Soybeans

H. D. Hughes
Iowa State College

F. Scott Wilkins
Iowa State College

Follow this and additional works at: http://lib.dr.iastate.edu/iaes_circulars

Part of the Agricultural Science Commons, Agriculture Commons, and the Agronomy and Crop Sciences Commons

Recommended Citation

This Article is brought to you for free and open access by the Iowa Agricultural and Home Economics Experiment Station Publications at Iowa State University Digital Repository. It has been accepted for inclusion in Circular (Iowa State College. Agricultural Experiment Station) by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.
Soybeans

Abstract
In Iowa soybeans have more uses than any other legume. They may be grown either alone or in combination with corn. The seed is one-third protein and contains two important vitamins, making it a high grade, home grown supplemental feed for any kind of livestock. The soybean plant is as high in feeding value as alfalfa and may be used in the form of hay, pasture, silage or soilage, or as a protein concentrate.

Keywords
Agronomy, Farm Crops

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

This article is available at Iowa State University Digital Repository: http://lib.dr.iastate.edu/iaes_circulars/87
SOYBEANS

AGRICULTURAL EXPERIMENT STATION
IOWA STATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS
C. E. CURTISS, Director
AMES, IOWA
SOYBEANS

BY H. D. HUGHES AND F. S. WILKINS

In Iowa soybeans have more uses than any other legume. They may be grown either alone or in combination with corn. The seed is one-third protein and contains two important vitamins, making it a high grade, home grown supplemental feed for any kind of livestock. The soybean plant is as high in feeding value as alfalfa and may be used in the form of hay, pasture, silage or sillage, or as a protein concentrate.

The planting of soybeans offers more certain returns than any other legume that may be grown in Iowa. The crop is well suited to Iowa’s climate and soil and it is dependable, even inexperienced growers rarely reporting failures. The Iowa Agricultural Experiment Station has grown a number of different varieties of soybeans each year since 1910. In only one year have the best varieties produced less than 16 bushels of seed or 2 tons of hay per acre. In that year only a third of a crop was harvested because of severe hail injury at a critical period. The varieties best suited for the production of seed have given a yield of over 20 bushels per acre as an average since 1916, despite the hail injury of 1918, while the best varieties for hay have produced over 2.5 tons per acre as an average since 1915. On the station farm, with soil of average fertility, yields as high as 37.5 bushels of seed and 4.75 tons of hay per acre have been secured.

The many uses of the crop on Iowa farms, the ease and certainty with which it may be grown and the profits derived from its production account for the fact that the soybean acreage in Iowa is more than doubling each year.
Soybeans were planted with over 230,000 acres of Iowa corn in 1922, an increase of 122 percent over the previous year, according to an estimate based upon reports from 79 county agents. The Iowa station finds that larger yields of silage are secured when soybeans are planted in the corn. A very large number of definite field trials carried through a series of years also indicate that the practice of planting beans in corn for hogging down is profitable. These conclusions are reached after obtaining yields on a total of 1,009 experimental plantings in four different sections of the state during the last eight years. In these tests nine different rates or methods of planting corn and beans were compared. Several different kinds of soil, rich and poor, and extremes in amount of rainfall during the growing season are represented.

**FOR HOGGING DOWN**

That planting soybeans in corn for hogging down is profitable under average conditions is indicated when results of latest dry lot feeding experiments are combined with current prices and applied to average yields secured by the Iowa station under many different conditions. That it is profitable for the state as a whole is more apparent when it is considered that a large percentage of farmers who hog down soybeans and corn would not buy concentrated feeds.

As an average for the series of hogging-down tests it was found that planting three and four beans of the Manchu variety per hill of corn gave a yield of 49.66 bushels of corn per acre while the yield of corn without beans was 54.55 bushels. The beans gave a yield of 197 pounds per acre but reduced the yield of shelled corn 273.8 pounds. On the basis of values given* below, the deducting

---

*It is indicated by dry lot feeding experiments at the Indiana station that soybeans are worth $1.60 a bushel as a supplement for corn in feeding hogs when tankage costs $170 a ton and corn can be sold for 60 cents a bushel. The latter are current, February, 1923, prices in country markets. The value of the beans is derived from a comparison of tankage and soybeans as supplements for corn when hogs are given access to a mineral mixture, which raised the value of soybeans from $1.11 to $1.60 a bushel. The most profitable mineral mixture consisted of wood ashes ten parts, 16 percent acid phosphate ten parts, and common salt one part, by weight.
the cost of the bean seed, the beans produced would have a value of $5.01 to offset a corn loss of $2.93. Other factors, such as cost of hauling tankage, value of the leguminous bean crop to the soil, etc., should have consideration. Planting the beans thicker gave higher yields of beans but reduced the yields of corn proportionately.

Thousands of Iowa farmers are now planting soybeans in corn for hogging down as a regular practice to furnish a home grown protein balance for corn. Reports concerning this question received from 699 farmers indicate that more than nine out of every ten believe it pays.

A definite solution of the problem as to whether the returns from soybeans planted in corn for hogging down make up for the reduction in the yield of corn is an exceedingly difficult one for experiment stations to solve because of the large number of complicating factors involved. The results of a number of definite feeding trials made under different conditions must be available before definite and final conclusions can be made.

FOR SILAGE

Soybeans with corn for silage apparently are more profitable than with corn for hogging down. In every series of experiments conducted since 1915, representing widely different conditions, the total yield of silage with corn and beans has been greater than for corn alone.

As an average for the series of silage tests, plantings with three and four beans per hill yielded 13.67 tons of corn and bean silage per acre when corn alone yielded 13.22 tons, a difference of .45 tons per acre in favor of the corn-bean mixture. The yield of corn was reduced .71 tons, but this was replaced by 1.15 tons of beans, which have a higher feeding value pound for pound than the corn.

ALONE FOR SEED OR HAY

Estimates from over three-fourths of the counties of the state place the acreage of soybeans grown for seed in 1922 at 8,762 acres, an increase of more than 100 percent over the previous year.

Approximately 95 percent of the soybean acreage in Iowa is with corn. However, the acreage grown alone will increase rapidly as the crop becomes better known.

Soybeans grown alone for seed or hay solve the problem of preparation of winter wheat ground since they leave the soil in excellent condition for wheat with no preparation whatever, the wheat drill following immediately behind the binder as the bean crop is being harvested.

Soybeans fit economically into a rotation of corn, corn, soybeans, winter wheat and clover. Soybeans and winter wheat may well be used to replace a considerable part of the oat acreage.

FOR SEED

On rich soil soybeans may be expected to yield approximately one-third as many bushels as corn. On poor soil the beans give a relatively greater yield. The cost of growing beans is below that of corn whenever the acreage of beans is sufficient to permit economical threshing.

The production of soybeans for seed has been exceedingly profitable and conditions indicate it will continue to be for some time.
The acreage is increasing rapidly, particularly in corn, and farmers are willing to pay a premium for Iowa grown seed.

Soybeans may be fed to advantage as a home grown high protein feed to dairy and beef cattle, sheep, hogs and chickens to take the place of such feeds as oilmeal and tankage. With the present ratio of prices between corn and commercial concentrates Iowa farmers may well afford to substitute soybeans for enough of their oat acreage to furnish sufficient concentrated feed for their own needs.

**FOR HAY**

Soybean hay has a higher feeding value than red clover and it can be grown successfully on soils deficient in lime and so acid that the common clovers cannot be grown with the greatest success, if at all.

Soybean hay has a higher feeding value than red clover and compares favorably with alfalfa. On many soils the assurance of a satisfactory crop is much greater with the beans than with the clover.

Soybeans have a distinct place in Iowa as a catch or emergency legume hay crop to be used when clover seedings fail. They may be seeded as late as June 15, with the assurance of a hay crop, altho

--

Net yield of seed when beans were planted ½ inch to 6 inches apart in rows.
considerably larger yields are secured when planted earlier. They may be used also for hay as a regular part of the rotation. The utilization of the clover crop for pasture, making hay in the fall from soybeans at a time when it least competes with other summer work, is a decided advantage from the standpoint of labor distribution. Soybeans drilled like small grain require but little labor during the growing season.

VARIETIES

The Iowa Agricultural Experiment Station advises that Iowa farmers confine their choice of seed to a few varieties which are easily identified. The use of many varieties in the same section causes confusion in identification and names and makes it difficult to keep seed pure.

The most important considerations in determining upon the best variety to use are ability to yield and adaptation in maturity to the location and to the purpose for which soybeans are grown. Several different varieties in tests at Ames have given nearly the same yields of seed over a series of years and others have produced nearly the same amounts of hay. Preliminary trials indicate that there may be much greater differences in the yields of seed and forage of varieties when planted in corn than when planted alone.

In addition to yield and maturity some other factors which must be considered in choosing a variety are color and size of seed, ease with which seed may be identified, availability of seed stocks, erectness of plants when grown either alone or in corn, adaptation to the soil on which grown, quality of hay and disease resistance.

During the past nine years 138 different varieties have been compared in the tests at Ames, either for seed, hay, in corn for hogging or sheeping down, or for silage. Recommendations regarding varieties for different uses are based on tests at Ames with soil of average fertility, on cooperative tests with several hundred Iowa farmers, on demonstration tests in various parts of the state and on reports from growers.

For Seed. Manchu has given the highest yield as an average for seven years. This fact, together with others here enumerated, makes it an outstanding favorite in all sections of Iowa. It is a yellow seeded variety easily identified because of its black seed scar. It has special value for planting in corn for hogging down and a much larger amount of Iowa grown seed of the Manchu is available than of any other variety. It is possible that some other variety, a week or so later in maturity, may give equally as good or even better yields in the southern one-fourth of Iowa. Black Eyebrow gives nearly as high yields as Manchu, is similar in habit of growth and yield of seed, is perhaps the easiest to identify of all varieties, but the dark color of its seed is objectionable for certain uses. Habaro, Elton and Ito San are yellow beans which have shown relatively high yields. Soyota and Early Brown give yields nearly as high as the Manchu, but their brown colored seeds detract from their general popularity. Wisconsin Black is not recommended largely because of low yields. These varieties are all medium to medium early in maturity.

The production of Peking in the southern two tiers of Iowa counties to furnish seed for hay and silage is encouraged. It is almost certain that a strong demand will develop in the state for seed of this variety. The fact that it is a black bean does not detract from its value for hay and silage purposes. Peking is a much
flattened, black bean with a dark gray seed scar. It is by far the smallest seeded variety yet tested at this station, requiring only about one-half as much seed to plant an acre as most varieties. This adds to its market value for seed purposes.

Midwest, another medium late maturing variety, formerly grown under the names Mongol, Medium Yellow and Hollybrook, may be grown to advantage for seed in the southern part of the state. Whether or not it will give a greater yield there than the Manchu has not been determined.

For Hogging Down. Manchu is the most satisfactory variety yet tested for planting in corn to hog down because of its yellow seeds, ability to yield and favorable maturity. In a three year period, in which yield comparisons were secured, Manchu yielded nearly twice as many beans in corn as Ito San. Yield comparisons of other varieties planted in corn are under way. Midwest, a yellow seed variety ten days later than Manchu, is also popular for hogging down in the southern one-fourth of the state. Black Eyebrow is used satisfactorily in central and northern Iowa. In general, varieties are wanted which will produce the largest yields of beans and which will mature about the same time the corn is ready for the hogs. A small percentage of growers prefer the plants to be green with pods nearly filled when they turn in the hogs.

For Hay. Peking is to be recommended especially because it may be used to unusual advantage for silage as well. Comparisons covering a six year period show Peking, Wilson, Wilson-five, Morse and Virginia to be nearly the same in their ability to yield. As an average for the last four years, Columbia, Haberlandt, Jet and Midwest compare favorably with the others in test over a longer period. The above named varieties will usually ripen seed in the southern tiers of Iowa counties. Manchu has yielded 85 percent as much hay
as have the leading hay varieties over a six year period, which makes it a good all-purpose variety.

For Silage and Sheeping Down. Peking is the most satisfactory variety yet tested to plant with corn for silage because of its erect habit of growth which permits cutting with the corn binder. Medium Green usually stands well but is not as good as Peking. Seed of Medium Green is becoming increasingly scarce owing to the fact that it shatters badly when ripe. It is also more susceptible to a mosaic disease which causes crinkling of the leaves and often reduces the yield. Midwest stands fairly well and there is more seed of it available than any other variety of similar maturity. Manchu is popular for planting with corn for silage in the two northern tiers of Iowa counties. Next to ability to stand, those varieties are best which give the largest yields and which have the pods well filled and the leaves beginning to turn yellow about the time the corn is ready for silage. For planting in corn for sheeping down any of the varieties recommended for hay may be used to advantage.

**CLIMATE AND SOIL**

Climatic requirements for soybeans are practically the same as for corn. The crop produces well in any part of Iowa. While it grows best with plenty of moisture in the soil, it withstands drought better than corn. The beans are not as easily injured by late spring or early fall frosts. Soil conditions for maximum production are practically the same as for corn. It may be grown on soil lower in nitrogen and organic matter than corn because when inoculated the beans may take their nitrogen largely from the air.

**INOCULATION**

Inoculation is necessary when the soybean bacteria are not already present if the most profitable returns are to be secured. Soybeans will grow better than any other legume of which we know without inoculation, but if the bacteria are not present large quantities of nitrogen are taken from the soil which might otherwise

**VARIETIES OF SOYBEANS RECOMMENDED FOR IOWA**

*(See text for adaptation to different parts of state)*

<table>
<thead>
<tr>
<th>Alone for seed (Figures give yield in bu. 4 yr. av.)</th>
<th>Alone for hay (Figures give yield in tons, 4 yr. av.)</th>
<th>In corn to hog down</th>
<th>In corn to sheep down</th>
<th>In corn for silage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manchu</td>
<td>Columbia</td>
<td>Manchu</td>
<td>Peking</td>
<td>Peking</td>
</tr>
<tr>
<td>(26.2)</td>
<td>(2.73)</td>
<td>Midwest</td>
<td>Black</td>
<td>Midwest</td>
</tr>
<tr>
<td>Black</td>
<td>Peking</td>
<td>Midwest</td>
<td>Wilson</td>
<td>Wilson</td>
</tr>
<tr>
<td>(25.5)</td>
<td>(2.59)</td>
<td>Midwest</td>
<td>Morse</td>
<td>Morse</td>
</tr>
<tr>
<td>Midwest*</td>
<td>Wilson</td>
<td>Midwest</td>
<td>Virginia</td>
<td>Virginia</td>
</tr>
<tr>
<td>Habaro</td>
<td>(2.50)</td>
<td>Midwest</td>
<td>Early Brown</td>
<td>Midwest</td>
</tr>
<tr>
<td>(26.0)</td>
<td>Virginia</td>
<td>Manchu</td>
<td>Brown</td>
<td>Manchu</td>
</tr>
<tr>
<td>Elton</td>
<td>(2.41)</td>
<td>Peking</td>
<td>Early Brown</td>
<td>Medium Green</td>
</tr>
<tr>
<td>(23.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ito San.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(24.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soysoyata</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(26.2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Brown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(26.0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peking*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Did not mature seed every year at Ames. Recommended only for southern Iowa.*
Soybean roots showing good nodule formation. The soybean is a legume and, when properly inoculated, can utilize the nitrogen of the air.

come from the air and the percentage of protein in the plant is reduced.

METHODS OF INOCULATING

Soil Applied to Seed. Applying soil gathered from the roots of well inoculated plants of the previous year is the most satisfactory since it is practically sure and requires but little labor. All that is necessary is to have several particles of the soil stick to each bean. This may be effected in several different ways. Some growers simply mix about a half gallon of moist soil with a bushel of beans; others prefer to mix the soil with water until it is a little thicker than cream, sprinkling this over the beans and stirring at the same time until every seed is thoroly soiled; still others prefer to apply dry or slightly moist soil to the seed after first moistening the beans with a thin sugar sirup or glue solution.

Soil Transfer. In this method from 300 to 500 pounds of soil per acre are scattered on the land on a cloudy day or late in the afternoon and harrowed in at once. Sunshine kills the bacteria.

Culture. Cultures for soybeans can be obtained from most seed companies. These are easy to use according to directions which are always supplied with the culture. Culture inoculation is not as sure as applying well inoculated soil to the beans, but inoculated soil is not always available, in which case the use of culture is recommended.

SEEDING

Time and manner and rate of seeding experiments extend over a six year period, and plantings have been repeated often enough to insure significant results. Yields have been secured on a total of 863 plots.
Seed Bed Preparation. The seed bed may best be prepared the same as for corn. Thorough shallow cultivation before planting, to kill weeds just starting in the surface soil, is very important in order to give the beans a start over the weeds. Many prefer to prepare their soybean ground before the corn ground, but to plant corn first. The bean ground may thus be harrowed at intervals and again just before planting, which results in killing most of the weeds before the beans are planted.

Time of Planting. In general the time of planting soybeans is the same as for corn. They have an advantage over corn, however, in that the time of planting may be extended over a longer period. Tests made at the Iowa station during the past six years, with planting extending from April 18 to July 4, show no difference in yield of either hay or seed for plantings made from the earliest date to June 7. April plantings might result in poor stand in years when the weather is unusually severe. Late planting often gives poor germination because of lack of moisture in the soil. A hay crop may be expected when soybeans are planted as late as June 25, although the yields will not be as large as from earlier plantings. Later maturing varieties ripen seed more satisfactorily when planted early. When the beans are planted in corn they should be planted at the same time as the corn.

MANNER OF PLANTING

For Seed. Experienced growers, who use proper cultural methods, can produce larger yields of seed and grow the crop much more economically with the crop drilled like small grain instead of planted in cultivated rows. Success with this method requires thorough cultivation with harrow, weeder or rotary hoe when the weeds are in the earliest period of growth. Drilling has given an average yield 18 percent higher than broadcasting. Beans drilled in 8-inch rows have given approximately the same yields as those drilled in 16-inch rows.

In cultivated rows the crop may be grown most economically in rows 36 to 42 inches apart. Yields are highest in rows 21 to 30 inches apart. However, because of difficulty in either planting or cultivating, on account of lack of special machinery, it is not advisable for most Iowa farmers to grow the crop in rows less than 36 inches apart.

When the crop is being grown for the first time it may be desirable to seed in cultivated rows, since the inexperienced grower can be more certain of keeping the crop reasonably free of weeds than when drilled like small grain.

For Hay. Drilling like small grain is always advisable when the crop is to be used for hay, because it can be cut and cured much more easily than when the crop is grown in rows. When soybeans are drilled there is provided a smooth and even surface, quite free from loose soil, on which to run a mower and other haying machinery. The slight ridges along cultivated rows, together with the side drooping of the plants, make it difficult to run the cutterbar low enough to get under all the branches and soil and gravel get into the sickle, resulting in dulling or breakage. Furthermore, the hay will cure more readily on the firm and stubbled surface of drilled plantings. Row cultivation leaves a loose, bare surface on which to work and cure the hay.
In Corn. The beans and corn are planted in the same rows and at the same time. The corn may be checked and the beans either checked with the corn or drilled, or both the corn and beans may be drilled. Results indicate that on ground comparatively free of weeds the yield of both the corn and beans may be greater when both are drilled than when checked. On account of weeds, check rowing both crops usually will be more satisfactory. Growers are almost unanimous in reporting that they do not get satisfactory stands by mixing corn and beans in the planter boxes and are therefore securing special bean attachments for their corn planters. These may be had for most makes of planters.

**RATE OF PLANTING**

Planting twice as much seed per acre as ordinarily recommended has consistently given the most profitable yields of seed and hay at the Iowa station. The thicker rates of planting have two other decided advantages. In cases of poor conditions for germination the thicker plantings are more likely to give fair stands than the thinner plantings. Also, the thicker rates of planting provide for a loss of 15 to 25 percent of the plants which may result from cultivation with harrow, weeder or rotary hoe and *such cultivation is absolutely necessary in growing a weed free crop.*

For Seed. Drilled like small grain, planting at the rate of two bushels per acre, has given the highest yields consistently, after deducing for the amount of seed used. The average net yield of seed for this rate of planting is 11.4 percent higher than for seedlings at the rate of one and one-half bushels per acre, and 27.2 percent higher than seedlings at the rate of one bushel. In these tests Manchu, a variety with seed of average size, was used.

In cultivated rows plantings with seed distributed one inch apart in the row have consistently given the highest net yields regardless of the width between rows. This rate requires 64.07 pounds of Manchu beans to plant an acre in 36-inch rows. The amount of seed required for other varieties varies with the size of the bean seed. Ordinary corn planter plates will not drop the seed thickly enough. It is advisable to gear the planter to drop faster, use special plates, double back over the rows, or run bean attachment and corn boxes at the same time.

For Hay. The crop may best be drilled at a rate of from one to two bushels per acre, depending upon the size of seed and cultural conditions. However, the heavier rates are to be recommended owing to the fact that the resulting crop is much freer from weeds and of finer quality. When the Peking variety is used only about one-half as much seed is required as for some of the larger seeded varieties such as Manchu.

In Corn. Planting three and four beans per three-stalk hill of corn will likely prove most satisfactory on the majority of farms for hogging down. Planting more beans than this increases the yield of beans, but reduces the yield of corn proportionately. With present prices for corn and beans, practically the same returns per acre were secured regardless of the rates of planting or the method of distribution.

In corn for silage, planting three, four, five or six beans per three-stalk hill of corn gives practically the same yields of corn and bean silage together. When three beans were planted per hill of corn, 7 percent of the silage was beans. This increased to 12 percent of bean forage for six beans per hill.
Soybeans will stand a great deal of rough treatment, and can be cultivated with the harrow.

DEPTH OF SEEDING

Soybeans should not be seeded deeper than one to two inches unless the soil is of a sandy nature or the ground is dry. It is difficult for the young plants to push thru the ground if planted too deeply. Shallow planting when the soil is just dry enough to work nicely results in the best stands.

CULTIVATION

"Kill the weeds and let the beans take care of themselves" may well be regarded as the most important thing to be remembered by the man who starts to the bean field with a harrow. Nine out of every ten new soybean growers are too fearful of injuring the beans and do not harrow the young, growing crop soon enough or often enough. Comparatively few beans will be broken if harrowing is done in the afternoon when the plants are least brittle. The extra amount of seed recommended takes care of the loss in stand and is paid for many times over by the increased yield resulting from a clean crop.

Thoro tillage is an important factor in the production of satisfactory crops. Cultivation may best begin by planting in freshly tilled soil and continuing at intervals as required until such time as possible injury to the crop may result.

Harrowing a couple of times before the young plants appear at the surface kills the small weeds at the easiest time to exterminate them and loosens the seed bed, which is especially beneficial if the
soli

is crusted. Soybean seedlings cannot readily break their way thru a hard, crusted soil surface.

Whether planted in cultivated rows, drilled or broadcasted, the growing crop should be observed closely and often and whenever weed seed have germinated the crop should be cultivated at once with the harrow, weeder or rotary hoe, from the time of planting until the plants are six to eight inches high. The young bean plants are more tender when coming thru the ground and until they get a couple of inches high than later and an effort should be made to have the ground in such shape that cultivation at this stage of growth will not be necessary. But the most important fact is: if necessary, cultivate.

Under average conditions for germination the soybean plants will be from two to four inches high at the time that cultivation is most important.

This is the most effective time for cultivation. At this stage two harrowings on the same day followed by another a few days later have been found very effective. With rotary hoe or weeder it is possible to cultivate until the plants are eight or ten inches high. This is not necessary, however, nor of benefit, for if the weeds are not killed while they are small, just coming thru the ground, they cannot be killed later by the type of cultivation possible.

Row cultivating may best be done in most cases with a corn cultivator. When the beans are grown in rows the corn cultivator is the implement used for the row work. In the early stages of growth the harrow or weeder should be used exactly as for the drilled plantings. A crop handled in this way will require only two, or at the most three, cultivations with the corn plow.

The harrow, weeder and rotary hoe have been compared and apparently are approximately equal as measured by the yield of beans secured. It has been possible to keep plantings somewhat cleaner with the weeder than with the harrow. The rotary hoe is especially valuable for working soil that is packed. This implement may be expected to give most satisfactory results when followed by a harrow or weeder. The rotary hoe stirs the ground deeper than the other two implements, which may be an advantage when winter wheat is to be drilled in the bean stubble immediately following the binder.

HARVESTING

For Seed. The beans may best be cut and bound with the grain binder when the pods are nearly ripe. At this stage about seven-eighths of the leaves will have fallen from most varieties. The beans are easily shocked and are not injured by the ordinary seasonal rains. As some varieties shatter rather easily it is a good plan not to delay cutting until the beans are dead ripe.

Some growers cut when the beans are dead ripe and prevent shattering by cutting when the plants are slightly damp from dew. This method permits threshing or stacking sooner after cutting and the bundles may often be left on the ground without shocking until threshed. Shattered beans may be cleaned up by turning hogs into the stubble.

For Hay. When soybeans are seeded solid like small grain they may be cut and handled similarly to other hay crops. They may best be cut for hay when the pods are about half full, shortly before
Soybeans for seed are cut with a grain binder. Grain saver guards are desirable, but not necessary.

the leaves begin to turn yellow. Earlier cutting gives a lower feeding yield of nutrients per acre, while later cutting results in woody stems and loss thru shattering of the mature seed. Raking and cocking before the leaves are quite dry prevent loss of leaves, which are by far the most valuable part of the hay. The hay may also be cured entirely in the swath, in which case it is raked while the dew is on to prevent loss of leaves. The feeding value of the hay is reduced but little by considerable weathering.

THRESHING

Soybeans can be threshed efficiently with the grain separator, removing the concaves and reducing the speed of the cylinder to 300 or 400 revolutions a minute, while the rest of the machine is run at the regular rate of speed. This requires two extra pulleys and most threshing machine companies can supply these. When operated in this way there are few split or cracked beans. About as many bushels of beans may be threshed in a day as of wheat. A small acreage may be threshed with the grain separator without change by running it at half the ordinary speed and feeding slowly.

A home made bean thresher which may be made out of a box and a manure spreader beater at a cost as low as $15 can be used to handle a very small acreage. The Agricultural Engineering Section will be glad to furnish blue prints and specifications for a more durable machine which will not cost over $30.

Small bean hullers are entirely too slow when the grower has more than one or two acres to thresh. Large hullers cost too much and will not thresh the crop any better than the grain separator when properly equipped and operated.
SOYBEANS AS HUMAN FOOD

Soybeans may be prepared to serve on the table in a large number of different ways. In the Orient they have been used as food for hundreds of years. They are a disappointment when prepared as navy beans. Ask the United States Department of Agriculture for recipes.

COW PEAS

Cowpeas have been grown at the Iowa Agricultural Experiment Station every season for the last 13 years. The crop is not suited to the climate of this state and cannot be grown profitably. For hay or forage of any kind it is greatly surpassed by soybeans.