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Soy Beans

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C.R. Megee, Farm Crops

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*Oakley Lardie*

**SPECIAL BULLETIN NO. 100**

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# MICHIGAN AGRICULTURAL COLLEGE

EXPERIMENT STATION

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SOY BEANS



Soy bean variety test on the College Station Field. The future of the soy bean crop in Michigan depends largely upon securing high yielding varieties.

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EAST LANSING, MICHIGAN  
1920

## SOY BEANS.

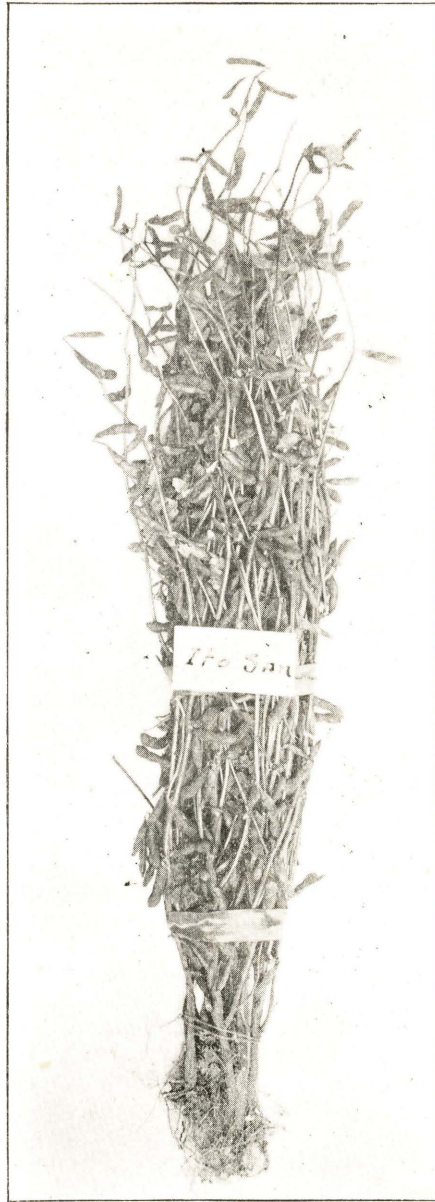
C. R. MEGEE, FARM CROPS SECTION.

Interest in soy beans has increased greatly in Michigan during the past two years due to the following reasons: First, frequent failure of clover has made it necessary to secure an emergency hay crop which will furnish hay the same season as planted; second, increase in favor of the practice of sowing soy beans with corn for ensilage and hogging-off; third, increased demand for northern grown soy bean seed throughout Michigan and bordering states; fourth, greater use of soy beans as a green manuring crop.

Since this crop is a comparatively new one, its value in Michigan agriculture will depend very largely on its proper use which makes necessary accurate knowledge of the nature of the plant, the time, rate and method of sowing, inoculation, varieties, method of harvesting and feeding value.

The soy bean is an annual plant, in that it grows and matures the same season under favorable conditions. It is a legume and when inoculated takes free nitrogen from the air and stores it in its tissues and in the soil, thereby making the crop a valuable one for improving soils deficient in nitrogen and organic matter. This fact makes it a better crop to substitute on ground where clover has failed, than some of the non-leguminous crops such as millet and sudan grass which often leaves the land in poor condition for a following crop. Chemical analyses show that soy bean hay is higher in protein than clover hay, and that when properly cured it makes a valuable substitute. Of recent years failures with clover seedings have been frequent, due to the lack of lime, organic matter and available plant food. When possible it is a better farm practice to correct the deficiency in the soil by the application of ground limestone or marl, barnyard manure and acid phosphate and make possible good crops of clover and alfalfa, rather than to depend upon substitute hay crops. However if clover or alfalfa hay is lacking, adapted varieties of soy beans offer an excellent substitute and quick returns.

While soy beans apparently are of greatest value in this State as an emergency hay crop, they are used in a number of other ways. When a late spring or early summer-sown leguminous green manuring crop is desired, the soy bean is preferable because of its comparatively high yield per acre. When corn is to be hogged-off, a practice increasing in favor in lower Michigan counties, soy beans may be planted at the same time as the corn, thereby supplying more feed of a greater variety and higher protein content than corn alone. Only varieties that will produce well-filled pods should be used for this purpose. Soy beans are frequently planted with corn for ensilage, a practice which is increasing in favor in Southern and Central Michigan.



Soybean plant showing pods.

The increased acreage of soy beans planted for hay, ensilage and green manuring has created a heavy demand for seed of the better varieties. Yields of from 12 to 16 bushels per acre are usually secured while yields as high as 25 to 30 bushels per acre have been reported. The soy bean is not seriously affected by blight, rust, and anthracnose, which frequently damage common field beans quite seriously. Owing to its high percentage of fat and protein, soy bean seed is sometimes fed as a concentrate. The seed ranks with cotton seed meal and oil meal in fat and protein content.



Soy beans are a valuable green manuring crop. The view above shows soybeans drilled on an impoverished sandy loam soil.

#### VARIETIES.

The selection of the variety is of great importance as shown by tests conducted during the past six years, some varieties yielding from three to four times as much forage as others.

The following varieties are considered among the best for Michigan conditions:

Manchu,  
Ito San,  
Early Brown,  
Black Eyebrow.

The Mammoth Yellow and Ogemaw are quite inferior for forage purposes. The Ogemaw matures very early and produces but little plant growth comparatively, while the Mammoth is quite late in maturing, and consequently, not adapted to this state.

In northern Michigan counties, the Early Black is apparently the best adapted variety.

The following table gives the yields in pounds per acre of air-dry hay

produced in 1919, a favorable year, by each variety, together with notes on maturity. In 1917, a very unfavorable year, few soy beans matured in this state.

## SOY BEAN VARIETY TEST—1919.

Planted June 8th, harvested September 4th.

Results corrected according to checks in pounds per acre on 12% moisture basis.

Variety.	Pounds per acre. Air Dry Hay.	Maturity.
Manchu.....	5107	Pods forming.
Ito San.....	4931	Seeds well formed.
Early Brown.....	4760	Seeds well formed.
Black Eyebrow.....	4688	Seeds well formed.
Medium Green.....	4370	Seeds just forming.
Mongol.....	4351	Seed just forming.
Virginia.....	4212	Pods just forming.
Wilson 5.....	4193	Pods just forming.
Hollybrook.....	4065	Pods forming.
Wisconsin Black.....	3698	Seed nearly mature.
Wilson.....	3475	Just past bloom.
Michigan Favorite Cow Pea.....	2108	No pods.
Ogemaw.....	1561	Mature.
Mammoth Yellow.....	1276	No pods.

During the past season (1919) five variety tests\* were conducted in four different counties. The results of these tests correspond very closely with results at the Station. In each test one of the following varieties: the Ito San, Black Eyebrow, or Early Brown, ranked first. The Manchu was not included. In each test the Mammoth Yellow ranked last. The following table gives the yields in tons per acre of air-dry hay produced by each variety:

County.	Ito San.	Black Eye- brow.	Med. Green.	Mammoth Yellow.	Ely. Black.	Wilson.	Hollybrook.	Mongol.	Ely. Brown.
Allegan.....	.86	1.10	.50	.18	.31	.56	.57	.44	.72
Bay.....	3.26	3.57	2.55	1.12	2.91	2.90	2.56	3.27	2.27
Monroe.....	3.42	2.55	2.74	.68	2.43	1.86	3.16	2.94	2.66
Monroe.....	1.68	1.44	1.26	Failure	1.71	1.65	1.62	1.73	1.81
Wayne.....	1.37	1.35	1.18	.45	.90	.98	1.07	1.28	1.41

## ADAPTATION.

Soy beans will grow on all types of well-drained soils of sufficiently long season such as are adapted to the production of corn for grain. They do best on soil well supplied with lime, but will make considerable growth on soils that are somewhat acid which makes them adapted to sandy soils. In case the soil is very acid a large growth should not be expected. Soy beans frequently make considerable growth on light, sandy soils that are so deficient in organic matter that alfalfa and red or June clover do not catch.

\*Sectional variety tests conducted by Prof. J. F. Cox, E. K. Chamberlin, and C. R. Megee.

## PREPARATION OF SEED BED.

The seed bed for soy beans should be prepared in the same manner as for corn or other cultivated crops. If not plowed in the fall, the ground should be plowed as early in the spring as possible and harrowed at frequent intervals until planting time. On light sandy soils or extremely heavy soils spring plowing is preferable, while both fall and spring plowing is satisfactory on well-drained clay loams, loams, and sandy loam soils. If the field is foul with weeds fall plowing followed by early spring cultivation is advisable especially if the soy beans are to be sown in drill rows seven inches apart and not cultivated.

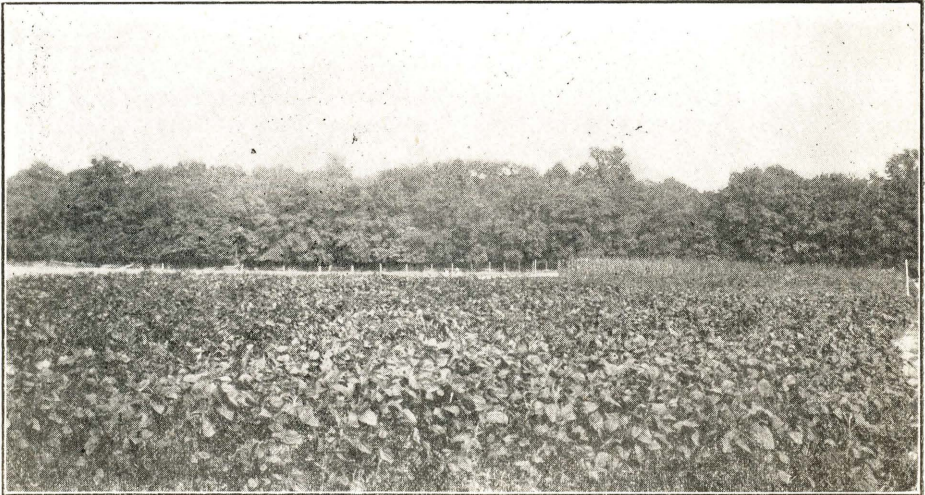
## TIME OF PLANTING.

As a rule the best time to plant soy beans is immediately after corn-planting time. From May 20 to June 15 is usually satisfactory for either hay or seed. For green manuring, plantings as late as July 1st can be



Soybean root system showing nodules.

made, though earlier planting is advisable. Mr. E. E. Evans, legume specialist of West Branch, Ogemaw Co., Michigan, states that the greatest error of soy bean growers in northern Michigan is too late planting and that he has never seen the crop seriously injured by frost between May 10th and October 1st. The past season (1919) Ito San soy beans planted at the Experiment Station on May 21st yielded 624 pounds per acre more hay than did the same variety planted June 7th. In southern and central Michigan and on the earlier soils of Northern Michigan it is good practice to have the soy beans planted by early June.



A Field of Soybeans.

#### DEPTH OF PLANTING.

It is advisable to plant as shallow as possible and still cover properly. Since it is difficult for soy beans to get above ground too deep planting will result in a very poor stand. When the seed is poorly covered on the loamy and lighter soils, a thorough rolling will usually cover all uncovered beans. If the ground is very dry deeper planting will do no harm unless a beating rain should form a crust. In case a crust is formed before the beans have made signs of appearance above the ground, a very light harrowing with a spike-tooth harrow will be beneficial.

#### INOCULATION.

When planting soy beans in a field for the first time, it is desirable to inoculate if the best results are to be secured that season. There are several methods of inoculation, one of the simplest being by the pure culture method. This material may be secured from the Department of Bacteriology, M. A. C., East Lansing, Mich. Full directions for application accompany the material.

Another method is to take well-inoculated soil from a field where soy



beans were grown successfully with an abundance of nodules on the roots the season previous. This soil may be applied through the fertilizer attachment or sown broadcast over the field and harrowed in. Three hundred pounds of soil is sufficient to inoculate one acre. The soil should be protected from the sun at all times, since bright sunlight injures the bacteria. The soil method of inoculation has been very successful. The glue method may be used when it is not convenient to secure large quantities of soil. From one to one and one-half ounce of carpenters' glue is dissolved in a quart of water and sprinkled over a bushel of seed, which has been spread out on the barn floor. The seed is shoveled over so that the glue solution will come in contact with each seed. About a quart of fine soil that has been secured from a soy bean field where the roots had an abundance of nodules is sprinkled over the seed. The soil should be screened to remove stones and clods. The glue method has also been successful, the pure culture method is being used largely, however, due to the ease of securing the culture and simplicity of application.

#### METHOD OF PLANTING.

The method of planting soy beans will depend largely upon the use which is to be made of the crop.

*For hay and green manure.* Soy beans may be planted in rows 28 inches apart, with an ordinary grain drill, by leaving open the second, sixth and tenth hole. When planted in this manner, the soy beans should receive an occasional cultivation.

If the land is free from weeds and there is sufficient moisture to carry the crop, larger yields and a finer quality of hay can be secured by planting with the ordinary grain drill all holes open and drill rows seven inches apart. On the Experiment Station Farm, East Lansing, the past season, 799 pounds more hay per acre was secured by the latter method. No cultivation is necessary when planted in this manner, which is an important factor when labor is scarce.

*For ensilage and hogging-off.* When soy beans are to be sown with corn for ensilage or hogging-off a special soy bean attachment should be secured for the corn-planter. This attachment consists of a separate drill and grain-box, so that it is not necessary to mix the corn and soy beans. The practice of mixing the corn and soy beans and drilling from the same grain box is not very satisfactory because the soy beans are round and smooth and soon work to the bottom of the box and an even stand of corn and soy beans is not secured. When only a small acreage is to be planted this may be overcome quite largely by putting in a small quantity of seed and mixing frequently. Experiments indicate that the yield of corn may be decreased from 3 to 5 bushels when planted together.

Soy beans sown at the last cultivation of corn seldom make a satisfactory growth. Some farmers prefer to sow the corn and soy beans separately and mix the two as they are put in the silo. When this method is followed the soy beans are sown the same as for hay.

*For seed.* The heaviest yield of soy bean seed is secured by drilling in rows from 28 to 32 inches apart, using an ordinary grain drill with every fourth cup open or planting with corn or bean drill.

*Amount of seed required.* When soy beans are planted in rows 28 inches apart it will require from two to three pecks of seed per acre,

two pecks of the smaller-sized seed being sufficient, while three pecks are necessary of the larger seeded varieties.

When sown with a grain drill and all cups are open, it will require from five to seven pecks of seed for one acre. When broad-casted, at least two bushels of seed should be used. This practice is not economical on account of the excessive amount of seed required. When planted with corn for ensilage four or five quarts of soy bean seed per acre together with the usual amount of corn is sufficient. Larger amounts of soy beans may decrease materially the yield of corn.

#### LIME.

Soy beans are not as sensitive to an acid or sour soil as alfalfa, sweet clover or red clover. This fact makes the soy beans a useful crop on the light soils. These soils are usually deficient in organic matter and nitrogen, and the growth of a legume makes it possible to secure larger yields of other crops. Consequently, when it is not practical to lime, soy beans may be used. When the soil is very deficient in lime an application of two tons of ground limestone or several cubic yards of marl per acre usually gives an increased yield of soy beans and makes possible the growth of other leguminous crops.

#### PHOSPHATE.

Soy beans can be expected to give the same return from the use of acid phosphate or a fertilizer high in phosphorus as field beans. An early and more evenly maturing crop and heavier yielding crop will result from proper fertilization. An application of from 200 to 250 pounds of acid phosphate or mixed fertilizer high in phosphorus is recommended. This application should be made at time of planting, through the fertilizer attachment on the drill or applied broad-cast in fitting the seed bed. The latter method is advised when soy beans are planted in rows and cultivated.

#### HARVESTING.

When grown for hay, soy beans should be harvested between pod formation and full development of the seed, and before the leaves have turned yellow and dropped off. If cut earlier than this, the yield of hay will be reduced and much more difficult to cure and if cut later, the stems become quite woody, the leaves drop off and the quality of the hay secured is much inferior.

Soy bean hay is cured in much the same way as a heavy crop of clover or alfalfa hay. It should be cut when the dew is off, and if the weather is favorable, raked into windrows the next day, and the third day put into small cocks where it is allowed to stand until well cured out and safe to store.

*Seed.* When desired for seed, harvesting should begin when a majority of the pods have reached maturity. Either the mowing machine or grain binder may be used. The soy beans should preferably be handled during the early morning while the dew is on to prevent shattering. The use of the bean harvester has not generally given satisfaction, but if blades are left very sharp it may be used with good results. When cut

with the mower, the plants are gathered into windrows and then into small cocks and allowed to cure. The use of the grain binder is very satisfactory, the soy bean plants being formed into small bundles and placed in open shocks. When cured, the beans may be threshed direct from the shocks or put into stacks. They may be threshed through a bean separator or through an ordinary grain separator, with the cylinder running at half-speed, and the other mechanism running at the usual speed. Small amounts can readily be beaten out with a flail.

## SUMMARY.

Soy beans are grown for hay, with corn for ensilage and hogging-off, for green manuring, as a protein concentrate, and a seed crop.

Soy beans are adapted to all types of well-drained soils in sections where the growing season is suited to the production of corn for grain.

Soy beans frequently make considerable growth on light, sandy soils that are so deficient in organic matter that alfalfa and red or June clover fail.

When planting soy beans in a field for the first time it is desirable to inoculate.

Selection of variety is very important, the Manchu, Ito San, Early Brown, and Black Eyebrow being high yielders of grain and forage.

Soy beans should be sown just after corn-planting time, from May 15th to June 15th.

Soy beans should be planted shallow. For hay or as a green manuring crop, either plant in rows 28 inches apart, using about 40 pounds of seed per acre or in rows 7 inches apart, with grain drill, using from six to eight pecks of seed per acre. For seed, plant in rows 28 inches apart, using from 30 to 40 pounds of seed per acre.

When planted with corn for ensilage better results are secured by using a soy bean planting attachment on the corn planter.

For hay, cut when the pods are well-formed and beginning to fill and before the lower leaves turn yellow and drop off.

For seed, allow pods to reach maturity, harvesting before shattering stage is reached.

Cowpeas are not as well adapted to Michigan conditions as soy beans.