants are shaded lightly during the brightest part of hot days it will save excessive watering. Young stock that is established should now be in cool quarters; 45 to 48 degrees at night and 56 to 60 degrees during the day is about the right temperature. Give an abundance of air. Fumigate freely; all young plants should be set in the field absolutely without taint of any insect pest.

April

Propagation may be continued, but is now coming to a close. Shade the propagating benches more heavily, and keep the propagating house as cool as possible. Fresh, or sterilized, sand only should be used. All flowering plants need a light shading. Keep down insects. Young plants are growing and need watching and prompt shifting. Late blooming varieties, such as Prosperity, Mme. Diaz Albertini, and others, may be set in the open ground by the end of this month, whenever temperature and soil conditions will permit. Plants intended for planting on benches for inside summer growth should now be in three-inch pots, ready to shift into four-inch pots. Such varieties as Mrs. Thomas W. Lawson and Prosperity, propagated in November and December, should be in three to three and a half-inch pots, according to strength of growth, and ought to be planted on benches by May 1st in order to get best results. Plough the field intended for carnations just as soon as the soil is dry enough. If chemical fertilizers are used, get them into the ground at the first harrowing. If stable manure is to be applied in the spring,



CERISE PINK SELF

PLATE IV. CARNATION MRS. T. W. LAWSON (FISHER)

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plough it under at once. Fumigate young stock either with tobacco, XL-All, or tobacco extract, for three consecutive nights before the stock is planted out either in the open ground or on benches. Exercise great care in fumigating; don't overdo it.

May

The growth of the plants is still increasing. Insect pests will now multiply rapidly if not attended to and destroyed. If red spider and thrips are allowed to get full possession of the plants at this season, the grower might as well go out of the carnation business. Use XL-All for thrips; syringe for red spider. (See Chapter XII., on Soap Solution and Salt Solution.) Fumigation with XL-All, tobacco, or tobacco extract, will kill green fly. Plant out all young stock as fast as ready. Plant in freshly cultivated soil. (See Chapter VII.) Fumigate all young stock before planting out. All ground should be ploughed a second time. Thorough preparation of the soil before planting out is necessary. (See Chapter IV., on Soils.) All blooming plants should be lightly shaded. Plants on the benches need abundant watering and all the air possible, and syringing once or twice each week, if there be any indication of red spider.

Houses intended for indoor culture of plants in summer should be cleaned out, the benches thoroughly washed inside and outside and underneath, the roofs and sides of the houses thoroughly washed down inside, and fumigated by burning flour of sulphur at the rate of four pounds to a house twenty by one hundred feet. Close up the house tight immediately after washing down, and fumigate while the house is full of moisture. Place the sulphur in several six-inch pans, or pots, or on plates; put these at different points on the walks, drop in live coals, and leave the house quickly, allowing the sulphur to burn itself out. This is very effective if done early on a bright, warm day. Leave the house closed twenty-four hours, then throw it wide open and wash down everything thoroughly with the hose and allow all to dry out for a day. Few insects and fungi will survive this treatment. Look after the shifting of all young stock. All field stock should be planted by the last of this month. Run the cultivator among all young plants whenever the surface of the ground shows hardening. Cultivate after each rain. Hoe the young plants, and break hard soil around their necks. Never allow weeds to get a foothold. Plants in pots intended for planting on the benches in June or July, should now be plunged in a frame, in order to harden them off and save care in watering. Sash should not be put on such plants except in case of heavy rains or a hard frost. When the sash is on, give plenty of air, even during heavy rains, by lifting up the sash at the back.

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June

Plants will now be in the height of the summer crop of bloom, will require an increasing quantity of water, and may be liberally fed. The amount of evaporating surface through the foliage and petals, in connection with the increasing heat, will consume the moisture in the soil five or six times as rapidly as during the winter time. Cuttings taken early in May will now be rooted, and should be potted up immediately and set in the open ground as soon as the roots have formed a fair-sized ball. Cuttings taken from the sand at this period may be planted immediately in the open ground, just preceding a rain. If successful in planting out such cuttings, so that they will not receive a serious check, they will make very fine medium-sized plants by the 1st to the middle of September. The later-struck stock is usually vigorous and healthy, for the reason that the cuttings are taken from plants in excellent condition. This, however, will not prove true, if the stock plants have been starved and allowed to run down in health.

All plants for growing inside during summer should now be upon the benches. Plants that are intended for blooming in pots should be shifted as needed, and plunged in an open position outdoors. It is well to place the bottom of the pot upon a floor of ashes, which should be made firm by rolling or beating. The position should be sheltered from prevailing winds and exposed to full sunshine, with an abundance of room for each plant. English growers do not recommend plunging carnations in pots, but in our hot, dry climate I think it preferable. The pots should be raised and turned every two weeks, in order to break the roots at the bottom and prevent the plants from rooting through the ashes into the soil. As fast as the benches are exhausted, the plants should be thrown out and the soil removed as promptly as possible. I strongly advise the burning of all discarded carnation plants as soon as thrown out. At this season of the year, the carnation is more or less infected with various insects and fungi. If old plants are burned as soon as taken from the greenhouses, the insects as well as their eggs will be destroyed; whereas, if the plants are thrown out on a heap, or anywhere upon the land, some considerable portion of the insects will escape to other plants, and finally find their way on to the carnation fields, or into the houses, to again annoy the grower and injure his stock.

Plants in the field will need cultivation and frequent hoeing, at least once in every two weeks; cultivation once a week will be no detriment. Growth is now pushing forth rapidly, and the blooming shoots will begin to elongate toward the bud formation. These should be cut back as soon as the

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bud is well developed. The carnation field should be gone over each week and all shoots showing bud development pinched out. Do not take off any shoot that is not well advanced, but leave it until the next pinching time. Some growers allow their plants to stand until the buds are fully developed and then cut everything back hard. This is detrimental, if a continuous crop of bloom is desired, as it has a tendency to cause the flowers to come in crops.

July

The hottest periods of the year are apt to occur during this month and the following one. All insect pests, especially thrips and red spider, will be exceedingly troublesome this month. In extreme hot weather, the plants may be syringed every evening and in the morning as well. Ventilation should be kept on at all times. Young stock upon the benches should be syringed, and close attention given to watering. The shoots should be pinched back as fast as they show formation of flower buds, care being taken not to cut them back too hard. In pinching back a shoot, at least three strong joints should be left. Cultivation outside, and the hoeing and weeding of stock in the field, should be persisted in. Follow up the pinching back of stock in the field. The bench soil should be cultivated wherever weeds are showing, or the surface soil has become encrusted. Plants for blooming in pots should all be outdoors, and will now be growing rapidly. When the pots have become well filled with roots, water must be administered liberally, but after shifting, and before the roots have taken possession of the new soil, watering must be carefully done. If too much water is given at this period, the new soil may become soured and the plants will not make as good growth as otherwise. All old flowering plants remaining inside should now be thrown out as rapidly as the houses are needed. As soon as it has been decided to stop the care of a bench of carnations, the plants should be thrown out at once and burned, as it will not pay to allow the plants to stand upon the benches and dry up, for insects will leave such plants and go to adjoining growing stock, to get food. The houses should now be cleared out, fumigated and refilled, and prepared for planting as rapidly as possible. Late varieties, such as Prosperity, Mrs. Thomas W. Lawson and Governor Roosevelt, should all be benched not later than the 20th to 25th of this month. Houses should be shaded lightly where any plants are growing. This shading, if not too heavy, may be kept on until October, at which time it should be gradually removed. Continue the pinching back of all plants, both in the field and in the houses. Follow up cultivation, both in the field and on the benches, vigorously.

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August

Cleaning out and filling and planting the houses should be carried on with energy, as it is now desirable to have all the plants benched as rapidly as possible. Fumigation for the destruction of thrips and green fly must be practiced at every favorable opportunity. Select the coolest nights for fumigating. The destruction of thrips must be followed up persistently. It is a very difficult insect to reach by any remedial agent, as the pest burrows down into the flower buds where it is safe from the fumes of the various gases used to destroy insects. Frequently the thrips will destroy the flower in the bud state before any color can be seen. Continue the stopping of early blooming sorts of carnations, but the late blooming varieties should not be cut back after the 1st of August. In the latitude of New York, the benching of all carnations should be finished by the 20th of August. Cultivation of the carnation fields should be energetically continued.

September

There is but little variation in the care of carnations in the months of September and August. Plants that were benched by the middle of July will be pushing forward their blooming shoots. All of these which indicate a short-stemmed flower, or show any signs of weakness, should be cut back; only the strong, vigorous shoots should be allowed to develop. Continue field cultivation, and cultivation on the benches. Follow up fumigation for insects. Look carefully after the watering in dark weather, especially of plants recently benched. Do not give any artificial fertilizer, unless the plants are thoroughly established and the benches filled with roots, and there is some indication of slackening in growth; then commence with a mulching of sheep manure, or a dressing of soot, or a combination of the two. Place wires wherever the plants have straightened up, and be sure to keep the wiring well in hand, doing the work at the proper time.

October

The earlier planted varieties will now be coming into bloom. As fast as the shoots begin to elongate the first wires should be placed, and the upper wiring of the benches should be continued as soon as the foremost buds show well above (say, four or five inches) the wires last placed. Never leave the wiring of benches until the stems have grown up and fallen down. Always keep the wiring well ahead of the growth of the plants. Shading should be gradually removed. Do not apply any fire heat, unless the night temperature falls below 45 degrees, and then the heat should be turned on

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but a short period of time. An exception to this would be in case of a cold rain storm, following immediately upon a heavy watering or syringing. In such a case, the ventilators, both on the sides and in the roof, should be left open a few inches, and the heat should be turned on a sufficient length of time to dry off the foliage and prevent the plants being chilled or checked. If the plants are checked by chilling or overwatering, they are very liable to be attacked by stem rot, rust, or some of the carnation spots. A fresh, sprightly, rather dry atmosphere is at all times better for the carnation than one that is cold and damp, or hot and charged with moisture. The best average temperature at night is 48 to 50 degrees, with a minimum of 55 to 56 degrees during the daytime. During this month artificial fertilization may be commenced, giving such plants as show by their vigorous growth that the benches are well filled with roots a light mulch of pulverized sheep manure, to which has been added a little soot, or, in lieu thereof a slight mulching of thoroughly decomposed cow manure, or stable manure. Chemical fertilizers may also be used, affording the plants a watering with a very weak solution, say, twice during the month. I prefer the mulching of sheep manure and soot at this period of the year, as all of the material is gradually dissolved and disappears into the soil. Where stable manure is used as a mulch, it must in the end be raked off. This not only entails labor, but disturbs and destroys the feeding roots which have pushed towards the surface of the soil, and frequently into the mulch. Stable manure is better than no mulch at all, but the dressing should be a light one.

November

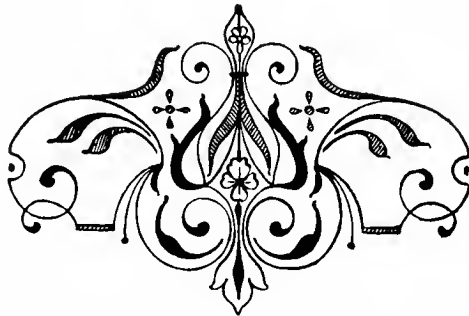
More artificial heat will be needed this month, but abundant ventilation must be daily provided. Upon dark, cloudy days, when dense fogs surround the greenhouses, a little heat should be kept on and the ventilators opened slightly at the top and on the sides, in order to provide a fresh circulation of air. The carnation is a fresh air loving plant, and the houses in which it is grown should be abundantly ventilated at all possible times. Be increasingly careful about watering, and do not water the benches until the soil is rather on the dry side. The same care should be exercised in watering plants in pots. Water about the temperature of the house is preferred by most growers. Avoid syringing the walks, or dashing water about the houses, excepting on warm, bright days. Disbudding should be followed up, and the young buds removed as soon as they are sufficiently developed to enable them to be seized and taken out without injuring the stems. The feeding of plants may be continued, especially of those that are in full bud.

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All plant food and mulchings that are to be given during the fall should be finished up in this month, as during the month of December, especially when the days are dark and cloudy, little fertilizer should be afforded.

December

This is the most critical month for the carnation grower, as it is the natural resting period of the carnation. The days are short, much of the weather is cloudy and dark, and great care is needed in ventilating, heating of the houses, and in watering. The same care and treatment of the carnation houses recommended for November applies to December. A cold, damp atmosphere is the worst enemy of flowering plants, and should be avoided at all times. A moderately warm, fresh buoyant atmosphere, supplied with fresh air whenever it is possible to admit it, is always best for the carnation. "Ventilation, even if but a crack can be allowed," should be the watchword. Remember, that on bright, sunny days the temperature may run comparatively high. From 65 to 70 degrees might be considered the normal temperature for carnations upon bright days, but in dark, cloudy weather, 56 to 65 degrees is all that should be allowed. The cooler the temperature can be kept and active growth maintained, the better it is for the plants. The grower will get larger and more perfect flowers, with stronger stems; the blooms will be brighter in color, and the constitution and vigor of the plants will be better maintained by cool treatment, than by higher, or forced, temperatures maintained by artificial heat.



CHAPTER XXV

The American Carnation Society

SHORTLY after the writer engaged in the culture of carnations at East Moriches, L. I., he became impressed with the idea that much more could be accomplished in the way of improving the Divine Flower if an association of those most interested in its culture could be organized. With this end in view, correspondence was opened with a number of florists who were at that time paying more than usual attention to the carnation. These letters met with favorable responses from almost every individual addressed, the result being the publication in the existing florists' trade papers of the following

CALL.

To American Carnation Growers: You are cordially invited to attend a meeting to be held in Horticultural Hall, Philadelphia, Pa., on Thursday, October 15, 1891, at 2.00 p. m., for the purpose of organizing a Society of American Carnation Growers.

"In order to make this Society as comprehensive as possible, and to insure the greatest benefit to growers, it is essential that all should become members.

"All those who are unable to attend will kindly send their names for enrollment. The object of this Society will be to materially benefit carnation growers, and to advance the popularity of the Divine Flower so that it shall stand second to none. Let us all step to the front and put our shoulders to the wheel.

C. W. WARD,
GEO. CREIGHTON,
C. E. ALLEN,
WM. SWAYNE,
R. T. LOMBARD,
FRED SCHNEIDER,

C. J. PENNOCK,
GEO. HANCOCK,
A. M. HERR,
EDWARD SWAYNE,
E. B. JENNINGS,
CHAS. T. STARR,

GEO. W. LOVE,
JOHN MCGOWAN,
ALEX. MCBRIDE,
H. E. CHITTY,
ISAAC LARKIN,
EDWIN LONSDALE,

W. R. SHELMIER."

[NOTE.—It may be interesting to note that only nine of those who joined in this call are now growing carnations as a specialty. Three are dead, and seven have entered other occupations.]

The proposition to organize this Society met with some criticism on the part of a few members of The Society of American Florists, who at that time probably imagined that the organization of another association composed of men interested in a special branch of floriculture might interfere

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in some manner with the future of The Society of American Florists. However, the futility of this criticism was soon seen, and active opposition to the plan ceased.

This call brought together an assemblage comprised of fifty enthusiasts, and The American Carnation Society was duly organized. The initial meeting was adjourned to November 4, 1891, when the promoters reassembled at the St. James Hotel, in New York City, and the Society was launched upon a very substantial basis, and its real work begun. Papers were there read covering the subjects of Carnation Soils, The Production of Seedlings, Greenhouse Construction for Carnation Culture, Cost of Producing Carnation Cuttings, and Business Methods. Since that date eleven annual meetings have been held, the first taking place at Buffalo, on February 16, 1892; the second at Pittsburg, February 21-22, 1893; third at Indianapolis, February 20-21, 1894; fourth at Boston, February 18-19, 1895; fifth at New York, February 20-21, 1896; sixth at Cincinnati, February 18-19, 1897; seventh at Chicago, February 17-18, 1898; eighth at Philadelphia, February 16-17, 1899; ninth at Buffalo, February 15-16, 1900; tenth at Baltimore, February 21-22, 1901; and the eleventh at Indianapolis, February 19-20, 1902. The twelfth annual meeting was held in the city of Brooklyn, N. Y., February 19-20, 1903.

Starting with fifty members, the Society now has a membership of approximately four hundred. It has accomplished a vast amount of good work, and to its efforts may be attributed a large measure of the popular favor with which the carnation is to-day regarded by the American people.

Beginning with the first exhibition of flowers given in connection with the second annual meeting at Buffalo, N. Y., in February, 1892, where perhaps two or three thousand blooms were displayed, the importance of the annual exhibitions held by the Society has steadily increased each year, until these magnificent yearly displays of carnations comprise thousands of blooms, the staging of the show at Indianapolis demanding the largest exhibition hall afforded by that progressive city; while in the city of Brooklyn the annual display for 1903 required its two largest exhibition halls.

The American Carnation Society has devoted itself strictly to the exploitation of the carnation, and its work has been carried on with an enthusiasm on the part of its members born of the knowledge that the efforts put forth were along the right lines, and, therefore, bound to succeed. Thus far the Society has formed no entangling alliances, nor has it sought to impede the growth, or cripple the usefulness, of any other florists' organization. Its membership acknowledged at the beginning the natural tendency

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of the times toward horticultural organization, and, with a broad view of the future, recognized that the larger the number of special societies composed of members thoroughly interested in the work that can be successfully maintained the more rapid will be the advancement of American horticulture.

There are those among the floriculturists of the United States who seem to believe that all American horticultural organizations must be combined under one head, and controlled by fixed influences. In support of this, The Royal Horticultural Society of England has been pointed out as an example of centralized horticultural effort. The membership of The American Carnation Society has not countenanced this idea, but has maintained its position and its work, replying to its critics by calling attention to the results achieved, and pointing to the fact that in England, aside from The Royal Horticultural Society, there exist at the present time not only a National Carnation Society, but a score of other special florists' associations, that are doing excellent work. They further cite the many State horticultural societies existing in the United States, and the various pomological, nurserymen's and fruit growers' organizations that are performing a permanent and splendid service. That The American Carnation Society, after having accomplished the magnificent results which now stand to its credit, will persist in maintaining its status, and continuing its good work, goes without saying. Through the efforts of its members a magnificent commercial business has been built up; a knowledge of the American carnation has been disseminated throughout the world, and a love of the flower awakened thereby that could have been accomplished in so short a period of time by no other means; and I am certain that every lover of the carnation will join with an "All Hail to the Carnation! Hail to The Carnation Society! May their usefulness never cease, nor their popularity ever wane!"

At each of the Society's annual meetings essays upon various subjects pertaining particularly to carnation culture have been read. Among the subjects covered by these essays are the following:

Soils.

The Production of New Seedlings.

Greenhouse Construction for Carnation Culture.

Cost of Producing Carnation Cuttings.

Business Methods.

Do Varieties Run Out?

Carnations in the Retail Trade.

Carnation Rust; a New and Destructive Disease.

Carnations in Southern California.

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The Carnation as it is grown in Europe.
John Thorpe's Ideal Carnation.
Sports and Variations.
Some Types and Tendencies in the Carnation.
Pot Culture of Carnations.
A Retailer's Views.
Growing New Varieties of Carnations.
Diseases of the Carnation, other than Rust.
Carnation Diseases.
Carnation Enemies and Supposed Remedies.
Discrimination of Diseases without the use of the Microscope.
New Carnations and their Introduction into Commerce.
Carnations for Cut Flowers.
Desirable Varieties and How they May Be Improved.
Carnations in Canada.
A Nematode Disease of the Carnation.
Carnations from Cutting to Field.
The Cultivation of Carnation Plants for Winter Flowering.
Care of Carnations in Winter.
Carnations That I Have Seen.
How to Distinguish Fungous Diseases of Carnations.
The Future of our Floricultural Societies.
What are the effects of Hybridization on Carnations?
Abnormal Carnation Flowers.
Some Recent Experiments on the Treatment of Rust.
Chemical Fertilizers.
Carnation Culture in Maryland.
Introduction of New Varieties and Their Commercial Value.
The Carnation from the Commission Man's Standpoint.
Moisture the Plant's Greatest Requirement.
In-door Grown Carnations.
Commercial Fertilizers.
Sub-watering and Dry Air.
Growing Carnations under Glass all Summer.
Summer Blooming Varieties Out-of-doors.
Cutting Prices.
The Ideal Form of Carnation.
Insects Infesting Carnations.
The Carnation in Health and Disease.

The compiled annual reports of The American Carnation Society, covering its proceedings during the first ten years of its existence, form one of the most valuable contributions to American floricultural literature. These reports contain a complete record of the Society's proceedings, besides a full list of varieties that were known to have been introduced and cultivated prior to and including the year 1899.

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The example set by the formation of The American Carnation Society has been followed by the establishment of several other organizations, notably The American Rose Society, The American Dahlia Society, and The American Peony Society. Up to November of the year 1902 none of these societies seems to have possessed the vigor shown by The American Carnation Society; but at the above-mentioned time The Chrysanthemum Society of America, which was established in 1889, entered upon a new departure by holding its annual meeting in connection with the yearly chrysanthemum show at Chicago, and it may be considered that The Chrysanthemum Society of America is now fairly committed to a plan practically similar to that which has governed the annual meetings of The American Carnation Society.

The objections to the organization of special societies, upon the ground that they would interfere with the welfare of The Society of American Florists, are well met by the fact that the latter Society has thrived and gained large acquisitions to its membership, notwithstanding the growth of the Carnation, Chrysanthemum, Rose, and other special societies; and it may be well said that if England, with forty millions of people, supports not only The Royal Horticultural Society, but a score of other special florists' associations, is there any reason why in the United States, with a population fully double that of England, and soon to be more than four times as large, there should not be able to exist not only The Society of American Florists, but as many other special horticultural organizations as thrive in England to-day?

The American Carnation Society is organized upon broad and liberal lines. It bars no one from the benefits of its membership. All are welcome to its ranks—the amateur as well as the professional grower of the Divine Flower.

American Carnation Nomenclature

Compiled and Corrected up to February 1, 1899, by The American Carnation Society

Abraham Lincoln	Agnes Shellem	Alhambra
Abundance	Agnes Snow	Al. Mailaiken
A. C. Fitzpatrick	Alaska	Alice
Acquisition	Albany	Amado
Ada	Alba Perfecta	Amazon
Adelaide Kresken	Alba Superba	America
Adelaide	Alegatiere	American Banner
Admiral Dewey	Alexander	American Flag

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American Florist	Boissy	Columbia
American Wonder	Bonibell	Chincheta
A. M. Herr	Bonny Doon	Conch Shell
Amy	Bon Ton	Constancy
Amy Phipps	Boule de Neige	Cora Collins
Andalusia	Bouton d'Or	Corsair
Angelus	Brester	Couronne de la Væla
Anna C. Eastburn	Bride of Erlescourt	Creole
Anna H. Shaw	Bridesmaid	Crimson Coronet
Anna Webb	Brower	Crimson King
Annie H. Lonsdale	Brunette	Crimson Velvet
Annie Pixley	Brussels	Crimson Wave
Annie Wiegand	Brutus	Crysta
Anthony's Pink	Bryant	Crystal
Argyle	Buster	C. Schmidt
Armazindy	Butler	Cymbeline
Astoria	Buttercup	Daisy
Attraction	Cæsar	Daisy Bell
Augusta Rath	C. J. Clark	Dards
Augusta Williams	Calico	Darkness
Aurora	Canada	Dawn
Avalanche	Captain King	Daybreak
Avondale	Cardinal	Dazzle
Azalea	Cardinalis	Dean Hole
B. A. Elliott	Casa Blanca	Defender
Baltic	Catherine Paul	DeRoo Mitting
Baltimore	Cecilia Schwencke	Delaware
Banner	Century	Delicate
Bayard Taylor	Cerise Queen	Delightful
Beatrice	Charles A. Dana	Della Fox
Beatrice White	Charles Sumner	Diadem
Beauty	Charles T. Starr	Diamond
Beauty of Oxford	Charmer	Diana
Ben Halliday	Chastity	Dolly Varden
Ben Hur	Cherry Lips	Dorinda
Bertha Rath	Cherry Ripe	Dorothy
Bertha Soper	Chester Pride	Dorothy Mandell
Bertha Stahl	Chicago	Dr. E. P. Lawrence
Bess	Christmas	Dr. Del Amo
Bettina	Christina Dorner	Dr. Lamborn
Bidwell	Chusco	Dr. Patski
Bird-in-Hand	Citrus	Dr. Smart
Black Knight	Clara Mawer	Dr. Tevis
Black Prince	Clara Morris	Dr. Warder
Blanche	Cleopatra	Du Marchand
Blizzard	Clifton	Duke of Orange
Bohemian Girl	Clio	Duke of York

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E. A. Wood	Fawn	Golden Triumph
Earlham	Fallow's New Red	Goldsmith
Eastern Queen	Ferdinand Mangold	Governor Griggs
Eclipse	Field of Gold	Governor Markham
Edelweiss	Firebrand	Governor Russell
Edith Foster	Firefly	Grace Battles
Edna Craig	Firelight	Grace Bollinger
Edmons	Fishkill	Grace Darling
Edward Bissell	Flame	Grace Fardon
Edwardsii	Fitzpatrick	Grace Runyan
Edwin Lonsdale	Fleta Fay Foster	Grace Wilder
Eglantine	Florence Bevis	Grave's Seedling
E. G. Clark	Florence Eddy	Grenadine
E. G. Hill	Florence Fisher	Guiding Star
Eldorado	Florence Van Reyper	Happy Day
Elmont	Frank McGregor	Harriett
Elsie Furgeson	Freedom	Harriett Bradford
Emerson	Fred. Creighton	Harriett Thorpe
Emiline	Fred. Dorner	Harrison's White
Emily Louise Taplin	Fred. Johnson	Harry Palmer
Emma Lowry	Gaiety	Hector
Emma Quintin	Gauntlet	Heintz's Red
Emma M. Thompson	General Burnside	Heintz's White
Emma Woche	General Custer	Helen Dean
Emperor of Morocco	General Maceo	Helen Galvin
Empress	General Maximo Gomez	Helen Keller
Encante	General Sherman	Henrietta
Ermine	Genesee	Henrietta Sargent
Esther	Geneva	Hesper
Ethel	Genevieve Lord	Hiawatha
Ethel Crocker	George Thorpe	Hilda
Ethel Ward	George Washington	Hinsdale
Eulalia	Germania	Holmes
Euphemia	Gertrude	Hon. T. B. Reed
Eureka	G. H. Crane	Hon. Wm. McKinley
Evangeline	Gibbonsii	Hoosier
Evanston	Glacier	Hugh Graham
Evelina	Gladys Ray	Iago
Evening Star	Glorious	Iantha
E. V. Low	Glory of Venice	Ida Feder
Excelsior	Glowing Coal	Ida May
Exquisite	Gold Coin	Ida McKinley
Fair Rosamond	Gold Finch	Ideal
Fairy Princess	Gold Nugget	Immaculate
Fancy	Golden Gate	Imogene
Farragut	Golden Gem	Indiana
Fascination	Golden State	Ingleside

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Innocence	Katheryne	Lucia
Intensive	Katie Shaffer	Lucy Brenner
Invincible	King Dianthus	Lucy Singler
Iris Miller	King of the Crimson	Lulu
Isabelle Hunnewell	Kitty Clover	Luna
Ivanhoe	Kohinoor	Lydia
Ivory	La Belle	Lyone
Jack Frost	Lady Chattin	Lyon's White
Jacqueminot	Lady Emma	Mabel F. Gray
Jahn's Scarlet	Lady Fair	Maiden Blush
James Corbett	Lady Martha	Magnet
James Dean	Lady Maud	M. A. Hunt
James Madison	Lady Rachel	Majesty
James Perkins	La Favorite	Manhattan
J. Gould	Lafayette	Mapledale
J. B. Jacquier	Lake City	Marian
J. B. Kidd	La Purité	Marie
J. C. Ainsworth	Lasandria	Marie Starr
Jean Sisley	Laura	Marina
Jeanne Morell	Laura Degenhardt	Margaret Rath
Jeannette	Laura E. Doty	Mark Hanna
Jennie Parker	Laura Hempstead	Marquise Lorne
Jewell	Laura Vick	Mars
J. J. Harrison	Lawrence Thompson	Marshall P. Wilder
John Carbon	Lela Underwood	Martin Wolfskill
John Hinkle	Lena Saling	Marvel
John McCullough	Leon Gambetta	Mary A. Baker
John Raynor	Leslie Paul	Mary Anderson
John R. Renere	Letty Coles	Mary Shepherd
John Thorpe	L'Excellent	Mary A. Wood
John Young	Liberty	Mary Darce
Josephine	Lieut. Gov. Sheehan	Maude
Joseph Jefferson	Lillian	Maude Adams
Joseph Perkins	Lily Dean	Maud Dean
Josiah Eaton	Little Beauty	Maud Granger
J. R. Freeman	Little Gem	Mayflower
Jubilee	Lizzie McGowan	Mayor Pingree
Juliet	L. L. Lamborn	May Queen
Jumbo	Logan	McConnell
Jupiter	Lois J. Haettel	Melba
J. W. Wolfskill	Lonesa	Mephisto
J. Y. Murkland	Longfellow	Meteor
Kaiser Wilhelm	Lord Clyde	Minerva's Pink
Karto	Los Angeles	Minnie Cook
Kate	Louise Porsch	Miranda
Kathleen Pantlind	Louis Lenoir	Miss Blanche Payne
Katherine Storrs	Lowell	Miss Donnelly

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Miss Joliffe	Mrs. Sprout	Pilgrim
Miss Moore	Mrs. T. B. Reed	Pink Beauty
Mlle. Carl	Mrs. Titus	Pink of Perfection
Madame Chassons	Mrs. Thomas W. Lawson	Poe
Mme. Diaz Albertini	Mrs. Wm. McKinley	Pomona
Mme. Cobette	Myrtle	Portia
Mons. Gambetta	Nancy Hanks	Potomac
Moore's Crimson	Nellie Lewis	Preciosa
Morello	Nellie Nolan	President Degraw
Morene	Nellie St. Clair	President Garfield
Morning Ray	Nelly Bly	Pride of Boston
Morning Star	Netherwood	Pride of Essex
Motor	New Jersey	Pride of Kennett
Mrs. Ada Lenton	New York	Pride of Penhurst
Mrs. A. Rolker	Nita Berringer	Princess
Mrs. Ayers	Nivea	Princess Bonnie
Mrs. B. Harrison	Northern Light	Princess Louise
Mrs. Carnegie	Oddity	Progress
Mrs. Cassel	Ohio	Psyche
Mrs. Chas. H. Duhme	Old Gold	Purdue
Mrs. Chas. M. Fick	Old Rose	Puritan
Mrs. Childs	Olympia	Purple Beauty
Mrs. E. Hippard	Oneida	Purple Crown
Mrs. Elizabeth Reynolds	Oona	Purple King
Mrs. E. V. Lawson	Ophelia	Purpurea
Mrs. Ferdinand Mangold	Orange Blossom	Quaker City
Mrs. Fisher	Orient	Queen of the Whites
Mrs. Frances Joost	Othello	Queens
Mrs. Garfield	Outcast	Queen of the West
Mrs. H. C. Frick	Pacific	Queens' Scarlet
Mrs. Harris	Painted Lady	Ramona
Mrs. Harrison	Paloma	Rebecca
Mrs. Henry M. Stanley	Panchita	Red Cross
Mrs. Jas. Dean	Paradise	Red Jacket
Mrs. J. B. Perkins	Pat O'Mara	Red Wave
Mrs. John W. Colflesh	Patti	Richmond
Mrs. Keene	Paxton	Robert Craig
Mrs. Lemuel Fawcett	Peachblow Coronet	Robin Hood
Mrs. L. Gay	Pearl	Rob Roy
Mrs. Lonsdale	Pearl White	Roi des Violets
Mrs. Mailander	Peerless	Romance
Mrs. H. Hallock Foote	Peru	Rosalie
Mrs. McBurney	Peter Henderson	Rosalind
Mrs. Pauline Gussman	Petunia	Rosa Pizer
Mrs. Robert Hitt	Philadelphia	Rose Hill
Mrs. Skinner	Philadelphia Variegated	Rosemary
Mrs. S. M. Inman	Pikes Peak	Rose Queen

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Rosy Morn	Small	Vice-Admiral Schley
R. R. Parker	Snowball	Victor
Ruby	Snow Bird	Victoria
Ruth	Snow Crest	Village Maid
Ruth Churchill	Snowden	Villisca
Saginaw	Snow Drift	Virginalis
Salmon Queen	Snow Flake	Vixen
Sambo	Snow Queen	Volunteer
Sam Gabriel	Snow White	Vulcan
Samson	Souriza	Wabash
Sandusky	Spartan	Wanderer
San Mateo	Sport	Waneta
Saturn	Springfield	Washington
Scallen	S. P. Rees	Waverly
Scarlet Gem	S. S. Pennock	W. D. Sloan
Scarlet King	Starlight	West End
Scarlet Queen	Star of the West	Western Pride
Scarlet Ray	Storm King	W. H. Brower
Scarlet Wave	Storm Queen	Whipper-in
Scribners	Stuart	White Beauty
Secaucus	Striped Unique	White Cap
Sea Foam	Sunshine	White Cloud
Sea Gull	Sweetbrier	White Coronet
Sears	Tecumseh	White Daybreak
Sea Shell	The Bride	White Dove
Seawan	The Grout	White Gem
Sebec	The Maine	White Grace Wilder
Secretary Blaine	The Marquis	White La Purité
Secretary Hunt	Thomas Caird	White Queen
Secretary James	Thorley	White Wings
Secretary Kirkwood	T. H. Spaulding	Whittier
Secretary Lincoln	Trilby	Wide-Awake
Secretary McVeagh	Triumph	Wilhelm
Secretary Windom	Twilight	Wm. E. Rowland
Seneca Chief	Uncle John	Wm. F. Dreer
Senator McPherson	Uncle Sam	Wm. I. Burke
Sensational	Uncle Walter	Wm. Pierce
Sentinel	Unique	Wm. Scott
Servia	Utica	Wm. Swayne
Shasta	Van Houtte	Winifred
Shell Flower	Van Leeuwen	W. W. Coles
Silver Ball	Variegated La Belle	Yellow Jack
Silver Lake	Variegated La Purité	Yellow Jacket
Silver Spray	Venus	Yellow Queen
Silver Star	Vesuvius	Young America
Silver Queen	Vesper	
Sirius	Vice-President G. A. Hobart	Zebra

CHAPTER XXVI

Carnation Culture

In Different Geographical Localities on the North American Continent,
With Biographical Sketches of the Writers

Carnation Culture in Lafayette, Ind.

BY FREDERICK DORNER

Space will not permit me to go into cultural details, so I will only touch upon the main points. I believe I can do this more comprehensively by outlining the manner in which these are observed at our place.

Our soil is a loam, of a rather light texture—partly sandy knolls, and heavier, lower ground. For fertilizers we use stable manure, wood ashes and bone meal.

On the light, sandy soil we grow the finest plants. There we are able to retain the moisture much longer, during dry weather, by thorough cultivation; and heavy rains drain off much quicker. The plants also lift with a large bunch of fine roots.

For bench soil we select, in the fall, a piece of the heavier loam, but would prefer a piece of sod-soil; manure it well with stable manure, wood ashes and bone meal, and plough it well under. Early in the spring we repeat the dose, plough again, and after five or six weeks apply some lime. We plough this under, and repeat the ploughing two or three times during the summer. Great care is exercised not to work this ground while wet.

We have only one soil, and one general treatment for all the varieties we grow—seedlings and standard sorts alike. At one time we thought to strengthen our soil by adding clay on the benches, but secured much more benefit from more lime and bone. We find it of great importance to have all manures put into the soil in the fall and the following spring, before the soil is used, so that the manures may become fully decomposed and incorporated. Plants will take hold much quicker in such soil than

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when manures are intermixed on the bench, though these manures may be as well decomposed as is possible.

Raised benches, with five inches of soil, are the rule with us.

After the plants are well established we apply a light mulch of well-rotted cow manure and light soil. We do this more to keep an even moisture all through the bench than to enrich the soil.

We use liquid manures, much diluted, as soon as the plants are able to assimilate the extra food, and increase the applications as the plants may demand it.

From the time the plants are established we only syringe if red spider should appear.

All the water is applied underneath, and is freely given when needed, so as to saturate the soil to the bottom. Sub-watering we consider advantageous, but for the average grower it will hardly justify the extra expense in building the benches.

The temperature we maintain is from 55 to 60 degrees in the evening, to 50 degrees toward morning. During the daytime, as soon as the temperature reaches 60 degrees, the ventilators are opened.

Plants are staked as soon as possible, to insure a straight growth from the beginning. We use the Model Support, and in place of the extension employ wire lengthwise, and twine across the benches.

A house 20 x 100 feet is used exclusively for propagation. The benches have brick bottoms, and are partially arranged for sub-watering. The sand is a medium-grained, sharp pit-sand. The benches are filled to a depth of three inches, and well packed, and the sand is renewed for each new lot of cuttings.

Wherever practicable, or the stock is large enough, the culture for cuttings and flowers is divided. The only difference in the treatment of stock reserved for cuttings is that the plants are grown on separate benches, and are not allowed to bloom. In this way we get more cuttings, and in my experience these are of a better quality than others taken from the flowering plants.

Cuttings are either picked out of the axil of the leaf, or are cut at the joint. In either case the cutting is trimmed, and great care observed so that the heel has a smooth cut, or break, and that no bare fiber projects beneath the cut.

All stock for our own use is potted up as soon as rooted, and placed in a light, but cool, house, being transferred to the field as early as the weather

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will permit. Cultivation is closely attended to, and the ground is never permitted to become baked and crusty. This is the only way to be prepared for a dry spell, and is much more beneficial to the plants than resorting to watering.

Topping is commenced as soon as the plants attain a height of five or six inches. A young shoot, topped in time, will break much quicker than one allowed to form a flower bud.

We commence planting in the house by the 1st of August. In our section of the country, with too early planting, we have to fight red spider; and in exterminating this pest, by excessive syringing, we invite fungous diseases.

FREDERICK DORNER

Frederick Dorner of Lafayette, Indiana, was born at Schiltack, situated in one of the valleys of the Black Forest Mountains in Baden, Germany, on November 29, 1837.



FREDERICK DORNER

There he attended the common schools and received a fair, practical education. At the age of seventeen he emigrated to America, landing in New York on May 7, 1855, going direct to Lafayette, Indiana, where an older brother resided. His occupation in the early part of his residence there was varied. Naturally fond of flowers, he concluded to follow their culture, and found employment with a Mr. Loyd, one of the pioneer florists and gardeners of Indiana, who was at that time supplying the Chicago and Indianapolis markets. Mr. Dorner remained there but a short time, fever and ague attacking him and compelling him to relinquish his situation.

Fifteen years were subsequently devoted to farming, when he again returned to his favorite occupation in 1870, renting a place to grow vegetables. Attached to this was a small greenhouse for the cultivation of pot plants. This location he left, and rented the establishment where he had first found employment. Here he erected three small greenhouses, and cultivated flowers, vegetables and small fruits.

From that period dates the beginning of his present establishment. His business gradually increased, and in 1889 it received a new impetus, when Mr. Dorner drifted into the growing of seedling carnations, and in 1890, when he moved into his present place.

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The present firm, F. Dorner & Sons Co., has been incorporated as a stock concern, and consists of Mr. Dorner himself, and his five elder children—two sons, Fred E. and Theodore A., and three daughters, Emily, Mrs. Anna D. Hudson, and Mrs. Emma D. Riddle. All are actually engaged in the business, excepting the last named.

Mr. Dorner's greatest achievement so far has been the variety *Fiancée*. It is considered the largest perfect carnation to date, for the stock of which it is reported he has received \$15,000 from The Chicago Carnation Co., of Joliet, Ill.

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BY PETER FISHER

Carnation culture of to-day differs so radically from the methods pursued ten years ago, and, no doubt, from those that will prevail five years hence, that it is extremely difficult, and almost impossible, to state any specific line of treatment, as one must be largely governed by the requirements of the special varieties of the times. It will be found that some sorts require culture radically different from others to develop the points of excellence they may possess; and it is unwise to condemn a variety because it may not succeed in some localities, as the wide variation of soils has much to do with many failures often charged to the variety denounced as worthless. Always remember, if the originator can grow a variety successfully others can, when its special requirements are understood. Simply because a variety may not be very early, as regards season, that does not, by any means, denote it is worthless commercially. For instance, allowing pure white to be, all around, the most valuable color, it will be found that an extremely early sort often gets partially off crop toward Christmas and the dull, short days of winter; when, by having one of the same color which gives a succession of blooms, as to season, coming in with its first crop, say, during November and early December, it will bridge over the defective season of the early variety, and so afford a continuance of first-quality flowers.

The selection of cuttings is of the first importance, and great care should be exercised that they are taken from the flowering stems of plants that are in robust health, and from varieties in colors commercially valuable. Late-blooming sorts should be propagated as early as the first week in January, while early varieties can be successfully grown from cuttings taken the latter part of March. A good average season in which to select the cuttings is from February 15 to March 15, providing they can be obtained in numbers sufficient for the needs of the grower; otherwise, judgment must be

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used, as one cannot get a quantity of blooms from late struck stock. Better be on the early side.

A well-ripened cutting is preferable, and a good guide to such is to select them from flowering stems with fully-developed buds, and just showing color; or with open flowers. Usually the first growth is useless, being spindling at the base, and inclined to run to bloom. The second and third growths are more stocky, and make good plants; but always try to leave one good growth on the flowering stem as a succession to the flower about to be cut, as dormant eyes are not desirable, either for stock or a future crop of blooms.

The cuttings should be sprinkled as soon as severed from the parent plant, and great care exercised to prevent wilting, or the cuttings getting checked in any way. Remove the lower leaves, but retain the heel, and only trim off any loose part. Cut the tops back so as to admit air and light to the propagating bed.

Clean, sharp sand is best for propagating purposes. This should be spread on a bench with a tile or brick bottom, firmly pressed down to a depth of three inches, and thoroughly watered before inserting the cuttings in it. These should be set in rows, three inches apart, and four cuttings to the inch in the row, inserting them three-quarters to one inch in depth, pressed firmly, and watered. A bottom heat of 60 degrees and a top temperature of 50 to 52 degrees will insure successful propagation in three to four weeks. Keep the beds moderately moist during this time. When the cuttings are rooted, pot them off into one and three-quarter-inch pots, shifting to two and one-quarter and three and one-half-inch pots as the season advances and the plants require the shift; but never allow them to get stunted, or dry, as this last condition is the first step toward the development of stem-rot, and, consequently, endless trouble.

Early planting is desirable, and may be done with safety from May 15 to 20, and later, when danger of severe frost is usually past in this locality. Some plant out earlier, and should the season prove favorable, make a decided gain in time, at a busy season, and good root action before extreme heat sets in; but a severe frost will more than offset this gain; and I have found it safer to defer planting for a week or two later. Eighteen to twenty inches is a convenient distance between the rows, and six to eight inches between the plants. Great care should be exercised not to plant too deep, as disaster through stem-rot is sure to follow, especially during a wet season. Thoroughly water the balls and roots before planting. Press the soil firmly around the ball, but don't set the surface of the ball lower than the level of the ground. Where the nature of the soil will permit, begin using the Planet

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Junior hand wheel hoe at once, and continue cultivating, on an average, once a week. This will keep the soil mellow, attract the night moisture on the surface, and retain the bottom moisture, especially should the season prove dry. Keep the soil clear of weeds at all times, as these often cause attacks of insect pests, and therefore no end of trouble, especially should red spider appear. Syringing with common salt, a two and one-quarter-inch potful to a pail of water, I have found the best remedy for this evil; and I have also checked it by covering the affected plants with fine tobacco dust.

Great care should be exercised in pinching back the plants while in the field; those with a tendency to bloom late should, in some cases, be pinched only once—removing the center shoot. This method usually insures a crop for the holidays, without fail. Early bloomers may be pinched as late as the latter part of July, or August, and still give early returns. Never pinch off all the shoots on a plant at one time, but pursue a method of going over the field, say, once a week, and, if necessary, pinch one or two shoots on each plant. This will induce a steady supply of flowers later and prevent them coming in crops. Any variety can be made a “cropper” by stopping all the shoots at one time, or a grower can help to change the tendency of a carnation to “crop” by pinching the stems at an interval of one or two weeks apart.

From July 15 to August 20 is a good time in which to transfer plants from the field to the carnation houses. If the weather be exceedingly hot, begin lifting a week or ten days later, but try and finish the work not later than August 20, as plants put in later seldom catch up to, or prove as profitable as, early-planted stock, which has thorough root action established before artificial heat is applied.

Thoroughly clean out all old soil from the carnation houses; repair and lime-wash all the woodwork with which the soil comes in contact. Spread a layer of stable or old cow manure over the bottom of the bench, and then fill in the soil to the depth of five or six inches, loose. Soil that is moderately moist is best, as it remains mellow, and does not get hard and caked when planting. Press the soil moderately firm before planting. (A man treading over the surface once will do it nicely.) Level the soil, and stretch wires lengthwise on the benches, eight or ten inches apart; pull these wires tight, and secure them to a nail at each end. They act as guides in keeping the lines straight, and, with cross strings, are used later as supports for the flowers. Wires inserted at this stage save much time and loss through breakage of the flower stems, as they can simply be raised into place when

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wanted. No. 12 wire on each side of the bench, and No. 22 galvanized wire between the rows, I find the best sizes.

Send careful men to lift the plants in the field. Be very careful to retain the small roots on pot-grown stock. Keep the plants covered from the sun to prevent them drying out, and be sure that the balls are moist before planting. Of course dull weather is most suited to the operation of transplanting, but one cannot always wait for it.

Have a good man working on each side of the bench (and your best men are none too good, as much depends on careful planting). Instead of digging a hole for the plant, pound the soil with the closed fist, which will usually make an indention deep enough for the ball; spread out the roots carefully, and be sure that the plant is not set any deeper than it was when growing in the field. Deep planting in the houses is a serious matter, and the cause of untold loss from stem-rot.

I find it pays to put a wire support to each plant before planting the next; the old *Excelsior* support answers the purpose well, as I use the wires and twine later.

Water carefully and in sufficient supply to thoroughly wet the soil through in the vicinity of the roots. Shade the houses for a few days, with fire-clay, or some material easily removed by rains or hose. Keep all walls, and space under the benches, dampened down until root action is well established; don't allow the plants to get dry and wilted on any account, but avoid getting the soil in a water-logged condition, which is equally bad. Keep a sharp lookout for aphid and red spider. Fumigating with tobacco stems, or powder, is a safeguard for the former; and syringing with salt—a two and a quarter-inch potful to a pail of water, and applied in a fine spray—is a sure remedy for the latter. Don't wait until you see the pests; apply the preventives once a week or ten days, and remember that "an ounce of prevention is worth more than a pound of cure." Carefully pinch off all flower stems that come too short, and encourage all strong growth. Disbud at regular intervals, and as soon as surplus buds can be removed without injury to the main flower.

Cultivate between the rows, just deep enough to remove the weeds as they appear; but don't disturb the small feeding roots, if possible. Should the soil show signs of becoming sour, an application of air-slaked lime will sweeten and regulate the evil. This lime may be applied with beneficial results all through the forcing season.

See to it that the network of wires and twine is put up before growth advances far, as it is then easier applied, and prevents crooked stems and

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breakage later. Six inches above the ring I find a good distance for the first tier, and ten to twelve inches above this for the next. But the needs of the variety must govern the distance. A light strip of wood, seven-eighths of an inch square, with a groove cut with a saw in each end, should run across the bed, at distances of five or six feet apart. The outside No. 12 wires, inserted into these grooves, keep the wires at a uniform distance, and allow tightening of the cross strips. Two-ply hemp is a good size to use. A sixpenny nail driven through, about one inch from each end of the cross strips, and inserted in the end of a bamboo cane, pushed down firmly to the bottom of the bench, and cut to the desired height, will keep the whole framework at a uniform distance from the surface of the bench. The strainers at the extreme ends of the bench can be made of pipe or angle-iron, which are neater in appearance than wood.

A night temperature of 52 to 55 degrees is a safe one to maintain during the winter months, with a rise of 15 degrees during the day, when sunny.

Plants that have been housed early in July will benefit by a light stimulant, in the form of weak liquid manure, during the latter part of November or December, but later planted stock will not require any extra nourishment for a month subsequently, providing the proper ingredients were incorporated into the soil before planting time.

Regarding the compost to use, in the East, where loam is generally shallow, the best plan is to plough the sod on an old pasture as soon as the hay is cut, which is usually during June or early in July. In the fall this should be stacked in ridges eight to ten feet wide and two to three feet deep, turning the grass side down; and a liberal dressing, say, about one foot of cow manure, or half stable manure, spread over the surface, and allowed to remain until early spring, when the whole should be cut up, thoroughly mixed, and a liberal sprinkling of bone meal applied. I have found it beneficial to apply half the fertilizer in the fall, when stacking up the sod, and the balance during spring, when turning and mixing the compost, as bone meal often requires months to decompose sufficiently to be available for plant food; and when applied as a top dressing indoors, during winter, has not become of service until after the soil has been cleaned out for the next season's crop, and so its fertilizing benefits have been lost.

As a stimulant, weak applications of liquid manure are beneficial during the spring and summer months, for general culture. For several years I have used pulverized sheep manure as a top dressing (instead of liquid)

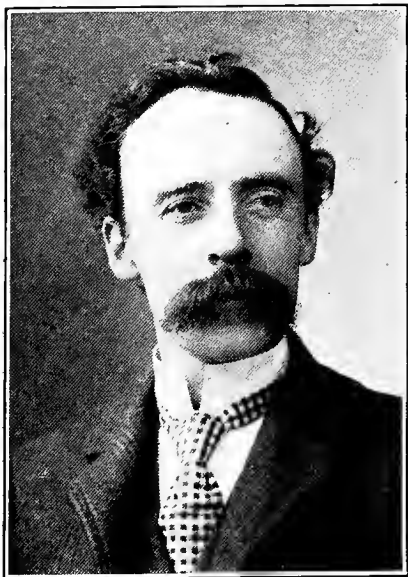
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with good results, applying it every two to three weeks during the spring and summer, affording two handfuls to the row on a four and one-half to five-foot bench. When the soil showed signs of becoming sour, that condition is easily rectified by an application of air-slaked lime, which should be at once watered into the soil to prevent the lime getting hard upon the surface.

Always keep a sharp lookout for insect pests. Fumigate regularly with the most effective and cheapest remedy procurable. Spray with salt to prevent attacks of red spider, but don't let the solution touch the blooms. Disbud regularly, and as soon as the surplus buds can be removed. Pay close attention to maintaining the proper night and day temperatures, affording ample ventilation on all favorable occasions; and keep the houses scrupulously clean of all rubbish, as this means health to the plants.

PETER FISHER

Peter Fisher of Ellis, Mass., was born November 4, 1857, at St. Colmes Farm, Parish of Dowally, Perthshire, Scotland, the home farm of the Duke of Athol, to whom his father was land steward for a period of nineteen years until his death in September, 1861. Mr. Fisher received his early education in the parish schools of Dunkeld, Perthshire, Scotland, and at the age of fifteen began to serve an apprenticeship of three years in the Dunkeld Gardens, the seat of the Dowager Duchess of Athol. There he remained for seven years, subsequently removing to London, England, where he was employed in the nurseries of B. S. Williams, Upper Holloway, and, later, in private establishments in the south and north of England.



PETER FISHER

Mr. Fisher came to America in 1884, landing in New York on June 22 of that year. He was first employed on the Payson Estate in Belmont, Mass., and, subsequently, at Oakley, Mass., on the estate of Robert M. Pratt, Esq. In company with his brother, he started in business in a commercial way in September, 1886, under the firm name of Fisher Bros. & Co. Having sold out his interest in that concern, Mr. Fisher moved to Ellis, Mass., on May 31, 1890. Here he became actively interested in the carnation in 1892. In 1893 he raised the varieties Edith Foster and

Freedom, both white varieties, crosses of Lizzie McGowan and Silver Spray. Edith Foster was disseminated in 1896 and Freedom in 1897. The now famous Mrs. Thomas

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W. Lawson carnation, cerise, was disseminated in 1900. The price at which this carnation was sold was \$11,500, the highest figure ever obtained for one variety of carnation up to that time. The Mrs. Thomas W. Lawson carnation was raised from Daybreak, crossed with Van Leeuwen, the former variety being the seed bearer, the latter the pollen parent in color, cerise, resembling the variety Tidal Wave. The seed was sown April 2, 1894, and the first flowers were obtained in September of the same year. The variety Mrs. Lawson has won five silver cups, two silver medals, a gold medal at The American Carnation Society meeting, held at Baltimore in 1901, and numerous certificates of merit.

Another of Mr. Fisher's productions is the variety Governor Wolcott, white, which was disseminated in 1902. It was obtained from Flora Hill, white, crossed with Mrs. Thos. W. Lawson, cerise, the former being the seed bearer. The seed of this variety was sown in March, 1898, and the plants bloomed the following September. It has been awarded numerous certificates of merit.

Enchantress, another of Mr. Fisher's productions, was raised from Mrs. Geo. M. Bradt variety crossed with Mrs. Thomas W. Lawson, in 1899. The seed was sown in March of that year; the variety first bloomed in the following August. Enchantress is being introduced to the trade by The J. D. Thompson Carnation Co., of Joliet, Ill., to whom Mr. Fisher sold all the stock, less 3,000 plants for his own use, for the sum of \$7,000.

Carnation Culture in Richmond, Indiana

By E. G. HILL.

Carnation culture has received no small degree of consideration at the hands of growers and specialists in this grand state of the Middle West. The attention of the trade growers of the country was directed toward this section, some twelve years ago, by a number of fine seedling novelties which had been originated in the State. The influence of Mr. Fred. Dorner's improved varieties tended to awaken and stimulate additional interest in the flower, both in his own section and throughout the whole country. This influence has its full effect here, at Richmond, and, as a consequence, the cross-fertilization of the carnation was gone into, with very interesting results. Armazindy, Triumph, and Flora Hill were the products of our earlier work; America and Gaiety, of more recent efforts.

In addition to the improvement of this flower, by the introduction of finer sorts, entirely new cultural methods were adopted gradually, through several years of careful experimenting, which has been done in a conservative and painstaking manner, requiring infinite patience in waiting for results, and in recording them for future use. The new culture has worked wonders for the carnation. The methods adopted began with the cuttings used for

Carnation Culture in Richmond, Indiana

propagation, and their treatment while being rooted on the bench. Healthy, vigorous side-shoots are selected; these are placed in clean, sharp sand, and are rooted in as cool a temperature as is practicable. It is absolutely essential that the sand be in the right condition; it must be clean, gritty, and free from loam, or other extraneous material. It is now generally believed that much of the disease called stem-rot is generated in impure sand, aided by a too-warm temperature. The sand is seldom used more than once, unless it be washed and dried thoroughly between times.

After the cuttings are rooted thoroughly, they are either pricked off into shallow flats, or planted out on the bench in a good carnation soil. The endeavor is made to keep this young stock in a house by itself, giving an abundance of air, and keeping a close watch to prevent the insect enemies of the carnation from getting a foothold. This is very important, for severe injury is often inflicted upon young stock by these pests, from which they never fully recover.

Here, at Richmond, the young plants are set out in the open ground as early in the spring as the soil can be worked. This method is preferred to growing indoors through the summer, though a few varieties like Mrs. Thomas W. Lawson are cultivated in the house, with very satisfactory results.

The preparation of the field for growing carnations is very important. If the ground is low, or inclined to be wet, underdraining is resorted to; if the ground is a stiff clay loam, it is the better for being sub-soiled. Manure is applied, old well-rotted humus being preferred. This is placed on the soil the preceding summer, and is ploughed in, to thoroughly incorporate it with the soil, and to render it easy of assimilation by the plants. A Planet Junior wheel hoe is used in cultivation; the rows being about twenty inches apart.

The matter of pinching is largely a question of variety, some sorts requiring more nipping back than others.

If climatic conditions are favorable, we prefer lifting our plants the latter part of July, usually finishing early in August.

We use for compost, for indoor planting, a good loam, enriched with one-eighth manure and with a liberal admixture of bone-flour; this is composted usually a year in advance, and is turned at least once before using. We place four to five inches of soil on our benches in which the plants are grown. We prefer for the bottoms of our benches the ordinary soft three-inch clay tile; these tiles afford a good drainage, and their porous character prevents anything like over-watering in dark weather.

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In supporting the carnation, we use a circle of wire, with a bent foot for the first help; after that, wires are strung lengthwise of the bed, these being cross-laced with twine, through which the stems of the carnations rise as they grow. Two sets of wires, with interlaced twine, one above the other, are necessary as the plants increase in height, the spacing of the second above the first tier depending upon the length of stem of the variety supported.

The distance that plants are spaced on the benches is usually ten or eleven inches; some varieties require wider spacing than others, and often an unusually favorable growing season will necessitate planting twelve by twelve inches.

We seldom use stimulants, in the shape of liquids, or chemical fertilizers, until the end of January, and then in a very cautious manner. We do, however, use a mulch of old, well-rotted cow manure over our benches soon after the plants start on their winter's growth. This is not so much for the enrichment of the soil, as to prevent excessive evaporation on sunny days, and to keep the soil in a nice, moist condition for the working of the young roots.

Watering is a science, and should be done by a careful and competent man. It is one of those processes requiring an intelligent knowledge of soils and plant natures, where extremes must be avoided, and where each variety must be studied individually and water applied accordingly to keep the plants in healthy, thrifty growth. One advantage of the tile bench is, that it speedily corrects over-watering, which is direfully fatal in dark weather, but on the other hand, the porosity of the tile requires a sharp watch that the roots do not dry out in warm and sunny weather.

Air is a prime factor in the healthy growth of carnations. Give air on every sunny day; and even in damp and wet weather it is still beneficial. Better use a little heat to dry the atmosphere, even if it does go out of the ventilators, and so sweeten and purify the house.

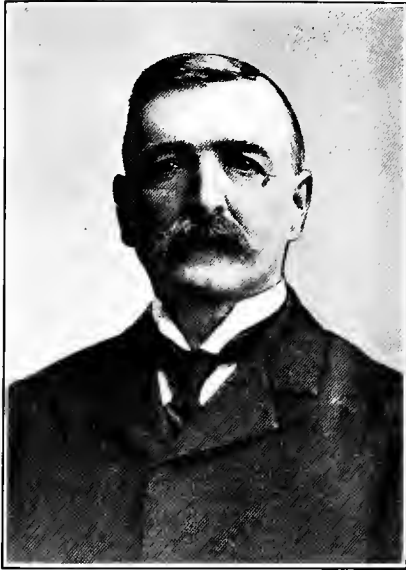
A temperature of 52 to 54 degrees will be found productive of good, hardy growth, with, say, 56 degrees for Mrs. Thomas W. Lawson and Ethel Crocker.

Fungoid diseases and insect pests are present where inattention, or carelessness, is allowed to govern. The use of tobacco is essential in keeping down aphid and some other pests. Bordeaux mixture is a preventive of rust; but a careful picking of the infected foliage will tend to eradicate this disease.

Carnation Culture in Richmond, Indiana

EDWARD GURNEY HILL

Edward Gurney Hill was born in Lancashire, England, in 1847, and with his parents came to this country in 1851. When quite a lad he entered the greenhouses of Messrs. T. C. Maxwell & Bros., Geneva, New York. In 1881 he formed a partnership with his father, and together they founded the present business at Richmond,



EDWARD GURNEY HILL

Indiana. Mr. Hill has been an enthusiastic lover of greenhouse work from his boyhood up. Hybridization and cross-fertilization have always had a special attraction for him, not only as regards carnations, but in all the leading lines of plants.

Mr. Hill became deeply interested in carnation culture in 1890, from a cut flower point of view. Previous to that, and dating back to 1884, the firm had bought the novelties as offered, and had grown *La Purité*, *Portia*, *Tidal Wave*, *Daybreak* and *Heintz's White* in quantity. In 1890, the concern purchased a large number of seedlings from Mr. Fred. Dornier, many of which proved extraordinarily fine as to blooming qualities, although all have been dropped by growers on account of defects which barred them from success when grown commercially. Among these may be remembered *Edna Craig*, *Fred.*

Dornier, *Edwin Lonsdale*, *Christine*, *Hoosier*, *Indiana*, *Creole*, *Red Cross*, *San Mateo*, *Canada*, *Cherry Lips*, *Sea Gull* and *Ben Hur*. A number of the kinds named would still rank with the finest if only the quality of bloom produced needed to be considered, apart from freedom, earliness or cost of production—factors not so carefully scanned ten years ago as at the present day, for we were then working with more than one unknown quantity in the carnation line.

About this time Mr. Hill's firm began growing seedling carnations on quite a large scale. Several years were required to test the varieties, and it was not until 1896 that any sorts of their own origination were sent out, when they introduced *Triumph*, *Armazindy*, *Abundance* and *Jubilee*, the latter purchased from Mr. John Hartje, of Indianapolis.

In 1897 the firm introduced the two seedlings, *Flora Hill* and *Mrs. McBurney*; in 1898, *Painted Lady*, *Psyche*; in 1899, *America*; and in 1903, *Adonis*, which was purchased from Richard Witterstatter and introduced jointly by Messrs. Robert Craig and E. G. Hill.

Mr. Hill has always been an enthusiastic worker for horticultural improvement and a loyal proponent and supporter of horticulturists' organizations. He is a member of The American Carnation Society, The Society of American Florists, The American Rose Society, The Indiana State Florists' Society, as well as other horticultural associations.

Carnation Culture in the Mountains

Carnation Culture in the Mountains

BY HENRY WEBER, OAKLAND, MD.

Variations in latitude, altitude, climate, etc., while having their effect on the modes of culture pursued by growers thus differently situated, do not, to any appreciable extent, alter the fundamental principles underlying the successful culture of the carnation.

Here, in the mountain district of Western Maryland, nearly 3,000 feet above tidewater, we find ourselves handicapped by extremely late frosts in the spring, and very early visitations in the fall. Owing to the former, we are very seldom able to commence field planting before May 20, and occasionally later; we therefore are frequently as late as June 5 to 10 in finishing up that work.

The effect of this must be at once apparent to those who plant in April and early May. Our plants do not get sufficiently developed in the field to permit us to plant in the house until the last of July, or first week in August. We are thus compelled to carry our young stock inside for from four to six weeks longer than the majority of growers, necessitating a quick dispatch of field-planting, when the proper season arrives. This handicap is partially offset by our cool nights during the summer, when the temperature ranges anywhere from 42 to 65 degrees. We are also very rarely troubled with drought, but more often have a wet season. On the whole, the growing conditions during the summer frequently approach the ideal.

By September 1 we can expect light frosts, and severe ones by the 15th, but occasionally we escape these until October 1. This, however, is unusual. We are thus not only compelled to carry our stock inside much longer than the average grower, but are also obliged to have our fields cleared of valuable plants proportionately earlier in the fall. Our firing season is affected in a like manner, ending usually about May 15 to 20, and commencing in September.

We begin propagating in December, and continue until May 1 to 10. We much prefer the early propagated stock, particularly in the case of such varieties as Mrs. Thomas W. Lawson, Cressbrook, Prosperity and Norway. Cuttings taken prior to February 15 can be depended upon, invariably, to give the best results, providing they receive proper attention as soon as rooted, and until they are transferred to the field.

Our propagating houses are all of the north-side type. We consider them far superior to those which admit the direct rays of the sun. They are

Carnation Culture in the Mountains

more easily managed and regulated, particularly as regards temperature and watering, the two most vital requisites connected with the unrooted cuttings. Frequent watering and spraying is unnecessary, thus largely diminishing the chances, or possibilities, of the development of cutting-bench fungus; in fact, if the pips are not put too closely in the sand, we have not the slightest fear of this disease. In this connection, I might say that we are never compelled to renew our sand during the entire season.

We ascribe all this to the advantages of the north-side propagating house, properly heated and ventilated, and the comparatively little watering and spraying required, as compared with a house which admits the direct rays of the sun. The tendency to make soft growth in the north-side house is practically overcome by keeping the cuttings on the dry side, as soon as they begin to make roots, and their being removed as soon as strong enough.

We use ordinary creek sand, which contains more or less loam, decayed particles of twigs, leaves, etc. We consider the loam and other materials mentioned beneficial rather than detrimental, for the reason that as soon as the first tiny rootlets appear, they begin to take some nourishment; and until they are removed from the sand, in ten to fifteen days, they are adding to the vitality, instead of being obliged to subsist on what small amount remains to them, as in the case where absolutely clean sand is used, and which contains no nourishment.

In taking cuttings, we are not so particular as to what portion of the plant the pips come from, as we are about the health and strength of the plants. We refrain, however, from taking the topmost pips from the flowering stems, and, also, the slow growth at the base of the plant. We also prefer the cuttings to be of good size, and well developed. What we consider the best cuttings are those taken from the short shoots before they begin to lengthen, preparatory to developing buds. We break off these shoots several joints away from the stem; cuttings so taken we regard as being the ideal.

We do very little trimming, and usually confine this operation to removing the bottom leaves so as to prevent their lying flat on the sand; and, if the cuttings are very long, we remove a little from the top. The more foliage removed the less vitality the pip has left on which to subsist until rooted, or potted, or boxed up.

We grow as much of our young stock as we can on benches, in two and one-half or three inches of fairly rich soil; and set the cuttings about three inches apart each way. As soon as established, we grow them cool, both night and day, affording plenty of fresh air.

Carnation Culture in the Mountains

Next to this system, we prefer flats, with treatment similar to that above described.

We regard growing cuttings in pots as the least desirable method, unless the stock is frequently repotted, or removed to flats, or benches, before the plants become potbound.

Before cutting back, we allow a young plant to attain a height of six or eight inches, this depending somewhat on the variety; and then we only remove the tip sufficiently to prevent the center from growing out again. This induces branching out a little distance above the soil, and makes a fast, strong, vigorous plant. If cut back close to the soil, when still small, a slow and checked plant is the result, with branches close to the ground, inviting all sorts of fungous diseases, and proving a harbor for snails and other pests.

Our preparation of the field, to receive the young plants in the spring, consists of putting on a good coating of stable manure (cow preferred) on either a clover or timothy sod, and plowing it under in November. To this is added, early in the spring, a light dressing of lime and a good dressing of kainit and bone meal. As soon as the soil is dry enough, we cut it up with a disk harrow, repeating this operation often enough to prevent weeds from growing. A smoothing harrow and leveler is next used, when we are ready to plant. The plants are set fifteen inches apart, each way, with ten rows to a bed.

At first, a wheel hoe, consisting simply of a sharp blade being passed horizontally just beneath the surface, is the only cultivation the plants receive. As they become larger, this hoe is discarded for a small shovel machine, that goes a trifle deeper. This cultivation, after every rain, or oftener if the weather be very dry, is all the plants receive, excepting that they are carefully hoed by hand once, and sometimes twice, during the season. All cultivation is discontinued, usually, by August 1.

In preparing soil for planting in, we top-dress either clover or timothy soil heavily with stable manure, and plough under to the depth of five to six inches. A heavy dressing of bonemeal, kainit and a little nitrate of soda, is then worked in with a disk harrow, after which the ground is again ploughed, and more bone meal, etc., applied. After another harrowing, the soil is ready to stack up conveniently near the houses, this being done in November. When ready to plant in, the soil is worked over with spades, and made fine. In planting, we use five inches of soil, placing the plants from ten to fourteen inches apart each way.

We always prefer to lift the plants when the soil is fairly dry, sprinkling them in the field as soon as put in boxes. We never shade when planting in;

Carnation Culture in the Mountains

and leave some soil on the roots. After the first good watering, just above the roots, we spray frequently, if the weather is bright, and keep the ventilators wide open. As the plants begin to take hold, we discontinue spraying, excepting at intervals, to wash them off, and to assist in keeping down red spider. For this pest we use salt water, applied with an "Auto-Spray" pump. This application also assists in keeping down snails and other insects. A four-inch potful of salt to two gallons of water is used, and, when washed off the plants with the hose, is very beneficial, making the growth firm, and improving the color.

We have discarded the V-shaped wire netting, and consider the wire stretched horizontally between the rows, and twine cross-wise, as infinitely superior, as well as cheaper than any other supporting device yet invented. The work of giving support is attended to as soon as planting is finished; after which, a light mulch, of especially prepared rich soil, is put on and worked in lightly.

If we plant early in August, we commence feeding with liquid manure in November, provided the plants are growing vigorously, the amount of stimulating they can stand depending entirely on how the soil is managed, thorough watering, and the manner in which temperature and ventilation are regulated.

A temperature of 58 to 60 degrees for the early part of the night, with a drop to 55 or 50 degrees by morning, is, we believe, the ideal temperature, and in keeping with the natural conditions as we find them when the plants make their best growth out-of-doors. A day temperature of 60 to 65 degrees, for cloudy days, and 70 to 80 degrees, for sunlight, is our rule. If the air outside is cold, we adhere to the first figures, and, if warm, the latter.

We believe in disbudding, and attend rigorously to this item, allowing the side buds to get large enough to be easily handled before removing them.

At the approach of late spring, we give an occasional dressing of nitrate of soda, simply broadcasting it thinly over the plants before watering. In this way the vitality of the plants can be prolonged well into the summer.

We begin shading from the middle to the latter part of April, using naphtha, or gasolene, and white lead.

HENRY WEBER

Henry Weber, of Oakland, Maryland, was born in the Province of Hessen-Cassel, Germany, in 1835. His father, John Weber, was a farmer and died at the age of sixty-three. The subject of this sketch is the youngest and only survivor of five children.

As is customary in Germany, Henry Weber attended the Government schools until he

Carnation Culture in Ohio

was fourteen years old, when, having from his earliest days shown an unusual love for flowers, he was apprenticed to a florist, and a few years thereafter was made foreman of his employer's gardens and greenhouses, on account of his executive ability.



HENRY WEBER

Having a natural inclination to travel, at nineteen years of age he entered the British Army, serving during the Crimean War. During his ten years' service in the British Army he was stationed at various points in Asia, Africa, Australia and New Zealand, where he had many thrilling experiences, particularly in the Hottentot country.

In 1885 he decided to come to America, and with his brother John, who had preceded him, embarked in general farming and market gardening, at Mount Savage, Allegheny Co., Maryland. At the end of five years he sold his interest to his brother, and removed to Cumberland, Maryland, where he established a general market gardening and florist business. In 1870, he bought a tract of land in Garrett County, adjoining the town of Oakland, where he established the present florist business. The soil and climate proving particularly favorable for carnation growing, special attention was paid to the culture of that plant, which [was started on a very

modest scale with a view of building up a local trade.

Mr. Weber thinks there is a great future for the carnation and that its improvement has only fairly begun. He also believes that Nature's laws regarding color and many other mysteries of plant life will be gradually unfolded to the persevering and untiring student. He takes much delight in the raising and cultivation of seedlings. He is also a firm believer in the ultimate success of sub-watering, and of the indoor culture of carnations.

Mr. Weber is an active member of The American Carnation Society, The Society of American Florists, and other organizations.

Carnation Culture in Ohio

BY RICHARD WITTERSTLETTER, SEDAMSVILLE, OHIO.

I commence propagation in January, only of such varieties of which the stock is limited, and those that do not make very large plants from later propagation, Estelle and Mrs. George M. Bradt being good types. I

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prefer to take cuttings of the larger growing varieties from February to the middle of March.

The style of propagating bed is one built of bricks, laid end to end on four-inch strips of one-inch lumber (red cedar, as it outlasts pine or hemlock four to one). This exposes just one-half the bottom of the bed to the heating pipes underneath. About two inches of clean sand is used. This sand should never be employed the second time, as experience has proven it dangerous, apt to breed fungus and cause other troubles, such as damping, etc., no matter how temptingly clean the sand may appear. The shading material should never be permitted to lie directly on the cuttings, as it creates a smothering atmosphere that is detrimental. A space of six inches (twelve inches will be found better) should at least be allowed.

In selecting the cuttings from the blooming plant, the pips on the stem, just where the stem is cut, and upward, should be used; the one on top not being taken. From such varieties as do not make many cuttings along the stem, I prefer to take the cuttings about the plant before they shoot to a flowering stem.

All cuttings are potted after being rooted, and are grown in a cool temperature. After root action has started, the pots are plunged out in some light soil (screened ashes from the boiler pit preferred, as these contain no weed seed that will become troublesome) in cold frames, during March. This helps the plants to harden for early planting, and there is no danger of their becoming pot-bound. Plants in cold frames have an advantage over those in the house, as the sash can be removed on any warm, bright day, and the warm rains being permitted to fall on the stock during the first part of April, before planting out, induce vigorous growth, which the plants do not attain in the house under the most careful attention.

Our planting season begins about the middle of April and ends about the 10th of May. It is very essential to the season's quality and quantity of cut blooms to have plants, at lifting time, in the most vigorous and healthy condition, and no amount of care should be spared in attaining this end.

In preparing the soil for planting, we give the same a top-dressing of good stable manure, ploughing to a depth and harrowing it thoroughly. After this, we reverse the harrow and drag the field, which leaves the surface smooth and well pulverized. Each plant is watered when set out, as a safeguard against its wilting before the next rain, as we are liable to have very drying winds at this season, and there is danger of the ball becoming dry.

Carnation Culture in Ohio

Plants are set six to ten inches apart, the space depending upon the variety; small growing sorts the former distance, and larger ones the latter. The distance between rows depends upon the method of cultivation; if for wheel hoe cultivation, sixteen inches; and for horse cultivator, twenty-six inches apart. Whatever method is used, we always follow with a hand hoeing, stirring the soil about the plant, which is done at least every two weeks, or oftener, as the conditions require, when weeds become troublesome, or after a good rain. I have always noticed that after a hot, dry spell of weather, followed by a rain with a hot, humid atmosphere, stem rot is more prevalent, and we lose no time in giving the soil a thorough stirring, as a means of checking it; in fact, I firmly believe this operation to be the means of saving quite a lot of plants, not only at this period, but at any other time when this disease makes its appearance.

We are always particular in attending to the topping of our plants once a week, up to the time of lifting, the last time just previous to lifting, as by this method the plants are not so liable to give their flowers in crops, and produce a more uniform cut than otherwise. The top should be taken out just as it begins to shoot a flower stem. Should the whole of the plants show this latter tendency, we take a part of the tops, allowing the others to be taken a week or two hence, to prevent the plants coming in crops. This practice is usually followed the latter part of June and July. We have been lifting earlier each year, and do not think after July 15 any too soon to do this work, providing the weather is favorable; that is, not extremely hot.

The soil for the benches is ploughed up in April, a good blue grass sod being selected, which is turned under to the depth of about four inches, then harrowed immediately and cultivated whenever weeds appear. We add no manure of any kind, as I believe that the plants, when lifted in the early part of summer, start off better in this soil than when fertilizers have been added. These are always afforded as the plants progress. Two years ago, during a very severe drought at lifting time, I had a variety planted in two separate lots in a field; one lot being planted on the edge, along a row of fruit trees. This lot was badly wilted, and being anxious to have them planted in the same house, at the same time as the others, I lifted the wilted plants, and after cleaning them of all the dead leaves the roots of the plants were placed in a tub containing about five inches of water, for about two hours, to freshen them up before planting. These plants recovered so much better than the remainder not so treated, that we have adopted this system ever since, in the case of all our plants, with gratifying results.

In shading, I prefer whitening, or air-slaked lime, put on evenly. Any

Carnation Culture in Ohio

dark shade, such as clay, I believe to be injurious to the plants, inducing a somewhat soft growth. Just enough ventilation is given the first two or three days to obtain a moderate circulation of air, gradually increasing the ventilation from day to day until the plants will take the full extent. Shading is also gradually diminished. After this, ventilation is kept on night and day, the ventilators being lowered only in case of storms.

We syringe overhead often enough to keep down red spider, which is about two or three times a week; or oftener, as the weather demands. This is kept up until there is danger of the plants not drying off before late in the day. We do not syringe overhead after November 15 or December 1, until March 1 to 15. If red spider appears, we use a solution of common salt and water (a 4-inch potful of salt to an ordinary bucket of water), and spray the plants thoroughly in the morning of any bright, sunny day. Before this practice is resorted to, all blooms must be cut close, as the syringing will make them worthless. We have never had any bad effects from the salt on the plants, although we have used it strong enough to have small crystals of salt form upon them, after they had become thoroughly dry.

Staking, or supporting, should be attended to as soon as the plants show any signs of making growth, as those supported in time show a greater advance than others not supported. A delay of from ten to fourteen days will disclose a marked difference.

After the plants have thoroughly recovered, weeds will make their appearance. These are removed either by hand or weeder, as the condition of the soil permits. If the soil be hard or baked, we use a weeder; if otherwise, we use our hands, stirring the soil to the depth of half an inch, or as lightly as possible, after which a light mulching is afforded to prevent any further hardening of the top soil. Then we begin feeding moderately with liquid manure (this usually six or eight weeks after lifting). About December we give a top-dressing of dried blood and pure, finely-ground bonemeal; two parts of bone and one of dried blood, using a heaping handful between the rows, half-way across a five-foot bench, evenly distributed over the surface. A similar dose is applied again in April, followed shortly by another light mulching of well-rotted stable manure, as a preventive of rapid evaporation, which takes place at this season of the year.

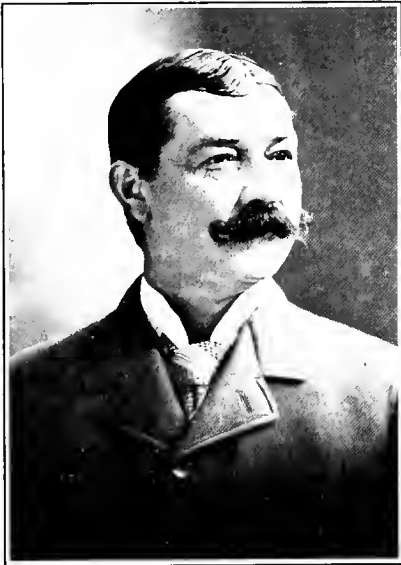
Ventilation is given on cold, bright days during the winter months, as soon as the temperature is affected by the sun; gradually, as it is necessary, reducing it with the lowering of the temperature. I find it essential to the welfare of the plants to guard against any sudden drop, or rise, in the temper-

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ature, which is sure to happen if ventilation is not attended to on cold, bright, clear days; in fact, at all times.

The care and treatment from October 1 to April 1 may be summed up as follows:

Gradually increase the quantity of liquid food until about December 15; then afford less and at longer intervals through mid-winter, augmenting the quantity again when spring suns appear and the plants are moving more rapidly. Guard against uneven night and day temperatures, which are maintained 48 to 52 degrees for night, six to eight degrees higher on dark days, and 65 to 70 degrees on bright days. Practice no excessive watering, especially in cloudy and moist weather; if necessary, frequent and light watering is the method preferred. Ventilation, even at the expense of firing, to change the atmosphere every twenty-four hours is afforded. Further supports are added promptly whenever necessary.



RICHARD WITTERSTETTER

RICHARD WITTERSTETTER

Richard Witterstetter was born at Sedamsville, Ohio, on November 17, 1859, where he has ever since resided. He began the growing of the carnation about 1886, when President Degraw and La Purité were the only varieties he cultivated. His first work at hybridizing the carnation was done in 1890, and although he has raised thousands of seedlings his introductions have been limited to only four sorts, namely, Emma Woche, light pink; Evelina, white; Estelle, scarlet; and Adonis, also scarlet. The latter variety was sold to Messrs. Craig and Hill, who are introducing it. Mr. Witterstetter is a very careful, painstaking hybridizer, and a most enthusiastic member of The American Carnation Society, of which he has been the vice-president and acting president.

Carnation Growing in the South

BY W. R. SHELMIER, ATLANTA, GA.

The average florist in the North has very little idea of the changed conditions under which floriculture is carried on by his Southern brother. He would be surprised to know that, should he change his location for these parts, his trade in great measure would have to be learned over again. Of course, the general principles are the same, but to apply those principles would mean to him another apprenticeship at the business.

The most marked changes are those of soil and climate. The Northern man naturally expects to find considerable difference in climate, but the matter of soil will hardly occur to him, or he will surmise that the choice of a suitable soil is merely a matter of selection. The truth is, there is no soil at all here as we understand that word in the North, and, practically, there is no sod from which to make greenhouse compost; consequently, the very foundation of successful floriculture is apparently lacking. The deficiency must be made up by the skillful manipulation of the material at hand. That which experience has taught us to be the most suitable is the red clay of the district. There is a choice even in this, the most desirable being of a dark red color and even texture, free from stones and admixture of any kind. It is dug from the bank, the same as brick clay, and to the depth of several feet, perhaps.

After being thoroughly broken up with rakes, this soil is mixed with about one-quarter well-rotted stable manure and what bone would equal 100 pounds applied to a 150-foot bench. I give the formula generally used, but it may, of course, vary to suit different purposes. This, when thoroughly mixed, constitutes the "soil" used for carnations, roses, etc. When placed on the benches, this material is packed hard by the feet, and the plants well firmed after planting. All potting, too, is done very firm. Experience has taught that all things do better in the available soil when thus well firmed.

A limited supply of green-grass sod is found in places, but it has not proved suitable.

Bermuda sod can also be had in quantity, but the roots are so full of vitality that it is not possible to use this grass in a compost. It would also grow on the benches and prove very troublesome.

Nearly all things thrive admirably in this red clay mixture, although in the clay itself weeds will hardly grow. Still, it is more or less of a handicap, and requires cautious management and no little skill, particularly in the matter of watering.

Carnation Growing in the South

Reference is not here made to soils, agriculturally speaking. The South has abundance and to spare of fertile farm lands. But good sod from which to prepare the very best soil for greenhouse purposes, and which is considered to lie at the very foundation of successful floriculture, is certainly almost wholly lacking in this section of the South, at least.

Climate I put secondary. There is a long summer of at least five months, the weather conditions being very similar to those in July and August in the North. During this period, if clear, the plants take a good deal of water and daily syringing, also all the air possible by top and side ventilation. The glass, too, should be well shaded.

The winters are short. Freezing weather is experienced in December, January, February and March; 15 or 20 degrees is then common; at times it is colder. During some winters, at long intervals, zero or below is reached. There is little snow, and the ground does not remain frozen for more than a few days at a time. The weather changes are often sudden and severe and high winds are frequent. In fact, the winter is comparable to the month of March in the Middle States; consequently, substantial glass-houses are required, with a good boiler capacity.

For the best results, it is considered that Northern-grown field plants are preferable. These are usually planted in August. Plants are grown here in open ground only with great difficulty. The soil is against the method to start with; droughts are often severe; the sunshine is intense, and the red spider, thrips and other insect pests are persistent, even with frequent syringing and irrigation.

The carnation can be propagated in the cool months without difficulty, and grown indoors in pots perfectly with care. But grown either in the open ground, or indoors in pots, the cost is too great, and the plants from the North are considered the cheaper.

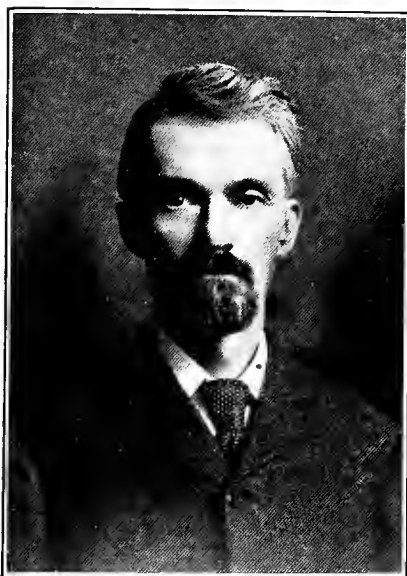
All these remarks apply more particularly to the vicinity of Atlanta, Georgia, but would also include that large section of the South where the red clay predominates.

It seems to me that what the South needs is to develop an individuality in the growing of greenhouse products. Varieties of carnations and other plants should be produced suitable to its soil, and perfectly acclimated. The glass structures should not follow Northern lines or ideas, but a form should be developed better suited to the climate. These changes no doubt will take place in time.

Carnation Culture in California

WARREN R. SHELMIRE

Warren R. Shelmire was born in Philadelphia in 1850. He removed to the country



WARREN R. SHELMIRE

at the age of nineteen. In 1884 Mr. Shelmire started in the florist business at Avondale, Pa., and immediately began the growing of carnations, becoming very much interested in the obtaining of new seedlings. His success was at the first indifferent, but, as he puts it, "the lesson must be learned sooner or later by the seedling grower, that improvement comes very slowly and the prizes are few indeed." Although he placed upon the market several new varieties, he had but one real good one, namely, Eldorado. This variety was the result of deliberate crossings along certain lines. The pollen of certain kinds seems to be potent in a definite direction; for instance, he found in his experiments that the pollen of Golden Gate almost invariably produced a yellow or yellow variegated flower, and at one time he had eighty or more yellow seedlings on trial. The same seed pod that produced Eldorado also produced two other very good sorts, namely, Kitty Clover and Eulalie.

Carnation Culture in California

By JOHN H. SIEVERS, SAN FRANCISCO.

Outdoor culture of carnations, commonly called "pinks," is well understood in California, because the plants, with us, are quite hardy, on account of the mildness of our climate, and, when properly cut-back and taken care of, last in the garden for a number of years. These plants in former days were generally raised from imported seed; and if any variety proved to be extra good, it was propagated by layers, or cuttings. Before greenhouse culture of carnations was introduced, plants were raised in this way, set out in rows, and left outside until the end of November. Being then in full bud, they were taken up from the ground and placed on benches in greenhouses, for whatever they would yield in flowers for the holidays.

Carnation Culture in California

This was necessary here, in San Francisco and suburbs, because when we do get a "norther," and there is snow on the Coast Range, the wind becomes quite cutting, sufficiently so to shrivel the buds and make the flowers unsalable. In the southern part of California, in Santa Barbara, Los Angeles, and other points, this does not occur; and, therefore, the florists in that region are able to cut thousands of blooms from their fields of carnations all winter through. True, these cannot compare with greenhouse-grown flowers; but they seem to find buyers and admirers, because the florists continue to extend their fields more and more every year. Growers there do not practice disbudding, which, carried out only in a partial manner even, would no doubt increase the size and perfection of their blooms.

Having heard of the very successful growing of carnations under glass in the East, and having received from there such varieties as Buttercup, Century, Heintz's White, President Degraw, Sunrise, and others, we began, in 1889, to hybridize these with a few of our seedlings that were grown from seed imported from Erfurt, Germany, among which we had found some flowers of fine colors and of fair size and shape. Seedlings produced by this, our first attempt at hybridization, were given a touch of the blood of imported hardy European varieties, to increase the dimensions of the flowers, and with excellent results. Having in the meantime continued to import all the latest novelties in carnations from the East, we followed up our experiments with some of them, and had the satisfaction to number, in our possession, in 1895, some seventy distinct varieties of greatest promise. Of these we catalogued, in 1897, fifty varieties, most of which are yet retained by us as standard sorts. It is true, that, strictly speaking, these were not all commercial varieties, according to Eastern ideas, because a great many were variegated, but they were nevertheless of large and perfect shape, fragrant, long-stemmed, prolific and constant bloomers. Since then, our efforts have been more directed to obtaining self-colored carnations.

During my visit, last spring, to several cities in the East, I could not help noticing and admiring the superior construction of the greenhouses on the large establishments there, in comparison with our structures. The substantial foundation, the iron frames and supports, the excellent ventilating apparatus, the draining tubes under the beds, and such like, are seldom met with here, and then only in private places. Perhaps it is not quite so necessary in our part of the country to build such solid houses, on account of the lesser degrees of heat in summer and cold in winter; but from the standpoint of economy alone, it would be wise, when one does

Carnation Culture in California

build, to build well; and if one can't afford it, to build less, otherwise a grower must be prepared to rebuild every seven years, at least.

I find the actual culture and treatment of carnations here about similar to those on the other side of the Rockies, with the exception of some dates. We begin making our cuttings about January 1; planting from two and one-half inch pots into the open ground, in the beginning of April, when heavy rains are not expected any more. After thoroughly cleaning and whitewashing the houses and beds, we fill the latter with a mixture of soil, as follows: To ten loads of rich loam we add, according to quality, from one to two loads of clean sand, and three loads of good old cow manure.

We start planting in the middle of July, and finish by the end of August. We find it necessary to assist the soil in the beds for the first time about the middle of December; after that, monthly, by using liquid manure, and alternating with nitrate of soda.

In training the flower shoots, we still adhere to the old practice of stretching twine to the sides and ends of the beds, attached to wires, in preference to the wire frames used in the East.

Starting with healthy plants; exercising cleanliness, affording plenty of fresh air, and not too much water during dull weather, maintaining about fifty degrees of temperature at night, will keep carnations healthy in California, and, I suppose, almost anywhere.



JOHN H. SIEVERS

JOHN H. SIEVERS

John H. Sievers, of San Francisco, was born in the city of Bremen, Germany, on October 31, 1837. After receiving his education he engaged in the mercantile business, and was clerk for two years in a large banking house. In 1857 Mr. Sievers started from Hamburg, per clipper "Virginia," round Cape Horn for San Francisco, arriving there December 25. He succeeded in obtaining a position as bookkeeper in a large French importing house. In 1861 he went as supercargo to Manila, returning by the same vessel after a sojourn of four months. After several ventures in mining properties, without much success, he took a position as bookkeeper in the Golden Gate Flour Mills.

Mr. Sievers' love for flowers developed in his early youth, being heightened by a well-kept garden and nice collection of window

Carnation Culture in Canada

plants at his boyhood home. After coming to San Francisco he gratified his taste for flowers, trees and shrubs, and built a greenhouse in his garden. In the beginning of the year 1871 he concluded to associate himself in business as a florist with Mr. F. A. Miller, a practical gardener, still retaining his position at the flour mills. Subsequently, the latter position was abandoned, and his entire time devoted to the florist and nursery trade. In 1875, the eventful and rather disastrous year for San Francisco, when the Bank of San Francisco failed, Mr. Sievers was in the Hawaii Islands superintending the removal of a large number of royal and other varieties of palms, crotons, tree ferns, etc., for which quite a demand had been created; but when he reached port with a whole deckload of magnificent plants in boxes, the financial conditions were so demoralizing that sales were out of the question and credit impossible, necessitating a new start in business, with more or less success at the beginning, but which has ultimately culminated in a most satisfactory manner, as is now pretty generally known.

Carnation Culture in Canada

BY JOHN H. DUNLOP, TORONTO

There is no commercial flower cultivated in the Dominion of Canada that has made as great progress toward general popularity, during the past ten years, as the carnation.

As I am writing particularly of the progress made in Canadian carnation culture, I will ask my readers to consider for a moment the varieties grown twelve or fourteen years ago, when the area of glass devoted to the growing of carnations was very limited. The varieties then cultivated, as I now remember, were President Degraw, La Purité, Mrs. Carnegie, and Crimson King. I can remember a bench of the Crimson King, which was growing remarkably well, about fourteen years ago. This bench, but forty feet in length by five feet in width, produced more than sufficient flowers of its particular color to supply the demand in Toronto; in fact, the blooms were frequently offered at \$1.00 per 100, and the average wholesale price of carnations during the holidays and through the winter was but the modest sum of \$1.50 per 100. As the Divine Flower was receiving more attention from the florists of the United States and a few firms had branched out as carnation specialists, and devoted their entire establishments to the culture of this flower, and were producing blooms showing marked improvement over the ordinary commercial varieties grown at that time, the possibilities of carnation culture began to be realized. Who will fail to remember with what delight we viewed the first blooms of the varieties

Carnation Culture in Canada

Daybreak, J. J. Harrison, Silver Spray, and the other novelties of that period? At that time John Thorpe, who could see farther into the future of American carnation culture than the majority of us, and who realized the great possibilities of this flower, prophesied the production of four-inch carnation blooms—a prophecy which was ridiculed and made light of by some.

The Canadian growers were then beginning to devote more attention to the carnation, and gradually increasing their plantings, buying of the new varieties more conservatively than their brothers in the craft of the United States—a conservatism in which the Canadian florist still persists, refusing to part with a tried variety for a new one until he is thoroughly satisfied that the newer candidate is worthy of succeeding the old. This condition has been largely brought about by the number of worthless varieties disseminated in the early history of placing new seedling carnations upon the market. These frequently looked well from the illustrations, and came highly recommended from the introducers, but they proved of little value after a year's trial. The small demand resulting from the above cited experience has been largely overcome, and confidence regained by the evident care exercised by the modern producer in sending out new varieties, which are now, generally, the result of years of careful selection and crossing, giving us thereby a strain of free blooming, stiff stemmed, large flowers.

The American Carnation Society has done more to stimulate the present interest in carnation growing than any other agency that I know of. Its annual convention held in connection with its splendid exhibition of the best products grown upon the American continent, cannot help but educate and stimulate the grower to attain a higher standard, and the valuable and highly instructive essays prepared by the best minds in the profession, all tend to the same end.

The past five years an annual carnation meeting has been held in Toronto during the first week in March, where the growers from surrounding cities and distant points exhibit their best products, and also come to see the new varieties that are to be disseminated during the season. These meetings have proved highly beneficial, and have served as efficient educators, by providing a means of comparing the standard varieties grown in different localities with the newer candidates for favor, and have materially aided in the dissemination of the new varieties.

Statistics compiled as completely as it is possible with the material at my command, show that there are about 450,000 carnation plants now grown in Canada under about 550,000 feet of glass, which statement will

Carnation Culture in Canada

give an idea of the growth that has taken place since the small beginning of twelve years ago.

The type of house devoted to carnation culture in the Dominion has not been overlooked. In the early days of the industry any house was considered good enough for this plant, the prevailing idea appearing to be to get as much timber and as little light as possible. This ancient type of house has gradually given away to improved structures, until to-day we have the iron frame, the wide glass, insuring all the light possible, with a minimum of shade. What is the result? The finest blooms are now grown to the greatest perfection and sell at prices four to five times higher than were obtained ten years ago. And the end is not yet; for, if the present ratio of increase is maintained, the estimated area of glass devoted to carnation culture should be doubled in the next five years, with attendant increase of production.

The Canadian grower has as yet produced but few new varieties. That work is carried on extensively and successfully by specialists in the United States, and few of our florists have had the time or patience to pursue hybridizing to any extent. But the Canadian florist is fully alive to the popularity of the Divine Flower, and will in future devote more time and money in order to produce the best results in its culture; and in the coming years he may be in a position to compete for the coveted honor of originating and introducing new and meritorious varieties of this popular flower.

A few words as to the cultivation of the carnation in Canada: One of the most important features of the season's success depends on the care exercised in the selection of cuttings, and the propagating bed. Our first batch of cuttings is taken when the first crop of bloom is maturing, and the plants are growing vigorously, usually from the 10th to the 15th of December. These cuttings we take from blooming stems, previous to the holiday crop being picked, and similar cuttings throughout the season; otherwise they would be sacrificed.

Our propagating house has been located on the north side of a three-quarter span house, with northern aspect, which answered the purpose admirably; but this year our new propagating houses run north and south. These are composed of a double ridge and furrow house, without partition, each compartment nine feet in width, which gives us a house eighteen feet wide, with two benches three feet six inches wide, one center bench seven feet

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wide, and two walks two feet wide. This makes an economical house, very handy for working in. The benches are framed to carry roofing slate for bottoms. This we cover with soft brick laid on flat. On this we place the sand firmed to about two inches in depth. This bench gives a very gentle and uniform temperature in the sand, retaining the heat longer. One of its most noticeable features is, that the sand remains sweet longer (the one batch can be used several times), an entire absence of fungus, and the most satisfactory results as far as strong, well-rooted cuttings are concerned. The temperature we aim to maintain is, for the sand fifty degrees, and for the house about three to five degrees lower.

The cuttings when rooted are removed to another house, generally one that has been cleared after a crop of chrysanthemums has been produced. The cuttings are dibbled in soil that is two inches in depth. This house we shade with cotton, tacked on the inside of the bars on the south side of the house, which shading is removed after the cuttings will stand the full sunlight, say in ten days to two weeks. This allows free circulation of air; and the cuttings will take hold of the soil more quickly and grow stronger than when the shading is placed close to the cuttings, as is frequently done.

For our stock for indoor planting we pot the cuttings that have been in the soil from eight to ten weeks, into three-inch pots. These are planted in a house about the first week in June. We use no shading on the house, but keep the ventilators open and the house as cool as possible by frequent syringing.

Field planting begins about the 15th of May, as the weather in this section is too changeable to permit of earlier planting.

The soil around the cuttings on the bench is cut in squares and these are taken in trays to the field, where beds are prepared for the young stock. A good firming of the soil around the plants at the time of planting is all that is necessary, with hoeing and cleaning during the time the plants are in the field, and pinching as soon as required.

The removal of the plants from the field to the house begins about the first week in August. The benches having been cleared out, thoroughly coated with hot lime and filled with fresh soil, are ready to receive the new plants, which are lifted carefully, with very little soil adhering to the roots. No time is lost in planting into permanent quarters.

We usually shade with a mud wash, which will remain on the glass long enough to give the plants a chance to take hold of the soil. I do not

Carnation Culture in Canada

think it advisable to allow the shade to remain on too long, about two weeks at most being sufficient.

JOHN H. DUNLOP

The subject of this sketch was born in New York City on January 7, 1855. He comes of Irish parentage. When he was seven years of age his parents removed to Toronto, Ont., where, while yet a lad, he spent two years in the book business, afterward returning to New York, where he worked for some time as a carpenter. In 1875 he returned to and finally settled in Toronto, leasing a newsstand and telegraph office from the Queen's Hotel. Up to this period he possessed no practical knowledge of floriculture, but during quiet afternoons such books and papers as gave any instruction on the subject, and upon rose growing

in particular, were eagerly studied.

Having become acquainted with the theory of rose growing, he made his first venture as a florist by building a modest structure, of a size 6 x 12 feet, in 1880. This was doubled during the following year, and the year thereafter a house, 8 x 50 feet, was built. This again, the succeeding year, gave place to a more modern structure, 12 x 50 feet, of the type known as the three-quarter span house. As the demand for choice roses was increasing, a large piece of ground was purchased on Lansdowne Avenue, near Bloor Street, where his present establishment now stands.

In 1885 Mr. Dunlop first forced the lily of the valley, which was considered quite a feat at that time. He also was the first to adopt the use of raised benches for the winter forcing of roses, which system has now superseded the old solid bed.

Mr. Dunlop has always taken a lively interest in carnations, testing all the new varieties that are exhibited at the annual conventions of the American Carnation

Society. The yearly display of carnations at Toronto is due to Mr. Dunlop's initiative. He is an active member of the American Carnation Society, and has been president of the Canadian Horticultural Society, as well as its first secretary. He has been a member of the Society of American Florists for a number of years, and has served upon its Executive Committee. He has also acted as president of the Toronto Gardeners and Florists' Association, and it was due to his call for a meeting that the association was formed.

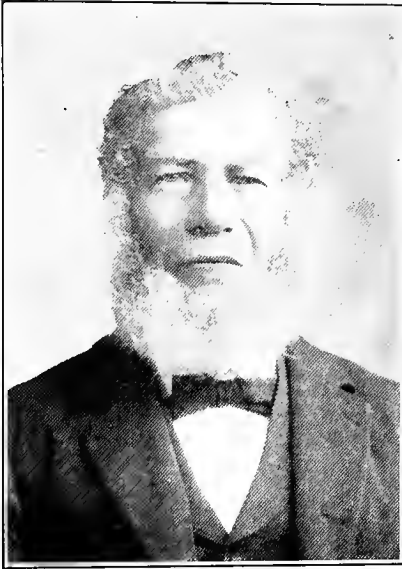


JOHN H. DUNLOP

Pioneer American Carnationists

CHARLES ZELLER

Charles Zeller, one of the earliest beginners in the growing of seedling carnations in America, was born seventy-five years ago at Lanzer, Department Haut-Rhin, Alsace,



CHARLES ZELLER

France, near Basle, Switzerland. In 1841 he went to his uncle, located at Basle, to learn the florist's business, but in a short time discovered that he could not there acquire everything according to his wishes. He then resolved to engage for a term of three years with Mr. Henry Fisher in Freidbourg, Grand Duchy of Baden, Germany, where he had an opportunity of learning florist, nursery, landscape and vegetable work. In 1844 he returned to Basle, and for some time was employed by Mr. Hammerlin, superintendent of the Botanic Garden. In 1847 Mr. Zeller went to Paris, France, to get better acquainted with his mother tongue before he should be drafted as a soldier. Fortunately, he was exempted from military service by drawing the second highest number. He remained in Paris for some time, working as a florist, landscape and vegetable gardener. Becoming disgusted with Parisian life, through the Revolution, he emigrated to America, landing in New York on October 28, 1851, "full of inspiration" as he says, when he "got the first glimpse of the noble flag, the emblem of Liberty and Prosperity." He was then twenty-one years of age. It was a great disappointment to him that he could get no work in his own line of business, and for the winter season he secured employment on the Hudson River Railroad, where, to use his own words, he "labored with a squad of twenty-two Irishmen, working with my spade; and when they found out I could use a shovel, crowbar and pickaxe as well as the rest of them, they became my friends."

With no regrets Mr. Zeller quitted this occupation in the spring of 1852, and obtained a situation with Mateo Donati, florist, at Bloomingdale, N. Y. He later went to work for Mr. Mantell, of the same place, and subsequently for Mr. Rinney, of Lodi, N. J., where in doing some landscaping he became acquainted with Mr. John Dailedouze, with whom he formed a lasting friendship. Together they concluded to rent a place and go into business at Flatbush, N. Y. After a period of three years another partner was added, and the firm became Dailedouze, Zeller & Gard. It continued for fifteen years, when it was dissolved, each of the partners remaining in business for himself in separate establishments.

Mr. Zeller, who throughout all his career has been a hard-working member of the craft, lost his father and mother when he was very young, and received a schooling of only two years; but he never missed an opportunity of obtaining knowledge. He

Pioneer American Carnationists

took for his motto the words inscribed on the monument of Charles Lambert, located behind the Protestant Church at Milhouse, which inscription told how the great astronomer became famous "by perseverance for those for whom he was doing a service." There was no greater recompense for him than to receive a candle to provide light in his room, that he might pursue his studies. "This," continues Mr. Zeller, "I preserved as my example."

JOHN DAILLEDOUZE

John Dailedouze, of Flatbush, New York, was born January 1, 1828, in Geneva, Switzerland. He received his early training as a florist in the nurseries of his father



JOHN DAILLEDOUZE

located there. In 1849 Mr. Dailedouze emigrated to America, landing at New Orleans, where he worked at the florist and nursery business until 1858, when, with Charles Zeller, he formed a copartnership and established a business in Flatbush, N. Y. Subsequently Mr. Joseph Gard was added to the concern. The firm was dissolved in 1868. Mr. Dailedouze continued to operate the greenhouses until his death, which occurred in 1882. The business was subsequently carried on by his widow until 1892, when the firm became Dailedouze Brothers, being composed of Messrs. Eugene, Paul and Henry Dailedouze, who have since developed the business into one of large proportions, making a special feature of the carnation.

Among the varieties introduced into commerce by this firm are Prosperity, Alice Roosevelt, and Bouton d'Or.

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