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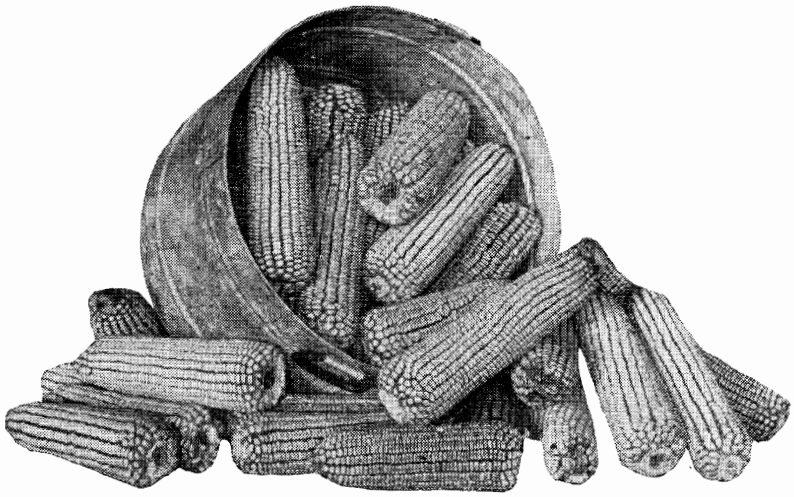
CORN CULTURE

AGRONOMY



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INDIAN CORN CULTURE

L. A. Moorhouse
W. L. Burlison
J. A. Ratcliff

Indian corn is one of the most valuable crops grown in the United States. The annual production for this country is more than 2,500,000,000 bushels with a value of almost $1,000,000,000.

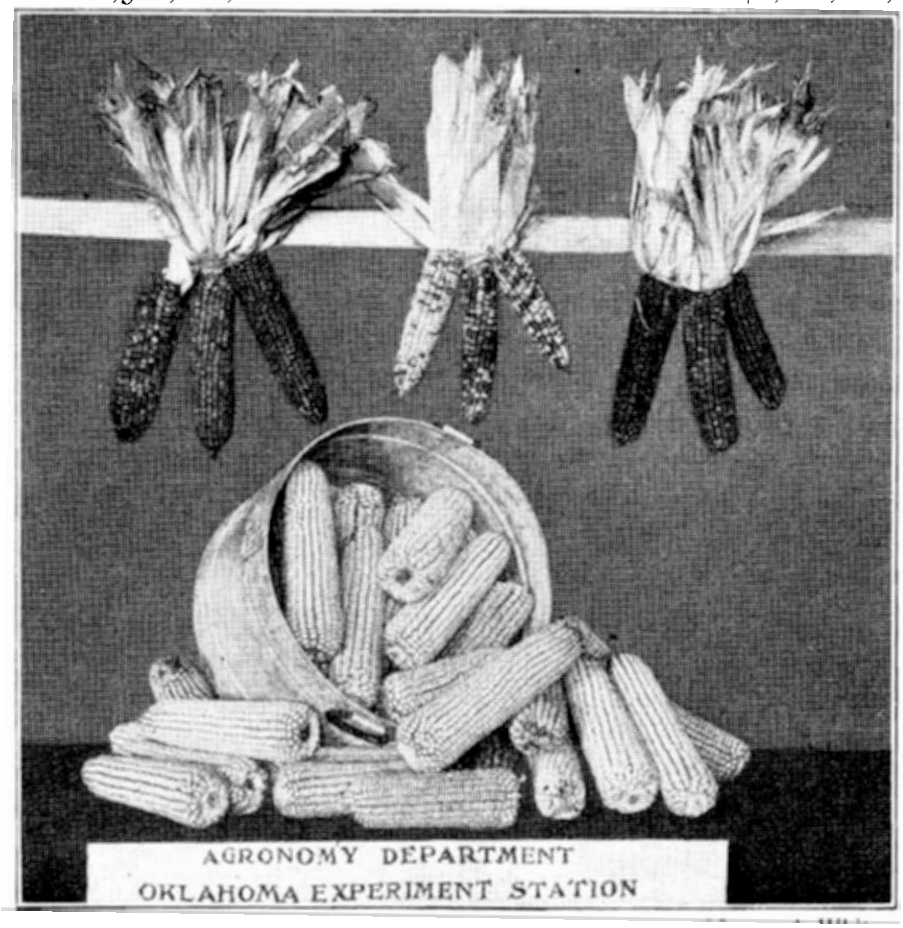

Fig. 1. Hildreth's Yellow Dent; Squaw Corn; Phelps' Yellow; Mammoth White.

The output from the American farm constitutes about 80 per cent. of the world's total crop; hence it would be safe to make the statement that the American farmer has a monopoly on this

crop. A few years ago Indian corn was used almost exclusively as a stock food; now over one hundred different commercial products and a large number of food stuffs are obtained from the grain. New methods will be devised for the utilization of Indian corn; new products will find a ready sale on the markets of the world; thus the grower may continue to increase his yields with the assurance that the demand will always be equal to the supply. It is true that cotton is cultivated in the Southwest as one of our money crops, and although corn is the main source of food for man and beast, at the same time it is also considered as a cash crop. A number of the states in the Middle West are more or less dependent upon the cultivation of this valuable cereal. Some have thought that practically all of the land which is available for the growth of Indian corn has been placed under tillage and it has therefore been suggested that additional supplies of grain must come through better culture and scientific breeding. We believe that this king of grains can be grown in new and untried areas; we are also firmly convinced that our present returns can be greatly improved by adopting Twentieth Century methods, and by keeping these methods up-to-date.

OKLAHOMA'S CORN CROP.—There is no cereal which has come into popular favor more rapidly in the new state than Indian corn. Commencing with a small acreage in 1900 this crop has continued to encroach upon the acreage of winter wheat until it is now recognized as our leading grain crop. The total acreage for the year 1907, as given by the Bureau of Statistics in the National Department of Agriculture, was 4,650,000 and the total production for the same year is listed as 113,265,000 bushels having a value of $49,837,000. The average yield for the year in question is reported as 24.4 bushels per acre. The estimates submitted by the State Board of Agriculture show an average of 22.4 bushels per acre with a production of 95,230,000 bushels for the crop season 1907. The State of Kansas reported 7,,020,-000 acres under cultivation in 1907 with a production of 155,-142,000 bushels of corn which was valued at $68,262,000. In making a comparison of the acreage and yield reported for these two states it will be observed that the Oklahoma acreage has increased very rapidly, and if similar gains are made within the coming decade, this new commonwealth will soon be known as

one of the great corn states. A partial history of maize production in Oklahoma may be traced in the following table:

TABLE I.

Acreage, Value, and Average Yield of Indian Corn in Oklahoma.

Year	Territory	Acreage	Value	Av'ge yield per acre
1900	Oklahoma	544,002	3,677,454	26.0
1901	Oklahoma	1,414,262	7,846,326	7.3
	Ind. Ter.	1,490,267	13,591,235	12.0
1902	Oklahoma	1,569,831	15,795,640	25.8
	Ind. Ter.	1,549,878	16,594,544	24.9
1903	Oklahoma	1,491,339	13,204,316	23.3
	Ind. Ter.	1,518,880	16,408,461	27.7
1904	Oklahoma	1,729,953	18,958,555	28.1
	Ind. Ter.	1,685,957	21,850,003	32.4
1905	Oklahoma	1,902,948	15,406,267	25.3
	Ind. Ter.	1,905,131	23,050,180	32.7
1906	Oklahoma	1,998,095	19,721,198	32.9
	Ind. Ter.	2,038,490	21,917,844	33.6
1907	Oklahoma	4,650,000	49,837,000	24.4
1908	Kansas	7,020,000	68,262,000	22.1

In reviewing these figures it will be seen that within seven years our Indian corn acreage has increased from approximately a million and a half to more than four and one-half, or almost five million acres. Under the territorial government the two sections, formerly known as Oklahoma and Indian Territory, reported practically the same acreage for maize; slight fluctuations occurred in the seasons which are represented, but these variations were exceedingly small in every case. The season 1901 was apparently not an ideal year for the corn crop; consequently the average yield per acre did not run beyond 7.3 bushels for the west side, and 12.0 bushels for the east side. High temperatures and dry weather caused these reductions.

Larger Yields Possible.—Although there has been a large increase in the area which has been set aside for Indian corn culture within the past five years, the average yield per acre remains practically the same. Moreover, a study of these averages reveals the fact that many corn growers are not getting as much as they should for the labor expended in cultivating, harvesting, and marketing this crop. Several reasons may be given as an explanation for these low averages. In the first place, this is a new

country, and extensive rather than intensive systems of farm practice have prevailed; hence the soil has received, in many cases at least, inadequate cultivation and our crop yields have dropped far below a profitable average. In the second place, many fail to appreciate the importance of maintaining the fertility of the soil; consequently a continuous system of cropping in which no provision is made for the return of a portion of the elements removed by the plant reduces the productive capacity of the soil type and a gradual decrease in the yield of grain becomes apparent within a very brief period. While the average yield for the entire state does not exceed twenty-five or possibly twenty-seven bushels per acre, it is a well known fact that several enterprising growers have made yields as high as 80 and 100 bushels per acre. Others have produced more than 50 bushels per acre during the same period. We must conclude therefore that the yield on many farms comes far short of the general average indicated in state and national reports. If the larger returns are possible on land of average fertility, it is obvious that some advancement can be made by each grower. More attention and study should be given to the cultural methods which have been adopted and are followed by our most successful farmers; the question of seed selection ought to be considered as an important feature in the improvement of the variety under study; and the fertility of the soil should be maintained or increased. Any system which fails to recognize these features of production is not suitable for comparison with the most approved plans of crop management.

Cost of Production.—It will not be out of place at this point in our discussion to remark that there is no part of the corn grower's business which is neglected to a greater extent than his system of keeping accounts. If a man contemplates building a house, he not only secures accurate estimates on the market value of materials and the cost of construction, but he also examines his bank account and determines whether he will be able to meet all the obligations which are associated with such an enterprise. The merchant does not conduct his business without ascertaining the cost of paying his clerks, or without securing an adequate statement of every other item of expense connected with the yearly transactions. Such a plan is essential to success. As corn growers we have assumed that it is not necessary to keep an ac-

count with our fields, and yet we expect to reap a profit at the end of the growing season. Many continue to grow corn or cotton from year to year, and they have no knowledge of the approximate cost of growing the crop. The profits of the business cannot be determined until we have calculated the cost. While it is true that different values will appear in reports which are compiled in separate sections, at the same time these slight discrepancies will not interfere with the general results of the study. What profits are we securing in the cultivation of our crops? The following table will suggest one method of getting at these values:

TABLE II.

Cost of Producing One Acre of Indian Corn.

	Items.	Dr.	Cr.
To	50 bushels of corn at 40c	$20.00	.....
To	Stalks allowed to remain in field	.....	.....
By	Plowing at $1.00 per acre	.....	$1.00
By	Harrowing at 15c per acre (twice)	.....	.30
By	Discing at 25c per acre (twice)	.....	.50
By	Planting at 17c per acre	.....	.17
By	Seed at 50c per acre ($2.50 for seed)	.....	.50
By	Cultivating at 25c per acre (three times)	.....	.75
By	Hoeing once at 20c per acre	.....	.20
By	Husking at $1.25 per acre	.....	1.25
By	Marketing at $1.25 per acre	.....	1.25
By	Plant food at 71c	.....	.71
By	Rent at $3.00	.....	3.00
By	Interest on investment (equipment)	.....	.50
By	Profit at 19.5c per bushel	.....	9.77
	Total	$20.00	$20.00

Fifty bushels per acre were taken as the average yield in estimating the net profit per acre on good corn land in Oklahoma. It may be stated that this average is much higher than the yields obtained on the farms of the Southwest taken as a whole; but we believe that if the treatment prescribed in the above outline were applied to average soil types, fifty bushels per acre would not be beyond the range of possibility. Our table shows that the estimated cost of producing such a crop of Indian corn with the market price at forty cents per bushel would be twenty and one-half cents per bushel, thus the grower would have a net profit of nineteen and one-half cents per bushel under such conditions. If the cost of raising an acre of corn approaches the amount which is given in the above table, and the estimate does

not vary more than two or three dollars per acre for different farms, it is certain that the margin of profit must drop almost to the zero point when twenty or twenty-two bushels per acre are harvested as the annual crop.

PRECIPITATION OR RAINFALL.—The climatic conditions which prevail in the Southwest are not ideal in every respect for Indian corn. This plant requires liberal supplies of moisture throughout the growing period and in seasons when deficiencies are met the crop yield is influenced to a perceptible degree. The precipitation in Oklahoma is not as well distributed as the rainfall in the great corn belt. In central Oklahoma the annual average precipitation for the five-year period commencing 1896 and ending 1900 was 33.9 inches and our reports show an average rainfall of 32.38 inches for a second five-year period extending from 1901 to 1905 inclusive or giving an average for a ten-year period of 33.03 inches per annum. The average monthly precipitation for the years 1896 to 1900 reached a maximum point during the month of May while the lowest rainfall occurred in January. In the second period, which includes the years 1901 to 1905, the month of May also gave the maximum precipitation and the lowest point was reached during the same month as in the preceding five-year period. The general distribution within the second period was practically the same as in the first. During the past three years the total rainfall has increased slightly and the distribution has been changed somewhat. The month of May still retains the maximum with heavy precipitations reported for June, August, and October. While the average rainfall for the three-year period 1906 to 1908 inclusive stands at 46.38 inches which is 13.35 inches above the ten-year average, we must not reach the conclusion that our annual rainfall is increasing. If complete records were available for twenty or thirty years, one could undoubtedly single out a group of two or three years in which the tendency appears to be toward a greater in place of a lower precipitation. Our reports for a number of consecutive seasons must stand considerably above the average before any such assertions can be made.

TABLE III.

Precipitation at Oklahoma Experiment Station, Stillwater, Okla.

Month	Average 5 years 1896-1900	Average 5 years 1901-1905	Average 3 years 1906-1908	Average 13 years 1896-1908
January	1.11	0.76	1.57	1.26
February	1.19	0.84	1.79	1.41
March	1.80	3.44	2.39	2.51
April	3.46	1.96	5.98	4.35
May	5.72	7.39	6.66	6.61
June	4.61	2.80	6.22	4.97
July	4.41	3.23	3.25	3.54
August	2.59	4.43	3.89	3.70
September	3.21	2.56	5.18	4.04
October	3.21	1.91	5.52	4.04
November	1.12	2.21	2.87	2.27
December	1.24	1.23	1.08	1.06
Total	33.68	32.38	46.38	36.11

The salient features which are brought to our attention in a perusal of these tables may be placed in concrete form in two or three simple statements. A low rainfall during the winter months precludes the possibility of permitting the corn fields to lie in a hard, compact condition throughout this period with the expectation that we can thereby appropriate and store liberal supplies of moisture for early spring use. In the second place, rolling or even gently undulating fields should be well stocked with vegetable mould in order to minimize the soil erosion which is a probable occurrence in May when the monthly rainfall comes to the highest point; the condition mentioned can be attained through the rational use of farmyard manure in sections where such material is available and through the use of green manure as cowpeas or soy beans. The fields should also receive suitable tillage after these heavy rains. One object to be gained may be found in the conservation of soil moisture; a second object is directly related to the proper aeration of the soil.

TEMPERATURE.—The corn grower can also examine our temperature records with profit. The heavy precipitation which usually comes with the month of May undoubtedly has a tendency to prevent a high range early in the season. When the rainfall is light during that portion of the season when the corn makes its early growth a higher range is evident and the subsequent summer temperatures invariably reach a maximum point

under such conditions. The dry weather which follows and the hot winds which frequently blow across this southwestern country constitute one of the drawbacks which the corn grower must meet. It may be possible to overcome these conditions by selecting early maturing varieties; in using such types, however, a high yield may be sacrificed. It is certain that a few of our early maturing types will make good under adverse conditions while the later maturing varieties are damaged to such an extent that they fail to give the grower profitable returns. The Oklahoma Station has undertaken a study of this phase of corn production. It will require at least five and perhaps as many as ten years to reach definite conclusions with reference to the two or three points which are under consideration.

When Indian corn is planted as early as the 20th or 28th of March, the crop comes into tassel during the latter part of June or early in July, and it is ready for the harvester about the middle of August. In reviewing our records we observe that high average temperatures are not reached until July; consequently if the corn is well advanced at this time, very little damage is likely to result. Early planting would seem to be advisable on farms where standard varieties of Dent corn are grown. Within the period included in our report frost occurred seventeen times in April and twice in May; but the damage was not great with the exception of one of two cases. It is a better plan to plant early and risk slight damage by frost rather than plant late and incur severe losses through high temperatures or dry weather.

Adaptability of Corn and Kafir Corn.—In making a comparison of the yields of Indian corn and Kafir corn which have been secured at this Station during the past four years we have found it necessary to study not only the character of the soil and the season, but some attention must also be given to the adaptation of these crops to Oklahoma conditions. Indian corn is indigenous to America and we have already noted that it appears to thrive best in those sections of the country where the July temperature ranges from 70 to 80 degrees Fah. Rainfall affects the yield to quite a marked extent, and in semi-arid districts high yields are not certain unless irrigation is practiced. Kafir corn is a native of South Africa. Prior to its introduction into America this plant was cultivated in sections of the country where unto-

ward conditions were met; hence the plant acquired certain qualities which enable it to overcome such conditions as periods of prolonged drouth or excessively hot weather. These qualities, which are highly important, have become more intensified as the plant has been cultivated continuously in those districts where high temperatures and low rainfall are common. Average upland types of soil in Oklahoma will produce good yields of Indian corn when the season is favorable, but the yields are exceedingly low when high temperatures and dry weather prevail. Kafir corn, on the other hand, will usually make fair yields under adverse conditions. The following table contains a report of yields with these two crops as grown on the Oklahoma Experiment Station farm on unmanured, medium upland soil:

TABLE IV.

Kafir Corn per Acre.

Year.	Lbs. of Stover.	Lbs. of Grain.
1900	4,600	1,744
1901	4,230	1,506
1902	4,500	1,154
1903	4,360	1,620
Average for four years	4,422	1,506

Indian Corn per Acre.

Year.	Lbs. of Stover.	Lbs. of Grain.
1900	3,260	1,063
1901	1,380	5
1902	1,424	1,440
1903	1,740	979
Average for four years	1,951	622

Press Bulletin No. 106 entitled "Comparative Yields of Kafir Corn and Indian Corn" contains the following comment on these results: "In reviewing these figures it will be seen that Indian corn was a complete failure during the season of 1901 from the standpoint of grain production while Kafir corn gave very fair returns. Again taking the yields which are given for Indian corn for four consecutive years wide variations are apparent both in yield of grain and in yield of stover. With Kafir corn, however, the results are quite uniform throughout the entire period. The average yield of Kafir corn for the four years was 884 pounds per acre in advance of the average yield made by the Indian corn. The difference in the average amount of stover produced by these two crops was 2,471 pounds in favor of Kafir corn. This study

brings two important facts to our attention. First, Kafir corn has given fair yields under unfavorable conditions, and for upland types of soil may be depended upon to give better results than Indian corn. Second, the hot dry weather which occurs about the time that Indian corn is tasseling is very detrimental to the process of fertilization. This in part is an explanation for the exceedingly low yields reported for Indian corn during certain seasons."

Soil Types Best Adapted for Indian Corn.—The character of the soil has a marked influence upon the yield of grain; thus the selection and preparation of the soil may mean the difference between success and failure in the cultivation of this plant. Indian corn makes its best growth upon a deep well drained soil. The alluvial river bottom lands of Oklahoma, more particularly where good drainage is provided, are well adapted to the likes of this plant. Some of the higher lands which are classified as upland soils are not especially well suited to the requirements of Indian corn. During favorable seasons good yields are invariably reported; however, in view of the fact that dry weather and hot winds come as a check to the Indian corn plant during the month of July, many of the types included under this general classification fail to produce normal yields under such conditions. The main cause of failure on such types may be traced to the fact that it is difficult to store a full supply of moisture within the surface and subsurface layer. Indian corn uses a large quantity of moisture throughout the growing season, and as a matter of fact, those soils which can be readily placed in good physical form have an advantage over the less pliable types. A soil which has good texture and will absorb and retain a maximum supply of water and is not submerged in free water is an ideal type for Indian corn. Such a soil will admit air quite readily, and the soil processes will not be retarded from the time the corn is planted up to maturity.

Fertility Problems Demand Attention.—The Indian corn plant requires not only a soil which carries liberal supplies of soil moisture, but the type should also abound in fertility, although generally speaking, the crop is not considered as an exhaustive one. A systematic plan of cropping together with the application of liberal amounts of farmyard manure will prevent a reduction

of the elements which are essential to plant growth. A fifty-bushel crop of corn will remove from one acre seventy-four pounds of nitrogen, eleven and one-half pounds of phosphorus, and thirty and one-half pounds of potassium. Of these amounts fifty pounds of nitrogen, eight and one-half pounds of phosphorus and nine and one-half pounds of potassium are stored within the grain; hence if this part of the crop is sold from the farm and this practice is continued for several seasons in succession, it is certain that the original quantity of nitrogen, phosphorus, and potassium will be reduced to such an extent as to throw the soil out of balance and low crop yields will be the result. In sections of the state where live stock farming does not form a part of the general farm plan, the elements in question must come from outside sources since no farmyard manure is available. Nitrogen, the most expensive element in this list, can be obtained through the use of such legumes as the cowpea or the soy bean. The cowpea is pre-eminently the most satisfactory plant in this section especially for short rotations. A ton of cowpea hay carries approximately forty pounds of nitrogen and in order to return the fifty pounds of this element removed in the corn, at least two and one-half tons of cowpea hay should be incorporated with the soil on each acre of land annually. A liberal quantity of green manure ought to be provided for the reason that some losses are sure to take place each year. The phosphorus can be returned either in the form of steamed bone meal or as ground rock phosphate; however, in cases where the latter material is applied, it should be used along with a goodly supply of organic matter. Both of these phosphatic fertilizers carry about two hundred and fifty pounds of phosphorus per ton; two hundred pounds would furnish enough phosphorus for three fifty-bushel crops of Indian corn. Many of our soil types contain liberal supplies of potassium, and when we consider the fact that the major portion of this element is stored within the stalk and leaf and is therefore returned to the field each season, it will not be necessary to expend much money in the purchase of this element. The nine and one-half pounds removed by the corn may be returned by adding twenty-five pounds of potassium sulphate or a like amount of potassium chloride. Burning the stalks will furnish an additional avenue for the escape of nitrogen. Unless this practice is expedient in

order to overcome insect enemies or plant diseases, we believe that all organic refuse should be plowed under, and should be used to replenish the stores of vegetable matter within the surface layer.

Composition of Farm Manure.—This by-product of the farm contains about ten pounds of nitrogen, two pounds of phosphorus, and ten pounds of potassium. A second calculation will show that an annual application of five tons of average manure would return to the soil fifty pounds of nitrogen, ten pounds of phosphorus, and fifty pounds of postassium. By referring to the notes on composition of the corn plant it will be observed that such an application would meet the needs of this crop from the standpoint of all elements concerned, excluding losses which undoubtedly take place under average conditions. An abundant supply of potassium is included in such an application. It is doubtful whether it would be possible to make such a return of manure on farms which are located some distance from town where the grower must depend wholly upon the supply which accumulates in the farmyard. The live stock farmer can undoubtedly maintain the fertility of his soil without investing large sums of money in commercial fertilizers, but the grower who follows the business of raising grain for market purposes must make special provision for the return of the essential plant food elements when farm manure is not available.

Organic Matter Is An Important Soil Constituent.—The application of farmyard manure not only adds new quantities of the essential elements to the soil, but it also carries material which forms an important part of the surface layer. The addition of organic matter will improve the physical condition of the soil and will place it in such position that larger stores of moisture may be retained, heat will be absorbed more readily, and the soil can be cultivated with greater ease. The organic matter or humus in our soil can be depleted quite readily; our long seasons together with poor methods of soil management bring about a rapid reduction in the supply of nitrogen, consequently this element becomes a limiting factor in crop production within a very short period. Good illustrations may be found in practically every district in Oklahoma where the soil type has been subjected

to the plow for some twelve or fifteen years in succession. Lands which formerly produced an average of twenty-five bushels of wheat per acre and were good for fifty to sixty bushels of corn on a like area are now giving all the way from thirteen to eighteen bushels of wheat and from twenty-five to thirty-five bushels of Indian corn per acre. It is true that the season has much to do with the yield which is obtained, and yet the grower should not lose sight of the fact that he controls the supply of the plant food constituents, although he may have little to do in regulating climatic conditions. We have already indicated the method which should be followed in maintaining the productive capacity of every soil type which may be found within the borders of this new state. Corn growers will do well to give the cowpea a place in their crop system. The green forage which is grown can in turn be incorporated with the soil directly, or, it may be pastured off in which case the essential elements will in large part be returned to the soil. Such a plan will assist in maintaining the stores of a very important soil element,—nitrogen.

Farm Manure Gives An Increase.—Several rotation experiments are under way on the Station farm. One of these requires a period of three years for its completion and the following crops are grown in the order given: First year, corn; second year, oats; third year, wheat and cowpeas. The latter crop is seeded immediately after the wheat has been removed, and thus far the grain and forage produced have been harvested; hence the crop has not been used for purposes of soil improvement. Four plats are included in this trial two of which receive manure at varying intervals while the remaining two received no manure whatever. The former was treated with an application of farmyard manure at the rate of 13.4 tons per acre in February, 1900, and the plats were cultivated for three cycles with no further application of this general manure. Three crops have been obtained from these plats and the yields of grain and stover for the respective seasons are reported in the following table:

Year.	Yield of Grain, Bushels.		Yield of Stover, Tons.	
	Manured.	Unmanured.	Manured.	Unmanured.
1900	17.27	18.92	2.81.	2.34
1903	37.22	17.48	2.55	1.48
1906	54.06	42.59	1.50	1.39
Average	36.18	26.33	2.28	1.73

In computing the yields of grain seventy pounds of ear corn were considered equal to fifty-six pounds of shelled grain. In this trial the manured ground gave an average of 9.85 bushels of grain per acre in advance of the untreated plot. There was an average difference of .55 ton of stover per acre in favor of manuring. It has been stated that manure was applied during the year 1900, and if the above table is consulted, it will be seen that this material exerted considerable influence in 1906. The latter season was favorable for the corn crop even on upland soils while in 1901 the crop was injured materially by the hot weather in June and later. As no continuous culture tests are under way in this series, definite statements cannot be made with regard to the beneficial effect which may have resulted through the adoption of the three-year rotation. It will be safe, however, to make the assertion that this rotation influenced the yields to some extent, although we are not prepared to say that the fertility of the soil can be maintained by using a rotation alone. In many instances such a plan may afford an opportunity to exhaust the soil of its essential constituents much more rapidly than by following the continuous system. The corn grower who wishes to attain permanent success in his work will make no mistake by giving heed to the suggestions which are presented with reference to manuring the soil and using a well defined plan of cropping on his farm.

ROTATIONS FOR OKLAHOMA.—A rotation of crops may not aid materially in the conservation of the plant food elements; but such a plan does have some advantages which should commend the system to the grower. Under this method the farm labor can be handled much more economically; a monthly income will enable the grower to meet all obligations; all the fields of the farm may be given regular tillage; farm manure or green manure can be applied at frequent intervals; an opportunity will be afforded for the control of weeds; and insect enemies and fungus diseases will not thrive to as great a degree as they are likely to do under a continuous system of culture.

Rotation System.

Three Years.	A.	B.
1st year	Corn-cowpeas	Corn-cowpeas.
2nd year	Oats	Oats-cowpeas.
3rd year	Wheat-cowpeas	Cotton.
Four years.		
1st year	Corn-cowpeas	Cotton.
2nd year	Corn	Oats-cowpeas.
3rd year	Oats	Corn-cowpeas.
4th year	Wheat-cowpeas	Cotton.
Five years.		
1st year	Corn-cowpeas	Corn.
2nd year	Kafir	Oats-cowpeas.
3rd year	Cotton	Wheat.
4th year	Oats	Corn-cowpeas.
5th year	Wheat-cowpeas	Cotton.

SOIL SHOULD BE WELL DRAINED.—Before taking up a discussion of tillage it might be well to refer briefly to the question of drainage. The corn plant requires a well drained soil; at the same time it is doubtful whether any harmful results will be met in cases where the bottom water remains three feet or more below

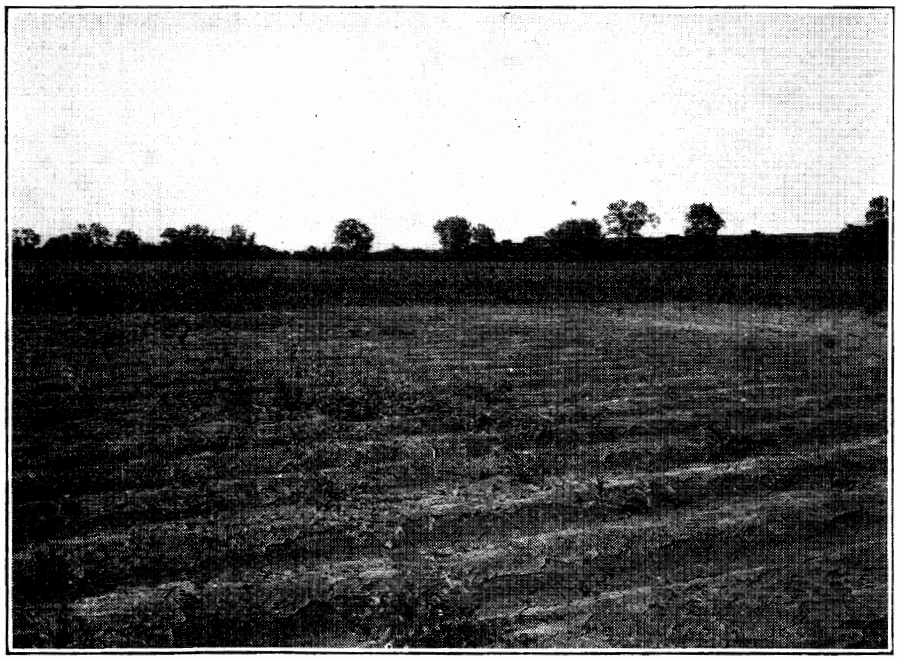

Fig. 2. Improperly drained areas produce practically no corn.

the surface. There are fields, however, which are not so situated. On many creek and river bottom areas of Oklahoma low lying fields and swampy places may be found; in such fields during sea-

sons of moderate rainfall the water accumulates on the surface in the natural basin frequently in large quantities. These sections or areas produce very little, if any, corn when the rainfall is above normal. Large fields which contain all the way from five to twenty-five per cent of undrained basins could be improved materially with a few tile drains. Putting in a few thousand feet of tile would not entail very heavy cost, and it is obvious that the extra yields which would be obtained not only from the water

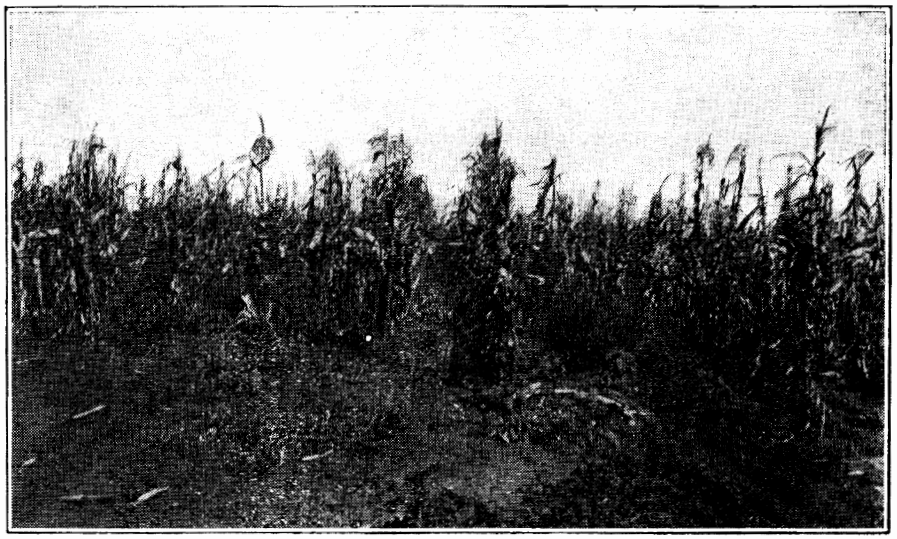

Fig. 3. The stand was impaired on account of poor drainage.

logged basins, but also from the adjacent land would soon repay the grower for his outlay. These sections in an undrained condition do not produce any corn, but they do raise a heavy crop of weeds late in the season, and from these noxious plants seed is distributed over the entire farm. It will require extra labor in subsequent seasons to keep the cultivated and uncultivated crop free from these pests. It is evident that a saving would be effected by providing adequate drainage.

Early Preparation of Soil.—The methods which are followed in the preparation of a seed bed for corn should be thorough in every sense of the word from the commencement of the plowing season until the corn is laid by in the summer. A good seed bed is a prime requisite, and in order to reach the proper goal the preparation should begin at an early date. The corn plant uses a large amount of moisture during the growing season and for this

reason an abundant supply should be stored within the soil. Early plowing, that is, plowing the land in late fall or early winter, will facilitate the collection and storage of water, while early surface tillage in the spring will prevent losses by evaporation. When exceptionally dry weather occurs during the fall and winter, the field should be given a stroke with the harrow, or it might be preferable to pack the loose soil with a roller, or sub-surface packer, and then give the surface light cultivation. The loose mulch, which is formed by this treatment, will prevent the plowed ground from drying out entirely. Some soils are so constituted that when plowed early in the fall, the particles have a tendency to run together; thus the surface becomes very compact by spring and plowing a second time is a necessity. It would be well to allow such soils to remain untouched until later in the season and then turn the surface to the proper depth. This treatment should also be modified somewhat for types which are affected by the wind.

Depth of Plowing.—The depth of plowing will depend upon the character of the soil, the previous treatment which the field has received, and the time of plowing. Other minor factors may also have some influence in determining the depth to which the soil should be stirred with the plow. Deep, friable soils will not require deep plowing, since the mechanical condition of the particles is not in need of improvement. Soils that have a very compact sub-surface should be loosened up with the plow, and if shallow plowing has been the practice in such fields the change to a greater depth should be gradual. By following this plan, large supplies of inert unavailable plant food will not accumulate at the surface, hence the young corn will not be checked in its growth throughout the early part of the season. Deep plowing, although more expensive than the plan of turning the earth to a shallow depth, will be found highly beneficial for the reason that the feeding area is much increased thereby. Sub-soiling is a costly operation and has not been practiced widely. The work can be done more effectively in most instances by using deep rooted plants to open the subsoil.

Preparation of Soil.—Our attention has been directed to the fact that the climatic conditions in this state favor intensive cultural methods. We have also observed that the corn plant

draws heavily upon the stores of moisture in the soil, and before the growing season has passed a large amount has been removed. Often the precipitation during the growing season is not sufficient to supply the necessary quantity; hence that which is stored within the soil must be drawn upon for plant use. In most sections of the state the rainfall is comparatively light throughout the winter months, and only when care is taken to collect as large a percentage of this as possible, is there a sufficient quantity stored up for the production of an average crop. The farmer is not altogether helpless in this matter, for there are at least two practical methods at his command whereby he may control very largely the moisture in his soil. First, by proper tillage he may collect a much larger percentage of the rainfall than is usually stored on the average farm. Second, by thorough surface cultivation he may prevent to some degree at least the process of evaporation which proceeds actively in uncultivated soils. The first one of these methods has a vital bearing upon the preparation of corn ground. The prime object is to till the soil so that the largest possible amount of rainfall may be absorbed. Such a condition may be brought about by loosening the soil to a considerable depth and leaving the surface in a rough condition. It is evident that a mellow soil will take water more rapidly than a hard compact one. It is also a matter of common observation that a rough surface checks the flow of free water and allows this to collect in small puddles, thus giving it time to be absorbed. With the advent of spring the surface should be worked down thoroughly with a disk and smoothing harrow. If the rains have been excessive and the soil has become hard it may be necessary to plow it again before planting, although a second stirring with the plow is scarcely advisable. Various types of soil require different treatment, and each grower must therefore adapt his cultural methods to suit the soil which is under cultivation. Sandy land takes less cultivation to bring it into good form than a heavy clay soil. It may be desirable to plow the sandy soils in the autumn; however, the surface should be covered during the winter with a coat of organic matter. This mulch may be in the form of a green crop, such as wheat, rye, or barley, or it may be a crop of cowpea vines, or a coat of manure. Even the stalks from a preceding crop of corn may be helpful. Such a cover will aid very materially in

collecting the rainfall, and will also prevent the fine particles from blowing. If organic matter is applied to the clayey or loamy types of soil, it should be plowed under early in the winter as this will give it opportunity to decay partly before planting.

LISTING.—There is another common method of preparing corn ground in Oklahoma, known as listing. This is simply a process of throwing open a series of furrows across a field by means of a specially devised plow provided with a double moldboard so that it throws the dirt both ways. The furrows are opened to a depth of six or seven inches and are spaced the usual width of the corn rows, the corn being planted in the bottom of these furrows. There are about three ways of preparing the ground with the lister. Perhaps the most common one is single listing. Under this treatment the ground remains untouched during the winter, and just before, or, at planting time, the grower goes into his field and begins work with his lister. The lister, of course, covers the entire surface between the rows with loose dirt; but underneath this covering of loose earth is a ridge of hard unbroken soil. Such a preparation does not present the most favorable conditions for plant growth nor does such treatment afford the best condition for the collection and storage of moisture. However, it presents a rapid and cheap method of preparing corn ground and it is a plan that requires only a minimum amount of labor.

DOUBLE LISTING.—There is a slight modification of the above method known as double listing. This differs from single listing only in that the ground is listed twice. The ridges which were left by the first operation are opened and thrown into the furrows by the second. This tillage completely loosens the surface soil, and leaves it in much better form as a seed bed for corn than does single listing. In many cases the first listing is done in the fall and the field is allowed to remain in that condition until spring, at which time the ridges are opened with the lister. The second listing and the planting may be done at the same time. Soils which will admit of fall and winter plowing should certainly be plowed early in the season, and should be given a fair amount of work in the spring and then listed, if so desired. This is by far

the best method of the three, and will give less trouble at the time of cultivation.

THE FURROW OPENER.—Within the past two years a new device for opening furrows has been introduced, and is coming into use as a substitute for the lister. This "furrow opener" consists of a pair of small disks so arranged as to throw the soil away from each other. One set of these disks is fastended to each runner of an ordinary two-row corn planter. These disks may be set deep or shallow as desired simply by regulating the lever on the planter. This method of planting possesses practically all of the advantages secured by listing, and in a few respects it has some commendable features. In order to use this attachment on the planter successfully, the ground must first be plowed and worked down into good condition. Such a thorough preparation of the soil is not always given where listing has been the adopted plan, and for this reason, the new method may often bring more satisfactory results than the old one. The "furrow opener" also provides a cheaper and a more rapid means of securing the same results obtained by listing and planting. Two horses and one machine do the work, and two rows are planted at once. While this method has been under trial for a short period only it is coming into favor very rapidly in the corn growing districts of this state.

LISTING VERSUS LEVEL PLANTING.—Farmers from eastern states who are not familiar with this plan are frequently in doubt concerning the advisability of adopting the former in pereference to the latter method. The two systems have been compared. The Kansas Station has reported six experiments, and the Oklahoma Station has conducted two trials in which listed maize was compared with corn planted on the surface. Taking this group as a whole, five out of eight trials of the listed maize gave the best results; but in making a study of the average yields for the eight tests it was found that the two systems gave about equal results. The surface planting gave a return of 34.4 bushels per acre as an average for the eight years; while the listed ground gave a yield of 36.8 bushels per acre; thus, it will be seen that there is a difference of 2.2 bushels per acre in favor of listing. Whatever plan is followed, it is obvious that the progressive corn grower has no place for a shiftless method of culture. At best, the soil receives a

minimum amount of tillage and any system which enhances the grower's success should be looked upon with favor.

TIME OF PLANTING.—The time of planting corn varies somewhat in different parts of the state inasmuch as the climatic conditions in various sections are not identical on account of latitude and change in elevation. Generally speaking, in the southern part of Oklahoma planting may begin about the middle of March; in the eastern and central parts the work may be done about the last week in March or the first week of April; while in the northern and western parts planting is delayed until the middle of April. Since our summer season is long and affords ample time for late varieties of corn to mature, the date of planting in any portion of the state may be extended until the first of June for types similar to the Mexican June. Owing to the dry hot weather which usually comes the latter part of July and August it is advisable to plant as early as possible so that the corn may have a chance to mature before it is damaged by the hot weather. It sometimes happens that the later plantings produce fair yields in September, but as a rule, weather conditions do not favor such an outcome. A few rains during the latter part of August and early in September assist the crop in reaching maturity; however, large yields can scarcely be expected, and as a whole, the early planting is much to be preferred to the late.

METHOD OF PLANTING.—There are four methods of planting corn in Oklahoma. These may be classified as follows: First, Listing is the favorite method with many who have lived in the semi-arid sections for several years and is particularly well adapted to the drier portions of the state. In such areas it has several advantages over ordinary surface planting. By placing the seed in the listed row the root system of the plant develops several inches below the surface; and for this reason, such a plant is able to withstand a longer or more severe drouth than if planted on the level. During the process of cultivation which may be reasonably deep without injury to the feeding roots the ridges are gradually worked down and the furrows are filled. Hilling enables the stalk to stand up much better until maturity. Nearly all of the listers which have been placed on the market are pro-

vided with a drill attachment and are so arranged that the planting may be done at the same time as the listing. The fields may be listed and planted afterwards with the one or two-row machine. The level or surface method of putting in the seed is used much more extensively in the eastern part of the state than in the western. In most cases if careful culture is practiced surface planting will give as good results as listing in so far as the yield of corn is concerned. The cultivated soils of Oklahoma are comparatively new and the weeds which are so troublesome in many other states have not made their appearance to any extent in the corn fields of the Southwest; hence it has not been necessary to check row the corn in order to give the grower a chance to cultivate both ways and thereby destroy all grass and weeds. But noxious plants are gradually gaining the ascendency and more thorough tillage must be advocated. Already some of the more progressive farmers have adopted the check row system of planting. The check row is suited alike to listing and surface planting and should be more extensively applied. Drilling is a common mode of planting corn in Oklahoma and in the past it has given very satisfactory results. Where the drill is used only one kernel is dropped in a place and the machine is set so that the corn plants are given the proper spacing.

QUANTITY OF SEED.—The stand will depend upon the fertility of the soil and the supply of moisture. A rich soil will support a thicker stand than a poor one; in a region where the rainfall is abundant, more plants can be grown per acre than in sections where the rainfall is sparse. By referring to preceding paragraphs it will be seen that the rate of planting may vary sightly in eastern as compared with western Oklahoma. As a rule, corn may be planted in the former districts so as to secure one stalk about every fifteen inches in the row. Passing to the latter section the plants should be given greater spacing; the usual distance will range from twenty-four to thirty inches. It may also be observed that corn on the upland should be planted thinner than Indian corn on the low land because of differences in fertility and in the supply of moisture. Where the check row is used from two to three kernels in a hill will be sufficient.

VARIETIES OF CORN.—There is no question that has been repeated more frequently than the one "What variety of corn is

best adapted to the section or district in which I am located?" In answering such a question we are obliged to consider phases of work which have been reviewed in part in the opening para-

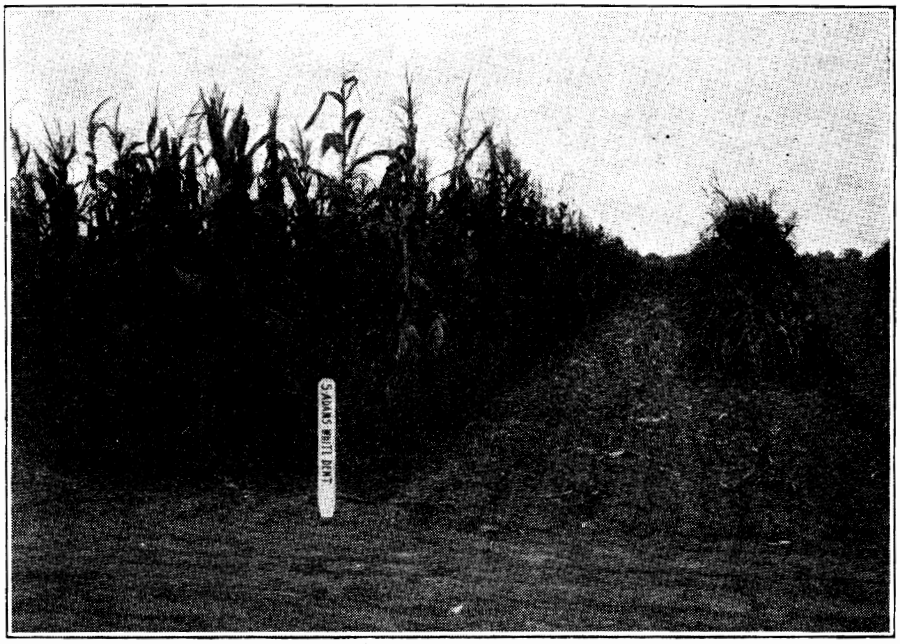

Fig. 4. Variety test showing difference in maturity.

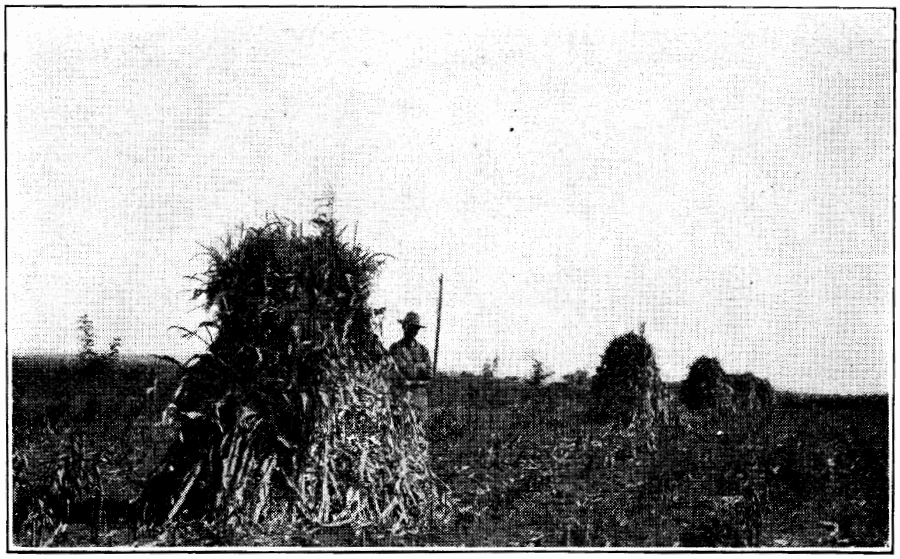

Fig. 5. Hildreth's Yellow Dent on upland soil.

graphs of this publication. The state may well be divided into four distinct divisions. The first should include the eastern part of Oklahoma or that portion in which the rainfall exceeds forty

inches annually; the second division with a rainfall of thirty to forty inches contains quite an extensive area in the central zone; the third belt has a precipitation of twenty to thirty inches and is made up of two or more series of counties on the west side; while the fourth belt takes in those counties which lie directly north of the Panhandle of Texas where the rainfall is less than eighteen inches.

Fig. 6. Typical stalks—Oklahoma varieties.

TYPES FOR DISTRICTS ONE AND TWO.—Starting with eastern Oklahoma it may be stated that any of the standard varieties of Dent corn will give satisfactory results in this area provided the planting is done at the proper date and good tillage is given

throughout the growing season. As a rule, well selected home grown seed should be given a preference in place of a similar grade that may be brought in from outside sources. It is also important to observe that varieties which have been confined to creek and river bottom lands produce their best yields when planted continuously in a suitable rotation on such areas; upland varieties invariably prove their adaptability to the higher lands and such seed should therefore be set aside for the latter fields. There is practically no difference in the types which are being grown in districts one and two.

TYPES UNDER TRIAL.—It may be of interest to some growers to know that we have a large number of standard varieties distributed throughout central and eastern Oklahoma. Such vigorous growing strains as Mammoth White, Boone County White, Golden Eagle, Hildreth's Yellow Dent, and perchance Reid's Yellow Dent have given exceptionally profitable returns on the fertile valleys of central Oklahoma and with proper culture they can be used to advantage on lands which have been classified as medium upland or such soils as are known as second bottom. This list would not be complete if we failed to add such well known varieties as Silver Mine, Leaming, White Superior, or even the commonplace Bloody Butcher with its relative Striped Calico corn. While the Experiment Station has not used either of the last named varieties in field tests we are certain that these types can be selected for many localities because they are now giving excellent returns in a large number of counties in central and southern portions of the state.

TYPES FOR WESTERN OKLAHOMA.—The standard varieties referred to above have even gained a foothold in District No. 3; however, a careful study of this section would appear to indicate the desirability of appropriating types that are more drouth resistant and using these to the exclusion of all other varieties. The writer has seen splendid fields of Dwarf Mexican June in some of the southwestern counties and he has also been informed that the variety known as Hickory King is producing reasonably good yields in the northwestern counties. A cross resulting from a combination of the squaw corn and white dent has shown some hardiness in western sections and it may prove to be a money

maker for the man who wishes to grow corn in an area of limited rainfall. This mixed corn as well as the Hickory King and a few early maturing sorts can be recommended for District No. 4. Kellogg's Pride of Saline might also be included. Perhaps less attention should be given to the introduction of new varieties in these western counties and more time set aside for the study of such plants as Kafir corn, milo maize, broom corn and other members of this group. These crops produce fair yields in poor seasons and they should be given a place on every farm within District No. 4.

CULTIVATION OF CORN.—Indian corn is a crop that requires thorough cultivation. The ground should not only be well prepared before the seed is planted, but the subsequent cultivation should also be intensive. Even before the young shoots are in

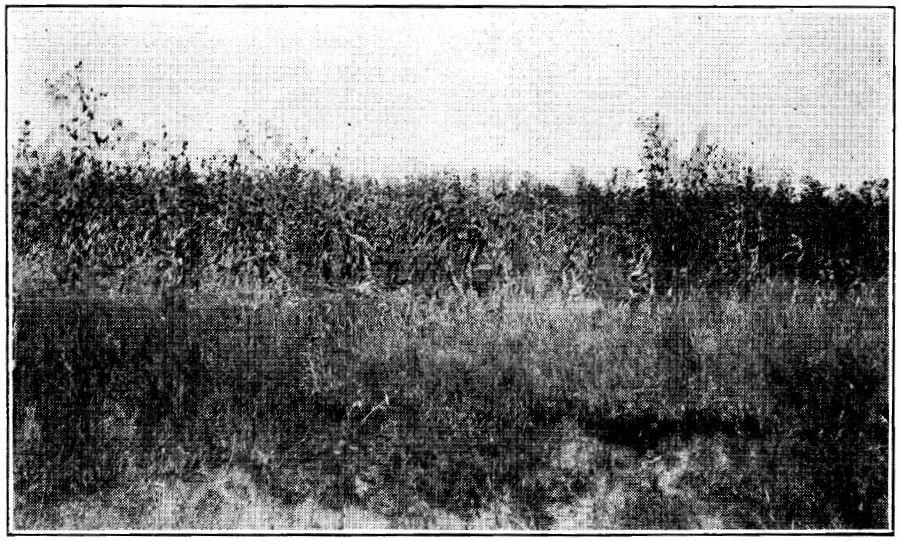

Fig. 7. Inadequate cultivation facilitates the growth of weeds.

sight the first operation can be performed. An ordinary smoothing harrow is well suited for this first treatment and it may frequently be used until the plants are two or three inches high. Listed corn is especially well situated for harrowing. Such cultivation gradually works down the ridges, fills the furrows and thereby keeps the weeds in check. A loose mulch is maintained at the same time. This pulverized condition of the surface prevents rapid loss of moisture and may mean much to the corn growers of Oklahoma. As soon as the plants are two or three

inches high the cultivator should be started. The first cultivation may be comparatively deep if desired, but later in the season it should be reasonably shallow. The corn plant like other members of the grass family sends out a large number of fibrous roots which run close to the surface. Some investigational work has been done to ascertain the depth to which corn roots penetrate the soil; studies have also been made concerning their lateral development. The results of these tests show that by far the larger per cent of the roots is found within the first twelve inches of soil and they are exceedingly abundant within four inches from the surface. The shovels should therefore be regulated so that

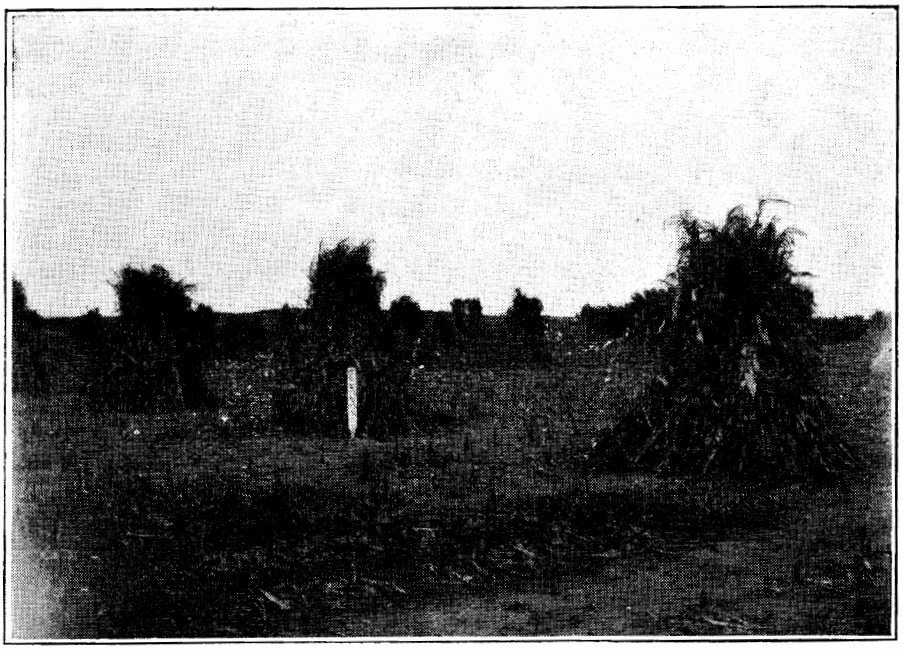

Fig. 8. Thorough tillage means freedom from weeds.

the uppermost mass of roots may remain undisturbed. The roots of young corn grow much faster than the top and long before the plant is six inches high the lateral branches extend half way across the row. It is these first roots that come nearest to the surface. If they are broken the food supply of the plant will be reduced and growth may be checked. The conclusion is self-evident. Cultivate the corn shallow, two and one-half to three inches is deep enough, and do not get too close to the plants. After cultivation has once begun it should be continued through the growing season at intervals of ten days or two weeks, and

any heavy rains which may occur during the season should be followed up with a repetition of the work in order to prevent the formation of a crust. A compact condition of the surface is ideal for the evaporation of soil moisture and as cultivation puts a check on this upward movement such a plan should be adopted by every grower. During the latter part of the growing season the weather is frequently dry and it is at this part of its growth that the plant requires the largest amount of moisture. Cultivation should not cease because the corn is too tall to be plowed with an ordinary two-horse implement, but the grower should provide himself with a single five-tooth cultivator and should continue the work with one horse until the corn has almost matured. Whether the field has been listed or surface planted cultivation should be such as to keep the ground level. Ridging is a bad practice for as we have already indicated corn roots develop only a short distance from the surface thus by throwing up a ridge next to the stalks the roots between the rows are uncovered and are left exposed to the sun. A machine which carries six shovels on each section will do more satisfactory work than one with two large shovels. The disk cultivator can be used for the first two or three treatments. Such a type may be adjusted readily and can be set so as to cultivate the sides of the furrows with little danger of covering the corn.

METHODS OF SELECTING AND SAVING SEED.—Every corn grower has some well defined plan of selecting seed. Some take the trouble to go through their fields before husking and they select the best ears early; this gives an opportunity to take into account the form of the stalk from which the ears are chosen. These selected ears are carefully stored in a safe place for the winter. This plan of securing seed corn is an excellent one and can be given an unqualified recommendation. Others find it convenient to single out the best ears which can be found during the husking season and these ears are thrown into a small box which has been attached to the side of the wagon bed. This material is stored for further examination. There is another class of men who give very little thought to the selection of seed corn until the planting season. They go to the crib and pick out the best ears available and use these for seed purposes. This is not a satis-

factory manner of securing seed corn, but is to be preferred to the scoop shovel method of selection. By all means secure seed ears in the autumn when there is a large assortment from which to make a choice. Later in the winter these ears may be carefully graded. They should be kept in a dry place and should be guarded from the attacks of the grain moth. Mice may also be considered a pest; hence seed should be placed where it will receive no damage whatever. Several plans have been suggested. First, a number of ears may be tied with a strong cord or wire and may then be suspended from the rafter in the seed house. Second, large finishing nails can be driven into a 4x4 scantling

Fig. 9. The best ears can be placed in a small box as shown in photograph.

which is about five or six feet in length and the seed ears may in turn be hung on these spikes. By adjusting a milk pan at the base of the scantling one can prevent mice from reaching the seed. Third, satisfactory drying racks can be constructed of wire. Such a rack should be about ten feet long and is usually made by stretching wires through the supports and fastening them at each end firmly. Each pair should lie in the same horizontal plane and should run parallel to each other. There is no feature of corn production that will bring greater returns to the grower in proportion to the time and labor expended as will come through the selection of first grade seed.

GRADING SEED CORN.—It is not enough that good ears be selected but when these ears have been tested and shelled, the corn should be graded into two or three sizes, namely: large, medium and small. This is done in order to secure an even stand. No planter can do regular work when kernels of all sizes are mixed and thrown into the planter box together. On the other hand, if the different grades of corn are separated, special plates may be

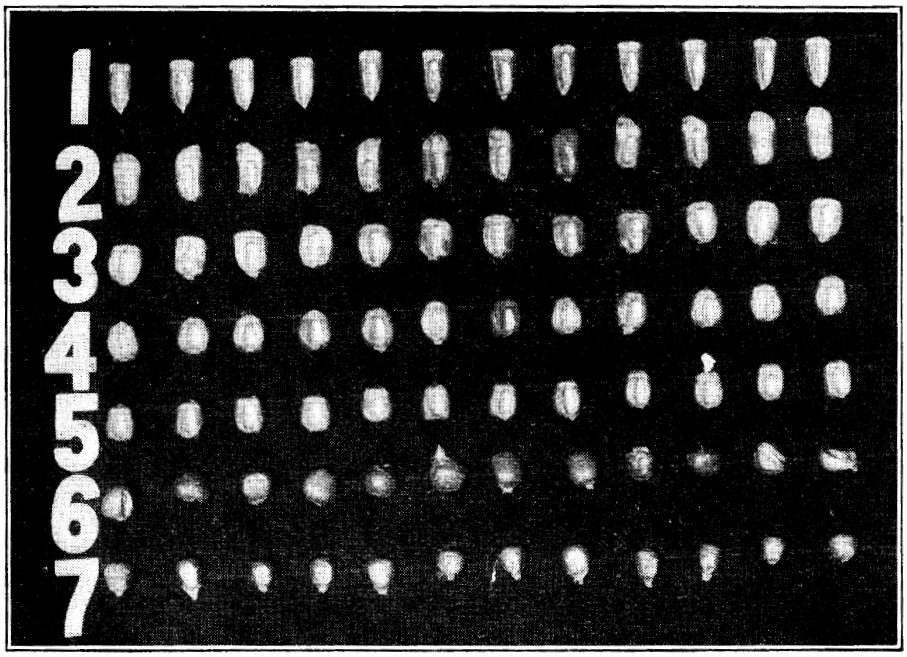

Fig. 10. These kernels were taken from one ear. They lack uniformity

selected for each grade and these will drop a proper number of kernels, thus a regular and even stand of corn may be insured. Nothing is more disheartening to the farmer than to be compelled to cultivate a poor stand of corn throughout the summer. A few days spent in testing and grading the seed may mean more than weeks of hard work later and will invariably result in greater production.

SELECTING SEED EARS.—Inasmuch as the yield and quality of the corn produced depend very largely on the grade of seed it is obvious that something can be gained by sorting and making a special study of the selected ears. It has already been suggested that a large number of good ears should be set aside early in the

fall. In the winter season when the farm work does not demand attention this corn may be taken down and may be spread on the table for a more careful examination. One may select for uniformity in size, shape, color or depth and indentation of kernel. Ears that are nearly cylindrical from butt to tip are considered as being ideal in shape and as far as possible it will be well to pick

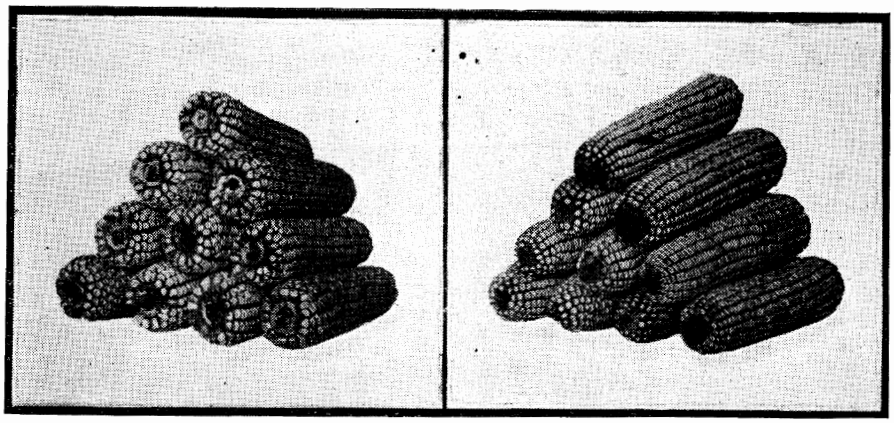

Fig. 11. Rough butts; poorly filled tips.

ears which are regularly filled from butt to tip. Examine a few kernels from each ear to see whether they are properly matured or to determine whether they have the proper depth and shape. A bright appearance is indicative of full maturity and strong vitality. The ears which are thus selected should be laid aside and prepared for a germination test.

HARVESTING AND STORING THE CROP.—Indian corn may be harvested in Oklahoma from August 15 to September 15 or even later depending upon the mode of handling the crop. There are two methods of harvesting: first, cutting and shocking; second, husking from the standing stalks. If the corn is to be cut and put in shocks the work should commence about the time the husks begin to turn yellow or when the grain is in the glazing stage. In cases where the area is limited, the cutting can be done economically by hand, but where large areas are to be harvested, the corn binder should be used. The ordinary shock contains 144 to 196 hills; however, if they are larger than this, they may be difficult to cure, often becoming mouldy even in dry weather, Each shock should be firmly tied around the top with twine so that it will stand up straight because they frequently remain in

the field for a month or six weeks before the corn is dry enough to husk and crib. When dry the corn can be husked and placed in storage; the stover may be removed from the field and stacked or put away in a shed. The most common method of harvesting the corn crop in Oklahoma is to allow the stalks to stand until the plant is thoroughly ripe. Usually the husking begins about the last of September and continues for eight or ten weeks. Where large quantities of corn are to be stored cribs permitting a free ventilation of air should be used; this will prevent the corn from heating and moulding. Where practicable the crib should be placed a few feet above ground to insure as much freedom as possible from rats and mice. It is needless to state that the crib should be provided with a roof or cover; however, large quantities of corn are piled on the ground and left exposed to the weather. Under such circumstances the losses are likely to be much greater than in cases where good cover and suitable ventilation are provided.

Corn Breeding In Oklahoma.—Systematic methods in behalf of corn improvement received some recognition in 1903, when the late William Howard Phelps of Autwine, Oklahoma, selected some of the best seed corn he could find in his district, and immediately proceeded to study the individual characteristics of the progeny of these ears in an isolated breeding plot; others joined in this movement, and in 1904 a well organized Corn Breeders' and Growers' Association was the result. It is a difficult matter to estimate the real value of such an association. The grower who becomes a part of an organization of this character, and decides to study methods of crop improvement in detail, not only brings about an increase in the yield per acre on his own farm, but he also improves the yield on his neighbor's farm, when seed of the selected strain is distributed. This will mean the return of many thousands of dollars annually to the farmers of the state. When every county within our broad domain can boast, and be proud of the fact, that several staunch citizens are making steady advancement in raising corn of superior quality, then we can be assured that every locality will be provided with suitable seed, and the average yield for the state will no longer remain at the present mark, but will exceed 35 or perchance 45 bushels per acre.

THE PLAN OF THE CORN GROWERS' ASSOCIATION.—The Oklahoma Seed Corn Breeders' and Growers' Association recognizes the following fundamental principle, upon which its methods of corn breeding are based: "Every individual corn plant is possessed of a distinct individuality, which corresponds with the individuality of animals."

SELECTION OF SEED EARS.—(*a*) "Every ear of corn to be considered as a possible seed ear for the breeding plot, must be selected in the field, and with special reference to the character of the individual corn plant, upon which it is produced. (*b*) Every ear which is ultimately selected for the breeding plot, must con-

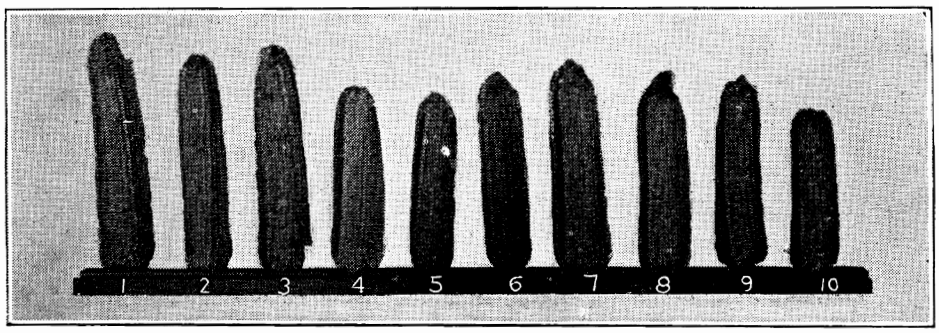

Fig. 12. **Showing difference in depth of kernel.**

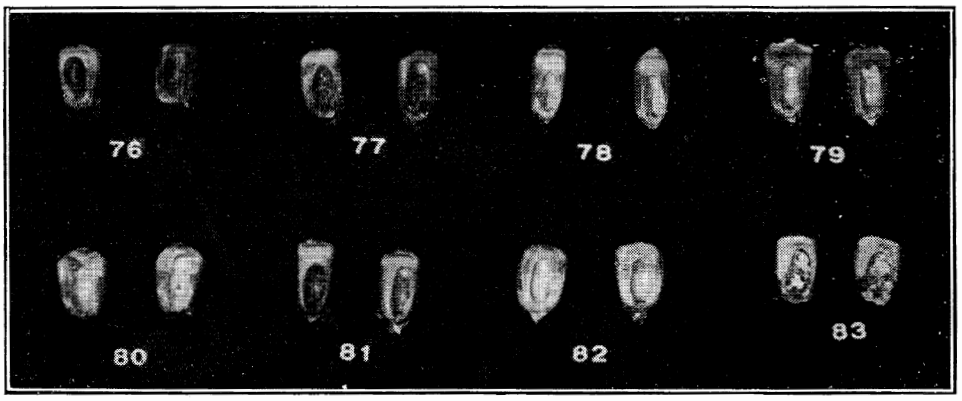

Fig. 13. Dark colored kernels indicating low vitality.

form as nearly as possible in appearance and physical measurements, to definite and desirable standards. (*c*) If the seed corn is selected by mechanical examination only of sections of kernels for improvement in composition, the efficiency of the selection shall be determined by the chemical analysis of at least two com-

posite samples, of which one sample shall represent all selected ears which were planted in the breeding plot, and the other sample shall represent all ears which were rejected by mechanical examination. (*d*) If the seed corn is selected by chemical analysis, for improvement in composition, the composition of each individual seed ear which is planted in the breeding plot, must be determined."

THE BREEDING PLOT.—(*a*) "The breeding plot shall contain at least twenty-five rows of corn, which are at least one hundred hills long. (*b*) Each separate row of corn in the breeding plot shall be planted with a separate, individual ear. (*c*) All rows which show, as a whole, marked inferiority, and also every individual corn plant which may show marked inferiority, in whatever row it may be found, shall be carefully detasseled before the pollen matures. (*d*) The performance record of each individual field row shall be determined, and this shall include an accurate record of the total weight of ear corn which the row produces."

SELECTION OF SEED EARS.—(*a*) "The selection of seed corn for the next year's breeding plot shall be confined to forty per cent of the field rows; that is, at least sixty per cent of the field rows must be rejected as a source of seed for the breeding plot. (*b*) The selection of the individual field rows, from which seed corn may be taken, shall be based upon the performance record of the row as a whole, but with special reference to the yield of corn which the row produces, and this, in all cases, must be ascertained by a computation from at least one hundred consecutive hills, without rejecting vacant hills."

REGISTRATION OF BREEDING PLOT.—"Every member of the association shall have on file with the custodian designated by the association, not later than June 30th of each year, a record of measurements and characteristics of each seed ear which is planted in his breeding plot, and not later than December 31st, a statement of the performance record of the individual field rows, which shall include the exact weight of ear corn and the total number of ears, including nubbins, from each of the selected field rows, and if breeding by chemical analysis for improvement in composition, he must also deposit samples, representative of the corn produced on each selected field row."

MULTIPLYING PLOT.—(*a*) "The seed for the multiplying plot shall be taken from the selected rows of the breeding plot and

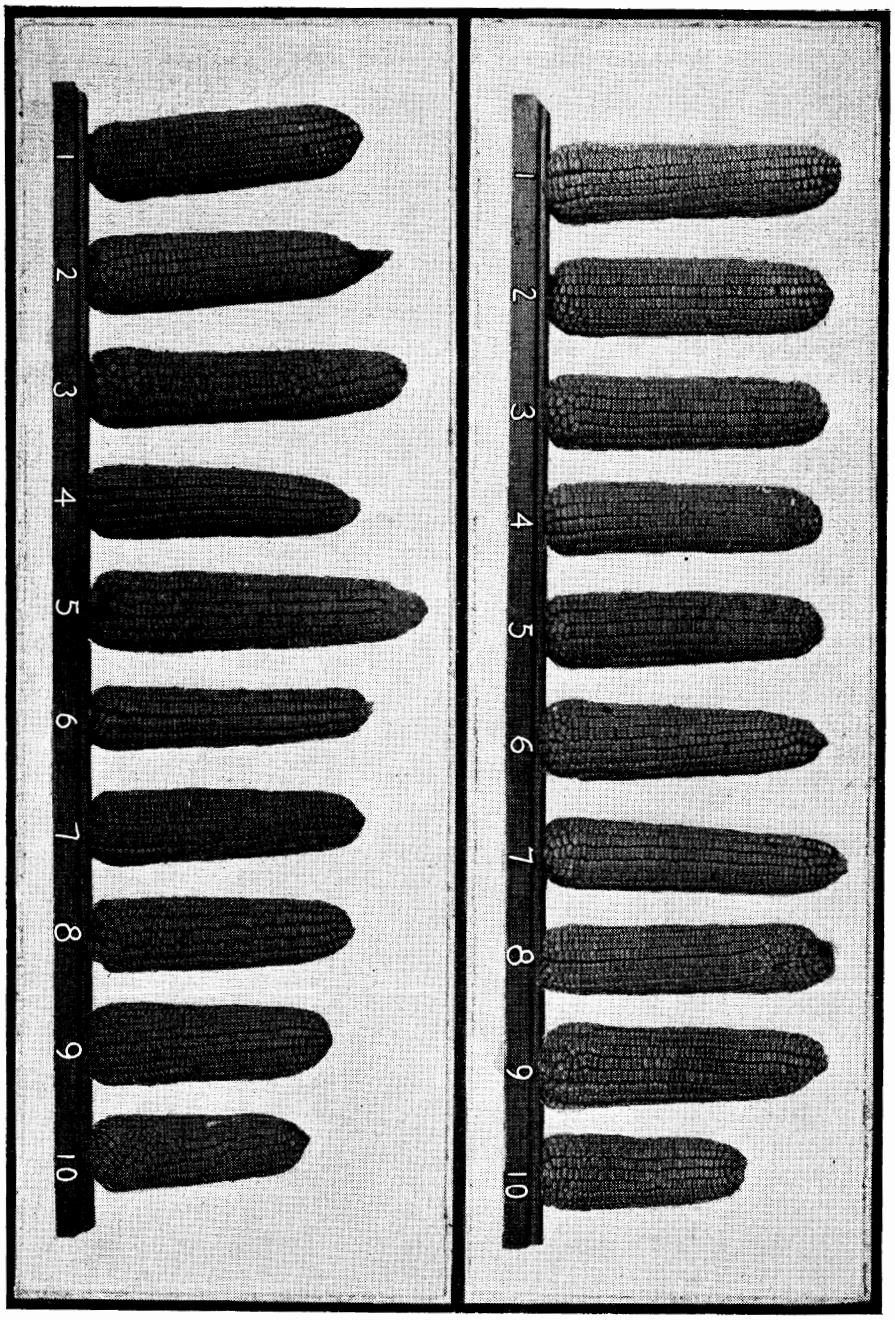

Fig. 14. Ears from high yielding rows.

may include all good seed corn which is not required for the breeding plot. This seed may be mixed together and planted on the multiplying plot. (*b*) The corn grown in the multiplying

plot shall be carefully protected from foreign pollen, and all inferior stalks shall be detasseled. (*c*) The exact yield of the multiplying plot must be determined and registered."

COMMERCIAL FIELD.—(*a*) "The seed for the commercial field shall be only the best obtainable seed corn from the multiplying plot. (*b*) The exact yield of the commercial field must be determined and registered. (*c*) From the commercial field the finest ears may be selected and sold to the trade as pedigree seed corn."

SELECTING SEED CORN.—(*a*) "When corn is sold as pedigreed corn, the record must accompany each lot of corn sold, showing the yield of the commercial field and multiplying plot and all preceding breeding plots. (*b*) If a claim is made for improved composition in the pedigreed corn, the record must show the average composition for each year. The crops produced in the selected rows of the breeding plot during the period of observation shall be included in this record. (*c*) All seed corn must be sold on the ear unless ordered shelled by the purchaser, and in no case shall the shelled corn be sold at a lower price per bushel than the same corn would be sold for on the ear."

(*a*) Reprinted by permission of Oklahoma Corn Breeders' and Growers' Association. W. A. Adams, Stillwater, Okla., President.

OKLAHOMA CORN CLUB.—This is a new association, and although the work has been under way for less than one year, more than one hundred corn growers have applied for membership. Recognizing the importance of the Indian corn crop, the farmers in attendance at the week's Short Course which is held annually at the Agricultural and Mechanical College at Stillwater, and was scheduled for the week beginning January 18 and ending January 23, 1909, decided to organize the corn growers of the state in an association, known as the Corn Club. Indian corn was the subject under discussion on Tuesday, January 19, and at the conclusion of this part of the program a special meeting was called for the purpose indicated. The work or plans of this organization will not interfere with the breeding operations, which have been conducted by the members of the Oklahoma Corn Breeders' and

Growers' Association. The men who have developed this field are the pioneers in a movement which has for its object, a better product in the field, and larger financial gains for the growers. They are the life of the Breeders' Association, and they are assisting in work which has been shouldered by the the members of the Oklahoma Corn Club.

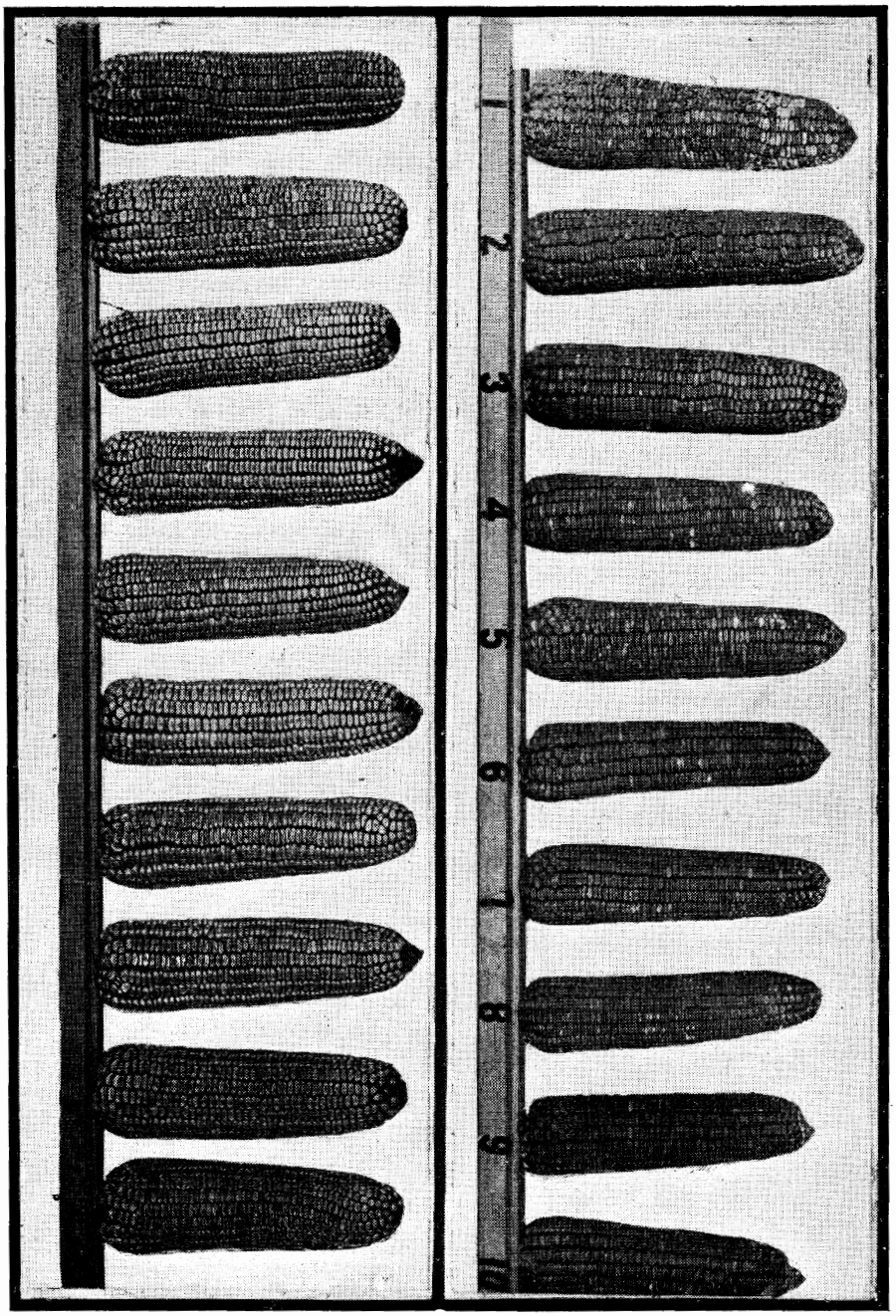

Fig. 15. These two samples are not uniform in size, shape or general type; but the selection contains some productive individuals.

General Plan of Admission.—Membership is open to any reputable citizen in Oklahoma, who is over sixteen years of age. There will be no membership fee, but the annual dues shall be 50 cents in advance. The officers of the association consist of President, Vice President, and Secretary-Treasurer. An advisory committee of three was also selected. This committee shall have authority to prepare blanks, issue reports or bulletins, and shall have charge of any other printed matter which is necessary in conducting the work of the association. This committee is instructed to inspect and recommend seed corn which is offered for sale. They may purchase seed corn, and supply the same at cost to members of the club. They have also been requested to secure information with reference to available seed corn, thus if any member wishes to purchase a special type or variety, he can make his wishes known to the committee, and the variety desired will be supplied, provided a suitable grade can be obtained from a reliable grower.

Reports Must Be Filed by Members.—Each member of the club pledges himself to plant for three years, not less than seven acres of corn annually, using selected seed for this planting. Provision was made that if more than one member of the club belongs to one family, and these members farm in common, using the same teams, implements and land, then such members may cooperate in growing the same plot of corn, and shall be entitled to exhibit in contests the same as if each member had a separate plot. Each member of the club shall make a report to the Secretary, not later than December first each year. Membership shall be forfeited if this report does not reach the Secretary's office within thirty days following December first. Members of the club will not be permitted to use the literature which is printed for advertising purposes, nor shall names of the members of the club be shown on printed letter heads.

Corn Breeding to Improve the Composition.—Practically every man who has had experience in growing Indian corn, has made some observations on the value of good seed. The increased yield, due to selection alone, has been measured by many bushels, and the changes which have been brought about in the

general type of the plant, have been marvelous. It has been demonstrated that corn improvement may be carried beyond this point. It is a well known fact that the chemical as well as the physical structure of the corn kernel may be changed almost at will, within certain limits. The Illinois Station is breeding corn along several distinct lines, namely: high protein and low protein;

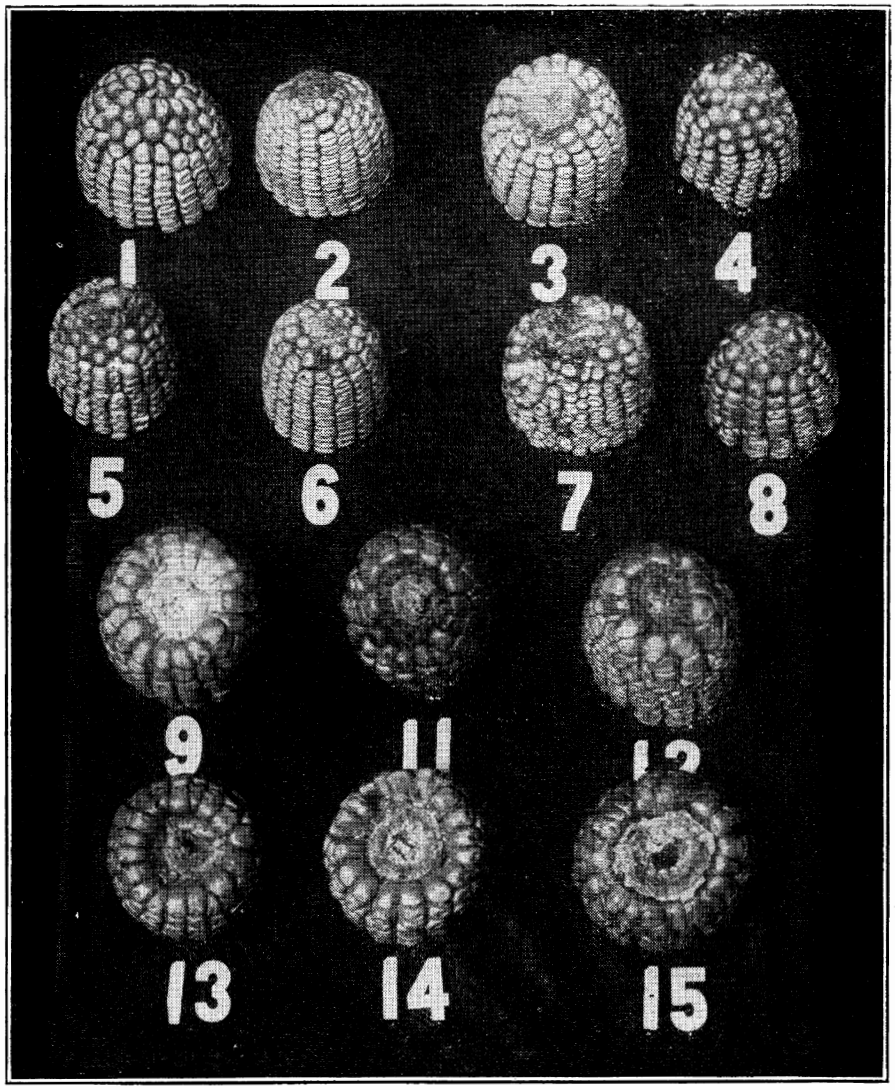

Fig. 16. Good and Poor Tips; also Good and Poor Butts.

high oil and low oil. In ten year's time the protein content has been increased from 10.92 per cent to 14.26 per cent; the per cent of oil has been raised from 4.70 per cent to 7.37 per cent. It has required only a few years of systematic work in order to produce

two distinct strains. The demand for corn to be used for certain commercial purposes has made such studies as these of extreme value.

OBJECT OF THE OKLAHOMA GROWER.—In the older states, where corn improvement has been a matter of study for several years, many have turned their attention to the improvement of the chemical composition of the corn kernel with profit. The prime object of corn breeding in Oklahoma should be increased yield; careful selection and breeding are steps in the production of varieties well suited to conditions that prevail in different localities. Although yield is the first object in corn improvement, there are certain other factors which should not be neglected. Uniformity, shape, color of ear, the filling at the butt and tip ends, the number and direction of the rows, furrows between the rows, depth and shape of kernels, are points which may well be considered when individual ears are being selected for breeding purposes. While the score card has some defects, when viewed from the standpoint of increased yield, at the same time it directs the eye to certain characteristics, which might otherwise be overlooked. When used exclusively, without regard to essentials, it may lead to the rejection of some of the best yielding ears. Performance is the surest basis of selection.

FIELD METHODS.—The breeding methods which have been adopted by some of our most practical growers include, first, the initial choice of ears in the field; second, the comparative trials of the progeny of these ears in the test field; third, the isolation of the best individual strains in a breeding plot; and fourth, the continued selection and improvement of the variety under study. In taking the initial step it is necessary, not only to examine the ear in the field but some attention should also be given to relative size and development of the plant. Length of stalk, position, number, size, and angle of ears are items of importance. The vigorous growing plant with an extensive root system ought to produce better seed ears than a corn plant which is deficient in these qualities. When the corn is husked in the autumn the ears may receive more careful study, and the best individuals in the plot can be set aside for future work. The breeder must have a

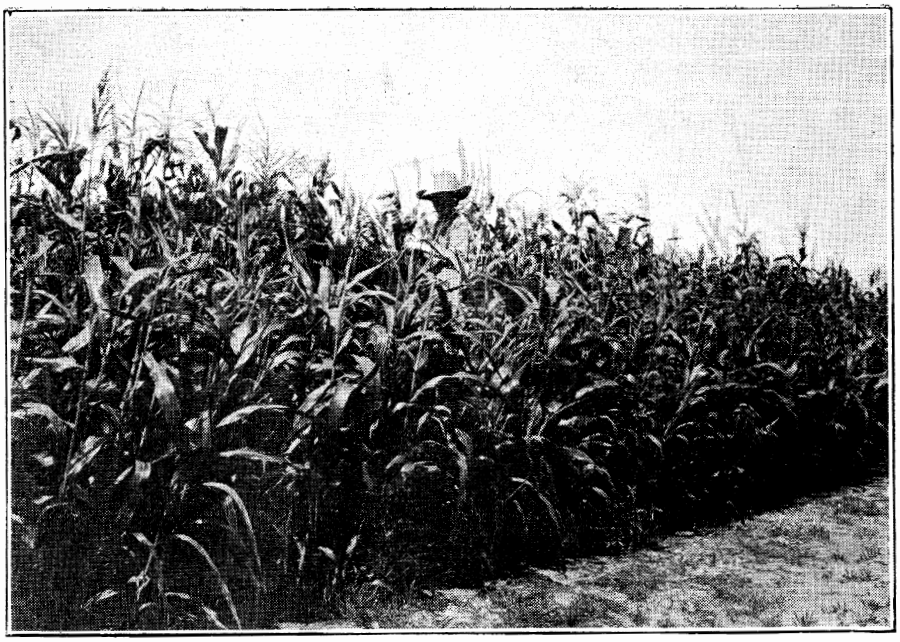

Fig. 17. The breeding plot may be protected from chinch bugs by a hedge of sorghum.

definite type in mind at the outset, and this should be kept in view constantly.

TESTING INDIVIDUAL EARS.—After the first selection is made a portion of seed from each ear is planted in a single row. Definite notes are taken throughout the growing season and in the autumn the product from this row is weighed. By comparing one row with another, it will not be difficult to find the most productive individual in the test plot. It might be well to note that it is advisable to save a portion of the seed from each of the individual ears used in the test plot. The following spring one may single out the seed from the high yielding individuals only, and this seed can be planted in the breeding plot proper. This will assist in eliminating crosses between high and low yielding individual ears, and will give the breeder an advantage from the viewpoint of production. In our work at the Experiment Station, a variety known as Mammoth White, was selected for the foundation stock. This is a vigorous growing type, and is one that has given good results in central Oklahoma. In nearly every case, the ears of the initial selection were uniform in size and shape, and were typical of the variety in question. The Mammoth

White is in all probability an offspring of the Boone County White. In making our records, notes were taken on length and weight of ear, circumference, number of rows of kernels, and general appearance. These ears were then numbered consecutively from 1 to 52, and two rows of one hundred hills each, were seeded from each ear. The grains were distributed in the rows at the rate of one kernel every eighteen inches. The breeding block was divided into two parts, (a) and (b), the rows extending east and west. Row number one was planted from ear number one, and seed from the same ear was used in planting row number fifty-two. Row two was seeded to grains from ear num-

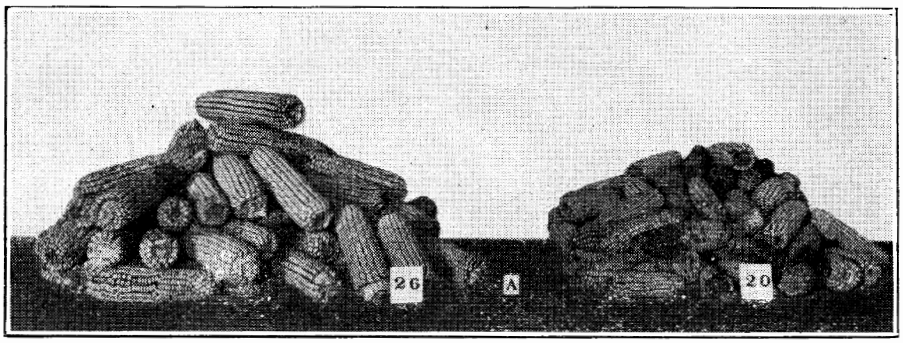

Fig. 18. The crop from two individual rows.

ber two and seed from the same ear was likewise used in planting row fifty-two. This plan of distribution was chosen in order to check up the difference in the fertility of the soil.

HARVESTING THE CROP.—During the entire growing period observations were made on each of the rows and any apparent differences were recorded in our field books. In some cases there was a tendency toward suckering; certain other rows gave evidence of many barren stalks. On some rows the ears were covered with heavy husks, while on others this feature was not so pronounced. When the corn had matured, the crop from each row was cut, tied, labeled, and placed in a large, well constructed shock to cure. After sufficient time had elapsed for the stalks and ears to dry thoroughly, the grain was husked and weighed. The yields were then recorded, and systematic study was made of the individuality of different rows. Yield per acre, and quality of the product, were features which received first consideration.

RESULTS.—A wide variation in the productive power of different ears is shown. The yields ranged from 40.3 bushels to 85.3 bushels per acre. Row 26 produced five bushels more than twice as much corn as row 16; this difference would certainly exert some influence on the yield of the large field provided all seed ears had the same productive efficiency as No. 26. Rows 1, 26, 37, 41, 43, and 48 were the highest producers in the plot. The corn from

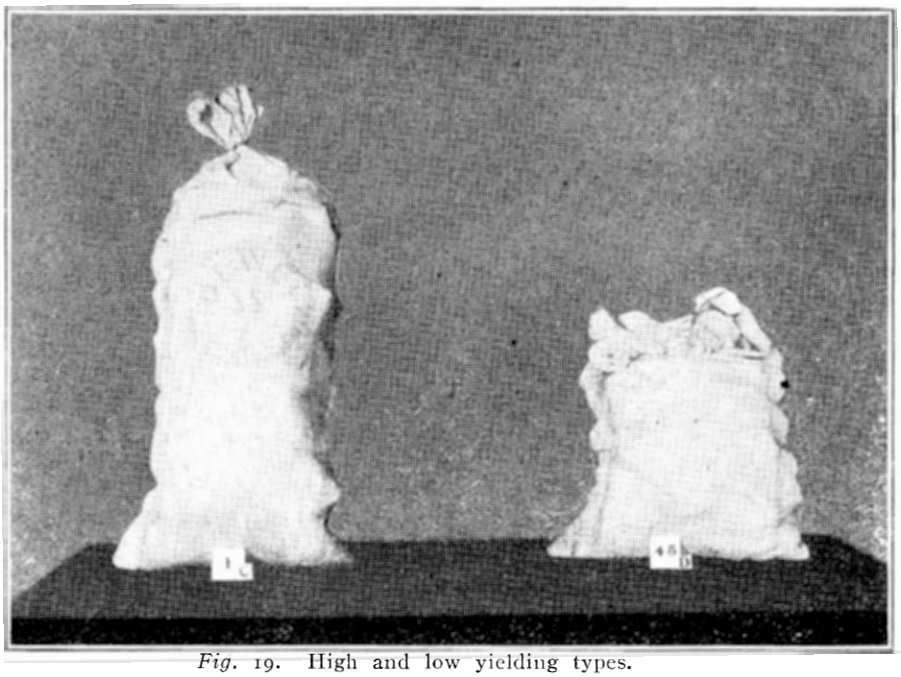

Fig. 19. High and low yielding types.

37 was very uniform in grade; however, there were other rows which produced high yields which did not possess this characteristic. From the examinations thus far conducted with the corn from our breeding field, we are not ready to state that fancy tips and butts, straight rows, and uniform grains go hand in hand with high yields.

CHECKING RESULTS FROM YEAR TO YEAR.—After the ears with the high performance record have been found by actual test, the only problem which remains for us to solve is whether or not these ears are capable of transmitting high yielding qualities. This may be done by taking the ears from the strongest producers and continuing the test in an ear to the row plot. In every case it is absolutely necessary to keep any pollen from other

strains of corn coming in contact with the ears in the breeding plot. If the tendency for high yield is pronounced for several seasons, we may be assured that the individual strain has superior power along this line and that the increased returns were not due in the first place to fluctuating variability. The ears from the best yielding rows which are not required for the breeding plot may be used for a larger field, from which seed may be obtained for general distribution. One of the chief objections in continuing to grow ears from the breeding plot together is that there may be a possibility of inbreeding. Detasseling alternate rows has been recommended for the prevention of too close crossing of certain ears. Last season this plan was not followed, however, it may be found necessary during succeeding trials.