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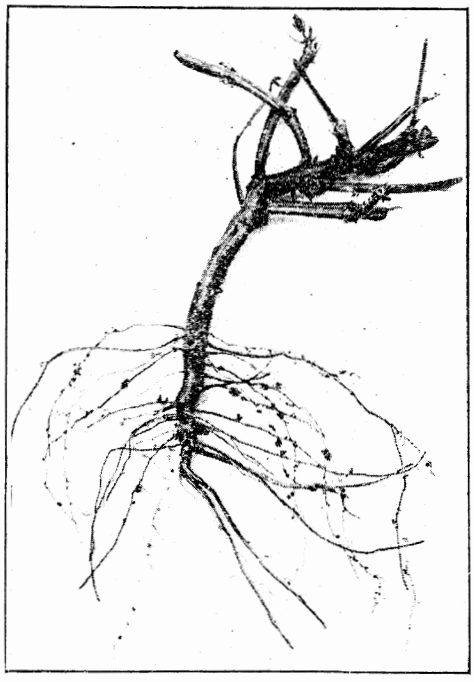
Cowpeas and Soy Beans.



CO-OPERATION IN THE PLANT KINGDOM.

Stillwater, Oklahoma.

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Oklahoma Agricultural and Mechanical College

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EXPERIMENT STATION, Stillwater, Oklahoma.

THE COWPEA AND SOY BEAN.

A written history of North American agriculture would be incomplete unless it included a sketch of the place which the cowpea and soy bean have taken in our modern systems of cropping, more especially within the past decade. Both plants are cultivated upon a wide range of soils, and they are apparently adapted to a fairly wide range of climate. It is true that the cowpea and soy bean have been cultivated possibly for centuries under warm climatic conditions, yet a careful study of these plants will reveal the fact that their culture is not limited to this belt alone. The introduction of the cowpea and soy bean into those states which are located upon our northern border has been attended with some measure of success. Possibly the soy bean is more at home, and thus gives better results in these northern sections, than the cowpea, but it should be observed that while the latter plant makes a fair record in the north, it thrives exceptionally well under southern skies. As farmers become better acquainted with the characteristics and uses of these plants, a larger area will be devoted to their culture. Both crops have been grown for several years on the station farm and close observation has led to the conclusion that one, or probably both crops, should occupy permanent places in Oklahoma rotations. Some experimental data have been collected during the past four or five years, hence this material will be used as a basis for some general suggestions concerning the culture and uses of the cowpea and soy bean. Several phases of this subject have been presented in brief form in the annual reports which have been issued by this station, and as much of this matter was considered extremely important it has been revised somewhat and inserted in this publication. Furthermore, the station has received a large number of inquiries of late concerning these crops, and it was thought advisable, therefore, to collect the available information and publish the same in bulletin form.

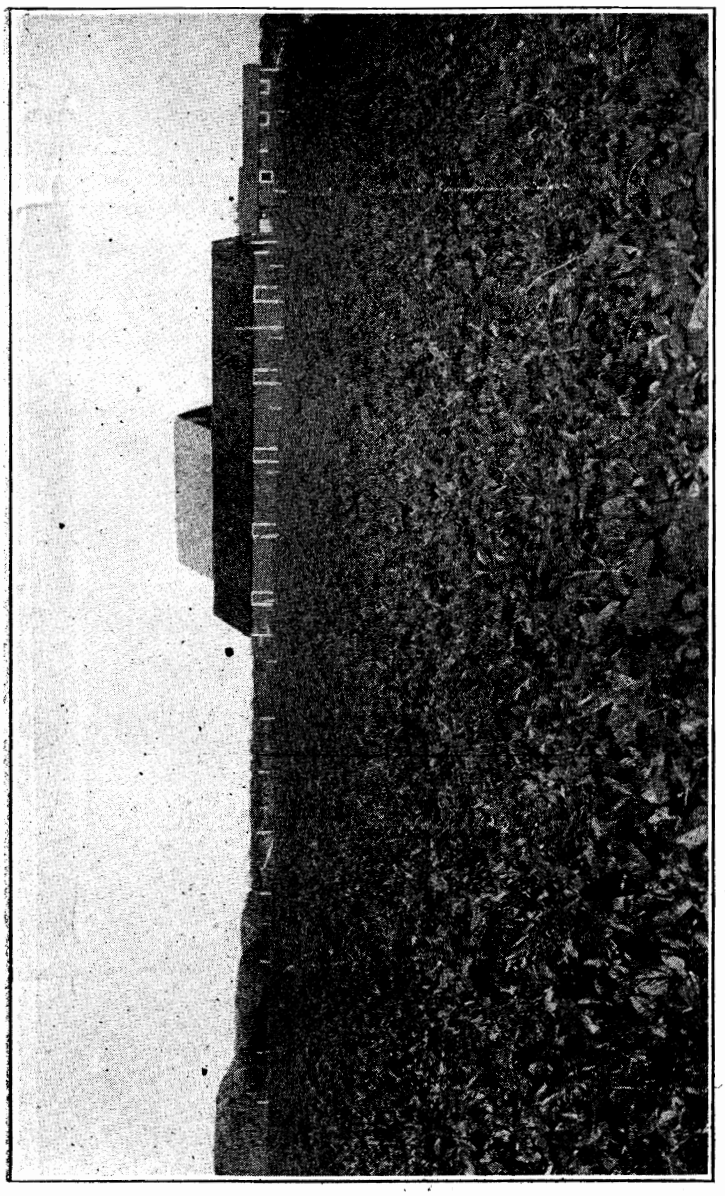
The cowpea and soy bean belong to that large and important order of plants known as Leguminosæ, commonly called the pulse family. It has been stated that this family contains about three hundred and ten genera, and about five thousand species. A large number of plants having economic value are classified in this order. The alfalfa plant and the true clovers are listed with this number. The cowpea belongs to the genus Vigna and the scientific name is given as Vigna sinensis (Hassk). "Other authors assign the name Vigna catjang, the crop itself being commonly known as the China bean, Blackeyed bean, Black pea and Cowpea. This plant differs very little from the plants which are grouped in the genus Phaseolus, or true bean, hence the plant should, in reality, be classified as a bean rather than a pea. The peas are white or dark with a dark circle around the scar. The plant, which is a native of China and Japan, is widely grown in the

southern states for forage." The soy bean belongs to the genus Glycine (a Greek term meaning sweet), and the scientific name is given as Glycine hispida, or Soja hispida. "The plants are strong and erect, two to four feet tall, loosely hairy; the leaflets are large and thin, with a common petiole six to twelve inches long. The pods are flat, two to four inches long, and contain two to four roundish or oblong beans. The pods split open when ripe. The crop is coming into prominence as a forage plant, and the beans are also edible. Japan and China are the native home of the bean."*

The cowpea is grown much more extensively in Oklahoma than the soy bean. This difference in acreage can be explained by the fact that the farmer is not as familiar with the habits and uses of the one as he is with the other. The cowpea occupies the same place on the Oklahoma farm that the red clover plant takes on the farms of the northern and eastern states. Although the soy bean has not come into general use as a forage or grain crop, it is a summer annual and can therefore be worked in either as a substitute for cowpeas, or it can be given a similar place in the rotation. The cowpea is essentially a southern plant, and as it makes its best growth during the hot summer months it will produce a large amount of forage when other plants have practically completed their growth. On the river and creek bottom soils the cowpea and soy bean make a luxuriant growth, but they can also be grown quite successfully on extreme upland soils. The soil areas which come within the latter class are quite extensive in some parts of this territory. Alfalfa does not appear to thrive exceptionally well on such soils, notably because a great many of these types are underlaid with an impervious, or close subsoil, which prevents the plant from sending its roots deeply into the same, hence the alfalfa fails to secure a full and continuous supply of moisture. The cowpea and soy bean, however, give good returns upon such soils when the proper cultivation is followed, and as both crops are classified as soil improvers, they should be used in the rotation which is planned for the upland farm.

In many sections where wheat raising is almost the sole industry the cowpea can be used to good advantage. As soon as the wheat crop is removed the fields are disced thoroughly and the cowpea seed is sown with a grain drill in rows thirty inches apart. During the early stages of growth the ground is given one or two cultivations in order to destroy any weeds which may appear, and to form a mulch, which assists in conserving the soil moisture. By following this method the soil is placed in a fine physical condition, noxious weeds are held in subjection, and the grower obtains a supply of nutritious forage for fall or winter feeding. Frequently cattle or hogs are turned into the field and the crop is used for pasture purposes. Where this plan is followed, at least seventy-five per cent of the essential elements will be returned to the soil, and the plant food will be utilized by subsequent crops. The stock should not be turned into the field when the

*Botanical notes—adapted from Gray.



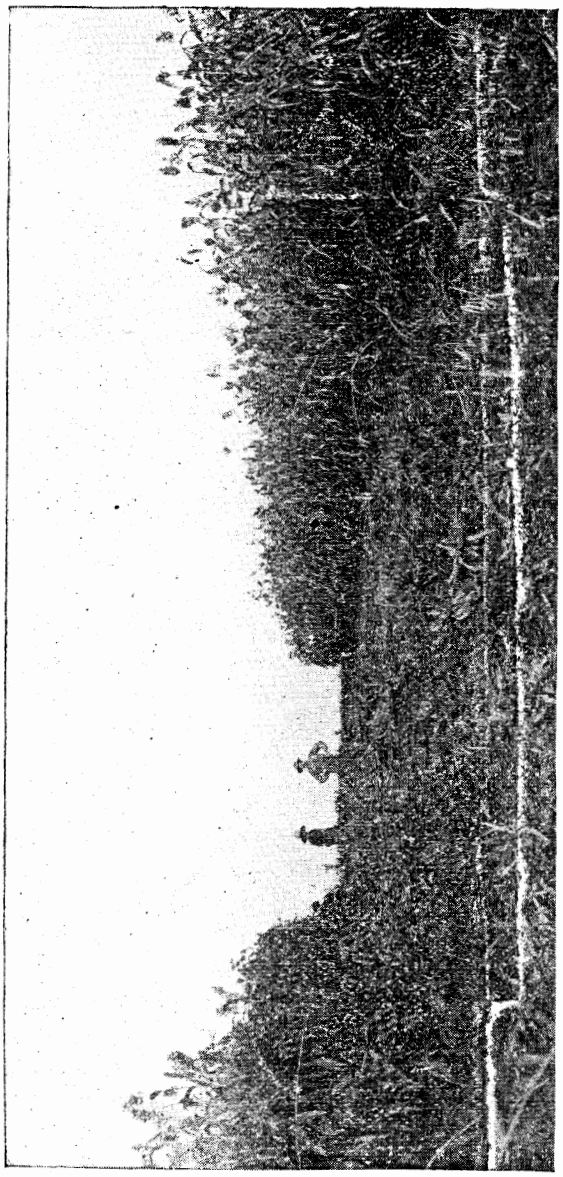
Cowpeas a Banner Forage Crop for Oklahoma.

soil is wet and soft, since a moderate amount of tramping at such a time will have a tendency to impair the physical structure of the soil.

In the farm rotation the cowpea and soy bean may occupy any one of a number of places. They make excellent crops to precede wheat. Where the seed is planted at an early date and the soil is given thorough cultivation, the fields ought to be in excellent form for wheat by the month of September. By planting the peas or beans early in May and by selecting early maturing varieties it will be possible to do the harvesting in August; thus there will be sufficient time to prepare the land for a crop like winter wheat. This arrangement conflicts, to some extent, with the cultural methods which have been submitted by this station for the guidance of wheat growers, inasmuch as early plowing (July) and thorough preparation have always given the most satisfactory results.* However, one could expect to obtain fair returns by adopting the above plan, more particularly in eastern portions of the state. In the north central states these legumes are frequently used as catch crops to follow wheat or oats during seasons when red clover is a partial or absolute failure. Since the cowpea and soy bean are annual plants, it is an easy matter to introduce them where the rotation has been broken through failure in the case of a regular crop. In the southern states these plants will always retain a more permanent place in our crop systems, than in the clover sections of the north and east. In the corn and wheat sections of this state the following three year rotation may be adopted: First year, corn; second year, oats; and third year, wheat followed by cowpeas or soy beans. If one desires to grow a larger number of crops, this plan could be extended as follows: First year, corn; second year, Kafir; third year, cotton; fourth year, oats; and fifth year, wheat followed by cowpeas or soy beans. Some farmers make a practice of sowing cowpeas with the corn at the time the latter is "laid by," or given the last cultivation. Such a plan gives the grower an opportunity to increase his supply of nitrogen, and at the same time he secures an extra supply of pasture or forage for fall feeding. It should be remembered that such a plan would result in consuming large quantities of moisture; thus during dry seasons a material reduction in the yield of corn may be expected. In the northwestern counties a three year rotation including, first year, broom corn; second year, cowpeas or soy beans; and third year, durum wheat, could be adopted with profit. In the southern part of the state where cotton is the staple crop, the cowpea might be used twice in a three year rotation, as, first year, oats followed by cowpeas; cotton the second year and corn for the third. These plans can be modified to suit the needs or requirements of the farmers who are working in various parts of the state.

The cowpea and soy bean cannot only be used to advantage in securing practical results in the management of the farm crops, but the plant also

*Bul. No. 65—Wheat Growing.



The Stockman's Delight—Sorghum and Cowpeas.

serves a useful purpose from a fertility standpoint. These plants, as well as other members of the legume family, are able, through the medium of the microscopic organisms which are found in small tubercles, or nodules on the root systems, to assimilate free nitrogen from the soil air. This nitrogen is stored up within the plant in an organic form, and if the crop is used as a green manure, the nitrogen in turn is rendered available for plant growth. Nitrogen is designated an essential element and rightly so, because without this substance the plant or crop cannot develop. In fields where the supply of nitrogen becomes deficient through the adoption of improper methods of soil management, the crop under average conditions, does not make a normal growth, hence in order to obtain maximum yields on such lands this element is frequently applied in some commercial form. The crop systems, which are in vogue in the southwest favor nitrogen exhaustion, thus if the present plans are continued it will be but a short time until our lands will cease to return profitable yields. Nitrogen when purchased in a commercial form is an expensive element and if care and judgment are not exercised in the application of the fertilizer, serious losses are likely to occur. On the other hand, the use of legumes, and we speak more particularly of the cowpea and soy bean, appears to offer a safe and satifactory solution for the problem of nitrogen restoration. It should be observed that the necessary bacteria must be present in the soil in order to insure the development of tubercles on the roots. In this section the cowpea nodule producing bacteria are normally present in the soil, but the soy bean fails to produce tubercles on its root system. Where the proper bacteria are wanting they can be supplied by obtaining samples of soil from fields in which the germs are present and scattering the same on the uninoculated area. A full description of the tubercle-forming bacteria of legumes with methods of inoculation is given in a recent station publication. *

The cowpea and soy bean plants are destined to play an important part in the role of crops which is finally adopted by the stockman farmer. It is true that these crops have not been given as much attention as their desirable characteristics warrant, however, as the stockman farmer comes to the point where he realizes that a balanced ration is absolutely indispensable in raising young stock, or in producing economic gains in the feed lot, then a larger portion of the farm will be devoted to legumes and the cowpea and soy bean will soon find their proper place in the new order of cropping. Indian corn and sorghum are grown extensively on the farms of the southwest, but as the grain and fodder produced contain a comparatively small amount of mineral matter, and a low percentage of protein as well, other crops must needs be introduced in order to make up this deficiency. This phase of the subject can be discussed more intelligently if reference is made to the composition of some of these feeding materials.

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*Okla. Sta. Bul. No. 68, "Soil Inoculation."

TABLE 1—THE COMPOSITION OF COWPEAS AND SOY BEANS IN COMPARISON WITH OTHER FEEDS.

Feeding Stuffs	Water	Ash	Protein	Crude Fiber	Nit. free ex.	Ether Ex.
Soy Bean seed	10.8	4.7	34.0	4.8	28.8	16.9
Cowpea seed	14.8	3.2	20.8	4.1	55.7	1.4
Cotton seed	10.3	3.5	18.4	23.2	24.7	19.9
Indian Corn—grain	10.6	1.5	10.3	2.2	70.4	5.0
Soy Bean hay	11.3	7.2	15.4	22.3	38.6	5.2
Cowpea hay	10.7	7.5	16.6	20.1	42.2	2 2
Alfalfa hay	8.4	7.4	14 3	25.0	42.7	2.2
Indian Corn stover	40.5	3.4	3.8	19.7	31.5	1.1

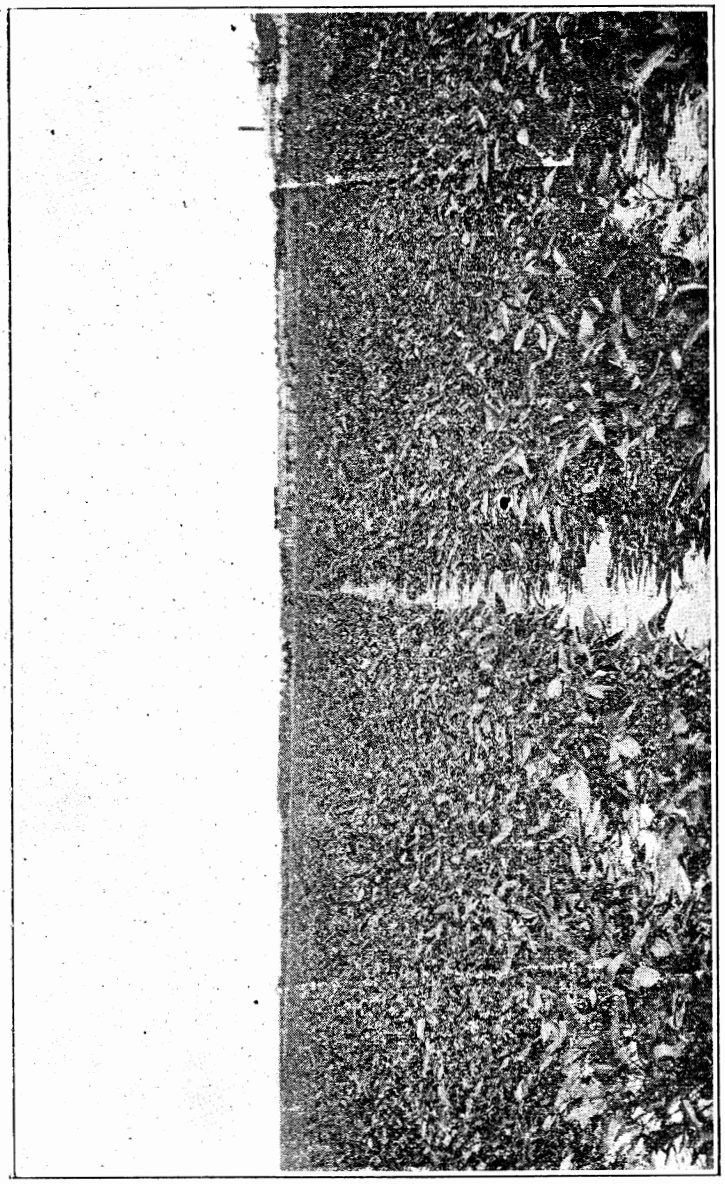
These figures are adapted from Henry's "Feeds and Feeding." In this table sufficient data are submitted to enable one to make a threefold comparison. First, cowpea seed and soy bean seed are compared with Indian corn grain and cotton seed, and the conclusion is self-evident that these grains are appreciably richer in ash and protein than the grain obtained from the Indian corn plant. The soy bean contains a high percentage of fat, and a comparatively low percentage of the nitrogen free extract, while with Indian corn the reverse is the case. The soy bean stands in advance of the cowpea notably in fat and protein. It is also clear that the grain produced by these legumes compares very favorably with cotton seed. The figures also indicate that soy bean and cowpea hay are slightly superior to alfalfa from the standpoint of composition, while corn fodder is decidedly inferior to any of these legumes. The mixing of soy bean hay with corn fodder during the ensiling process would appear to be a good practice, since an improved product is the result.

A study of the acreage which is devoted to cowpeas and soy beans in this territory, will reveal the fact that both plants give profitable returns on a wide range of soil types. It is probable that our river bottom lands will return the heaviest yield of forage, and our level prairie lands of the loam types will undoubtedly produce the maximum yields of grain. It has been intimated that the upland farmer can expect results which will warrant him in giving these plants a permanent place in his system of cropping. All classes of soil from the extreme clay type to the coarse, sandy soil are adapted to the growth of cowpeas and soy beans, but in all cases it is expedient to have the respective soils in a proper physical condition. While it is true that these legumes are able to secure free nitrogen from the soil air in the manner previously described, the grower must not take it for granted that remunerative crops will be forthcoming from soils which are decidedly poor in texture, nor can he expect the plant to thrive on soils which are thin and badly worn. Soils which afford an ample supply of

lime, phosphorus, and potassium make an ideal home for either legume, and if one or more of these elements chance to be markedly deficient it will be economy to make some return to the area in question. Well-preserved farm yard manure makes an excellent fertilizer to apply in such cases. The results which have been obtained by this station in the application of farm yard manure have certainly been encouraging, hence there has been no hesitation in recommending the grower to take better care and make better use of this by-product of the farm.

Two rotations, in which the yields from given sections of untreated land are compared with the yields from similar sections receiving applications of farm manure at varying intervals, were started on the station farm a few years ago. The cowpea crop is used in one of these systems and the soy bean in the other. The first series included four crops; namely, corn, oats, wheat and cowpeas, and the rotation is planned to cover a period of three years, two crops, wheat and cowpeas, being taken from the land in one season. Cowpeas were grown on this series in 1902 and 1905. In the former year heavy rains occurred at the harvest season, consequently the major portion of the crop was destroyed. The cowpea pod is comparatively brittle when thoroughly dry, and as it was necessary to turn the peas several times, the pods split open and most of the seed was scattered upon the the surface of the field. In 1905, the seed which was planted on this area did not give a good germination, hence, the stand was poor and the resulting yields were low. The manured plats gave an average yield of 3.23 bushels of grain and .35 tons of straw per acre, while the un-manured ground gave 2.88 bushels of grain and .29 tons of straw as an average yield. Duplicate plats are used in this rotation experiment, and the tests are also duplicated in the five year series.

Six crops, castor beans, Kafir, cotton, oats, wheat and soy beans are included in the second rotation, and the series is completed in five years. This necessitates the removal of two crops, wheat and soy beans, in the final year. In 1904 the plats were cropped to wheat and soy beans. The manured sections received an application of farm yard manure at the rate of fourteen tons per acre in the spring of 1902, and since that season no manure or fertilizer whatever has been applied. As soon as the wheat crop was removed in June, 1904, all the plats in the series were given a double stroke with the disc harrow. About the first of July, after heavy rains had fallen they were disced again. The plats were seeded to soy beans on July 12th and 13th. The seed was put in with a disc drill in rows thirty-two inches apart. It required about thirty pounds of seed per acre to plant the area as indicated. The ground was given three cultivations, and the beans were harvested on October 1st. The following table contains a report of this experiment:



This Crop of Soy Beans Was Grown After Wheat, 1905.

TABLE NO. 2.

Treatment	Area Planted	Date of Planting	Date of Harvest	Yield per Acre Tons Straw	Yield per Acre Bushels Grain.
Unmanured	.5 acre	7 12–13	10 1	.67	11.6
Manured	.5 acre	7 12–13	10 1	1.01	18.2
Unmanured	.5 acre	7 12–13	10 1	.68	11.6
Manured	.5 acre	7 12–13	10 1	1.03	17.0
Average unmanured				.68	11.6
Average manured				1.02	17.6

The yields for the individual plats are given in the first part of this table, while the average yields for the respective treatments are tabulated in the second part of this table. On all plats the yields were exceptionally good considering the fact that the crop was seeded rather late in the season. The manured area gave an average return of six bushels per acre more than the un-treated area. In the second place it will be observed that manuring produced a decided gain in the average yield of straw. The summer culture, which was given in order to produce this crop, left the soil in excellent tilth, and it was instrumental as well in keeping all weeds in subjection. It required seventy-nine days to mature this crop of beans.

The selection of a suitable variety is an item of some importance, and it should be given some attention by the man who contemplates introducing these crops into his series. The known varieties of cowpeas and soy beans are many. Some of these varieties are particularly well adapted to northern sections, while other varieties mature so late in the season that they cannot be recommended to northern growers. The following varieties of soy beans have been grown successsully in sections of the country where the season is much shorter than the growing period in Oklahoma: Medium Green, Early White, Ito San, Medium Yellow, and Black. The list of distinct varieties of cowpeas is much more extensive than the list of soy beans which one finds in this country. If early varieties of cowpeas are desired, Warren's Extra Early, Old Man's, New Era, Early Black Eye, and California Black Eye can be counted upon to give satisfactory results. In selecting a variety two characteristics at least should be kept in mind. First, uniformity with respect to the time of maturity, more especially where grain is the object sought, should be given some consideration, and second, it should be noted that productiveness is a desirable quality. A moderate growth of vine and a good yield of grain should be obtained. This station has made a few variety tests with cowpeas, but only a limited number has been used in each case. Varieties of soy beans have not been studied under Oklahoma conditions.

EXPERIMENTAL DATA.—Three varieties of cowpeas were grown on the station farm during the season of 1903. The different varieties included in

this test can scarcely be compared, since the peas were planted on different dates and under variable soil conditions. The soil in all fields was well prepared before planting and the crop was given good cultivation during the growing season. In all cases the peas were planted in rows to permit intertillage.

TABLE NO. 3.

Variety	Area of Plat in Acres	Date of Planting	Date of Harvest	Yield per Acre	
				Tons hay	Bu. Grain
California Black Eye	2.69	6–9	9 17–23	.63	6.2
Whip-poor-will	.19	6–9	10 26	6.2 G.	9.9
California Black Eye	1.00	6–23	Oct.	.98	9.7
Iron Cowpea	.10	6–11	10 26	7.2 G.	4.3

As the first two varieties in this list were grown side by side and the planting was done at the same time, a few deductions can be drawn. The Whip-poor-will variety produced a more vigorous growth of vines and gave a larger yield of cowpeas per acre than the California Black Eye variety. Early maturity is apparently a feature of the latter variety. Number three, which is the same as number one, was grown upon a more fertile section of the land than the latter, thus a slightly increased yield was secured. The seed of the Iron Cowpea was obtained from the Bureau of Plant Industry, Washington, D. C. "This variety is noteworthy for its resistance to the cowpea wilt disease and also root knot." These diseases, however, have not been noticed on the crop in Oklahoma, hence no comparison with other varieties in this one particular can be made. The Iron cowpea gave a heavy yield of forage per acre, but the yield of grain was low. In the case of numbers two and four, the yields are reported as green weight in place of cured hay per acre.

TRIALS IN 1904.—The variety test this season included five varieties of cowpeas. The field upon which the crop was grown was well prepared, and the seed was sown on the 21st of May in rows forty-two inches apart. This distance is somewhat wider than the usual distance suggested in the case of this crop, but the crop on this area covered the ground quite thoroughly. All of the varieties in this list ripened pods before the vines were ready to harvest. These pods were picked as they ripened, weighed, and threshed separately, and the total yield of grain was obtained by adding the respective yields together.

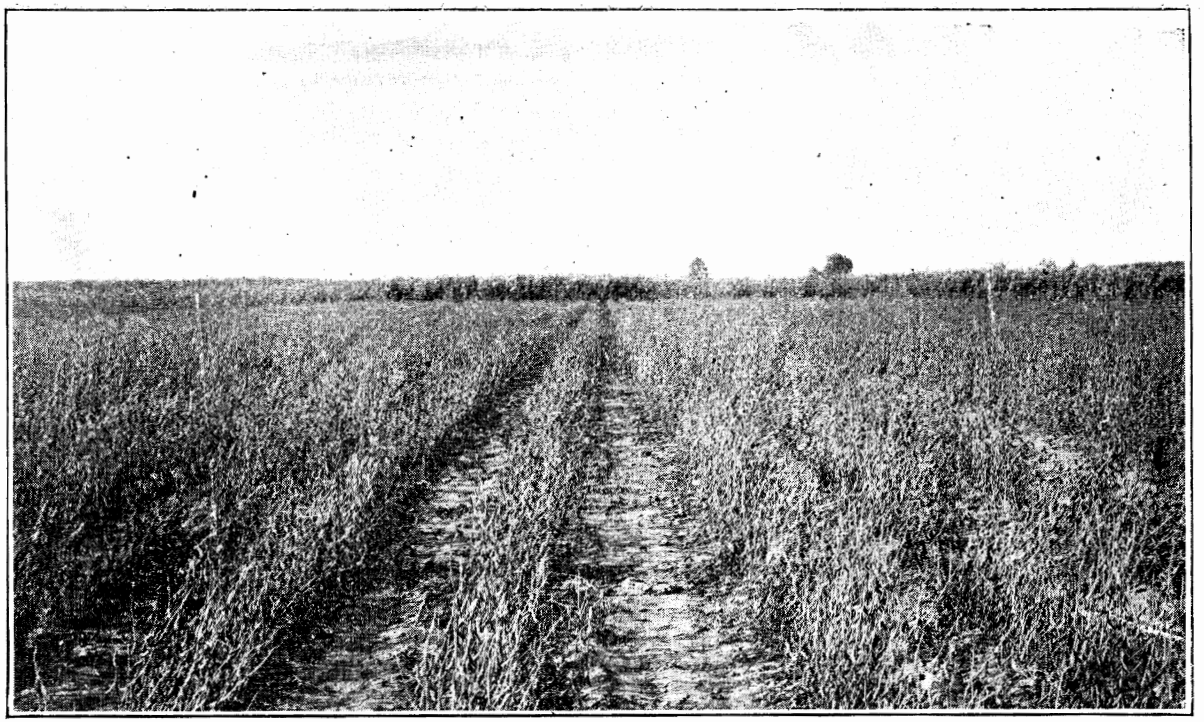
TABLE NO. 4.

Variety.	Area of Plat in Acres	Date of Planting	Date of Harvest	Yield Per Acre.	
				Tons of Straw.	Bu. of Grain.
California Black Eye	1-7	5-21	9-10	Not rep'd	8.71
Iron Cowpea	1-7	5-21	10-10	2.63	7.93
Iron Cowpea	1-7	5-21	10-10	2.87	9.27
Local variety	1-7	5-21	10-10	2.22	13.59
Whip-poor-will	1-7	5-21	10-10	1.32	11.55
White Era	1-7	5-21	10-10	1.33	18.20

In this test the White Era variety gave the largest yield of grain per acre. A local variety, which was similar in some respects to the Whip-poor-will, gave the second largest yield, while the Whip-poor-will variety occupied third place in amount of seed produced. The Iron cowpea gave the maxium yield of cured hay yer acre, but the amount of seed obtained was not large. For earliness (of maturity) the California Black Eye stands at the head of this list. It required 112 days to bring this crop to complete maturity, while the other varieties continued to grow and blossom for a period of 142 days. The growing and blossoming periods of the cowpea are determined largely by the character of the season. The supply of soil moisture and the available mineral constituents are also important factors.

The first four varieties mentioned in this list were planted at a later date on larger plats. The seed was sown with a disc drill in rows thirty-two inches apart on June 23-24. In this test all crops matured earlier than the crops in the variety experiment, but the yield of grain was not as large. The California Black Eye variety was the first to mature and produced a yield of 7.8 bushels of seed per acre. It should be stated, however, that a poor stand was secured on the Whip-poor-will p'at, hence the yield of grain was reduced somewhat. The Iron cowpea gave an excellent yield of forage. Possibly it would be safe to presume that the production of a heavy growth of forage, which appears to be a characteristic of the Iron variety, has a tendency to prevent the formation of pods. Another feature which should not be overlooked in the culture of the cowpea is the fact that the seed does not all mature at one time, and as the pods open quite readily, a considerable portion of the grain may be lost. The adoption of a systematic plan of selecting seed from plants which mature their pods uniformly will undoubtedly assist materially in overcoming this difficulty.

In 1904 cowpeas and soy beans were grown side by side in general farm work, not only on bottom land but also on upland soil. The crops were planted early on the former area and comparatively late on the latter sec-



This Crop of Soy Beans Has Passed the Harvesting Stage. Most of the Leaves Have Fallen.

tion. The bottom land was seeded on May 5th and the upland on June 30th. The seed was sown in rows thirty-two inches apart, and the crops were well cultivated during the early stages of growth.

TABLE NO. 5—COWPEA AND SOY BEAN YIELDS.

Crop	Area of Plat in Acres	Date of Planting	Date of Harvest	Yield Per Acre.	
				Tons of Hay	Bu. of Grain
Soy beans	.5	5- 2	8-26	.70	9.90
Cowpeas	.5	5- 2	8-11	1.79	8.00
Soy beans	1.58	6-30	9-13	.61	9.45
Cowpeas	1.81	6-30	9-13	1.07	12.45

The first section of this table gives the yields for the botton land, and the second section records the returns for the upland area. Heavy rains in May damaged both soy beans and the cowpeas on the bottom field, consequently the yields reported for these plats are appreciably lower than they would have been under more favorable weather and soil conditions. In both trials the cowpea gave heavier yields of cured hay per acre than the soy bean. The late planting gave better results than the earlier seeding, more particularly from the standpoint of seed production. The soy bean will withstand excessively moist conditions much better than the cowpea. In general practice it is a good plan to defer the planting of cowpeas or soy beans until the soil has become thoroughly warmed.

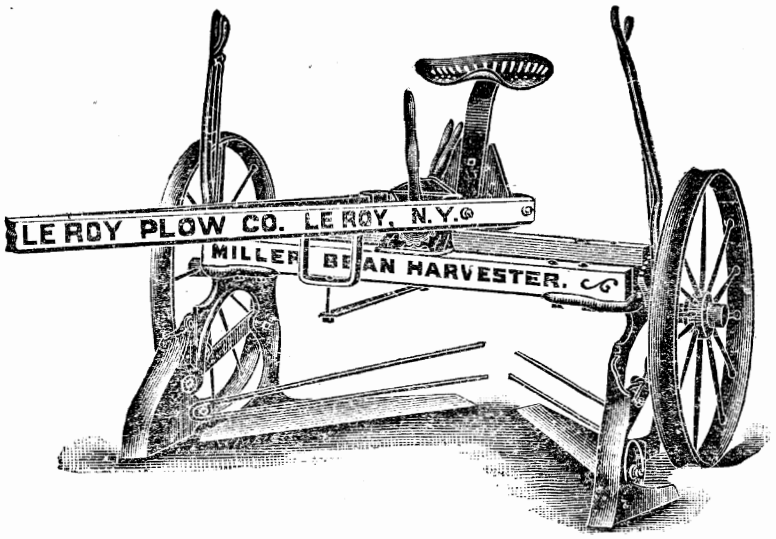
A well prepared seed bed is an essential step toward success in the culture of the cowpea and soy bean plants. The principles which are observed in the preparation of corn land will apply equally as well in the case of these crops. In the first place, the soil should be well pulverized so that a mellow seed bed may be secured. With some soils an early preparation would be highly desirable. This is true more especially of those types which are somewhat tenacious, thus where the plowing is done in the late fall the frosts of winter will aid materially in breaking down the soil and forming a mellow surface. Soils which have a tendency to wash and run together should be given spring treatment. Growing a good catch crop upon fields of this type and turning the green material under early in the spring is an exceedingly good practice to follow. If the plowing is done during the winter months or in the early spring, the surface of the field can readily be brought into fine tilth by giving the soil a stroke or two with an ordinary smoothing harrow. It is not well to allow a crust to form upon the surface, since such a condition facilitates the evaporation of moisture.

As soon as the soil becomes thoroughly warmed, the seed may be planted. No advantage will be gained by seeding until the soil has reached this condition. Generally speaking the peas and beans are drilled in rows, which are from thirty to thirty-six inches apart. Spacing the rows less than thirty inches is not recommended, since it is much more difficult to cultivate effectively, when the rows are narrowed down rather close. Some observations were made during the season of 1904 with soy beans planted in rows twenty-four and thirty two-inches apart, respectively. The beans which were planted in rows thirty-two inches apart gave a yield of 10 bushels of grain and .89 tons of straw per acre, while the twenty-four inch planting gave a return of 8.6 bushels of grain and .77 tons of straw per acre as an average yield. There was not only an increase in yield with the wider planting, but a superior quality of grain was also secured. On rich bottom soils larger yields of grain may perchance be grown when the rows are located twenty-four inches apart as compared with the thirty-two or thirty-six inch rows. The seed can be sown with a grain drill. By blocking a portion of the feed holes the rows may be spaced the desired distance. If the seed is first-class in quality, two pecks (thirty pounds) will give a good set of plants. For broadcast seeding five or six pecks will be required. On the station farm seeding commences from the first to the fifteenth of May, and may be continued up to the first of August. The July seedings are usually made on wheat and oat stubble after the soil has been disced or listed, and cultivation is given as indicated for the earlier seeding.

As soon as the plants have made a good start, the first cultivation should be given. It is important that this work be done as early as the young plants will permit without being covered and destroyed with the moving soil. It is an easy matter to eradicate weeds when they are just breaking through the surface, and this is one good reason for urging that the work be done early. In the second place cultivation breaks the surface crust and the mulch which is formed intercepts the upward movement of soil moisture. Loss of moisture is thus prevented in large measure, and in the average season a full supply may be retained for the growing crop. The cowpea and soy bean consume large quantities of moisture, hence it is neeessary that some attention be given to the supply which is held within the soil. Two or three cultivations subsequent to the one mentioned will probably be sufficient to keep the field in good condition until the ground is well shaded. These treatments can be given at intervals of six to ten days, or where the crops make a rapid growth shorter intervals may elapse.

The question of harvesting the cowpea crop economically is an important one from the standpoint of the Oklahoma farmer. Seed has to be saved for the succeeding crop, and as the hay can frequently be turned to good account for winter feeding, some attention has to be given to the time of harvesting as well as to the best methods of curing the green forage. With

some varieties of cowpeas, the pods develop and commence to ripen long before the vines have reached the proper stage for cutting, hence if the entire crop of seed is to be secured, it will be necessary to remove the ripened portion by hand. Occasionally the grower wishes to save the seed and he is not particular about the forage, since it is his purpose to use the same for pasture. Hand picking can also be resorted to under such conditions. However, this method of harvesting the seed is expensive and for this reason the practice will not be followed extensively. An active boy can pick at least seventy-five pounds of pods per day, provided the variety grown is fairly productive. One hundred pounds of pods will yield about seventy pounds of seed. It will be seen that the cost of harvesting the seed in this manner will amount to about one dollar per bushel.



A Bean Harvester.

Loaned through the courtesy of the LeRoy Plow Company, LeRoy, N. Y.

Harvesting machinery has undergone a remarkable improvement within the last decade. Machines have been and are being constructed for handling every crop of economic importance that is grown upon the American farm today. To this end the bean harvester has been evolved in order to enable the bean grower in the northeastern states to handle his crop with greater ease. This type of machine is efficient in its work and can be used to advantage in harvesting the cowpea and soy bean in the south. There are at least ten or a dozen types of this machine on the market at the present time and they can be purchased at the nominal cost of $25.00. The harvester, which is mounted upon wheels, is fitted with rods on rolling dividers so that the vines are gathered two rows at a time and brought

together at the rear end of the machine in a windrow, the plants being almost entirely free from roots and dust. The roots are severed by two knives, which are set in a V-shaped position, and adjusted by levers in such a manner that they can be set to run just below the surface. In harvesting the crop these knives not only sever the plant from the root: but in passing beneath the surface they also stir the soil and leave it in an excellent condition for wheat. Planting the peas in rows thirty to thirty-six inches apart facilitates harvesting where one of these machines is used.

A combined cultivator and bean harvester has been placed upon the market within the recent years. When the cultivating season has passed the sections of teeth can be removed from the machine, and the harvester attachment, which is similar in construction to the one described, can be readily substituted. Another type of machine can be constructed at small cost by making a knife eighteen inches long with a ten inch shank to be used in attaching the piece to a plow or cultivator. The knife should be made out of spring steel and when in place it should slant backward at an angle of about forty-five degrees with the free end dropping slightly from the horizontal position. A better machine than this could be built at a slightly advanced cost with a double knife attachment arranged for cutting two rows at once. The mower is also used for harvesting the cowpea, but where the crop is heavy and the vines of some length, difficulty will be experienced in separating the tangled mass.

When one wishes to obtain both hay and seed the crop should be harvested when the leaves of the plant commence to show a tinge of yellow. If the ordinary bean harvester is used the vines will be placed in fair sized windrows, and can be allowed to cure out partially in this condition. Permitting them to stand thus for one day would not be too long, especially in fields where heavy crops are obtained. The vines can then be piled in coils and be given an opportunity to cure out thoroughly. With a bright sun they will be in splendid condition in the course of three or four days. Rain sometimes occurs before the uncured hay is placed in the coil. In such cases the crop should be stirred as soon as possible in order to insure the removal of the free moisture and when the vines are comparatively dry they can be stacked in small coils. After the hay is properly cured it can be hauled to some suitable place and stacked permanently. Since cowpea hay takes water very easily a stack cover of some description should be provided. Fine prairie grass will answer the purpose admirably.

Where the grain is to be used for seed the threshing may be done with a flail. The average machine cracks the seed and renders it unfit for use. Some report that by putting in blank concaves and removing some of the teeth from the cylinder, as well as reducing the speed, satisfactory work can be accomplished, but our experience after taking all these precautions is that too many peas are cracked to make the operation practicable when

grain is selling at a high price. Threshing the seed with a flail will give better results, and the work can be done at a season when other farm duties are rather slack. It will cost from four to five cents per bushel to thresh the peas with a machine and at least one-half or more will be spoiled for planting. Threshing with a flail will entail a cost of approximately six to eight cents per bushel. The soy bean is not as brittle as the cowpea, hence the grain can be threshed quite readily with a machine, provided the above precautions are taken. Threshing machines suitable for handling the cowpea will, no doubt, be placed upon the market at an early date.

Every grower is, no doubt, familiar with the fact that the pea weevil works incessantly in the stored grain during the fall and winter months, and it is certain that, if systematic measures are not adopted by the farmers of the south to overcome the ravages of this insect, enormous losses will result in the next few years. The beetles, which are dark-brown in color and scarcely more than one-fifth of an inch in length, make their appearance in the early spring and summer. Some of them may be seen in the fall of the year and these probably pass the winter under dead leaves and grass, or in fact any refuse that may chance to accumulate in the field. The insects may also be found encased within the seed. In the spring the adult beetles appear and the female deposits her eggs upon the newly formed pods. It is only a few days until the grub hatches, and immediately it finds its way through the wall of the pod into the nearest pea. A close examination of infested peas will reveal small black spots upon the surface of the grain, and if these peas are opened the small white grub may be found working within the seed in an oval-shaped aperture. The pupal stage is passed within the seed and finally the adult beetle emerges.

The question is frequently asked, "How can the weevils be kept from working in the cowpeas?" It is a fact that when they are present in large numbers and are not interfered with, a large quantity of the grain will be destroyed. The carbon bi-sulphide treatment is undoubtedly the most effective method in vogue for combating this insect. In 1903-04 the station made a test with carbon bi-sulphide and gasoline to determine their value in the treatment of infested peas. Five large, galvanized-iron cans which held about ten bushels of grain each were filled with the cowpeas. Two cans were treated with one-half pound of carbon bi-sulphide (one-quarter of a pound each), the liquid being placed in shallow pans on top of the peas. The liquid evaporates rapidly, and as the gas which forms is heavier than air it settles into the grain and destroys the weevils. A canvas covering was thrown over the cans to insure a more perfect confinement of the gas. The

remaining cans were treated with gasoline in the same manner except that a larger quantity of the liquid was used.

In this experiment it was found that the gasoline did not evaporate as readily as the carbon bi-sulphide, and thus it did not do as effective work as the latter. It was necessary to make a second application in the case of the cowpeas which were treated with gasoline. Carbon bi-sulphide was used at the rate of one pound to thirty-five bushels of grain. Ordinarily a smaller amount of carbon bi-sulphide is recommended, but in order to make the work sure a larger quantity was used in this trial. Recent investigations have shown that where the cowpeas are badly infested with weevils it has been necessary at times to give a second treatment. A tight box with a good lid will answer as well for storage purposes as the galvanized cans used in this experiment. The peas should be allowed to stand covered for thirty-six to forty-eight hours. Use the carbon bi-sulphide at the rate of one pound of the liquid to forty bushels of grain. Watch the peas and if the treatment has not been thorough, a second light treatment should be given, using one-half the amount stated above.

CAUTION—The gas which comes from the carbon bi-sulphide is very inflammable and scrupulous care should be exercised to see that no lighted match or lantern is brought in contact with this substance. If you are in the habit of smoking, it will be highly desirable to leave the pipe at the house while this work is under way. The seed should be treated preferably in sheds which are located some distance from the large buildings on the farm, although, if the proper precautions are taken, the work may be carried out with safety in the granary or barn.

Other methods of treatment have been recommended, but these have not been practiced generally, possibly for the reason that they have not given as good results as the above method. Peas may be treated successfully by heating them to a temperature of 145° F., but this is not feasible for the average farmer. The coal oil treatment has also been advocated as a remedy. In this case the peas are scattered out on the granary or barn floor and given a thorough sprinkling with coal oil. Enough oil should be used to coat every pea with a thin film, and the grain be allowed to remain upon the floor for two or three days. One quart of oil will treat twenty bushels of seed.

SUMMARY

1. The cowpea and soy bean belong to the legume family. These plants are able through the medium of bacteria which are associated with their root systems to assimilate free nitrogen from the soil air. This characteristic makes these plants a valuable asset to the farmer's list of crops.

2. As forage crops, the cowpea and soy bean should be given a conspicuous place in the rotation. The grain and forage furnish nitro-

genous material for the ration, which is used in feeding the live stock of the farm.

3. On upland soils both crops will respond to applications of farmyard manure, hence this by-product of the farm should receive special attention even if our lands are comparatively new.

4. The farmer has a long list of varieties at his disposal. In making a selection, productiveness is an important item.

5. Good results can be obtained by planting the seed in rows thirty-two inches apart, which plan will enable the grower to cultivate the crop during the early part of the season.

6. Where grain is infested with pea weevil, the insect may be held in subjection by the use of carbon bi-sulphide.

L. A. MOORHOUSE, Agronomist.