

EXPERIMENT STATION
OF THE
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FARM DEPARTMENT.

H. M. COTTRELL, M. S., Agriculturist.
D. H. OTIS, M. S., Assistant in Dairying.
J. G. HANEY, B. S., Assistant in Field and Feeding Experiments.

A NEW DROUGHT-RESISTING CROP—SOY BEANS.

THE Kansas Experiment Station began raising soy beans in 1889, and has raised them every year since—in 1899 having seventy acres in this crop. We have found the soy bean to stand the drought as well as Kafir-corn or sorghum; it is not touched by chinch-bugs; the grain is a richer feed than linseed-meal, and the plant enriches the soil on which it is grown. We believe that in 1900 the soy bean should be tried on a small scale by every Kansas farmer.

DESCRIPTION OF THE SOY BEAN.

The soy bean is an erect-growing plant, one and one-half to three and one-half feet in height, with a stiff, woody stem, having numerous branches like a miniature tree. The foliage is heavy and the plants start to branch close to the ground. The branches are thickly covered with pods, which usually contain two to three beans to the pod.

The soy bean was brought from Japan, where it is extensively cultivated for human food, taking the place of beef on account of its richness in protein. Because of its peculiar flavor but few Americans like it.

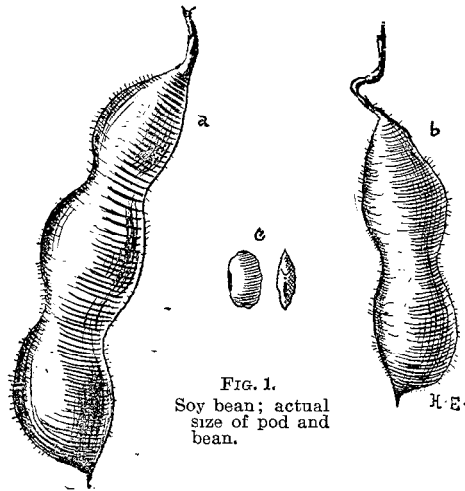


FIG. 1.
Soy bean; actual
size of pod and
bean.

VARIETY TO PLANT.

Kansas farmers should plant the Early Yellow soy bean. The Kansas Experiment Station has tried many other varieties, and the Early Yellow is the only sort that we have found that is satisfactory under Kansas conditions. Other kinds either yield too little or the crop does not mature during our season. In the spring of 1899 we issued a press bulletin describing the merits of the soy bean and recommending the farmers to give the crop a trial. The College had no seed for sale and farmers ordered from the seed men, simply writing for soy beans. As long as the supply of Early Yellow soy lasted orders were filled with it, and the crops are reported satisfactory. After this supply was exhausted the seed men filled the orders with the Late Yellow soy, a variety that matures in Georgia and Alabama. Kansas farmers who planted the seed of this late variety report that but a small portion of the crop matured, the rest being killed by frost. Early Yellow soy beans planted May 12, 1899, were harvested August 23; planted after wheat, July 14, 1898, were ripe October 9.

PLANTING.

The soy bean should not be planted until the ground becomes warm and the danger of severe frost is over. While the plants may not die if the seed is put in earlier, they do not thrive. No extra growth is gained by too early planting, and the weeds are more likely to grow and make more cultivation necessary. We usually begin putting in soy beans as soon as we have finished planting corn. The beans should be planted in rows thirty to forty-two inches apart, with the single beans dropped one to two inches apart in the rows. One-

half bushel of seed per acre is required. The ground should be in good tilth, and the weeds thoroughly killed just before the beans are planted.

We prefer surface planting. Shallow listing is sometimes successful, but we have lost several crops from listing by heavy rains falling before the beans came up, filling the furrows so full that the young plants were killed. Several Kansas farmers have reported good stands by listing, then filling the furrows nearly full with the cultivator and planting the beans in the shallow furrow that is left.

The beans may be planted with a grain-drill or with a corn-drill, having the plate drilled to drop right. At the College we plant with an eleven-hole grain-drill, stopping all holes but the two outside ones and the middle hole. This puts the beans in rows thirty inches apart. We prefer this distance where the teams are trained to work in narrow rows.

CULTIVATING.

We cultivate the same as corn, using the two-horse cultivator with small shovels and taking great care not to ridge the ground. Level culture is necessary to harvesting a full crop. The ground should be kept clean, free from weeds and grass, and we prefer the shallow tillage which secures a good earth mulch.

HARVESTING.

The crop should be harvested when the pods turn brown and before the beans are fully ripe. If left until the beans become thoroughly ripe the pods will open and the beans will be scattered on the ground.

The only satisfactory way we have found for harvesting the crop is to cut the plants off just below the surface of the ground and rake them into windrows with a horse-rake. Where not over ten acres are grown this cutting can be done by removing the shovels from a two-horse cultivator and bolting to the inner shank of each beam a horizontal knife about eighteen inches long, the knife set out from the cultivator and sloping back from point of attachment to point so as not to clog. Any blacksmith can make these knives. The cut shows a knife made for this purpose from an old knife belonging to a stalk-cutter. With such an arrangement two rows are cut at a time, the knives being set to cut the plants just below the surface.

Where more than ten acres of soy beans are grown, it will pay to harvest them with a regular bean harvester. We tried a number of these harvesters during the summer of 1899, and can recommend bean harvesters made by Chas. H. Bidwell, Medina, N. Y., and the Le Roy Plow Company, Le Roy, N. Y.

As soon as cut, the beans should be raked into windrows and immediately shocked, and left to cure in the cocks. The thrashing may

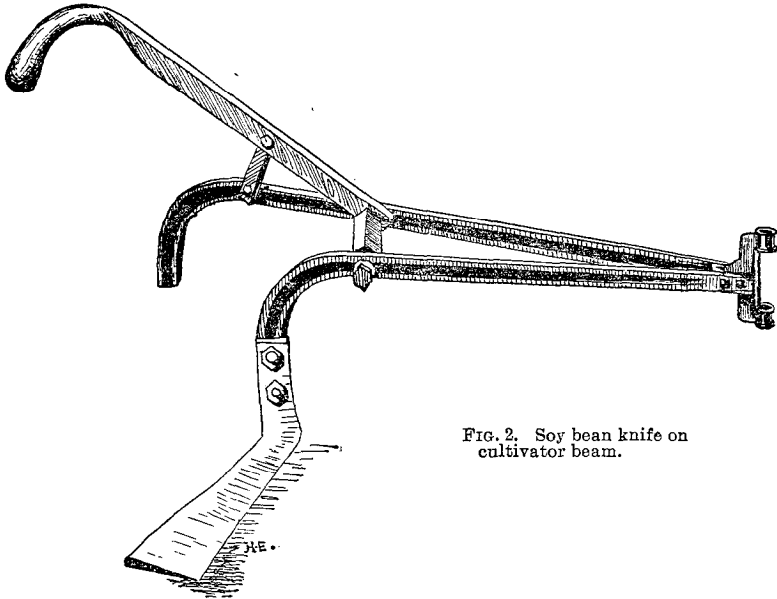


FIG. 2. Soy bean knife on cultivator beam.

be done with the ordinary grain thrasher, using all blank concaves, and running the machine slow enough to prevent cracking the beans.

YIELD.

The Early Yellow soy bean, planted in the spring, will yield from ten to twenty bushels per acre, depending upon the soil and season. The College farm is upland. In 1898 thirty-five acres of soy beans were grown, with an average yield of thirteen bushels per acre. In 1899 seventy acres gave an average yield of fifteen and one-half bushels per acre. With sufficient moisture to germinate them, a crop of soy beans can be grown after wheat and oats have been harvested. In 1896 the yield on the College farm on ground after wheat was eight bushels per acre; in 1898, six and one-fourth bushels. With linseed-meal at twenty-five dollars per ton, these crops after wheat would be worth \$6 and \$4.68 per acre. In addition to these returns we received the benefit of increased yields from succeeding crops.

Farmers with better ground than ours report a yield of twenty bushels per acre, using our seed.

FEEDING VALUE.

Most Kansas feeds, with the exception of alfalfa, are deficient in protein, and have too much carbohydrates. Protein is the material in food that is needed to form flesh, blood, and milk. Carbohydrates in the food form fat in the body and furnish the animal heat. Soy



FIG. 3. THE SOY BEAN.

beans are extremely rich in protein. The following table shows the digestible nutrients of soy beans and several of our common feeds:

| FEED. | Digestible nutrients, pounds per 100 lbs. feed. | | |
|--------------------------------|---|-----------------|-------------|
| | Protein. | Carbo-hydrates. | Fat. |
| <i>Soy beans</i> | 29.6 | 22.3 | 14.4 |
| Flaxseed | 20.6 | 17.1 | 29.0 |
| Linseed-meal—old process | 28.8 | 32.8 | 7.1 |
| Bran | 12.3 | 37.1 | 2.6 |
| Oats | 9.3 | 48.3 | 4.2 |
| Corn | 7.8 | 66.7 | 4.3 |

We have not had a sufficient quantity of soy beans to make extensive experiments of their feeding value for cattle. So far as we have tested soy-bean grain we have found it to take the place and have about the same effect as linseed-meal for feeding steers, dairy cows, and calves. The soy beans are richer in protein and fat than linseed-meal; they have the same laxative effect, and, when fed to cows giving milk, tend to soften the butter the same as linseed-meal. Farmers who have a sufficient amount of alfalfa do not need soy beans for cattle, but farmers not having alfalfa should feed soy beans. Three to four pounds of soy-bean meal per day, added to the ordinary winter ration of the Kansas dairy cow, will increase the flow of milk and improve the texture of the butte. Kansas farmers who desire to raise all the feed given their steers, cows and young stock should grow soy beans without fail, unless they have alfalfa. We have always fed soy beans ground to cattle.

We have made a number of tests of the value of soy beans for fattening hogs. We have ground the beans used in these experiments; but for ordinary feeding, where accurate work is not necessary, soy beans for hogs may be thrashed and fed whole, or the unthrashed stalks may be given and the hogs will pick out the beans. Following are the results obtained in five tests of soy beans for fattening hogs:

1. Hogs seven and one-half months old, averaging 188 pounds each, were fed seven weeks, when they were ready for market, with the following results:

| | Average gain per hog. | Gain per bus. of feed. | Feed per 100 lbs. gain. |
|--|-----------------------|------------------------|-------------------------|
| Kafir-corn meal..... | 90.6 lbs. | 11.9 lbs. | 471 lbs. |
| Kafir-corn meal four-fifths, soy-bean meal one-fifth | 103.8 “ | 13.9 “ | 409 “ |

This experiment shows that by adding soy beans to the Kafir-corn a saving of thirteen per cent. was made in the amount of feed required to make 100 pounds of gain.

2. Pigs six months old, averaging 122 pounds each, were fed twelve weeks, with the following results:

| | Average gain per hog. | Gain per bus. of feed. | Feed per 100 lbs. gain. |
|--|--------------------------|---------------------------|----------------------------|
| Kafir-corn meal | 102.0 lbs. | 10.0 lbs. | 559 lbs. |
| Kafir-corn meal four-fifths, soy-bean meal one-fifth | 146 0 " | 13.9 " | 408 " |

This experiment shows a saving of twenty-seven per cent. by adding the beans to the Kafir-corn.

3. Weaning pigs were put on experiment November 22 and fed sixteen weeks. In addition to the grain they were allowed the run of an alfalfa pasture. Snow fell in December and allowed slight picking thereafter. The results, not considering the pasture, were as follows:

| | Average gain per hog. | Gain per bus. of feed. | Feed per 100 lbs. gain. |
|---|--------------------------|---------------------------|----------------------------|
| Kafir-corn meal | 74.2 lbs. | 10.3 lbs. | 542 lbs. |
| Kafir-corn meal two-thirds, soy-bean meal one-third | 129.2 " | 15.3 " | 374 " |
| Corn-meal | 82.6 " | 11.6 " | 484 " |
| Corn-meal two-thirds, soy-bean meal one-third | 120 4 " | 15.5 " | 369 " |

Showing a saving in amount of feed required to make 100 pounds of gain of thirty-one percent, by adding soy beans to the Kafir-corn, and of twenty-four per cent. by adding soy beans to the corn.

4. Hogs were purchased that averaged 126 pounds each, and were fed nine weeks, with the following results.

| | Average gain per hog. | Gain per bus. of feed. | Feed per 100 lbs. gain. |
|--|--------------------------|---------------------------|----------------------------|
| Kafir-corn meal | 52.4 lbs. | 7.5 lbs. | 749 lbs. |
| Kafir-corn meal four-fifths, soy-bean meal one-fifth | 97.8 " | 12.1 " | 468 " |

This experiment shows a saving, by adding soy beans to the Kafir-corn, of over thirty-seven per cent.

5. Hogs were purchased that averaged 140 pounds each, and were fed fifty days, with returns as follows:

| | Average gain per hog. | Gain per bus. of feed. | Feed per 100 lbs. gain. |
|--|--------------------------|---------------------------|----------------------------|
| Kafir-corn meal | 44.1 lbs. | 8.6 lbs. | 653 lbs. |
| Kafir-corn meal four-fifths, soy-bean meal one-fifth | 86 6 " | 13.0 " | 435 " |

This experiment shows a saving in feed of thirty-three per cent. by adding the soy beans to the Kafir-corn.

These experiments show that when soy beans were fed with corn or Kafir-corn for fattening hogs a saving was made in the amount of feed needed to make 100 pounds of gain of 13, 24, 31, 33 and 37 per cent., the amount varying in different experiments. Can the Kansas farmer afford to go without the soy bean and lose this saving?

In feeding hogs, mix the Kafir-corn and soy beans just before feeding, and add sufficient water to thoroughly wet the mixture; soaking for any length of time gives less returns.

We have not tried soy beans for sheep feeding, but many feeders

report this crop as valuable for sheep feeding as we have found it for feeding hogs.

Soy beans make a pasture that is greatly relished by hogs and they make good gains on it while the pasture lasts, but soy-bean pasture is not sufficiently lasting to be profitable under most circumstances. Soy-bean vines fed green make a good milk-producing food.

We have not found the Early Yellow soy bean to be a profitable hay crop. Other soy-bean raisers have reported so favorably on soy beans for hay that we shall try other varieties and new methods for making soy-bean hay. We have not found any kind of stock that likes the fodder after the ripe beans are removed.

COST OF PRODUCTION.

Kansas farmers who have tried soy beans on a large scale report that with ordinary prices for farm labor it costs forty cents per bushel to raise them. This includes all expense from preparing the ground for planting to storing the thrashed beans in the bin, but does not include rent.

During the summer of 1899 we kept an account of the cost of raising soy beans on fields containing a total area of sixty acres. Labor cost \$1.25 per day for a man and \$2.50 per day for a man and team. The cost per acre was: Preparation of land, \$1.35; planting, 30 cents; cultivating, \$2; hoeing, 70 cents; harvesting, \$1.40; thrashing, \$2.57; total, \$8.32. The yield of the 60 acres was 932 bushels, making the total cost per bushel nearly 54 cents.

FAULTS OF THE SOY BEAN.

Soy beans stand drought well and are not touched by chinch-bugs, but are a favorite feed for rabbits. The College sent out many small lots—one and two quarts in a lot. Most of the reports from these small lots said that the beans came up well, and while still young were entirely destroyed by rabbits. For this reason we now refuse to sell less than one bushel of beans, and recommend Kansas farmers to plant five acres for a trial patch. One bushel will plant two acres, and where two to five acres are planted the rabbits can take the outside rows and there will be enough left to give a fair test.

If the beans are allowed to become ripe before being cut they sometimes shell badly, farmers occasionally reporting a loss of half or more of the crops from this cause. The beans should be cut before becoming ripe. Beans cut when the pods begin to turn brown shell but little.

Accidents or other pressing labor may prevent the grower from cutting at the right time. In this case the beans may be saved by

turning pigs on the field after the crop is harvested. The pigs will pick up the scattered beans.

FERTILIZING VALUE.

The soy bean not only furnishes a highly concentrated feed, but it improves the soil on which it is grown. Henry Rogler, one of our graduates, reports an increase in large fields of five bushels of wheat per acre on land where soy beans had previously been grown over the yield from the same kind of land that had not been in soy beans. We have noticed an increased yield in crops of all kinds that have followed the soy bean.

Where farmers in eastern Kansas have had difficulty in getting alfalfa to grow, they will find that a crop of soy beans raised just before seeding to alfalfa will aid them in getting the alfalfa started, as the soy bean leaves in the surface soil just the material needed for the young alfalfa plants.

Will it Pay the Kansas Farmer to Raise Soy Beans?

The soy bean stands drought as well as Kafir-corn or sorghum; it is not touched by the chinch-bugs; the grain is a richer feed than linseed-meal, and the plant enriches the soil on which it is grown. It will cost the Kansas farmer from forty to fifty-five cents per bushel to raise the soy bean—thirteen to eighteen dollars per ton. Pound for pound, soy beans are worth a little more than oil-meal, and feeders are paying twenty-four to thirty dollars a ton for oil-meal.

Kansas dairymen should raise soy beans. A bountiful supply of protein will greatly increase the milk yield. Soy beans are rich in protein and our ordinary Kansas feeds are poor in this material. Three to four pounds of soy beans per day added to the usual dairy ration of hay, fodder, sorghum and corn will increase the winter milk yield of the average Kansas cow from 25 to 100 per cent.

Kansas hog raisers should grow soy beans. Fed to young pigs, soy beans will make them grow more rapidly and have better health. Fed to fattening hogs, soy beans will induce them to eat more, make more gain for each bushel of feed eaten, and shorten the fattening period.

The Kansas stockman should raise soy beans, as soy beans fed to young stock will push their growth and enable them to "keep the calf fat," which is so necessary to economical feeding. Fed to fattening animals, soy beans will produce the same results as linseed-meal at less cost.

Kansas sheep men should raise soy beans and secure the results obtained from linseed-meal with a home-grown feed at a reduced cost.

Kansas crop growers should raise soy beans to quickly and cheaply increase the yield of their other crops.

Plant five acres or more of soy beans this spring and give them a trial.

OBTAINING THE SEED.

Most seed men sell soy beans, listing them as soy beans, soja beans, or coffee beans. The following farmers report having raised soy beans in large quantities in 1899:

HON. GEO. M. MUNGER, Eureka, Kan.

A. E. CLARK, Pleasant Hill, Kan.

M. L. DICKSON, Edgerton, Kan.

WM. C. LEE, Manhattan, Kan.

H. H. CLOTHIER, Vera, Kan.

D. L. BEALE, Montana, Kan.

O. E. SIMMERS, Abilene, Kan.

Soy beans intended for seed should be stored in shallow bins; kept in large quantities or in sacks they heat, and will not germinate. Farmers buying seed should take the beans out of the sacks as soon as received, and spread them out in a dry place until planting. Last spring a farmer bought a sack of soy beans and planted part of them as soon as received, securing a good stand. A rain stopped the planting for two weeks, when the remainder of the beans were put in, but failed to grow. They had become heated in the sack.