THE USE of good seed corn would materially increase the yields commonly obtained by many farmers. By good seed corn is meant well-selected, viable seed of a productive strain that is adapted to the locality.

Corn hybrids are expanding rapidly in the Corn Belt, but there are many sections of the country for which no adapted hybrids are available. In these sections open-pollinated varieties maintained by careful mass selection offer most promise.

Mass selection is outstandingly the best method that can be recommended at the present time for general farm use for the selection of seed corn from open-pollinated varieties.

Field selection of seed corn from standing stalks is absolutely essential if the best results are to be obtained. The grower should select sound ears that are free from disease and insect damage and have matured on erect, disease-free plants. Narrow selection for any character should be avoided, as past experience has shown that such selection always results in reduced yields.

Seed corn should be picked as soon as the crop has matured; it should be promptly dried to 12- to 14-percent moisture and stored in a cool, dry place and protected from damage by grain moths, weevils, and mice.

Seed corn that has matured normally and been quickly dried and properly preserved will grow satisfactorily. It is well, however, to make certain of the viability by a preliminary germination test before the seed ears are shelled.

Individual shelling of the ears and inspection of the seed from each ear before it is added to the bulk seed lot are recommended.

The seed should be graded for size to obtain the most uniform drop with planters, particularly those of the edge-drop type.

The treatment of seed corn with any of the mercury dusts manufactured for that purpose is recommended under some conditions.

This bulletin supersedes Farmers' Bulletin 1175, Better Seed Corn.

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SEED CORN

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CONTENTS

INTRODUCTION

THE AVERAGE YIELD of corn for the entire United States for the 10-year period 1927–36 was only 22.9 bushels per acre. In many sections of the country yields of two, three, or even four times that quantity frequently are produced with only such labor and expense as are entirely warranted in practical corn production. The use of inferior seed is one of the important factors contributing to the low yields commonly obtained by many farmers. Losses from this source may be readily controlled if proper attention is given to the choice of an adapted, high-yielding strain and to the selection and care of the seed.

Each spring good seed corn is scarce. This condition is entirely unnecessary in most seasons. It usually is because of negligence or delay. If a 2-year supply of seed were saved each fall there would be no shortage of good seed even following the occasional seasons when little sound corn is produced.

This bulletin discusses the essentials in the selection and care of seed of open-pollinated varieties of corn. It is intended primarily for the grower who maintains and seriously endeavors to improve his locally adapted strain of open-pollinated corn by careful mass selection.

In the Corn Belt the use of hybrid seed corn is increasing rapidly. The breeding and development of corn hybrids is a specialized undertaking and will not be discussed in this bulletin. The subject is fully covered in Farmers' Bulletin 1744, The What and How of Hybrid Corn. However, many of the procedures and precautions to be observed in the harvesting, drying, and storing of any seed corn necessarily must be observed in the handling of seed of corn hybrids if a product of high quality is to be obtained. Such items are discussed in the following pages.

CHOICE OF STRAIN

Corn is grown in every State, from sea level to high elevations, from regions with more than 100 inches of rainfall annually to others with less than 15 inches, and from the Southern States with their extremely long growing seasons and short summer days to the Northern States which have relatively short growing seasons and long summer days.

It is only natural, therefore, that enormous differences should exist among the strains from different sections of the country and that regional adaptation should be of first importance in the selection of the strain for planting.

In this connection it should be emphasized that varietal names of corn mean less than those of almost any other field crop. Because of its cross pollination, corn is maintained in an extremely heterozygous condition. Even the most carefully selected varieties of corn are such mixtures that they are changed readily by selection under a new environment. Variations in the ideals and methods of selection of different breeders have resulted in the development of innumerable strains within all of the important varieties. In fact, it often has been shown in yield trials that there may be larger differences among strains within a variety than among varieties of the same seasonal requirements. These facts simply emphasize that in choosing the strain of corn to plant, the important thing is to know that the particular strain in question has performed well in the given locality or under similar soil and seasonal conditions.

The agricultural experiment stations in nearly all States have data available as a result of their varietal yield tests, which are used as a basis for their recommendations of the strains of corn best suited for planting in the different sections of their States. In most cases they maintain up-to-date lists of reliable growers of the strains of seed they recommend for planting. This information usually is placed in the hands of the county agricultural agents. Accordingly, those interested in the best available information on this subject should consult their local county agricultural agent or write to the agricultural experiment station in the State where they expect to grow the crop.

SHOULD THE AVERAGE GROWER OF OPEN-POLLINATED CORN BUY OR SAVE HIS OWN SEED?

Many farmers annually buy all of their seed corn; others buy only enough every few years for a special seed plot and produce their own seed for main-crop planting; still others maintain their own strain and save all of the seed required for their own needs. The choice of plan in each particular case will depend on whether the farmer has the time and ability to produce as good seed and care for it as well as the person from whom he buys.

Corn breeding requires a special interest in the crop and an attention to the details of selection that farmers generally do not have the time to apply. The farmer who is not willing to make the effort necessary to maintain the productivity of his own variety will do better to obtain his seed year after year from a reliable producer of an adapted strain of proved performance, if such a producer is known. Unless seed from a reliable producer is available, however, the best place for the farmer to obtain seed corn is from the fields on his farm that were planted with a strain which has generally proved successful in the locality. Or he may be able to get such seed from a neighbor.

A conscientious seed-corn breeder may render real service to his community, for which he should be adequately compensated. A bushel of seed will plant from 4 to 8 acres, depending on the variety and locality. Only a small increase in productivity is needed, therefore, to pay good dividends on an investment in superior seed corn.

METHODS OF CORN IMPROVEMENT

The two important methods of corn improvement in use at the present time are: (1) Mass selection among open-pollinated plants, and (2) selection in inbred lines for use in the production of corn hybrids. For many years the ear-to-row method of breeding was popular and very widely used, but as the results were disappointing it now has passed out of use. Mass selection is the only breeding method that will be discussed in this bulletin.

MASS SELECTION

Mass selection consists in choosing certain desired individuals from the main crop and bulking the seed harvested from them. It has been amply demonstrated that when consistently and intelligently used over a period of years, this method of breeding will radically modify practically any or all characteristics of the plant and ear. The rate of change in an open-pollinated crop, such as corn, is not so rapid with mass selection as with certain other methods of breeding. In spite of its limitations, however, it is outstandingly the best method that can be recommended for general farm use in the selection of seed corn from open-pollinated varieties.

A certain amount of mass selection probably has been practiced since the very earliest times. Corn ears are large, and they usually have been handled individually, both at harvest and when shelled for seed. Under these circumstances some selection among the ears is inevitable.

Nearly all of the present varieties of corn have been developed by mass selection through the painstaking efforts of competent, interested breeders. Reid Yellow Dent, developed in central Illinois by Robert Reid and his son, James L. Reid, during a lifetime of conscientious selection, is a typical example. Neal Paymaster, a two-eared variety developed by W. H. Neal, of Lebanon, Tenn., after many years of carefully selecting seed from two-eared plants, is another typical example from a different section of the country. Numerous other examples of this sort might be given.

Corn breeders of the past have differed widely in their ideas of what constituted a good variety of corn. Hence, the wide diversity of types represented by the present well-selected varieties. They have differed also in their ability to develop productive strains, as has been demonstrated in practically every State in yield comparisons. Farmers who obtain seed of well-bred varieties also differ greatly in their ability to select seed from these varieties and maintain or improve their yielding capacity. This is well illustrated in the differences in yielding ability of different strains of Reid Yellow Dent reported by the agricultural experiment stations of Iowa, Illinois, and other States and in similar differences among strains of Neal Paymaster reported by the Tennessee Agricultural Experiment Station and by other stations in the Southern States.

FIELD SELECTION OF SEED CORN

The field selection of seed corn from the standing stalks is absolutely essential if the best results are to be obtained. Field selection provides an opportunity to inspect the plant from which each seed ear comes, to observe its characteristics, and to evaluate its general

desirability for breeding purposes. It is true that such minor and unimportant characteristics as ear type or kernel type may be modified by careful selection of seed ears from the crib. However, the important characteristics of the plant, its productivity, disease resistance, insect resistance, and general adaptation to its environment can be modified intelligently only by careful field selection.

Seed corn should be picked as soon as the crop has matured. The gathering of seed corn should be made a special and all-important task when it is ripe. In the Northern States there is always danger of injury to the seed by freezing weather if it is left in the field. Although the dangers of loss from this cause are not important in the South, serious damage in that section may result from insects and disease if the seed is not harvested promptly. Bags, such as are shown in figure 1, are very convenient for field picking.

FIGURE 1.—Bags like those shown above are very convenient for use in selecting seed from standing stalks in the field.

It is a good practice to field-select more seed in the fall than actually will be needed for spring planting. A little extra seed is added insurance against a real shortage in case of accidental losses that may occur during storage. Extra seed also will permit the discarding of ears which, though apparently healthy when harvested, show disease when shelled.

Occasionally very unfavorable seasons occur in which the crop is subjected to severe conditions, such as high temperatures, drought, frost injury, insect attacks, or disease. Seed matured by the plants that are able to survive these adverse conditions is especially valuable and should be saved and increased. Such plants represent the hardiest individuals of the variety and those that were able to reproduce under the particular vicissitudes of the season. There is always a tendency, however, for farmers to discard the poor-looking seed that survives a bad season and obtain new and often poorly adapted seed from other areas.

CHARACTERISTICS OF A DESIRABLE PLANT

While plant type varies widely in the different corn-growing areas, the following general suggestions will apply to most all sections:

1. Seed ears should be taken only from plants that have produced heavily in competition with a full stand of vigorous plants. Avoid large ears on stalks standing singly with an unusual amount of space around them.

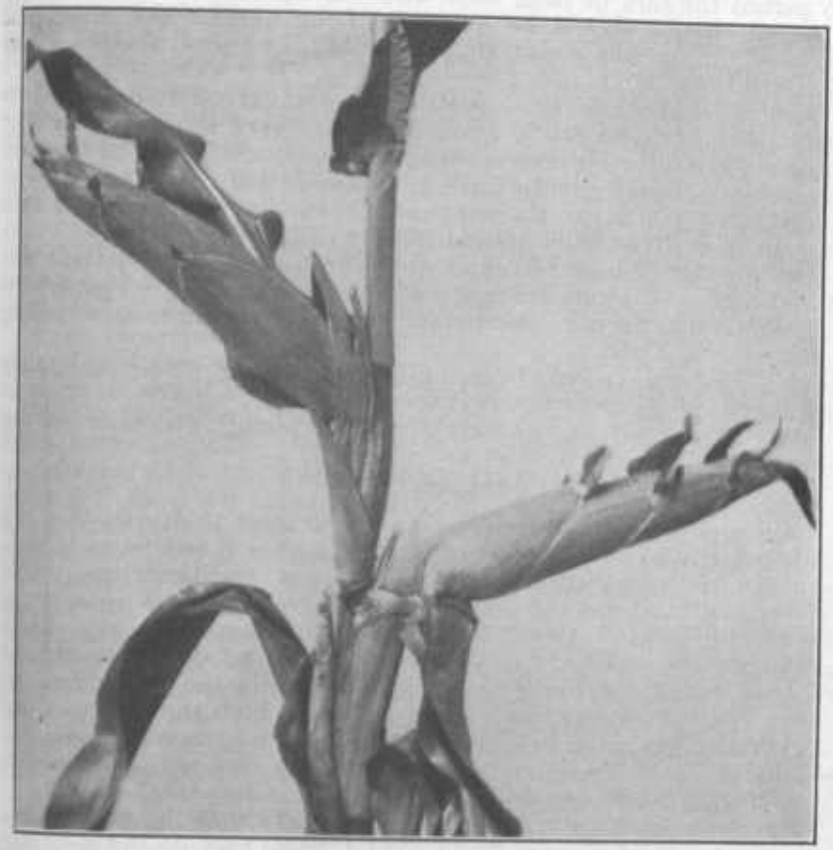

FIGURE 2.—A typical stalk of a prolific variety of corn, showing two good ears well balanced on the stalk. The number of ears per stalk can be modified by selection.

2. The plants and ears should be free from disease, such as smut, ear rot, stalk rot, and root rot. The shank scar should be light in color and should show no shredding or dark discoloration.

3. The plant should be erect and have a well-developed root system as indicated by good anchorage in the soil.

4. The plants should be of medium height for the variety, and the ears should be at a convenient height for husking.

5. The stalks should be of medium size for the variety and should not have an excessive number of tillers.

6. The leaves should remain deep green in color and of good texture until the ear is ripe. The number of leaves should be about average

for the variety in the locality. Avoid selection to develop strains with excessively large or excessively small leaf area.

7. The number of ears per stalk should be typical of the variety. Prolific varieties should have two or more good ears per stalk (fig. 2). All of the ears on any one stalk are of equal value from the breeding standpoint.

8. The shanks of the ears should be of such length and strength as to permit the ears to hang over with the tips down, but broken or diseased shanks should be avoided. Long shanks also should be avoided. In prolific varieties long shanks may permit the lower ears to touch the ground.

9. The husks should be of good texture and extend well over the tip of the ear. In the South, good husks are very important as they may be a considerable protection against insects. To afford the most protection, they should be thick and close fitting. The tendency to fit the ear closely is greatly increased if the individual husks are wide enough to reach entirely around the ear and overlap slightly.

10. The ears should be sound, well-filled, and heavy for their size. Avoid narrow selection for any particular ear type. Past experience has shown that narrow selection for any ear type will reduce yielding ability.

11. The kernels should be well filled and mature. They should not be excessively rough or starchy.

12. The germs should be large, clear, and plump, with no indication of rotting.

DRYING SEED CORN

Seed corn should be placed where it will start to dry the day it is gathered. A free circulation of air is essential if seed corn is to be properly and promptly dried. Under many conditions heat will be found beneficial. In the cooler climates, heat may be necessary to dry the corn and protect it from freezing weather until dry. In the more southern sections there may be little or no danger from frost, but the humidity often is high in the fall, and the corn dries very slowly. In warm weather if the humidity is high the seed ears may be overrun with mold before they dry unless a little circulating heat is provided. This is particularly true if the ears are not stored on hangers or racks where they cannot touch one another.

If heat is employed it is especially necessary that the room be well ventilated. Heat in a poorly ventilated room may do the seed more harm than good. The fire should be slow and, if possible, should be situated well below the ears, which should have good ventilation above them. With good ventilation, quick and satisfactory drying will be obtained at a temperature of about 100° F. The temperature should in no case be allowed to go above 110°, as it may result in injury to the seed.

Small quantities of seed, or even lots containing as much as 500 bushels, may be dried satisfactorily on hangers or racks, of which there are numerous kinds. Any arrangement that will hold the ears so that they do not touch one another should be entirely satisfactory.

For small quantities of seed, temporary hangers made of binder twine or cord, such as are shown in figure 3, may be used.

Wire racks like those shown in figures 4 and 5 are more convenient and in the end cheaper than hangers made of binder twine or cord. A method of cutting electrically welded fencing into racks without

waste is shown in figure 5. Fencing having horizontal wires 4 inches apart and upright wires 2 inches apart may be obtained in widths of 2, 3, and 4 feet. Dealers can usually supply such fencing to farmers at an initial cost of about 10 cents for each bushel of seed suspended. These racks will last many years and are light and easily stored when not in use.

Racks as shown in the cover page illustration may be made conveniently by nailing 2-inch cross strips on 2- by 4-inch uprights. The ears are separated by vertical wires. Similar racks may be made from woven or welded fencing wire. Wire having a mesh 3 inches square is preferable, as it provides an individual space for each ear. Such a rack is shown in figure 6.

FIGURE 3.—Temporary hangers of binder twine or cord used for drying small quantities of seed.

Where large quantities of seed corn are to be dried, the Wisconsin bin method of drying, or some slight modification of it to fit the individual conditions, will be found most satisfactory. In this method, developed by the Wisconsin Agricultural Experiment Station in 1926, the ears are piled in bins to a depth of 6 or 7 feet. The bins have slatted false bottoms and are made so that they may be tightly closed. Warm air from a furnace, heated to about 110° F., is forced into the bins with a multivane blower large enough to move the air through the corn at a rate of about 70 feet a minute. The bins and airways are designed to permit reversing the direction of the air flow through the corn as desired. Various modifications of this method are in use.

The bin method of drying is intended primarily for those who make a commercial business of producing seed corn. It is most economical for lots of 500 bushels or more. Consequently, it is not practical for the farmer who produces seed corn only for himself.

Seedsmen wishing information on the Wisconsin bin method of drying seed corn should consult their State agricultural experiment station or write directly to the Wisconsin Agricultural Experiment Station, Madison, Wis.

WINTER STORAGE OF SEED CORN

When the ears are sufficiently dry so that they contain not more than 12 to 14 percent of moisture, they should be stored in a cool, dry place where they will be protected from mice or insects. In the Northern States, if the seed-drying room is mouseproof, the ears may remain on the hangers or in the bins where they were dried. This is never feasible in warm climates or in storage buildings that remain warm throughout the winter, because of the danger of damage by grain moths and weevils. The seed must not be exposed to high temperatures or to damp atmospheres. Both of these conditions injure viability.

PREVENTING INJURY BY WEEVILS OR GRAIN MOTHS

FIGURE 4.—Seed ears suspended by means of wire racks made from electrically welded fencing. Figure 5 shows how these racks may be cut.

In localities where weevils and grain moths injure stored grain, the dry seed ears should be stored in tight receptacles, with 1 pound of moth balls or flake naphthalene enclosed for each bushel of corn. This quantity tightly enclosed with the corn will prevent damage from those insects and will not injure the seed.

The material will cost about 10 cents a pound. One dollar's worth will protect seed enough to plant 60 acres.

If at any time weevils or grain moths on the dry seed ears show evidence of getting beyond control of the moth balls or flake naphthalene, the ears should be enclosed in airtight rooms, bins, boxes, or barrels and fumigated with carbon disulphide for 48 hours. The carbon disulphide should be placed in shallow dishes or pans on top of the seed. A half pound is sufficient for a box or barrel holding 10 bushels or less. In larger containers, such as airtight rooms or cribs, 8 to 25 pounds of carbon disulphide per 1,000 cubic feet of space is enough for thorough fumigation. The amount of fumigant necessary depends on the temperature of the grain and the tightness of the container. The cooler the grain the larger the dosage that is required. Fumigations at temperatures below 60° F. are not highly effective.[1]

Carbon disulphide is a highly inflammable liquid and should be handled with extreme care. The greatest danger with this material is due to its highly inflammable vapors which form explosive mixtures with air. The vapors are heavier than air and may travel a considerable distance to a source of ignition and flash back to cause an explosion.

[1] Additional information on fumigating corn with carbon disulphide and information on the use of noninflammable fumigants in cases where the fire hazards might make carbon disulphide unsafe are given in Farmers' Bulletin 1483, Control of Insect Pests in Stored Grain, and in Farmers' Bulletin 1811, Control of Insects Attacking Grain in Farm Storage.

Carbon disulphide vapors can be ignited by any kind of flame, such as a lighted lantern, sparks from electric switches or motors, and

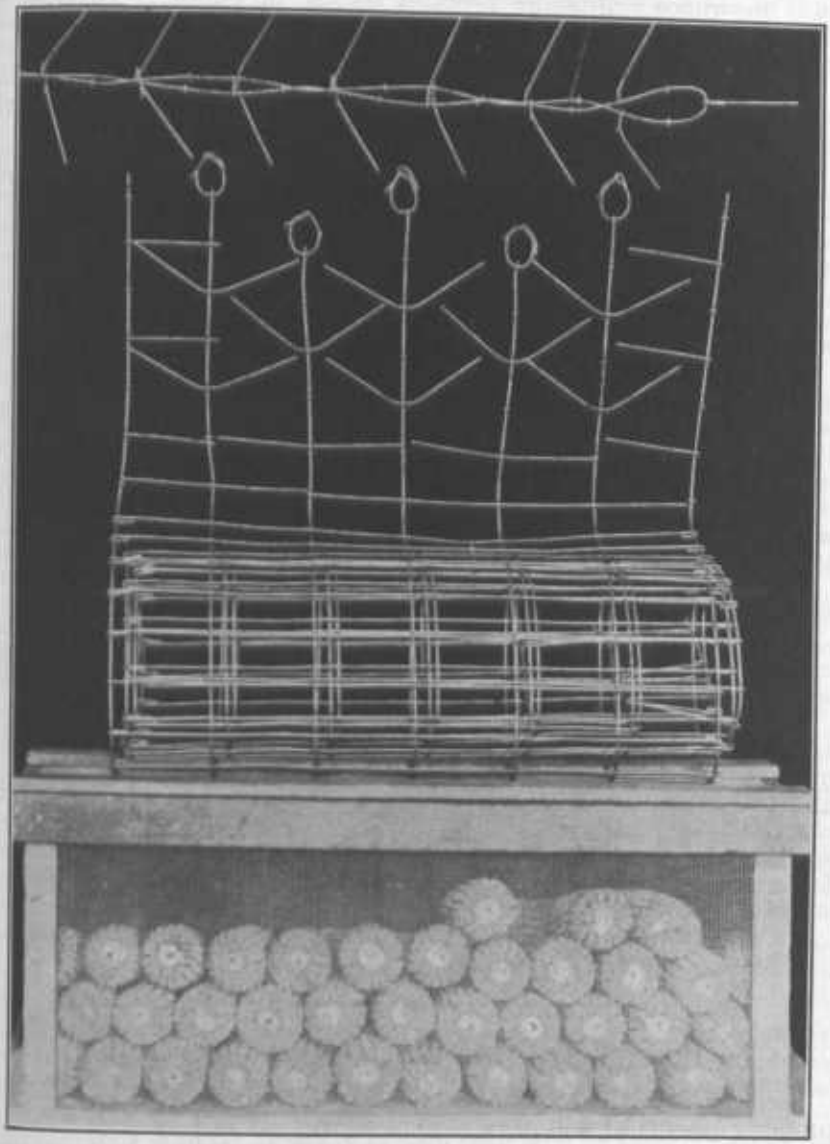

FIGURE 5.—Seed-corn racks made from electrically welded wire fencing, showing the method of construction; also a mouse-proof crate for storing seed corn in winter.

lighted smoking materials. The vapors also may be ignited by a hot steam pipe, or a heavy blow such as may be struck by a hammer, or by heated grain where the temperature rises to the ignition temperature of the vapors.

From a fire and explosion standpoint, carbon disulphide is much more hazardous than gasoline. Because of the fire hazard involved, most insurance companies prohibit its use in buildings covered by their policies, except in certain cases and then only under conditions imposed by the insurance companies.

It always is desirable to handle the seed in such a manner that this more extreme treatment is unnecessary, as it may injure seed of high moisture content.

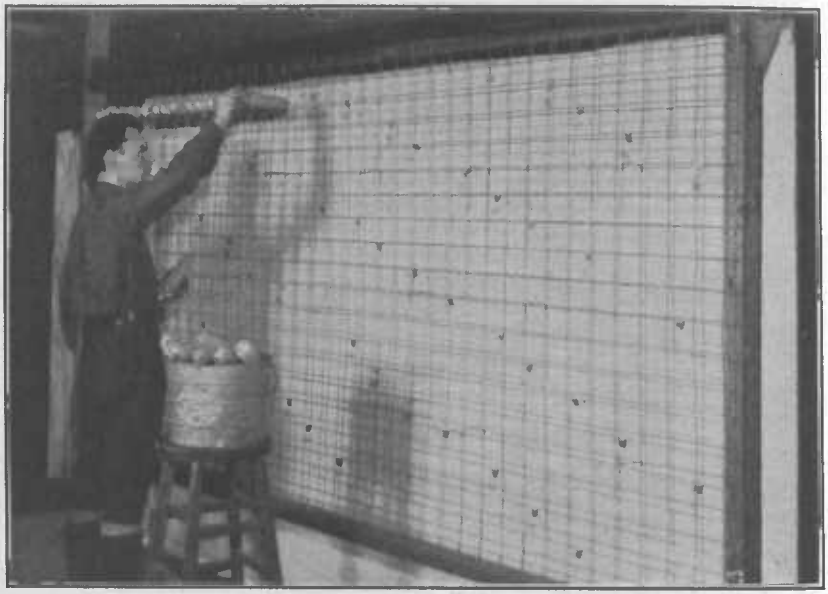

FIGURE 6.—Seed-corn rack made of electrically welded wire with a mesh 3 inches square.

WARNING!

Carbon disulphide is highly inflammable. Extreme care should be taken to insure against fire.

TESTING THE GERMINATION OF SEED CORN

Seed corn that has matured normally and been dried quickly and properly preserved will grow satisfactorily. It is very poor management to neglect proper preservation and as a result have to spend time in the spring separating by germination tests ears that have been badly damaged from those that have been slightly damaged. Prevention is better than cure, and in many cases cure is impossible.

Ears slightly damaged by poor preservation may germinate 100 percent but will produce less than if they had received better care.

Before shelling the ears, it is wise to test separately 10 kernels from each of 100 ears in a rag-doll tester or seed-corn testing box. Be sure that the kernels tested were not injured when removed from the ear.

If 3 or more kernels out of 10 from any ear fail to grow, it will be advisable to test every ear before planting. If the seed has been properly selected and preserved, the 100 ears tested will seldom reveal any of low viability, and further testing of the supply will be unnecessary.[2]

SHELLING SEED CORN

The first operation in shelling seed corn properly is to remove the small kernels from the tips of the ears. The round, thick kernels from the butts may or may not be removed preparatory to shelling. The small tip kernels complicate the grading of the seed for size and are more likely to be diseased than the other kernels of the ear, and hence frequently are less productive. The round butt kernels are as productive as the other kernels of the ear but may not drop as uniformly through standard planter plates. When they are not removed prior to shelling they usually are separated from the more uniform kernels on the central portion of the ear by grading for size.

It always is desirable to shell seed ears separately and examine the shelled grain from each ear individually before it is added to the general seed supply. Many ears may be found the kernels of which look perfectly healthy and of good quality while on the ear but on shelling show disease, poor germs, "silk cut," or other undesirable characteristics. The seed from a large ear sometimes will plant as much as one-tenth of an acre, and the inclusion of the seed from only a few bad ears may cause considerable loss in yield.

Small lots of seed corn are best shelled carefully by hand. Each ear should be shelled separately into a sieve,[3] any worm-eaten or blemished kernels being rejected. If the seed from an ear appears good and contains no poor kernels, it should be poured into the general supply and another ear shelled in the same way.

Hand shelling is not practicable for large lots of seed corn. For such lots a one-hole hand or power sheller may be used. Extreme care should be exercised to insure that the sheller does not break or crack an undue number of kernels. When a sheller is used the ears should always be shelled separately into a pan, sieve, or other receptacle, or spaced on a flat, moving belt so that the seed from each ear may be examined and rejected if necessary before it goes into the general seed supply.

GRADING SEED CORN FOR SIZE

The kernels from different ears of corn vary widely in size and shape. It will be found that most corn planters will drop the seed more uniformly if it is carefully graded for size. This is especially true of those with the edge-drop type of planter plates.

Where only a small quantity of seed corn is to be used, much of the grading for size can be done before the ears are shelled. After the butt and tip kernels are removed, the ears may be separated into lots on the basis of kernel size. These lots may be shelled separately, run over a small hand grader such as is shown in figure 7, and tried out in the corn planter. The lots may be numbered to correspond with the number on the planter plates found to drop them most uniformly.

[2] Complete directions for testing seed corn are given in Farmers' Bulletin 948, The Rag-Doll Seed Tester.
[3] A large sieve with quarter-inch mesh and a concave bottom screens the chaff from the kernels and is easily emptied.

These arrangements can be completed before the rush of spring work begins.

Large lots of seed corn, particularly of seed of corn hybrids, present an entirely different and much more complex problem of grading for size. When large lots of seed corn are shelled the butt kernels usually are not removed prior to shelling. Occasionally in the production of hybrid seed corn, poor pollination will result in a rather large percentage of round or misshapen kernels. The various corn hybrids also have a natural range of kernel sizes and shapes much greater than the common open-pollinated varieties.

In grading large lots of seed corn for size it is a good practice to run the seed as it comes from the sheller first through a fanning mill fitted with a large screen to remove all pieces of cob and other coarse material and a small screen to remove all dirt, chaff, and any very small kernels. The clean seed from the fanning mill may next be run through

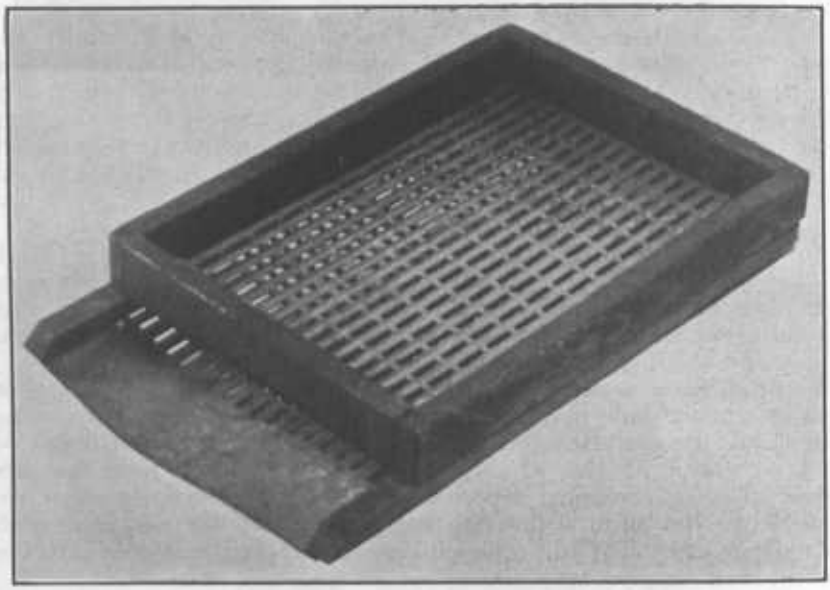

FIGURE 7.—Hand graders of the general type shown above may be used satisfactorily for small quantities of seed corn.

a corn grader (the squirrel-cage type is most commonly used) and separated into three to five lots on the basis of kernel size and shape.

Each kernel lot should be carefully tested in the planter in which it is to be used before planting time and a planter plate selected (or obtained if necessary) that will drop the seed uniformly.

SEED TREATMENT

The treatment of seed corn with any of the mercury dusts manufactured for that purpose is recommended under some conditions. The primary purpose of seed treatment is to kill certain seed-borne disease-producing organisms without injuring the seed. Increases in yield from seed treatment will depend largely on the percentage of kernels infected with these parasites.

Even the best lots of seed may carry appreciable amounts of infection with the ear rot organisms, principally *Diplodia*, *Fusarium*, *Gibberella*, and *Basisporium*. Seed matured or stored under unfavorable conditions may carry appreciable amounts of *Penicillium* and other of the so-called weak parasites. The planting of seed carrying such infections may result in reduced field germination, blighting of the young plants, or reduction in the vigor of the plants that survive. The extent of such infections in seed corn, as well as the reduction in yield following the planting of such seed, depends on many factors and varies from year to year. In general, it may be said that damage caused by the seedling blight diseases appears to be of greatest importance in the central, more humid areas of the Corn Belt.

Seed treatments usually, though not always, improve stands and yields of corn in the central Corn Belt States and, in some years, in other States. Such treatments are most likely to improve low-germinating seed or that planted early or in cold, wet soil.

The following three dust treatments are available commercially from most dealers in farm supplies at the present time: New Improved Semesan, Jr.; active ingredient, ethyl mercuric phosphate. Barbak C.; active ingredients, mercuric phenyl cyanamide and cadmium oxide. Merko; active ingredient, mercury (metallic).

The names of these products are furnished merely as information, and their mention does not imply any recommendation of them.

These three dust treatments are usually applied to the seed in a mixing machine at the rate of 2 ounces a bushel. The directions printed on the containers should be followed. When treating seed, the operator should use every precaution to avoid breathing the mercury dust, which is poisonous.

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