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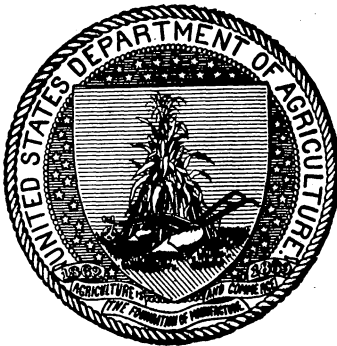
FARMERS' BULLETIN No. 148.

CELERY CULTURE.

BY

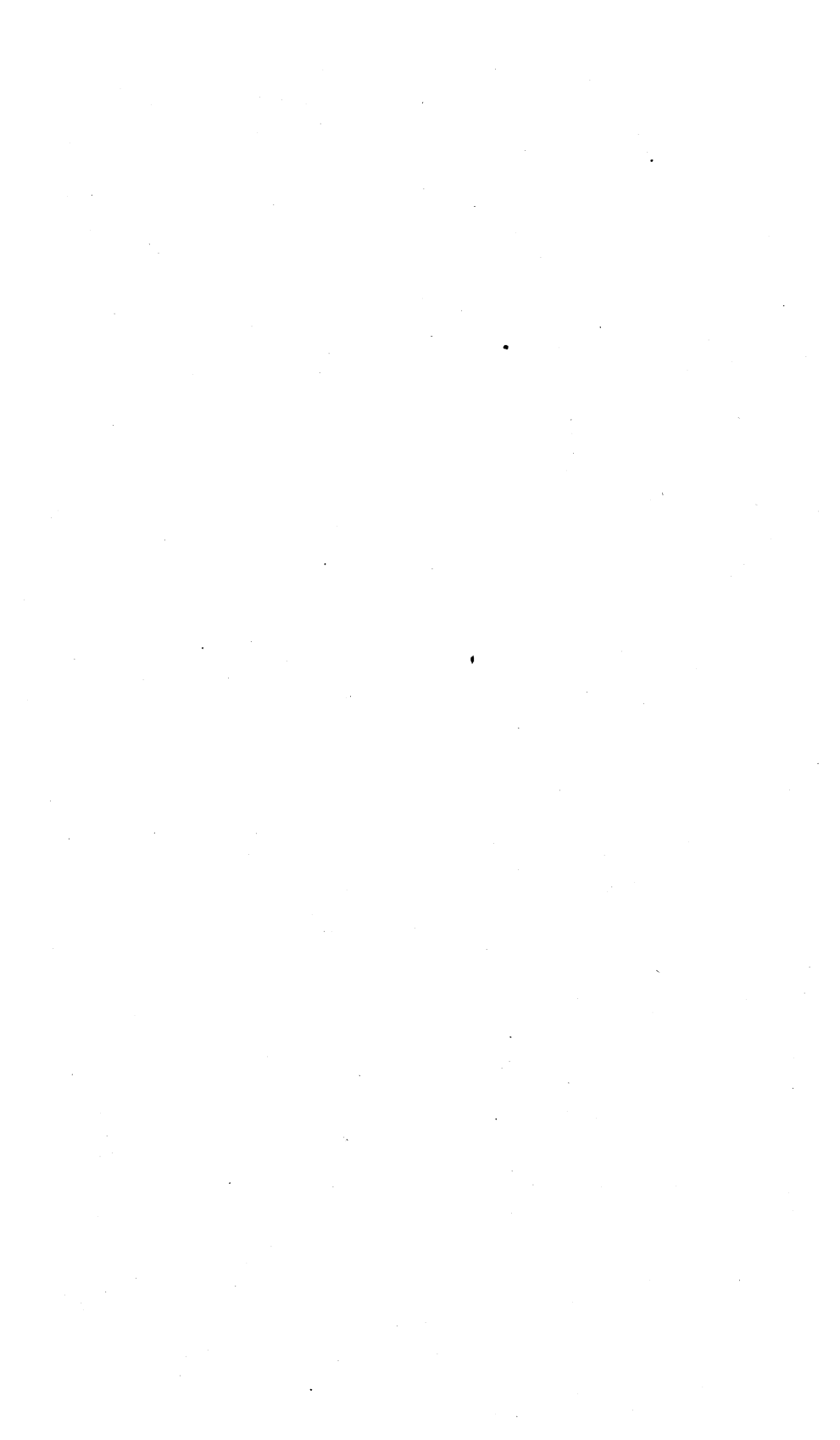
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*In Charge of Testing Gardens, Office of Botanical Investigations
and Experiments.*



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LETTER OF TRANSMITTAL.

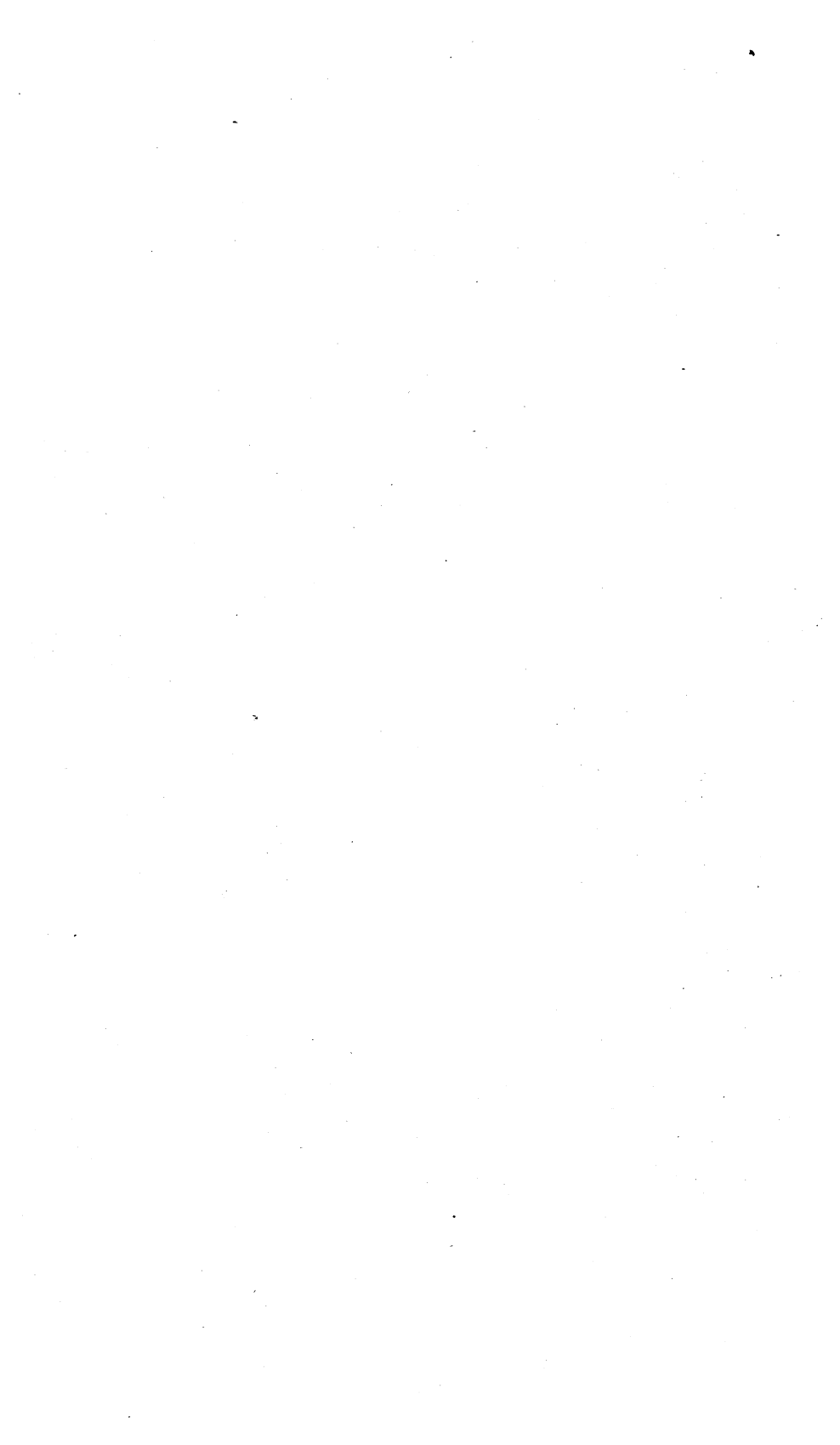
U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF PLANT INDUSTRY,
OFFICE OF THE CHIEF,
Washington, D. C., February 6, 1902.

SIR: I have the honor to transmit herewith a paper on Celery Culture, and respectfully recommend that it be published as a Farmers' Bulletin. The paper was prepared by Mr. W. R. Beattie, in charge of testing gardens, Botanical Investigations and Experiments, and was submitted by the Botanist.

Respectfully,

B. T. GALLOWAY,
Chief of Bureau.

Hon. JAMES WILSON,
Secretary of Agriculture.



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CELERY CULTURE.

INTRODUCTION.

Increase in use of celery.—Little more than twenty-five years ago this crop, which now forms such an important factor in market-gardening interests, was cultivated by a few growers only, confined to a still more limited number of localities. Celery was to be found on the menu of a few of the leading hotels, and had found its way into many homes, but was often used only as a flavoring for some other dish. Its use has rapidly increased until at present the output is reckoned by hundreds of carloads. Celery is no longer classed among the commodities available for the use of a select few, but as a wholesome and palatable addition to the fare of the general population.

Botany of the plant.—The many cultivated varieties now in use have been derived from the wild celery, which is a native of the marshes of southern England and many parts of the Eastern Continent. This wild celery was for a long time considered poisonous, which was a very natural supposition, as it belongs to the same family of plants as do Cicuta and poison hemlock.

The Latin or scientific name of celery is *Apium graveolens*, and it belongs to the Apiaceæ, a family of plants formerly known as Umbelliferae. It is a biennial, producing its seed the second season, after which the plants die. Occasionally a plant will throw up a flower stalk and produce seed the first season, but this occurs only in cases where the growth of the plant has received a severe check, or the vitality of the seed was low. As ordinarily grown, the celery plant has no true stem, the first season being spent in the production of plant food, which is stored up in the root, and in the enlarged succulent basal leaves. It is the stalks or stems of these leaves which, when blanched, form the edible part. The seeds of celery, also, are very largely used for flavoring salads, soups, and a variety of dishes. The fleshy root of the celery plant is used in soups; it is also prepared as a separate dish, being cut in small pieces, boiled until tender, then served like asparagus, with a dressing of cream. There is a special turnip-rooted form of celery, known as celeriac, which produces a large root and very small leaf stems. This is more suitable for cooking than the common celery, although the edible portion of the latter

makes a very palatable dish when stewed in butter, with salt and pepper to taste. The principal value of celery, however, lies in its excellence of flavor and other desirable qualities when well blanched and served in the raw state.

While celery may not possess much actual food value, it is very attractive and its use is an important one from the fact that it furnishes an essential vegetable ingredient of a well-regulated diet. Coming as it does at a time of the year when large quantities of meat are consumed and green foods are not plentiful, the use of celery makes other foods more palatable and greatly aids digestion. The taste of celery is at first unpleasant to some persons, but they usually acquire a liking for it after eating it a few times.

Growth of the industry.—Celery growing on a commercial scale in this country received special attention and made its greatest progress after the opening and draining of the "muck-bed" areas of the Great Lake region. In Michigan, Ohio, and New York several thousand acres of celery are grown annually. One firm, besides cultivating about 80 acres in Michigan, has a tract of celery land in Florida and one in California. This firm is thus in the celery business practically the entire year, and its shipping period extends from the 1st of August until the following March or April.

Celery growing in Florida and California constitutes a different business proposition from what it is in the Northern and Eastern States. Maturing as it does in those warmer climates between the middle of December and April, the crop does not come into competition with that of the northern and eastern territory to any extent, but serves to lengthen the season of celery consumption.

It has been found unprofitable in most localities to store celery for any great length of time, it being more satisfactory to load it into the car direct from the field, and place it upon the market as rapidly as it becomes blanched. The Northern and Eastern States can supply all that is wanted in a commercial way from early in June until about the 1st of January; the Florida and California product comes upon the market about the last week in December and continues until March or April, after which time there is very little demand for celery until the Northern crop again comes upon the market.

Object of this bulletin.—It is the purpose in this bulletin to deal principally with that phase of the celery industry consisting of its production for home use, and to give directions for growing and storing in small quantities. It has also been found advisable to include such instructions and estimates as would be required by any person wishing to begin growing celery to supply the market.

No argument is necessary in regard to the desirability of having plenty of good, crisp celery for table use. The experimental stage in celery growing, especially as to the determination of its value, has

long passed. There remains but one problem, that of securing the supply, and, under most circumstances, the farmer or amateur horticulturist can devote a few square feet of rich land to the growing of it. If the quantity desired is small, and there is a market near at hand where celery may be had at all times during its season, it may be more economical to purchase the supply, but the pleasure of obtaining it from one's own garden will more than repay the effort required. Celery purchased in the market can not possibly be as crisp and tender as when dug at home and served within two or three hours without having been handled many times and exposed for sale.

THE SOIL AND ITS PREPARATION.

Suitable soils.—In the production of celery for domestic use, a rich, mellow, sandy loam will give the best results. The soil of the seed bed should contain plenty of leaf mold and should be passed through a sieve having not less than six meshes to the inch. The soil of the transplanting bed need not be sifted so fine, and some well-rotted barnyard manure should replace a part of the leaf mold; in other respects it should be the same as that of the seed bed.

Any fertile, well-drained soil will grow celery, but a loose, sandy loam is preferable. In the regions where peat bogs or muck soils abound the crop may be more easily produced on these than on any other soil, but the keeping qualities are not so good, and the flavor is never equal to that of celery grown on sandy loam, or even on clay soils. If nothing but clay soil is available, it may be made to produce good celery by the liberal application of well-rotted barnyard manures. On clay soils there is liable to be injury caused by the soil becoming washed into the hearts of the plants while they are yet small.

Rotation of crops.—Where celery is grown for market, even on a small scale, attention should be given to the rotation of crops. Since nitrogen forms the principal plant food for celery, the soil will soon become deficient in this element unless means be provided for restoring the proper amount. This may be accomplished either by the application of large quantities of fertilizers or manures that contain a high percentage of nitrates, or better by planting the land for one or more years to some leguminous crop, such as clover, cowpeas, beans, peas, or soy beans. Celery growing not only exhausts the chemical fertility of the soil, but also injures the physical condition, after a time rendering it unfit for cultivation. Any of the above-mentioned crops will tend to restore the soil to its proper condition.

Fertilizing the soil.—On recently reclaimed peat or muck soil, which usually contains a large percentage of nitrogen, it would be poor economy to apply nitrate of soda, worth, perhaps, 20 cents per pound, while it is potash, worth about 4 cents per pound, that is needed to

form a balanced ration with the nitrogen already in the soil. On the other hand, it would not be economical to apply large quantities of potash to a soil which is already lacking in nitrates and lime. As a general rule a moderate application of phosphates should accompany the nitrates and potash. The fact that at first a peat or muck soil contains an excess of nitrates and is deficient in potash does not imply that it will always remain so; and as the nitrogen supply decreases by cropping for four or five years and the potash increases through excessive application, the amount of nitrates contained in the chemical fertilizer used should be increased and that of the potash decreased in order to maintain the proper plant-food conditions in the soil. In clay or sandy soils the reverse is usually true, and as a rule larger proportions of nitrates should be employed. When using barnyard manure on such exhausted peat or muck land, there should be added both potash and nitrate of soda to the manure, or bone meal may be used in conjunction with it.

Some growers maintain that the application of large quantities of barnyard manure to celery ground will produce, or at least stimulate conditions suitable to the development of, diseases. This may be true as regards muck land, especially when the manure is applied to the soil shortly before the celery is set, but there is little danger from this source on either sandy or clay upland. It is well, however, to apply the fertilizer either very early in the spring or late the preceding autumn in order that it may become thoroughly incorporated with the soil before time for planting the celery.

Preparation of ground.—In many locations a crop of early cabbage, beans, peas, or lettuce can be grown upon the celery ground during the first part of the season; but unless there is a good market for the first crop it will not pay so to overtax the soil, and the diminution of the size of the celery may more than offset the gain from the first crop. Before planting this first crop the main plowing should be done; then the soil should be pulverized to a depth of 4 or 5 inches with the disk harrow and roller immediately before planting the celery. Under most conditions, it is more desirable to plow the celery land in the fall and allow the soil to lie exposed to the action of frost during the winter.

METHODS OF SOWING SEED.

Selection of seed.—The first and most important consideration when preparing to grow a crop of celery is the securing of good seed, not merely seed of which a large percentage will germinate, but that having strength and vigor sufficient to give the seedling a good start. As the seeds of celery are very small, it may only be necessary that a small percentage of the number usually sown should actually grow in order to secure an abundance of plants, but, as low germination and

the necessary vigor are seldom both to be found in the same packet of seed, that having a high percentage of germination is preferable. Celery seed, like that of parsley, carrot, and parsnip, parts with its vitality very quickly, and is practically worthless when kept over until the second year. In addition to the above qualities, the seed should be from selected stock and true to name. Place your order for seed early, before the supply of the best grade is exhausted, and there will be little difficulty in getting good seed. Purchase from a seedsman who expects to sell to you again the following year, pay the highest price if necessary, and demand the best.

Sowing for early or small crop.—For sowing seed during the early part of the season, the plan best suited to the requirements of the farmer or amateur grower of celery is to secure a wooden flat or tray (fig. 1), about 16 by 24 inches in size and 3 inches deep, with plenty of small holes in the bottom for drainage. After filling with sifted soil as mentioned above for seed bed, stroke off even with the top, and

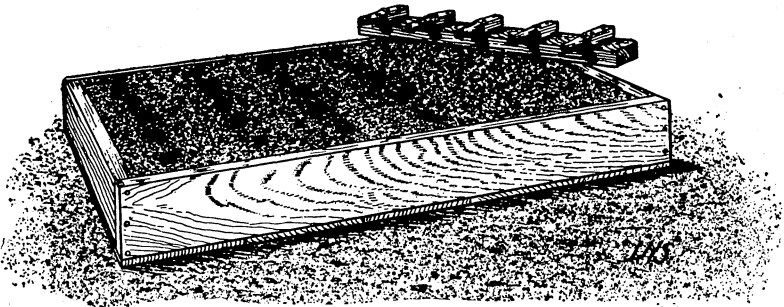


FIG. 1.—Flat or tray for early sowing or for transplanting, with marker for making holes in soil into which the seedlings are set.

either shake down the soil or press it down by means of a board before the seeds are sown. Either sow in drills 2 inches apart, or scatter broadcast and cover by sifting on a mere sprinkling of leaf mold or sand by means of a fine sieve. This tray can be placed in the window of a moderately warm room in the dwelling, and the soil should be watered by sprinkling very lightly as often as necessary to keep the surface from showing dryness, but the soil should not become waterlogged. The seedlings will appear in from two to three weeks, after which the tray should be turned around once each day to prevent the plants "drawing" toward the light. If early plants are needed on a somewhat larger scale, sow the seeds in like manner in a hotbed or on the greenhouse bench.

Sowing for general or larger crop.—For later plants, from which the main crop is to be planted, sow the seeds in a cold frame or in the open ground. Several methods are in vogue for starting celery plants in the open ground, and the one selected should depend entirely upon

the scale on which the crop is to be grown. One plan is to sow the seed broadcast in a bed about 3 feet wide, and of any desired length, from which the plants may be transplanted to another similar bed, and again to the open field, or they may be thinned and allowed to remain in the seed bed until the time for setting in the open ground where they are to mature. Another method is to sow in drills, 10 or 12 inches apart, and cover very lightly by sifting soil, or by passing a roller along the drill after the seed has been dropped. When the seedlings are well started they may be thinned out and allowed to remain until planted in the field. Plants grown in this manner require very little attention, as they can be worked by means of a wheel hoe or other hand cultivator.

The method now in use by most large growers is to prepare a tract of land by pulverizing with horse tools and then raking by hand, after which the seed is sown broadcast by means of a wheelbarrow grass-seed drill. The soil is sometimes pressed down with a plank after the seeds are scattered, but some growers maintain that there is a decided advantage in leaving the soil slightly uneven, as the seeds fall into the shaded places and are protected from the direct rays of the sun. The seed will become sufficiently covered by rains or watering. Should more than 20 per cent of the seed usually sown germinate, it will be necessary to thin out to prevent overcrowding, with its attendant injury. To prevent the surface of the soil becoming too dry, it may be necessary to partially shade the young plants during the warm days of early summer, but the shading should never be so dense as to cause them to become "drawn."

For early celery, throughout the Northern States, a planting should be made in the house during January or February, but for the main crop the seed may be sown in a frame or hotbed, or in the open ground six weeks or two months later. In the latitude of Washington, D. C., good celery can be grown from seed sown as late as the middle of May, and to the southward still later.

TRANSPLANTING.

In case the grower adopts the plan of transplanting twice, the seedlings will be ready for the first handling in four to six weeks from the time the seed is sown. The seedlings may be transplanted to trays (fig. 1) or to beds in the open ground. This transplanting answers two purposes: First, the seedling plant of celery has a straight root, or taproot, which is broken in transplanting, causing a large mass of fibrous roots to be formed. In the case of a plant allowed to remain in the seed bed until planting-out time, this taproot has gone far down into the soil and the plant has formed very few side roots; consequently it suffers a great shock in the process of planting in the field, and a large number of plants will need to be replaced. Second, when transplant-

ing twice is practiced there is no necessity for thinning, and a more uniform lot of plants is obtained. Two handlings can not be recommended on a large scale, as the cost of labor is too great; it is better to have a surplus of plants and renew those that fail.

WATERING.

Moisture requirements.—When the seed bed is made up, the soil of which it is composed should contain sufficient moisture so that very little watering will be necessary immediately after sowing the seeds. Before the seedlings appear the surface of the seed bed should never be allowed to become very dry; but, on the other hand, the soil should not become so wet as to be heavy. After the plants are up, care should be taken not to water too heavily, as the seedlings are liable to “damp off;” but the ground should not become so dry as to check their growth.

Methods of securing and applying water.—No definite rules can be given for the application of water to a growing crop of celery, as the requirements vary with the character of the soil, atmospheric conditions, and temperature. Its being a marsh plant in its native habitat, however, indicates that it will suffer less from too much water than from drought. The cost of application should determine largely the extent to which water should be used, and as a rule it is not profitable to give more than three waterings in addition to the one given at the time the plants are set in the field. Where celery is to be grown on a large scale it will be desirable, where a natural water supply can not be brought into service, to provide pumping machinery, and to give the soil two or three good soakings during the season, especially in the absence of heavy rains. Celery requires the most water while making its greatest growth, which occurs late in the summer. As the crop approaches maturity the water should be applied sparingly, and it should be withheld altogether for some time before blanching.

Among the methods of applying the water, the most simple and usually the most desirable, especially where the surface of the soil is even, is to run the water along the rows by means of small furrows, 8 or 10 inches distant on either side of the row. This method is well adapted to use on a gentle slope with the rows running up and down the incline.

The deluge-sprinkler system.—Some growers in California and New York have adopted what is known as the deluge-sprinkler system. By this method lines of pipe are laid on the surface 16 or 18 feet apart, having upright pipes about 3 feet high every 18 or 20 feet along their length. At the top of each upright is placed a distributor, known as a deluge sprinkler, which will spread the water very evenly over the entire intervening surface. The system has its disadvantages, as it is costly to install; the lines of pipes are in the way of cultivation, and

must be removed at the end of each season and replaced at the beginning of the following year; and the expense of pumping is considerable, since the water must be driven through the pipes under a pressure of at least 80 pounds to the square inch in order to secure the best results. An 8 or 10 horsepower pump, with a 4-inch suction and a 3-inch discharge, is required to operate 16 of these sprinklers at one time; but these will thoroughly soak an area of about 20 square rods every fifteen minutes, or 1 acre every two hours. With the cost of fuel for a ten-hour day at \$5, and the wages of two men \$3, the cost for the running expense of watering 5 acres would be at the rate of \$1.60 per acre for each watering.

During the season of 1901 experiments were tried in the Department testing gardens with a view to ascertaining some means of applying this sprinkler system on a large scale at a moderate cost for installation. Fair success was attained by means of a traveling sprinkler pipe, mounted on pulleys, which were made to travel upon tightly drawn wires supported by posts 8 or 10 feet above the ground; the lines of wire were about 50 feet apart, and the grooved pulleys were given 2 or 3 inches side play on their bearings to accommodate any difference of distance between the wires. It was also found to be necessary to support and brace the pipe by means of lines of wire running parallel with it, forming a complete bridge work to hold the pipe from sagging, and also to insure its traveling along evenly. A pipe of this kind about 180 feet long and supplied with 12 sprinklers will water a strip of ground about 200 feet in width. The pipe is connected to hydrants attached to the main lines by means of a 50-foot piece of hose, which can be changed from one hydrant to another as it becomes necessary to accommodate the movement of the sprinkler. The lines of wire are placed well above the ground that they may be out of the way of plowing and cultivating and remain in position from one year to another.

Subirrigation.—Subirrigation consists of placing perforated pipes or lines of ordinary farm drain tiles at intervals, preferably corresponding in distance with the width of the rows, at a depth of 8 or 10 inches below the surface of the soil, with surface openings every 100 feet or so to admit the water, which is run in and allowed to escape at the holes or joints of the tiles. The system works fairly well where there is an impervious subsoil, and it does not require so much water as for surface irrigation; but where the subsoil is porous the water escapes downward and is lost, and in muck or sandy soils the tiles soon become filled with silt or the roots of plants and are worthless. The beneficial results ascribed to subirrigation, as applied in the growing of greenhouse crops, are due mainly to the warming of the soil by the circulation of air through the tiles. As celery does best under cooler conditions,

this method is not advantageous when applied to it, except under very limited conditions, where the subsoil is suitable and a supply of cold water can be carried to the system by gravitation.

GROWING IN THE OPEN GROUND.

Planting in rows or beds.—For domestic use, where plenty of land is available, it will be found most economical to plant in single rows 4, 5, or 6 feet apart, with the plants 6 or 7 inches apart in the row. If the space is limited solid beds about 5 feet wide will be found suitable, with the plants set 7 inches apart each way. By planting in rows the crop may be worked with a horse cultivator or a wheel hoe and the banking more easily done, and thus the cost of production is cut down. With the solid-bed system the work must all be done by hand.

Directions for planting.—If possible the planting should be done when the soil is rather moist and the atmospheric conditions suitable to the subsistence of the plants until the root can again furnish sufficient moisture to supply them. The plant bed should be thoroughly watered a few hours before the plants are removed, and a knife or trowel should be run between the plants so that they may be lifted with a clump of earth and with most of their roots attached. Mark off the rows with a wheel hoe, a hand hoe and line, or a horse marker. Place the plants in a shallow tray and set in the ground from the tray, or have them distributed by boys ahead of the planters. When the plants are set and the soil well pressed down around them, they should be just a little below the general level of the soil, but not low enough to become covered by heavy rains. The same method should be followed when setting in beds, except as to marking, which should be in both directions, the plants to be set at the intersections. If no mulch is to be applied, the plants should be watered before the soil is entirely filled in around them; then, after watering, cover the wet earth with dry to prevent a crust being formed.

MULCHING.

In muck soils it will not be found necessary to mulch the ground around the plants after setting, but some kind of a covering is desirable on sandy land, and absolutely indispensable on clay soils. As soon as the plants are in position, and before any water is applied, cover the ground for a distance of 8 or 10 inches on either side with any finely divided material that will shade the top of the soil and prevent a crust being formed after watering; half-rotted manure is preferable for this, as it aids the growth by its fertilizing qualities. Good celery can be grown on clay upland with but one watering—at the time of planting—provided that plenty of mulch is applied as soon as the plants are set. The roots of celery, after it is once transplanted, run close to the surface, and the mulch will protect them from the heat of the sun. Among

things that may be used for a mulch may be mentioned pine needles, leaves of any kind, straw, cornstalks run through the cutter, clippings from the lawn, etc., none of which, however, are as good as barnyard manure.

Have the material to be used as a mulch near at hand, and as the plants are set cover the soil around them to a depth of 2 inches, bringing the material up close to the plant, but being careful to allow none to get into the heart. Apply the mulch before watering if possible.

CULTIVATION.

Directions for cultivation.—Where celery is planted in single rows and mulched it will only be necessary to maintain shallow cultivation between the rows, not allowing the cultivator teeth to come nearer the plants than the edge of the mulch. Where no mulch is used the cultivation may be carried a little closer to the plants, but should be very shallow, and at no time should deep cultivation be practiced, as the roots are to be found very near to the surface of the soil. If a mulch is used no hand cultivation will be required, either along the side or between the plants in the row, except to pull any weeds that may spring up. Where no mulch is used it will be necessary lightly to stir the surface with a hoe or iron rake, to prevent a crust being formed after each rain or watering. Keep the surface of the soil smooth and in no case allow lumps of earth to remain near the plants.

Depth of cultivation.—When a crop of celery is in a good growing condition the roots will be near the surface. During a dry season the roots will go deeply into the soil in order to secure enough moisture; this can be prevented by keeping the surface of the soil well stirred to a depth of not more than 2 inches, forming a sort of dust mulch, beneath which the moisture will be drawn upward by capillary attraction and prevented from passing into the air by the presence of the loose soil on top. Under these conditions the roots will work near the moisture line, and in addition to securing the required water they will also receive more air and will be at the point in the soil where the natural preparation of plant food is taking place most rapidly; consequently a large growth and a better quality will be produced. The effects of a drought may in most cases be met by frequent shallow cultivations, supplemented by the use of water, if available.

When the water is sprinkled over the entire surface it should be done late in the day, so that the soil may, during the night, absorb the moisture and prevent a crust being formed, as would be the case were the water applied under the direct heat of the sun.

FUNGOUS DISEASES AND THEIR CONTROL.

“Damping off.”—There are several diseases which attack celery, but only two or three need be mentioned in this paper. “Damping off,”

caused by a fungus which follows careless watering while the plants are very small, attacks the seedlings at the point where they emerge from the soil, causing them to decay at this point. This disease may be avoided by starting the plants in trays, such as have already been described, and subwatering them by setting the trays in a shallow trough containing about 1 inch of water, allowing the water to enter through the drainage holes in the bottom of the tray. In this way the surface of the soil will remain slightly dry, while the roots of the plants receive plenty of moisture. Where it is impracticable to apply subwatering methods it will be necessary to water very carefully and to avoid extremes of drought and moisture. It is best to prevent too rapid evaporation by partial shading with lath screens.

Blight or leaf spot.—The disease known as “blight” or “leaf spot,” caused by a fungus, is far more prevalent and destructive. It makes its appearance at any time, usually after the plants have been set in the open field, and many acres of celery are annually destroyed as a result of its development. The first visible indication of the disease is in the form of grayish spots upon the leaves, changing to a brown or burned appearance in a day or two. If conditions continue suitable to the development of the disease it will spread to all parts of the plant, the stems will droop, and the entire plant assume the appearance of having been scalded. The heart of the plant will continue to throw up new leaves, but, when once badly infected, it never sufficiently overcomes the disease to produce a marketable product. When the disease makes its appearance it is already too late to attempt to eradicate it, as much of the injury is done before the existence of blight is visible.

Conditions favoring blight.—There are two conditions which contribute to the development of celery blight, either of which may be present without the plants becoming infected, but where both occur the disease is sure to follow. The first of these conditions lies in the seed itself, and is beyond the control of the farmer or market grower. Owing to close selection and constant inbreeding without giving due consideration to resistance to disease, the self-blanching varieties seem to be more subject to the attacks of disease. Selection along this particular line has a tendency to weaken the constitution of the plant. As the self-blanching character is abnormal—a sort of albinism, brought about largely by selection—the plant is largely deprived of the power to resist disease. The second and more important condition lies entirely within the control of the grower, and comes as a result of any check in the active growth of the plant. This may occur at any time from the day on which the seed is placed in the earth until the grown product has reached the customer. Instances are on record in which cases of blight have developed while the celery was in the car, or even after arriving at its destination. This, of course,

is due to the development of the spores of the fungus present on the leaves.

How to combat blight.—Under favorable conditions spraying has in many instances proved beneficial in checking blight; Bordeaux mixture^a applied at intervals of ten days to two weeks will serve a good purpose.

Severe loss from blight is noted only where large quantities of celery are grown and handled together, and the farmer or amateur horticulturist will not as a rule be troubled if the plants are kept in a vigorous condition throughout the entire period of their growth. This may be greatly facilitated by partially shading the plants up to the time when they are planted in the open field and by planting the crop on land that is rich enough to keep up a rapid and uninterrupted growth. The most satisfactory shade for the plant bed consists of a screen made of plastering lath, with openings between the lath. The size of ordinary hotbed sash is the most convenient for these screens, as they can then be placed on top of or in place of the sash.

Black rot.—While in the storehouse the celery is sometimes attacked by a "black rot," which will, if not checked, soon destroy the entire crop. This disease is induced by too heavy watering, and by wetting the tops of the celery after it has been stored; also by keeping the storehouse too warm without sufficient ventilation. The disease is almost sure to occur where celery is stored in cellars or under the benches of greenhouses, but will rarely be found in storehouses or trenches such as are described further on in this paper, provided proper ventilation is maintained.

There remains no doubt that some varieties have a greater power of resisting the attacks of disease than others, and the larger growers especially should test some of the newer sorts, and secure if possible one that will combine resistance to disease with suitable market value.

INSECT ENEMIES AND THEIR CONTROL.^b

Owing to the fact that celery has been grown only during the past few years, it has as yet very few insect enemies that do any considerable damage, and these can be controlled by very simple means.

Grasshoppers.—Some species of grasshoppers often prove destructive pests during the early part of the season, especially where the celery is planted near meadows or other habitat of these insects. Where no fowls are allowed to run, it is practicable to poison the grasshoppers by means of wheat bran to which there has been added molasses and water and enough paris green to give the mixture a slightly green color.

The celery leaf tyer.—This insect (fig. 2) often becomes very trouble-

^a For approved formula, see Farmers' Bulletin No. 38.

^b Read and approved by the Division of Entomology.—F. H. Chittenden, acting chief.

some, not only because it destroys the leaves by eating them, but by spinning a web and tying the leaves together. Injury as a result of the work of this insect has been reported only from a few localities, but the insect itself is thoroughly distributed and may at any time become a troublesome pest in any celery field. As a means of controlling this insect, hand picking will be effectual on a small scale; but should they become very numerous, it may be necessary to place open lamps in the celery field during the night to destroy the moths as they fly about to lay their eggs. Spraying with paris green might be practiced in cases where the larvæ have become very numerous, but should be so applied as to reach the underside of the leaves, where the insects feed. It would not be advisable to spray with a poisonous solution late in the season after the edible portion of the celery has begun to form.

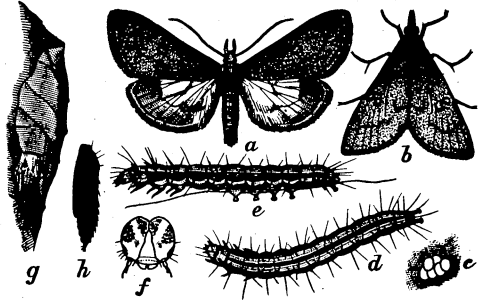


FIG. 2.—The celery leaf tyer (*Phlyctenia rubigalis*).

The celery caterpillar.—Besides being the most conspicuous of all celery insects, this is perhaps the most harmful. It feeds upon the leaves, and, owing to its size and yellow color with black transverse bands, it is readily seen against the background of green foliage. This caterpillar, however, does not appear in great numbers, and hand picking is sufficient to control it.

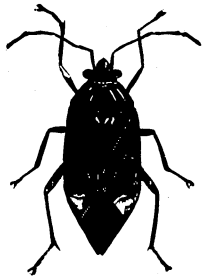


FIG. 3.—The tarnished plant bug (*Lygus pratensis*).

The zebra caterpillar is much smaller, but fully as striking in appearance as the above. It appears in greater numbers, but as a rule is easily controlled by hand picking.

The tarnished plant bug.—This insect (fig. 3), while not as yet considered a dangerous celery insect, has been known to injure the crop in several instances. While young this bug is very small, being only about one-twentieth of an inch in length, of a yellowish or yellowish-green color, which changes to a faded yellow or dull brown when it is fully grown. It works especially where weeds abound and on crops that are somewhat neglected. As a preventive keep the celery well cultivated and free from weeds, and do not allow any trash to lie over the ground beneath which the insects can pass the winter. Kerosene emulsion is moderately effective when thoroughly applied. The insects are sluggish during the early morning and many of them can be caught by means of a large butterfly net; but in all cases it will be as neces-

sary to destroy the insects found upon surrounding crops and weeds as on the celery.

General suggestions.—For the present it is only necessary that the farmer or gardener should occasionally go over his celery and gather any insects that may be found working upon the plants, but with the development of the industry it is only a matter of a short time when this crop will be attacked by insects of a large number of species. Where any considerable damage is noted as the result of the work of an insect specimens should be sent to the Department of Agriculture or to the local experiment station, for the determination of the species and to learn how to combat it.

METHODS OF BLANCHING CELERY.

In its original wild state the stems of celery are tough, full of woody strands, of a rank flavor, and green in color, being similar to the outside stems or trimmings of our present varieties. The object of blanching is to secure leaf-stalks free from woody strands, crisp and tender, and without the rank flavor found in those that are green. Of the cultivated plant we have two classes of varieties, the large-growing, or giant, and the dwarf. These are again divided into those which must be blanched by excluding all the light, and those which are in a measure self-blanching. Of the former the Giant Pascal is a type, and of the latter Golden Self-Blanching is a good illustration.

Blanching is accomplished by the same general method as is employed for destroying the coloring matter in any plant tissue, that is, by excluding the light and allowing the growth to proceed in the dark. The particular method to be adopted must be determined largely by the time when the crop is to be used. If for early use or marketing, the blanching must be completed where the plants are grown; but if the celery be for winter use the blanching may take place after the crop has been removed from the field and placed in storage. In fact, it is best to blanch as little as possible before storing when the product is to be kept until late, as the keeping qualities are better while it is unblanched. When planting for early use it is necessary to choose one of the self-blanching kinds, such as may be conveniently blanched by the use of boards or other similar means.

Use of boards in blanching.—For early blanching on a small scale, such as would be employed on the farm or in the garden of the amateur horticulturist, there are several methods. One of the most common is by means of boards (fig. 4) placed on edge along each side of the row of celery. These boards should be 1 inch thick by 12 to 14 inches wide and 12 to 16 feet long. The cheaper grades of pine will do, but new boards are liable to impart an unpleasant flavor to the celery. The kind used by growers in Michigan, Ohio, and New York, at the rate now prevailing costs \$21 to \$23 per thousand feet. In placing the

boards in position, slip one edge well under the outside leaves of the plants, then bring this edge upward until in a vertical position along the row, having another board at the same time placed on the other side so that when in position there will be as little space between the boards as the thickness of the plants will permit. These boards may, when

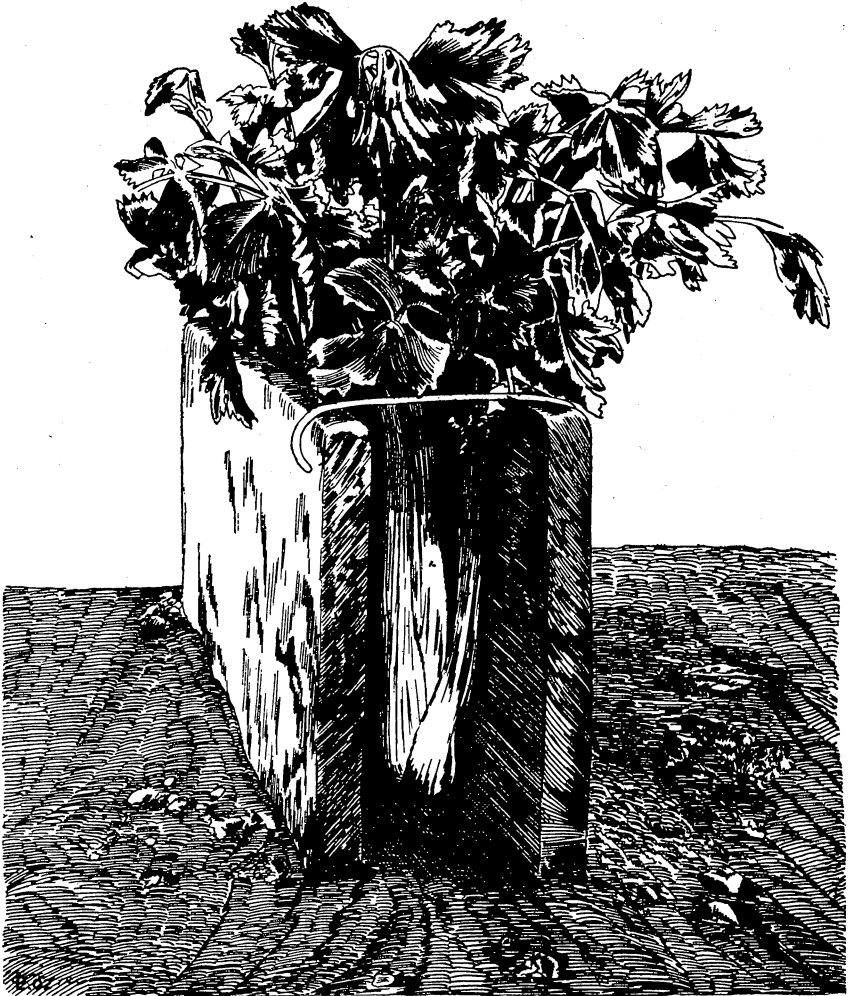


FIG. 4.—Blanching celery by means of boards, showing wire hook or spanner in position for holding the boards in place.

used on a small scale only, be fastened in position by means of stakes driven in the ground, by nailing short pieces of lath across the top every 6 or 8 feet, or by means of notched sticks placed over the tops of the boards. Any one of these methods would be too inconvenient when applied on a large scale, and a far better one is that practiced by the large growers, namely, that of using hooks or spanners about 6 inches

long made of heavy galvanized wire, bent somewhat in the shape of the thumb and first finger distended. These spanners are slipped over the upper edges of the boards every few feet to hold them together, and the plants are rigid enough to keep the boards in an upright position.

Two or three weeks' time will be required to complete the blanching of the early varieties, but the boards must be kept in position until the crop is removed from the ground, after which they may be used

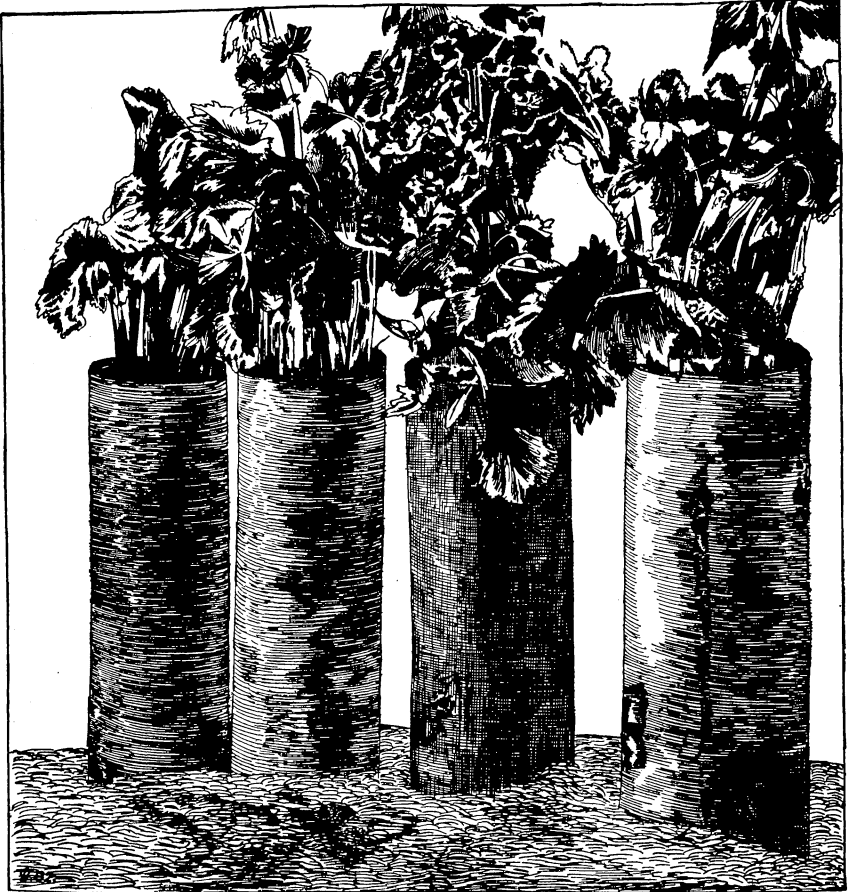


FIG. 5.—Blanching celery by means of drain tiles.

again two or three times during the season. If the celery is allowed to remain in the boards too long after it has reached a marketable stage it loses in weight and flavor, and is liable to be injured or even destroyed by the attacks of blight. This is especially true during the earlier part of the season when the weather is warm. At the end of the season the boards should be piled flat, with strips inserted at every fourth or fifth course, and the whole pile roofed over to shed off rain; treated in this manner they will last from ten to twelve years.

Another method of blanching is by banking with straw or leaves, but this is objectionable, as the material used generally imparts an undesirable flavor to the stems. The use of any material that is in process of decomposition will cause the disease known as rust to attack the stems.

Common brown grocery paper is sometimes employed for blanching on a small scale by wrapping it around the plants three or four times, then fastening by means of string or rubber bands. This method is scarcely to be recommended, as it is too tedious and does not produce a good grade of celery.

Use of drain tiles in blanching.—Perhaps the most satisfactory way of blanching early celery on a small scale is by means of ordinary farm drain tiles (fig. 5) of about 4 inches inside diameter, placed over the plants after they have become almost fully grown. To facilitate the work of placing the tiles over the plants, some of the outside leaves should be pulled away and the main part of the plant loosely tied together by means of a soft string, or, better, with what is known as paper twine, being a string made by twisting a strip of soft paper. This string will lose its strength as soon as it becomes wet, and will offer no resistance to the further growth of the plant. The presence of the tiles will cause the leaves all to draw up above the top of the tiles, thereby forming a screen over the top to shut out the light from the interior. If the common unglazed tiles are used the evaporation from their surface has a tendency to keep the plant cool during the heat of the day, and a very crisp and tender product is the result. This system is desirable also on account of its cleanliness, as celery blanched in this way will need very little washing before marketing.

Blanching by banking up with soil.—The most common method of all for blanching celery on a small scale is that of banking with soil, and it is by this method that the finest flavor can be obtained. Where the plants are set in single rows the soil can often be partially thrown up by means of a plow, or, better, by a celery hiller. There are several forms of this machine, but they all work on one principle, that of a diagonally set surface to throw up the soil. Before the plow or banking machine is used a small amount of dirt must be placed around the plants by hand to hold them up in position while the earth is being thrown around them. This may also be accomplished by tying up the plants with paper twine as mentioned above for use in connection with tiles. Instead of tying each plant by knotting around it a short piece of string, fasten the end of the string around the first plant in a row, then pass to the second plant without cutting or breaking the string. While the outside leaves of the second plant are brought up together by the left hand, carry the string once around by allowing it to run between the thumb and finger of the right hand, and so on from plant to plant until a whole row is held up without breaking the string and by tying it at the ends only. This work is greatly facilitated by

strapping to the right forearm a tin can, in which the ball of cord is placed, the inside end of the string being delivered through a hole in the bottom of the can. Another very good method of holding the celery up while the earth is being placed around it is by temporarily setting up boards, which are removed as soon as the soil is in position.

Where celery planted in solid beds is banked with earth, the entire amount of soil required must be thrown up by hand. Under these conditions banking by soil is not profitable except on a very limited scale. Owing to the cost, blanching by banking with earth is not to be recommended, except when the crop is to be stored where grown for late fall marketing, and even then it is better, especially on muck or sandy soil, to trench that part of the crop which is to be held for a short time.

Blanching for winter use.—As regards blanching for winter use, very little need be added to that which has been said under blanching for early use. As a rule celery that is not blanched at all will keep longer. Since the necessary blanching will take place while the crop is in storage, it need only be mentioned that it is essential to place merely enough earth around the base of the plants while in the open ground to insure an upright and compact growth.

STORING FOR WINTER USE.

Banking and covering with straw, etc.—The plan usually adopted where but a small quantity of celery is to be stored for winter use is to bank up with earth and cover where grown. Place enough earth around the base of the plants to hold them in good form, and then allow them to remain without any further banking as long as there is not danger of a hard frost; when absolutely necessary to do so, the earth should be thrown up to the very tops of the plants, almost covering them; then, as the weather becomes colder, cover the ridge with coarse stable manure, straw, or corn fodder, held in place by means of stakes or old boards. Celery will withstand considerable frost, but its keeping qualities, as well as flavor, will be impaired if it is allowed to freeze. The celery can be removed from these ridges as needed, but will be found to be very inaccessible during the time when the ground is frozen hard.

Trenching.—Large growers handle the last of the crop by the method known as trenching. The celery is partially banked with earth and allowed to remain where grown so long as there is no danger from heavy frosts. The work of trenching will be greatly facilitated by setting up two parallel lines of 12-inch boards, about 18 or 20 inches apart, between which the celery is packed with the roots embedded in the soil. When the space between the boards is filled, the soil is thrown up on the outside to the tops of the boards. The boards are then lifted out and used again, the soil being allowed to come in direct contact with

the celery. These trenches are usually made only 50 or 60 feet in length and are small enough to permit the removal of a whole trench at one time. As colder weather approaches, the celery is either removed and marketed or a covering of boards, straw, or corn fodder is placed over the tops for protection.

Another method of trenching is to excavate a pit (fig. 6) to a depth of about 24 inches, 3 feet wide, and of any desired length. Thoroughly loosen the soil in the bottom or shovel in loose top soil to form a bed, in which the roots of the celery may be set. Pack this trench with fully grown plants, placing the roots close together with considerable soil adhering to them. As the celery is placed in the trench



FIG. 6.—Cross section of pit for storage of celery on a small scale.

it should be well watered and then allowed to remain open long enough for the tops to become dried off. Unless the soil is very dry at the time of storing, or extended warm weather should follow, it will not be necessary to apply any more water. Place a 12-inch board on edge along one side of the trench and bank up the surplus earth on the outside; cover the trench with a roof of boards, sash, straw on poles, or cornstalks from which the tops have been removed, placing the stalks across the pit with one end resting on the board and the other on the ground; spread over this a light covering of straw or other closely packing material, and as the weather becomes colder increase the covering to keep out the frost. Celery stored in

this manner will keep until late in the winter, and while the method is too laborious for application on a large commercial scale it is to be recommended for the use of the farmer and small grower because of its simplicity.

Storing in cellars.—Storing in cellars is not to be recommended, as the dampness and lack of ventilation generally cause the loss of the greater part of the crop through the attacks of diseases. The space under the benches of greenhouses is also unfit for celery storage, as the temperature is usually too high.

Use of a celery storehouse.—Almost without exception the larger northern growers have found it unprofitable to store celery for late keeping, and those who still adhere to the practice do so in order that they may control and supply a special trade. Even under special

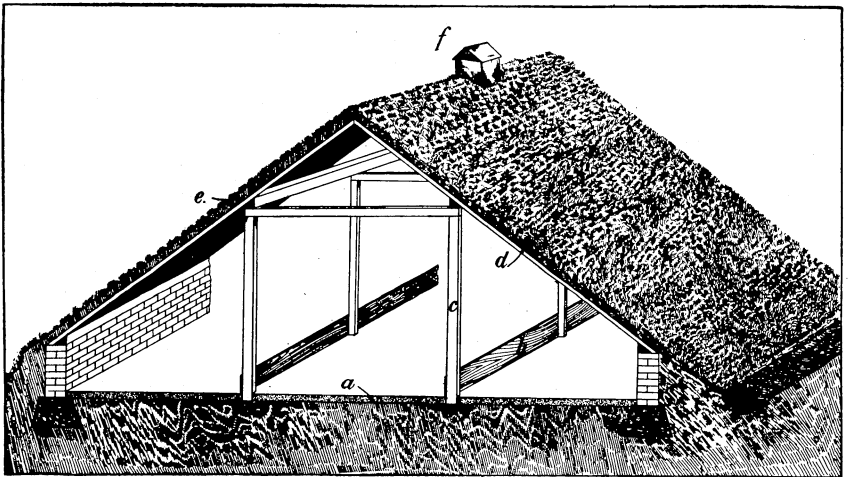


FIG. 7.—Cross section of celery storage house—width 24 feet, height of side walls 2 feet, and height in center to ridge 11 feet: *a*, bed of sand on earth floor; *b*, division boards through house; *c*, posts supporting roof; *d*, roof planks; *e*, sod, straw, or manure for frost proofing on roof; *f*, ventilator.

circumstances there is only a moderate profit in storing for late marketing. Where these circumstances exist the best form of storage is a broad and long structure (fig. 7), with low walls and even-span roof coming almost to the ground at the sides. The roof should be of heavy planks, with one end resting on top of the wall and the other on a ridge pole supported by a line of posts through the center. The cracks between the roof planks may be battened with old celery blanching boards and the whole covered to a depth of 4 inches with earth, and sodded over or double-roofed to keep out frost. The ends of the house should be built double with a dead air space between or consist of a heavy wall, and there should be a large door in each end. The dirt floor of the house should have a covering of 3 or 4 inches of loose sand or fine earth in which to pack the roots of the celery. It is

desirable to have the storehouse subdivided lengthwise into beds about 6 or 8 feet wide by means of 6-inch boards, raised 3 or 4 inches from the ground and fastened to stakes. These partitions increase the circulation of air through the celery and tend to keep the plants up in good position.

Digging, handling, and putting away celery.—Where any considerable quantity of celery is to be stored, everything should be in readiness beforehand so that the crop may be brought in quickly. In the field the celery should be loosened as required so that it may be easily pulled up by hand; for any quantity less than 4 or 5 acres this work can be done with spades, but on a larger scale a machine for digging should be used. The digger most commonly employed consists of a steel cutter 5 or 6 inches in width and one-half inch thick, bent upward at the ends and sharpened on the front edge, mounted beneath and between two wheels to which a tongue is attached. The blade must be so arranged that it may be adjusted to any depth, and about 18 inches of its length should be below the surface of the soil when in operation. The machine is drawn by two horses, and one row can be loosened as fast as the team will walk.

If the celery is not too tender, the handling from the field to the storehouse may be accomplished without the use of boxes; otherwise a number of boxes should be provided, each 12 by 12 by 26 or 28 inches in size, constructed of inch lumber for the ends and half-inch for the sides and bottom. A wagon with low, broad-tire wheels will be found convenient for the transfer. If boxes are not used, the celery should be gathered up in armfuls and piled upon the wagon. If boxes are employed, one set may be filled while the wagon is at the storehouse unloading. In using the boxes the celery should be placed with the roots in the bottom. The celery should be loosened only as removed to the storehouse, as a short exposure to the sun after the roots have been disturbed is very injurious and detracts from the keeping qualities.

Upon reaching the storehouse, the celery is removed from the wagon and laid in piles near where it is to be stored, or if in boxes they can be set near at hand. Beginning at the end of one of the divisions, a small furrow is opened in the sand by means of a spade, the celery is stood along in this furrow, and the sand filled in around the roots. The sand should be rather moist at the time the celery is stored, and it may be necessary to moisten it a little from time to time by inserting a pipe between the plants and pouring the water around the roots, but the tops should never be wet after entering the storehouse. After the storehouse is filled, constant ventilation should be maintained by means of openings near the ridge, and the temperature should be carried as low as possible; care should be taken, however, that the celery does not become frozen, although a temperature that will often produce a trace of frost will not injure it.

MARKETING THE CROP.

During the early part of the season, or until the time for heavy frosts, the marketing will be done entirely from the rows where the crop is grown, later from the trenches, and afterwards from the storehouse.

Preparing celery for market.—In preparing the celery for market from the rows where grown, it is not necessary to remove the entire root from the earth, but it may be cut off just below the surface of the soil by means of a stiff knife. Remove the outside leaves and trim the root evenly, pack in boxes, and load on the wagon for removal to the washing house. The blanching boards should not be removed till necessary, and the trimmed celery must not be allowed to lie exposed to the sun or wind for any length of time. It is well also to have a piece of canvas to protect the celery while it is on the wagon being transported to the washing house. In marketing from the trenches, the process is practically the same as from the rows, except that the celery is already loosened from the soil and the roots can be removed more easily.

Upon reaching the washing room the celery is immediately placed upon a rack consisting of wooden slats over a large trough, and subjected to a spray of cold water to cool it and to remove the soil. After washing, it is allowed to drain; then it is tied in bunches of 12 or more plants each, according to the size. The bunches are packed, 6 in a box for first grade, and 8 or 9 for second or third grades. These boxes should be practically air-tight and a lining of paper should be placed in them before packing the celery, or each bunch should be wrapped separately. The celery should be nearly dry before it is placed in the boxes, and throughout the entire handling must be kept as cool as possible.

Sanitary considerations.—Up to the present time very little attention has been given to the sanitary phase of celery growing and marketing. It is essential that the celery should be washed in pure water to prevent the transmission of disease germs. Any germ, such as that producing typhoid fever, which is found in contaminated water, is readily carried to the digestive system of the consumer, and may or may not produce an attack of the disease, according to the strength of the person to resist it. The washhouse and its surroundings should be kept clean and free from any decomposing materials. Shippers and dealers alike lose sight of the fact that the edible portion of celery is constantly being exposed to the contaminating effects of dirty wagons, cars, and dusty markets. Many persons have now discontinued the use of celery on account of the unclean condition in which it is served. This statement will hold good for all vegetables that are served in the raw state, but is especially applicable to celery.

Shipping in carload lots.—The greater part of the celery produced by the growers of Michigan, Ohio, and New York is shipped in car-

load lots to the Eastern cities. Some growers follow the practice of washing and boxing the entire crop; others wash and tie in bunches and set the bunches in an upright position on decks in the car. The select bunches are usually boxed and placed in the middle of the car, filling up the space between the doors. As quickly as the car is filled it is replenished with ice and rushed to its destination by fast freight. When celery is shipped in this manner all necessary arrangements must be completed beforehand, as any delay along the line or in handling will cause the loss of the entire shipment.

Several of the larger growers now follow the plan of shipping in the rough; by this method only about two-thirds as many bunches can be placed in a car, but the expense of loading is greatly reduced. The celery is lifted from the field, a few of the outer leaves pulled off, and the root trimmed roughly, after which the plants are tied in bunches of 12 to 14 each by means of common binder twine. These bunches are loaded upon a low wagon and hurried to the car before the celery has had time to become wilted. The first course is set root end down on the floor of the car and 2 decks are put in above, which will fill the car to the roof, and the space between the doors is filled in the same manner. A car loaded by this method will hold about 950 bunches, and the celery is usually in the car from seven to ten days, during which time the temperature is kept down by means of ice. Another method of shipping in the rough is in crates similar to those used by California and Florida shippers; the celery is more easily handled in these crates than in loose bunches and is less liable to become broken and bruised.

In all cases where the crop is shipped in the rough it is necessary for the commission man to provide means for washing and rebunching the celery; or a grocer or dealer can purchase in the rough and wash as needed to supply his trade. By shipping in the rough, the saleable portion is protected from bruising, and the bunches look more fresh and clean when trimmed and washed but a few hours before being offered for sale.

PROFITS TO BE DERIVED FROM CELERY CULTURE.

Estimates of costs.—The cost of equipment for celery work should not under most circumstances be great. Assuming that the market gardener has his land in good condition, and the tools necessary for its ordinary cultivation at his command, it will be essential only to provide a few sash under which the plants may be started, a small number of special tools, about 3,000 feet of lumber to each acre to be grown, and boxes for handling and marketing the crop, the whole outlay not to exceed \$100 per acre. The annual expense of growing one acre of celery, including fertilizers, seed, labor, and wear and tear on equipment, will not exceed \$100, provided the soil is suited to

the work and the product can be placed upon the market without undue expense or labor. It would not be advisable to undertake celery culture on a large scale unless located within 2 or 3 miles of a convenient shipping point.

Plants to the acre.—The following table gives the number of plants required to set one acre by the several methods and distances of planting:

Plants per acre of celery set at different distances.

Distance between rows.	Distance between plants.	Plants per acre.	Distance between rows.	Distance between plants.	Plants per acre.
<i>Feet.</i>	<i>Inches.</i>	<i>Number.</i>	<i>Feet.</i>	<i>Inches.</i>	<i>Number.</i>
4	4	32,700	5	6	17,440
4	5	26,160	6	4	21,800
4	6	21,800	6	5	17,496
5	4	26,160	6	6	14,533
5	5	20,940			

To plant one acre by the solid method, having one-half of the entire area devoted to beds, and the plants set 6 by 8 inches, would require 65,000 plants. It would be impossible to grow this amount of good celery on one acre, and 30,000 plants is a good yield on the best celery land; on land such as is ordinarily devoted to celery growing, 20,000 plants will be found to be as many as will do well. It is much better to have a moderate number of well-developed plants that can be packed 12 to the bunch than a larger number that are so small as to require putting in 15 or 16 to make up a bunch of the size sold for a dozen.

Estimates of returns.—Any one contemplating making a start in celery growing will do well to first investigate the market prospects, and unless satisfactory shipping arrangements can be made beforehand, the crop should be planted only on a small scale for one or two years, until a local trade can be established. It is fair to estimate a return of 1,500 dozen from one acre, and this should bring 15 cents per dozen, at the lowest average estimate; this will yield a gross income of \$225 to the acre, leaving a net balance of \$125 to cover the cost of investment and as profit. As a matter of fact, the growers who are making a success of celery raising—and many are doing so—receive a net profit of \$100 an acre, over and above the interest on the investment. Hundreds of acres are grown annually which do not much more than pay expenses, but this is due to the fact that the soil has become exhausted and the product is undersized and inferior.

VARIETIES.

For home use.—Where it is desirable to have celery for table use from midsummer until late in winter it is well to plant four or five varieties. For the earliest, plant White Plume or Golden Self-blanching; for autumn use, Golden Self-blanching and Pink Plume or Rose

ribbed Paris Self-blanching; for late keeping, Giant Solid or Evans' Triumph.

Under the name of White Plume may be included all the similar names, such as Improved White Plume, etc., as these represent but special stocks of the same variety. This variety is one of the older, and is still the most important with many of the Northern growers, although Golden Self-blanching is rapidly taking its place. It grows rather slender, blanches early, and has a fine flavor.

Golden Self-blanching is rather dwarf in its habit of growth, is stocky, and blanches readily. This variety is one of the best and is now grown exclusively by many of the Northern growers, with whom it takes the place of White Plume.

Pink Plume attains about the same size as Golden Self-blanching, and has a rather stocky growth. The outer stems are tinted with pink color, but this is scarcely visible on the blanched and trimmed bunches. The stems are heavily ribbed, and when grown on adhesive soil they are hard to clean. It blanches well, has a fair flavor, and is a good keeper.

Giant Solid is a large-growing variety, with broad, solid stems. It is one of the best for keeping purposes, has a good flavor, blanches clean and white, and is a desirable variety for winter use.

Evans' Triumph grows to a medium height; the stems are broad at the base, and it blanches well. It has a splendid flavor, is a good keeper, and is suitable for late winter use.

There are several other varieties of equal merit, and in making a selection a beginner should accept the assistance of his seedsman.

For marketing.—For market purposes it is best to grow but two or three varieties and build up a trade for a uniform product. The Northern growers, for the most part, plant White Plume and Golden Self-blanching for summer and fall marketing, and those who make a practice of storing also plant some such variety as Giant Solid. At present there is possibly more of Golden Self-blanching grown than of all other varieties together.

No particular variety can be recommended for a locality until the demands of the markets are ascertained, and it would be best for any one who contemplates engaging in the business to learn what varieties are used by growers under similar conditions and adopt those; however, it is always safe to begin with such varieties as those mentioned.

FARMERS' BULLETINS.

The following is a list of the Farmers' Bulletins available for distribution, showing the number, title, and size in pages of each. Copies will be sent to any address on application to Senators, Representatives, and Delegates in Congress, or to the Secretary of Agriculture, Washington, D. C.:

16. Leguminous Plants. Pp. 24.
19. [Superseded by No. 127.]
21. Barnyard Manure. Pp. 32.
22. The Feeding of Farm Animals. Pp. 32.
23. [Superseded by No. 142.]
24. Hog Cholera and Swine Plague. Pp. 16.
25. Peanuts: Culture and Uses. Pp. 24.
26. [Superseded by No. 129.]
27. Flax for Seed and Fiber. Pp. 16.
28. Weeds: And How to Kill Them. Pp. 32.
29. Souring and Other Changes in Milk. Pp. 23.
30. Grape Diseases on the Pacific Coast. Pp. 15.
31. Alfalfa, or Lucern. Pp. 24.
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38. Spraying for Fruit Diseases. Pp. 12.
39. Onion Culture. Pp. 31.
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53. How to Grow Mushrooms. Pp. 20.
54. Some Common Birds. Pp. 40.
55. The Dairy Herd. Pp. 24.
56. Experiment Station Work—I. Pp. 31.
57. Butter Making on the Farm. Pp. 16.
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61. Asparagus Culture. Pp. 40.
62. Marketing Farm Produce. Pp. 28.
63. Care of Milk on the Farm. Pp. 40.
64. Ducks and Geese. Pp. 48.
65. Experiment Station Work—II. Pp. 32.
66. Meadows and Pastures. Pp. 28.
67. Forestry for Farmers. Pp. 48.
68. The Black Rot of the Cabbage. Pp. 22.
69. Experiment Station Work—III. Pp. 32.
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