CIRCULAR OF INFORMATION.

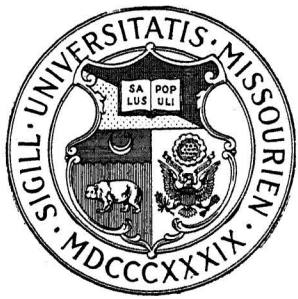
NUMBER 19.

UNIVERSITY OF MISSOURI.

College of Agriculture and Mechanic Arts.

AGRICULTURAL EXPERIMENT STATION.

SUGGESTIONS FOR MISSOURI CORN GROWERS.



COLUMBIA, MISSOURI.

March, 1905

PRESS OF E. W. STEPHENS
Columbia, Mo.
1905

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SUGGESTIONS FOR MISSOURI CORN GROWERS.

BY M. F. MILLER.

Professor of Agronomy.

The three important essentials to high yields of corn in any locality are good seed, good soil and good tillage. By neglecting to give proper attention to any one of these the yield may be greatly decreased; by careful attention to all three the yield may be increased to a maximum. Probably the essential that is deserving of most special attention at this time is that of the seed. Proper attention to the selection and care of seed corn would increase the average Missouri corn yield not less than 20 per cent at a conservative estimate, and many careful men can increase the yields on their individual farms much more than this. It is with the idea of calling especial attention to this important detail in corn growing that this circular is issued.

IMPORTANCE OF SECURING A GOOD STAND.

It has been found by investigation that the average stand of corn is usually not above 70 per cent. This means that where a man is growing 100 acres of corn he is harvesting a crop which could be grown on 70 acres. The cost of plowing, planting and cultivating is the same whether we have a stand of 70 per cent or of 95 per cent, so that any increase in the yield or corn resulting from a good stand will be almost pure profit. The difficulty of getting perfect stands lies almost entirely in the improper attention to selection and care of seed ears, and a careful attention to this one particular offers large opportunity for increasing the yield of corn.

The Seed Should be Evenly Distributed.

An essential step in securing a perfect stand of corn is to get an even distribution by the planter. The average corn planter will drop quite accurately providing the kernels that are put through it are of uniform shape and size. Reference

to the photograph (Fig. 1) will show three ears of corn from the same field which differ largely in the general character of the kernels. The ear on the left bears broad rounded kernels, the one on the right deep pointed ones, while the middle ear shows a shape and size differing from either of the others. A planter may be adjusted to plant kernels from either

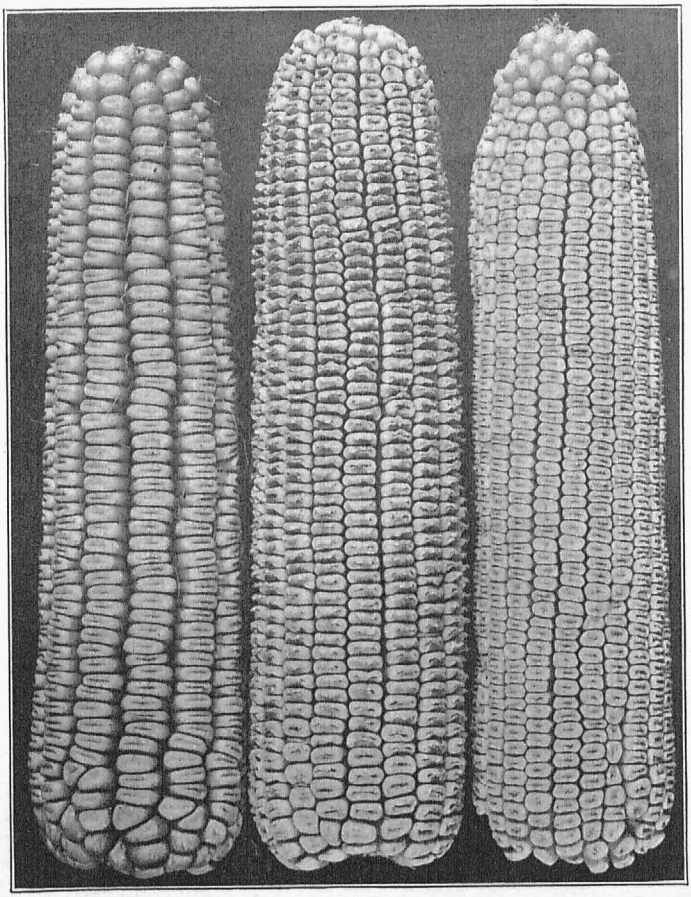

FIG 1.—Ears showing variation in the shape and size of kernel.

of these ears quite uniformly when they are planted separately, but not when the three are shelled together. It has been found, for instance, that after shelling the butts and tips, if the kernels

from a single ear are placed in a planter box and the plate properly adjusted, a good planter will drop, say three kernels in a hill 90 to 95 times in a hundred; but when corn from ears of such widely differing kernels are mixed, no adjustment of the plates will allow the planter to drop over 75 to 80 hills of the required number of kernels. The importance of selecting seed ears which have as nearly as possible the same shape and size of kernels is thus emphasized. Whatever type of ear one prefers, therefore, let that type alone be selected for planting, and let the plates of the planter be arranged to drop accurately the number of kernels desired.

A second means of controlling the uniformity of distribution is found in the custom of removing the butt and tip kernels of the seed ears. It has been determined experimentally that when all the kernels of an ear are shelled together a good planter will not drop over 70 to 75 per cent with the proper number per hill, but when the irregular kernels from butt and tip are removed, the same planter will drop as high as 90 to 95 per cent with the desired number. It is therefore always necessary that butts and tips be removed from ears before shelling.

Plant Corn of Strong Vitality.

The failure to plant corn of strong germinating qualities is undoubtedly responsible for the greater number of poor stands of corn. The matter of getting a uniform distribution of seed is but secondary to the more important factor, that of planting only corn which is known to be of strong vitality. Germination tests which have just been made at the experiment station with a number of samples of corn from farmers' cribs around Columbia, show an average germination of but 63½ per cent. This means that there will be a great deal of corn in the state this spring of weak vitality, and unless proper precautions are taken to test such corn before planting, very poor stands will certainly result. If only corn of strong vitality were planted, with due consideration to securing a uniform distribution of seed, the stand on average seasons should not run much under 95 per cent. Such a stand means a long step in the direction of a profitable corn crop.

Test the Vitality of Corn in a Germinating Box.

It is perfectly practical for the average farmer to test for germination every ear of corn he plants, and where corn has not been carefully preserved this should always be done. It has been found that if an ear is lacking in vitality, the character is shared to a great extent by the majority of the kernels on that ear; consequently if a half dozen kernels are selected from different parts of the ear and tested, a very good idea of the strength of germination of that particular ear may be obtained. The method of doing this is as follows: Lay out the ears selected on a long board or on the crib floor, marking a number opposite each. Prepare a box 2 or 3 inches deep and 2 or

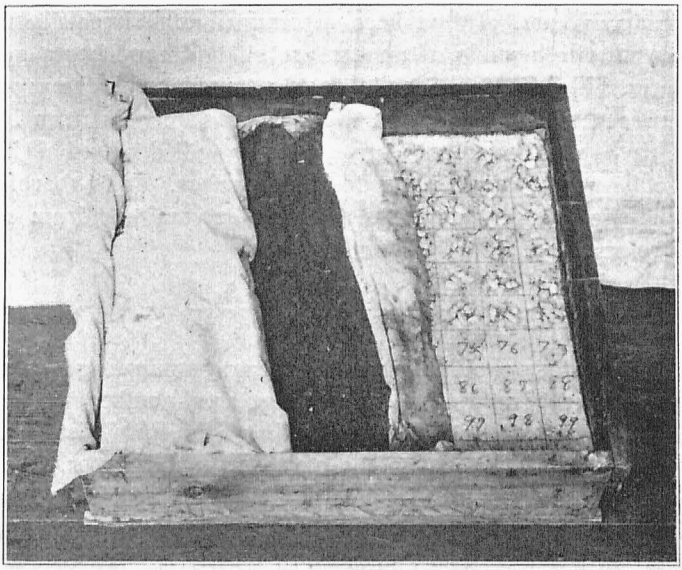

FIG. 2.—Germinating Box. The cloth on which the sand is placed is rolled back to show the squares holding the corn.

3 feet square (Fig. 2) nailing the bottom on tightly in order that it will not warp when it becomes wet. Place in the bottom of the box a half to three-quarters of an inch of sand and moisten thoroughly. Cut a piece of white cloth to fit the box and mark it off with a pencil into squares 2 to 2½ inches in size, numbering them from one up, laying the cloth on the sand. Now

remove two kernels about 2 inches from the butt of ear No. 1, turn it one-third around and take two more from near the middle, again turn it one-third around and remove two from near the tip, placing the half dozen kernels in square No. 1. In like manner take the same number of kernels from ear No. 2 and place in square No. 2 and so on until all the squares are filled. Cover the corn with another piece of moist cloth, which is somewhat larger than the box, filling in on top of this with three quarters of an inch of moist sand. A piece of oilcloth or some wet paper thrown over the top helps to keep the germinator from drying out. Set in a warm place, say near the kitchen stove where the temperature will stand from 70 to 90 degrees, and allow it to remain about a week, moistening the sand occasionally if neccessary and noting the progress of germination from time to time. At the end of this time the kernels of good vitality will have sprouted strongly and one can tell by looking at the different squares which ears are to be discarded for seed. For instance, if ear No. 10 shows a tendency to weak germination, or if one or more of the kernels failed to sprout at all, such an ear should be thrown out. It will be found in ordinary crib corn that a large per cent of the ears will have to be discarded entirely. The ordinary practice of planting such ears is responsible for most of our poor corn stands.

The time necessary to do this testing is very trifling compared to the money return which it will bring. By such a test, if one is depending upon the crib corn for seed, a most conservative estimate is that the stand may be increased 5 per cent which should mean two bushels more corn per acre, where the average yield is 40 bushels. The actual time necessary to test sufficient corn to plant 50 acres in this way is not over two days and a little figuring will show at once the income which such work will bring. The germinating box costs practically nothing and if one wishes, several may be run at once. Probably the most convenient size is one 2 feet square which will test about one bushel of corn. Another method of arranging this germinator is to use instead of the sand, layers of wet paper, or sometimes bran is used, but the sand is probably the most satisfactory.

It should be said that where very careful attention has been given to drying out and preserving the seed corn it should test

as high as 95 per cent of the kernels germinating strongly. In such a case it will probably not be necessary to test each individual ear that is planted, but rather to test say ten kernels from fifty representative ears. Some test, however, should always be made before planting, to be sure that the corn is of strong vitality.

IMPORTANCE OF THE PROPER CARE OF SEED CORN.

The low vitality of much of our seed corn is due to the fact that it is improperly cared for during the fall and winter months. If the corn is not thoroughly dry by the time hard freezing weather comes, its vitality is sure to be injured. It makes little difference how low the temperature may fall if the corn is perfectly dry, but any hard freezing when the corn is damp will weaken its vitality and even prevent the germination of many kernels entirely. It is usually thought that if corn comes up, the vitality has not been injured, but experiments have shown that corn stored in the crib will not only produce less vigorous stalks than those from corn that has been properly cared for but will fail to make as much corn per acre under exactly similar circumstances, the difference running from 4 to 16 bushels per acre, depending on the season. These figures should convince any one that the proper care of seed corn offers one of the simplest and most important means of increasing corn yields. If we allow an increase of 5 bushels per acre (it will usually be much more than this) on a crop of 50 acres, the extra yield would amount to 250 bushels which at 35 cents is worth $87.50. The extra time necessary to properly care for the seed would not be over a day and the expense of putting up drying racks is very trifling, as they may be made of any sort of lumber.

Methods of Preserving Strong Vitality.

The best method of preserving corn is to spread it out in shallow layers or in small piles in some well ventilated room until dry, then transfer it before freezing weather to a dry room

where a moderate temperature is maintained throughout the winter. If such a room is not available, build a series of rough board shelves or open racks in any well-ventilated room where the corn will dry out rapidly and remain dry. Another method is to hang the corn on binder twine or wire in a dry room. (A good seed corn rack is made of 2 by 4 uprights upon which are nailed 1 by 2 inch strips to hold the corn.)

Corn should never be piled in large piles or placed in tight barrels or boxes until perfectly dry, neither should it be placed when moist in a warm room, as in either case the vitality is liable to be injured by a tendency to heat or sprout. Again corn which is thoroughly dry, if subjected to a moist atmosphere, may absorb water in sufficient amounts to be injured by a hard freeze. It is never desirable, therefore, to store corn over a stable because of the moist air arising from the stalls. Any method by which the corn *is dried quickly and kept dry will maintain its vitality.*

CHARACTERS OF GOOD SEED EARS.

There are certain characteristics in ears of corn which indicate high yields per acre and which the corn grower should observe in selection. Some of these are based on the observations of both practical and scientific men, others are more or less theoretical. We must maintain certain ideals if we are to improve our corn as we have improved our live stock. It will be understood that the purpose for which corn is grown will influence largely the ears to be selected but the characters mentioned here are those which deal simply with yield of shelled corn per acre.

Shape of Ear.

The best shape for an ear of corn is as nearly cylindrical as possible. This is desirable for two important reasons. In the first place, a tapering ear usually means a less amount of shelled corn to the cob, than if the ear is cylindrical; it means either shallow grains near the tip or the dropping out of rows, neither of which is desirable. The second reason for selecting cylindrical ears is that such an ear bears kernels of nearer uniform shape and size than the tapering ear, thus giving a more

even distribution of the seed by the planter. It will be understood that ears perfectly cylindrical can rarely be found but those that are nearly cylindrical are the ones to select.

Proportions of the Ear.

The proper proportion of length to circumference in an ear of corn is about 4 to 3, or the circumference should be $\frac{3}{4}$ the length; that is, an ear 10 inches long should be $7\frac{1}{2}$ inches around at a point one-third the distance from butt to tip. It is rarely desirable therefore to select the longest ears that can be found, neither is it wise to select the shortest ones, when shelled corn per acre is wanted. It is a common opinion among farmers that the very long ears are best but the experience of corn breeders has not shown this to be true when a series of seasons is considered. Where the corn is to be fed on the stalk it may sometimes be advisable to select the shorter ears when two occur on a stalk, but this would not apply to the case where a high yield of marketable corn per acre is the object.

Space Between Kernels.

It is rarely desirable to select corn with wide spaces between the rows either at the tips of the kernels, or at the base next the cob. The space between the various kernels in the individual row should be small, so that the ear will be solid and compact. The flint varieties of the northern part of the United States show the wide-furrowed character, but for Missouri we should select the more compact ears, ears in which there is just as little lost space as possible. Reference to the photograph (Fig. 3) will show what is meant by wide and narrow furrows between rows. The ear on the right shows very wide furrows, the one in the middle a medium width and the one to the left very narrow space between the rows.

Butts and Tips.

The butts and tips should be well filled out with deep regular kernels. This is important because it gives more corn to the ear. The characters of the butt are more important in determining the ears to select than those of the tip since they are

capable of being transmitted with greater certainty. The tip of the ear is affected quite largely by season and soil conditions or it may be injured during pollination, thus preventing a proper filling out.

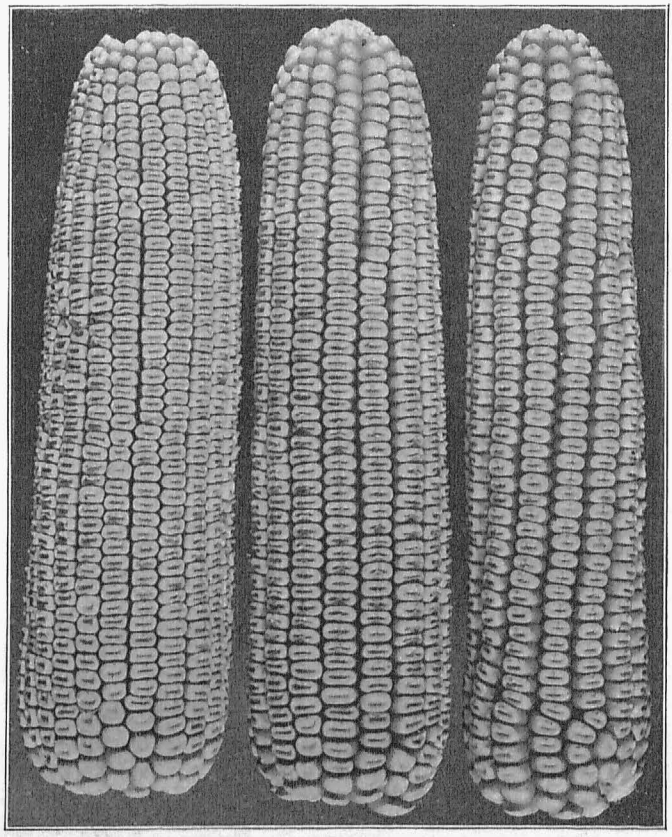

FIG. 3.—Ears showing a variation in space between rows.

The kernels at the butt should be uniformly and compactly arranged about a clean cup shaped depression, the diameter of the scar where the shank was attached being about three-fourths of an inch in diameter for medium sized varieties. If the butt is too small and contracted, many of the ears will blow off or

they will be knocked off in harvesting with a corn binder. Too large a butt, makes the shucking difficult and is an indication of poor breeding and careless selection. Well bred corn is usually shown by the character of the butts of the ears. In Fig. 4 the middle ear shows the best butt. The one on the right is large and coarse the one on the left too small.

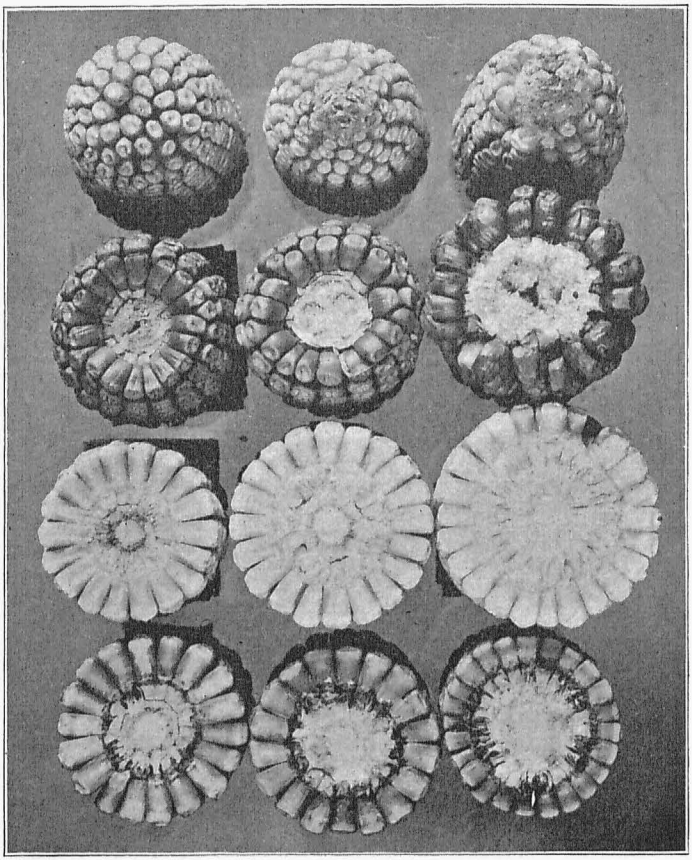

FIG. 4—The tip on the left in the top row is ideal, the one in the middle is good and the one on the right is poor. The butt on left is too small, the one in the middle very good, the one on the right poor. The cobs on the left are small, those in the middle are good, those on the right are too large.

The tips should be as nearly covered with deep, well-formed kernels as it is possible to get them and still maintain an ear of proper length. A well covered tip is a character usually observed on the shorter ears; consequently if one selects primarily for covered tips there is danger of shortening the ears beyond a profitable limit. It is better to have a good sized ear with a tip not completely covered, than a shorter ear with a covered tip. Of course if a well covered tip can be secured on an ear of the proper length that is ideal, but there are so few long ears which show this characteristic that it is usually impossible to secure enough of these for seed. It is, therefore better to select for deep, regular kernels well out to the end of the ear than for kernels over the end of the ear. For show corn, however, the more nearly covered the tip, providing the length is maintained, the higher the score. In Fig. 4 the tip on the left is ideal, the one in the middle is good, the one on the right rather poor.

Size of Cob.

The prevailing opinion among farmers is that the smaller the cob the better. In general this may be said to be true, although there is a limit beyond which it is not profitable to go in the matter of reducing the size of the cob. It has been well said that the cob bears much the same relation to the ear of corn as does the bone to the beef animal. The animal must not be coarse boned, neither must it be fined boned, a medium bone of clean quality being much preferred to either. Likewise in corn we should select for a medium sized cob rather than for a large or very small one. Large cobs usually mean shallow grains and a coarse appearance. They do not show high quality. A very small cob tends to narrow pointed chaffy grains which are very often loose on the cob and uniformly lacking in vitality. What is wanted is a goodly number of straight, well compacted rows and sufficient cob must be maintained to bear them. In Fig. 4 the middle ears show the best sizes of cobs, the ones on the left being too small, those on the right too large.

Shape of Kernels.

The proper shape of kernel is one a little over one and one-half times as long as wide, of a straight, wedge shape, but not pointed. It should be of good thickness and while not wide at the end next the cob, it should still be well shouldered out, giving room for a strong, plump germ. In the accompanying photograph (Fig. 5) the two rows of kernels at the top are poorly

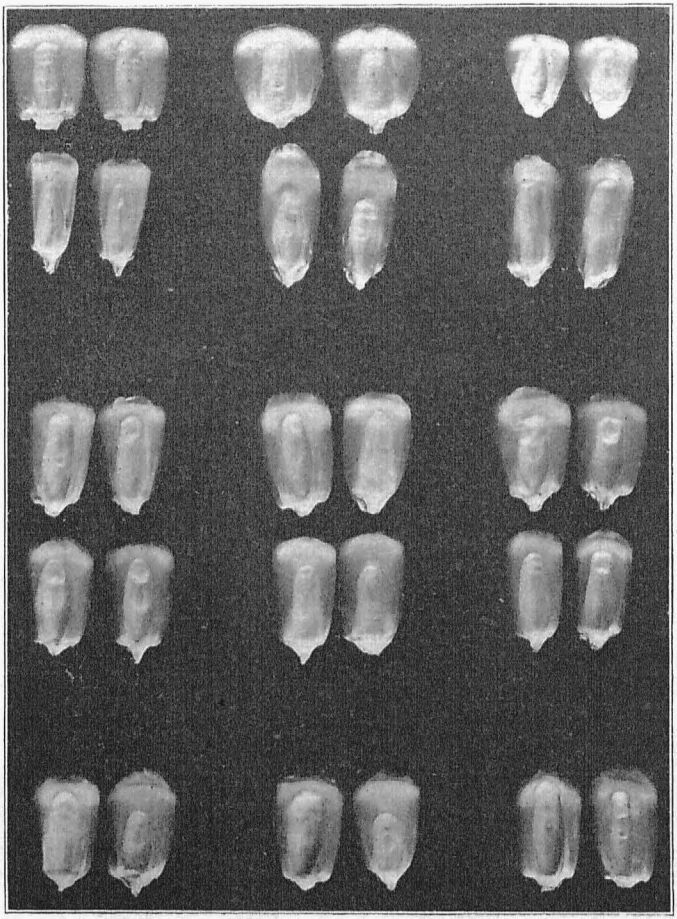

FIG. 5—The two upper rows show poor shapes of kernels, the two rows near the middle good shapes, and those in the lower row different sizes of germs.

shaped, those in the top row being too shallow and those in the second row too long and slim. The shallow ones will give a low per cent of corn to the cob while the long slim ones indicate weakness and low vitality. The two rows near the middle show the best shapes. They differ somewhat in appearance but represent very well the characters to be observed in selection. The kernels in the lower row show a difference in size of germ. Large germs are desirable in seed corn for two reasons; first, because such kernels usually have strong vitality and second because they have a higher feeding value. A large proportion of the oil in the kernel is found in the germ so that the larger the germ the higher the per cent of oil. By noticing a number of ears it will be found that while there is often quite a difference in the size of the germs in the kernels of the same ear, yet as a rule they tend to uniformity in size, some ears having large germs, some medium and some small. It is well, therefore, to select ears which show large strong germs, especially when the corn is being selected for a breeding plot.

IMPORTANCE OF USING PURE BRED CORN.

The importance of using seed corn that has been well bred (sometimes spoken of as "pure bred") is just the same as the use of well bred animals in breeding live stock. The laws governing the breeding of animals are the same as those governing the breeding of plants and the arguments in favor of using well bred animals for breeding purposes apply with equal force to the use of well bred corn for seed. The terms "well bred" or "pure bred" as applied to corn, mean much the same as they do in animals, that is, strains or varieties that have been kept pure and selected for a series of years for high production and high quality. The productive power of such corn as compared with that which has received little attention in the matter of selection is very marked, the well bred varities often yielding from 5 to 40 bushels more per acre under conditions exactly similar. There is probably no one thing connected with the growing of corn in Missouri at this time more productive of immediate results than the use of very carefully selected and well bred seed. It

is understood, of course that there may be conditions which will prevent any corn from yielding a profitable crop, such as poor soil, unfavorable season; improper tillage or lack of adaptability of the variety to the soil and climate, but if conditions are ordinarily favorable a much better yield may be expected from well bred and carefully selected seed.

Buy Seed Corn in the Ear.

It will undoubtedly be necesssary for two or three years at least for most farmers in the State to send to a greater or less distance in order to get corn that is well bred. In such case the corn should always be bought in the ear. The corn which seedsmen or breeders sell in the ear is usually the most select, and that is the kind to buy. Moreover a man should know exactly the character of the corn he plants. It will always be economy therefore unless one knows definitely the kind of ears shelled, to pay the extra price for ear corn. Another thing that farmers should be cautioned against is the buying of corn from men who are not perfectly reliable. It has become quite common during the last few years for seedsmen to use the term "pedigreed" in describing their seeds. This is especially true of corn and while there are some who use the word legitimately, others do not. It is always wise therefore to inquire into the standing of either corn breeders or seedsmen before buying corn from them.

Corn Must be Adapted to Soil and Climate.

The corn plant is greatly affected by differences in soil and climate, and varieties suited to one locality are often poorly adapted to another. For instance, varieties grown in northern Missouri are not at all adapted to the southern part of the State and vice versa; while varieties grown on the Mississippi River bottoms are usually not adapted to the uplands. Corn will of course become acclimated to a given soil and climate by a careful selection of the mature ears for two or three seasons, but this requires time so that it is always desirable to secure seed corn as near home as possible. Probably the most immediate demand of Mis-

souri corn growers to-day is for corn breeders who will give attention to the development of pure bred varieties adapted to the different corn growing sections of the State. The Station is receiving daily many inquiries regarding pure bred corn and there are so few men in the State who have given attention to this matter that it is often necessary to refer them to men in the neighboring states who have made reputations as corn breeders. This condition should not be allowed to continue. Missouri is noted for her breeders of pure bred cattle and she should have just as noted breeders of pure bred corn.

CORN BREEDING.

The matter of corn breeding should appeal to our farmers just as does the matter of animal breeding. There are various methods of improvement which are entirely practical on the average farm. It must be remembered, that in corn as in animals, like tends to produce like; and if an ear of a certain character be planted it tends to produce ears of the same character, and stalks like that on which it grew, providing the season and conditions are favorable. Since corn is a cross fertilized plant, however, the kernels on any given ear are usually fertilized with pollen from some other stalk or stalks, and we cannot always be sure of the characters of the ears which such kernels will produce. Hence if we plant only good ears together year after year so that good will cross with good we tend continually to increase the number of good ears, thus improving the quality and yield of the corn. The importance of growing seed corn in a plot by itself or at least in a separate part of the field is thus suggested, for by this means we may to a large degree control both parents.

There is another important matter that should be observed in this connection. Different ears of corn seemingly of like quality vary in their powers of reproducing themselves and especially in their tendency to produce corn. This is best shown by taking a number of ears and planting each in a row by itself where the character of stalks and corn may be observed. It is found that there is a great difference both in the stalks pro-

duced and in the yield of corn, some rows often producing twice as much corn as others. In the breeding plot at the Experiment Station last year it was found that while the poorest row yielded at the rate of 38 bushels per acre, the best one yielded at the rate of 85 bushels per acre under exactly similar conditions of soil and treatment. It will be readily seen that if we always select seed from the highest yielding rows, providing the corn and stalks are of good quality, it will be possible to develop a tendency to high production and good quality just as animal breeders have increased the value of their herds by selecting animals from their performance records. Again since each row is shown to possess in general, a particular type of stalk the fact is brought out that an ear of corn tends to reproduce the stalk from which it came. This emphasizes the importance of always selecting seed corn on the stalk in order that only ears from desirable stalks may be used.

Methods of Improvement.

It will be well in any system of corn improvement or corn breeding to begin with a good variety, preferably one that is well bred. It may be that a particular variety which has been grown in the community has given good results and has been kept fairly pure, or it may be necessary to buy improved seed from some man living at a greater or less distance; but whatever the source the seed should be good. There is nothing to be gained in beginning with very poor corn, as several years may be saved by beginning with a strain that has received some care in the matter of selection, providing it is fairly well adapted to the community. If there are any marked peculiarities of soil or climate, however, such as hardpan or drouth, the best yielding variety of the community should be used.

First Method. The simplest method of corn breeding is to set aside each year a plot of ground of 2 or 3 acres on which to grow seed corn for the next year. The idea in this is to allow only good individuals to cross with good individuals, consequently only the very choicest ears should be used for this purpose. The plot should be located preferably in a spot removed from the other corn or it may be located in one corner

or along one side of the main field. Corn pollen will often blow a long distance so that the plot should be located as far from corn of another variety as possible. It should never be nearer than 40 rods. If the plot is placed in a part of the field with the same variety the east side should be selected, as prevailing winds are generally from the west or southwest, and there will be less danger of outside crossing. The only disadvantage in crossing with corn of the same variety is that pollen from an undesirable stalk in the general field may blow into the plot and fertilize some of the silks of the seed ears. It should be remembered, however, that most of the silks of an ear on a given stalk are fertilized by pollen of stalks near by, so that there is not a great deal to be feared from this source. The soil on which this seed plot should be located should be the average of that used for corn on the farm.

Select 30 ears that are nearest ideal in character and which represent perfectly the type which it is proposed to breed. It is never advisable to select less than 25 ears as there is danger of inbreeding if the number is few. It is best to test the vitality of each ear used in the plot before planting, in order that only those of strong germinating qualities may be used. Remove butts and tips and shell the ears together. From this mixture take enough to plant a plot of the desired size. The corn may be planted in the same manner as the rest of the field, but it should receive good cultivation and care. When coming into tassel it may be well to go through every day for a week and cut out with a knife all barren stalks in order that their pollen may not fertilize the ears on other stalks. This is not absolutely necessary but it is desirable. It has been found that barren stalks vary in number with the season rather than with the variety, and it is nature's tendency to breed them out, since they produce no ears. Nevertheless better results would undoubtedly be secured if they were removed.

Allow the corn to become thoroughly ripe on the stalk and then go through and select from desirable stalks sufficient perfect ears for planting the next season's crop. See that the ears are thoroughly dried before frost, following directions already given for preserving seed corn.

Each succeeding year's planting will be exactly similar to the first, always keeping the corn pure and tending by this careful selection and the crossing of good with good, to build up a variety of high yield and high quality. Some such method as this should be practiced by every corn grower.

Second Method. This method has already been referred to, and is what is known as the "Row System of Breeding." The idea is to select ears from their performance records, thus bringing about a much more rapid improvement than is possible under the method described above.

Select, say 100 of the choicest ears of a variety it is proposed to breed, taking care to have them as nearly uniform in character as possible. Test the germinating qualities of each ear in a germinator as previously described, using 10 kernels or more from each ear. Preserve 50 to 90 of those that germinated well for planting the breeding plot, shelling the butts and tips from each. Select a plot of ground representing average soil conditions on the farm or in the community and as uniform in character as can be found. The width should be sufficient to accommodate the number of rows desired, and the length should be from 100 to 200 hills, the longer the better if the soil is uniform. This plot, as in the first case, should be located preferably in an isolated place, but it may be located in the east part of the field of the same variety. Where the plot is isolated it will be necessary to plant a border of say four rows around it from the corn left of the various ears in order to prevent outside pollination and to make the conditions exactly comparable between the rows. In planting, if the rows are long it will probably be desirable to use a planter, cleaning the boxes each time through. It will usually be more accurate, however, to plant the corn by hand, covering it with a hoe; and this may be done where the rows are short, marking the plot out both ways with a marker. It is best to plant four kernels in each hill, and when the corn is six or eight inches high, go through and thin to an average of two or three stalks in a hill, whichever number is preferred.

Give the corn good cultivation and care during the season. Note the time of ripening and any marked peculiarity of each row, such as height of stalks or of ears on the stalk, leafiness, barren stalks, etc. It is often possible by observing the character of the stalks to mark some rows for discard before the corn is ripe. When well ripened go through the plot selecting say 25 of the very best ears from each row, placing them in a bag and numbering the bag according to the number of the row. Remove at once to the crib or drying room, weigh and place in separate piles on a seed rack or on boards, being careful to keep the number of the row with each pile. Now harvest the rest of the corn, keeping that from each row separate and weighing it. Add these weights to the weights of the 25 ears previously gathered and get the total weight of each row. Discard for breeding purposes the produce of all rows excepting the 20 yielding highest which also show good quality. From each of the 25 ear selections of the 20 good rows select the 10 best ears and when dry, place in cloth bags, properly numbered and hang away in a safe dry place. In making the selections for the next year's breeding plot three to six ears should be selected from each of the 20 bags in order to lessen the danger of inbreeding, which would be possible where all the selections were made from a few of the very best rows.

The remainder of the corn from these 20 good rows should be carefully preserved and used the next year for planting a large area, probably the whole crop. Such corn will be the product of high yielding rows and should give good results in the field. It will be seen that at the end of the second or third year, if a well bred variety of corn has been used to begin with one will be able to put on the market a considerable quantity of seed corn of good quality.

The breeding of corn by the row method has not been followed long enough to have secured very definite results regarding the effects of inbreeding, but indications seem to show that there is some danger from this source. It will be noted that where a row is planted from the kernels of a single ear there

is a possibility of increasing the amount of "close breeding," that is, the crossing of two individuals which grew from kernels on the same ear. The surest method then for preventing any deterioration from such close fertilization will be to plant say 90 rows and detassel every other one, always selecting the corn for the next year from the detasseled rows. This of course, limits the number of rows from which selections may be made to 45.

The Experiment Station will endeavor to co-operate with anyone interested in this method of corn breeding, if it is so desired.

A Co-operative Plan.

It is not expected that every farmer will practice the second method of breeding outlined above, although no man who grows corn can fail to practice one of these methods. Since the second plan is more productive of immediate results, however, it will often be found desirable for farmers in a community to co-operate in this matter, selecting some one of their number who is capable and whose soil is an average of the community and arranging with him to grow one or more varieties of corn in this way to supply seed for the neighborhood. Farmers can well afford to pay this man well for selected seed which has thus been bred up for high yields and which is well adapted to the community. After each farmer has thus been supplied with a good variety of corn he may keep it pure by the first method if he chooses, or he may buy the improved seed each year. It will be found that such a plan will result in much benefit to all concerned.

Methods of Increasing the Productiveness of Soils.

Although this circular deals largely with the seed, a paragraph as to the means of soil improvement may be inserted. It is well known that the yield of any variety of corn is largely determined by the fertility of the soil. It has been found that continual cropping of corn on any soil, unless it be occasionally

overflowed, tends to decrease its productiveness and sooner or later the yield will be reduced beyond a profitable basis. Where a systematic rotation of corn with other crops is followed this decrease is not nearly so marked. Again if all available barn yard manure be returned to the soil in connection with a rotation which includes some luguminous plant like clover, vetch or cow pea, the fertility of the soil may be maintained almost indefinitely. It may be said also, that even on bottom lands subject to overflow, a benefit will usually be derived by rotating the corn crop with wheat or oats and sowing cow peas in the corn at the last cultivation or after the wheat. The proper method of using commercial fertilizers is usually in connection with a definite system of rotation of crops and the return of as much farm manure to the land as possible.

Tillage.

The third essential to good corn yields is proper cultivation. The land should be plowed at such depth as will allow the overturned layer of soil to be thoroughly pulverized to the bottom. It is usually found desirable to harrow corn land two or three times before the corn is large enough to plow. On most soils, particularly uplands, shallow cultivation (from 3 to 3 1-2 inches deep) especially during the latter part of the season, is best. Deeper cultivation breaks the roots and injures the corn. For this purpose a cultivator with 3 or 4 small shovels on each gang is better than one with large shovels. There may be exceptions to this matter of shallow cultivation but they are mainly on lands that are so foul with weeds that they cannot be kept in condition by such tillage, or on soils which are badly in need of aeration.

CORN EXHIBITS AND METHODS OF CORN JUDGING.

In view of the fact that much interest has been shown in corn exhibitions throughout the State, and since by such means do we come to understand better the qualities which go to make up good corn, it is thought advisable to add a few notes concerning this matter.

In selecting corn for show purposes either 10 or 20 ears constitute an entry. All State corn growers associations have fixed 10 ears as the proper number. The first essential in selecting corn for an exhibit is that the ears be as nearly uniform in every way as possible. Reference to the photograph (Fig. 6) will show the difference between a properly selected sample and an improperly selected sample in this respect.

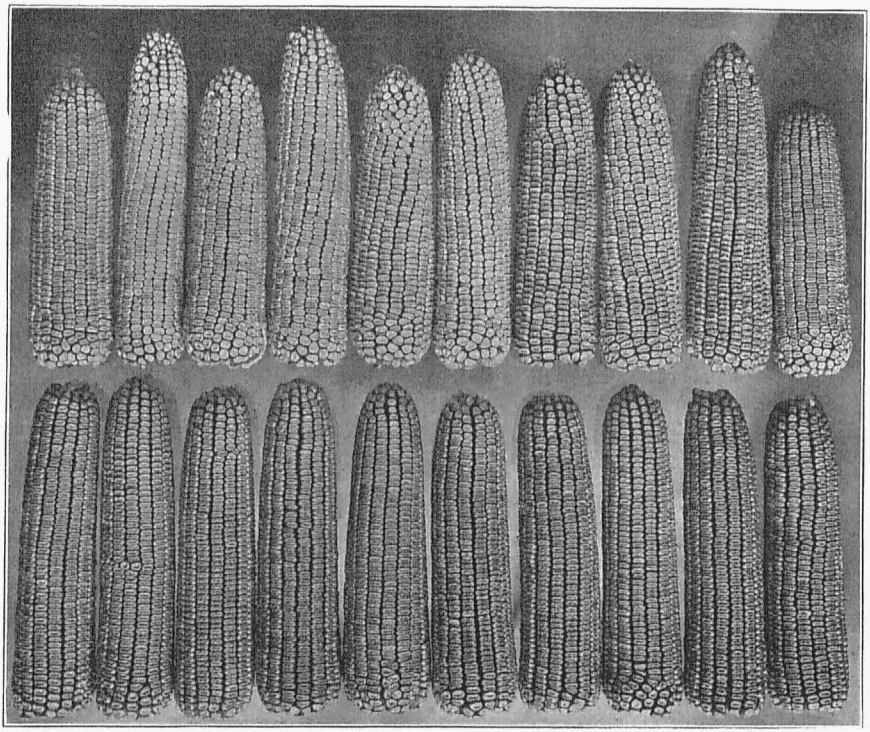

FIG. 6.—The lower row shows a very uniform sample of show corn, the upper row a sample lacking in uniformity. The ears must be uniform if they represent a type.

In order to become familiar with the good points of corn and to aid in the selection of corn samples for show purposes a score card is usually followed by which the sample may be judged. It must be understood that the score card is simply

a means of maintaining an ideal. No score card can be made to fit perfectly all varieties of corn because different varieties have different characteristics.

However, where no varities have been recognized as standard, as in Missouri, it is necessary to adopt a general score card which will have sufficient range to fit all varieties which may be presented at a corn exhibition. At the last meeting of the Missouri Corn Growers Association a committee was appointed to prepare a score card for the organization. Acting in accordance with instructions the committee presented the score card here given, which is recommended for use in selecting corn for exhibition and for judging the different samples at both the local corn shows and at the State Corn Show this year.

Score Card of the Missouri Corn Growers Association.

Uniformity of Exhibit	10
Maturity and Market Condition	15
Shape of Ear	10
Color.	
(a) Kernel	5
(b) Cob	5
Butts	10
Tips	5
Shape of Kernel	10
Proportion of Circumference to Length	10
Space between Kernels	5
Proportion of Corn to Ear	15
Total	100

DIRECTIONS FOR JUDGING.

(Note.—In the use of any score card if an ear is only slightly deficient it may be cut a fraction of the total cut allowed as $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ as the case requires.)

Uniformity of Exhibit. The ears of an exhibit should be similar in size, shape, color and indentation. For each ear defective in these respects the exhibit should be cut not to exceed one point.

Maturity and Market Conditions. Ears should be firm and the kernels free from mould or injury. The firmness of the ear is best determined by twisting in the hand or by moving kernels with the thumb. Cut not to exceed 1½ points for each ear that is defective.

Shape of Ear. The shape of ear should be as nearly cylindrical as possible, as such ears usually bear more corn and a less number of grains which are not uniform in size or shape. Cut the exhibit not to exceed one point for each tapering ear.

Color. (a) Kernels. Kernels should be uniform in color, that is, they should be of the same shade and there should be no white caps in yellow samples or yellowish caps in white samples. Cut 1-10 point for each kernel that is off color. If five or more kernels show this character the ear will of course, be cut the full limit, ½ point. (b) Cob. The cobs should all be of one color. For most varieties red cobs in yellow samples and white cobs in white samples are required. Cut one point for each cob that is off color up to three which will disqualify the exhibit. A variation in the color of the cob is an indication of very poor selection and careless breeding.

Butts. The butts should be well rounded out with deep regular kernels, solidly compacted together around a clean cup-shaped cavity. Attachment of the ear with the stalk should be about ¾ of an inch in diameter for medium sized varieties. Cut not to exceed one point for each cob showing marked defects in these respects.

Tips. There should be deep kernels well out to the end of the ear in as regular rows as possible. The ideal tip is completely covered but as this is largely a seasonal characteristic too much stress must not be laid on this point. Cut not to exceed one half point for tips seriously defective.

Shape of Kernel. The kernels should be uniform in size and shape. They should be slightly wedge shaped with straight edges so as to fit tightly together but should not be pointed. The length should be a little over once and a half as long as the width. They should carry a uniform thickness from end to end and should possess germs of good size. Remove three ker-

nels from near the middle of each ear for comparison. Cut the exhibit not to exceed one point for each ear showing kernels of poor shape.

Proportion of Circumference to Length. The proportion of circumference to length should be as three to four or the circumference should be ¾ the length. An ear 10 inches long should be 7½ inches around one-third the distance from butt to tip. Cut not to exceed one point for each ear markedly defective in this proportion.

Space between Kernels. Furrows between the rows should be narrow and the kernels should fit tightly together in the row. Cut not to exceed one-half point for each ear that is seriously defective.

Proportion of Corn to Ear: The proportion of corn to ear should not be less than 85 per cent. The per cent is best determined by shelling every other ear of the exhibit and weighing. It may be done with a fair degree of accuracy by shelling two representative ears. Cut 1½ points for each per cent below this limit. (It is suggested that at local corn shows it might be possible to enter 12 or 15 ears, allowing the extra ones to be weighed and shelled for making this determination. This will allow the ten remaining ears to be again exhibited at the State corn show.)

Local Corn Shows.

Local corn shows have been held in a great number of localities throughout the State during the last two years and have proved of great benefit in improving the corn of such communities. It will often be found possible also to arrange with the State Board of Agriculture for an Institute to be held in connection with the corn meeting at which some one capable of judging corn and of giving a scientific corn talk may be present. The formation of local organizations is also advisable, as by this means much better results can be obtained. The Experiment Station, the Missouri Corn Growers Association and the State Board of Agriculture are usually willing to co-operate with such organizations in any way possible.