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Agricultural College, Mississippi

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FORAGE CROPS



By J. R. RICKS

AGRICULTURAL COLLEGE, MISSISSIPPI

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* In co-operation with U. S. Department of Agriculture.

FORAGE CROPS

BY J. R. RICKS.

INTRODUCTION.

On account of the uncertainty of cotton growing in the State and still more the uncertain market conditions for this product, a large number of cotton farmers are turning their attention to live stock, and for profitable live stock farming it is necessary to grow an abundance of forage crops and to grow them cheaply. On crops like Johnson grass and others yielding as much, the cost per ton at the Mississippi Experiment Station is usually around \$4.00 under ordinary conditions.

A forage crop may be defined as a crop that may be used as hay, as a soiling crop, as silage, or as a grazing crop. In this bulletin the subject matter is treated under three general headings, as follows:

1. Grass Crops.
2. Leguminous Crops.
3. Miscellaneous Crops.

For the past four years this Station has been experimenting with the crops mentioned in this bulletin to determine in a comparative way their yields, the cost of growing, and their suitability for feeding or grazing.

The various crops have been discussed somewhat in detail, and the merits or demerits of each have been mentioned.

JOHNSON GRASS.

Johnson grass is one of the most valuable hay grasses in localities suited to its growth. It grows best on the heavy lime soils in the north-east prairie region of Mississippi and does fairly well on other stiff rich soils of the State where there is a large percentage of lime. On account of its being perennial the only expense in growing it for hay is the rent on the land and the harvesting. On soils where it grows well, from 3 to 5 cuttings may be had, which will yield from 3 to 5 tons of dry hay per acre.

In preparing a seed bed for planting the seed of Johnson grass it is very necessary to have a very finely pulverized surface in which

to put the seed. It is very difficult to secure a stand from the seed without a proper seed bed and good moisture conditions. In a test of different rates of seeding we secured our best results from one bushel of seed per acre. Plantings made the first part of April have given us the best results. In case poor stands are secured, the cultivation of the field will cause the grass to spread, and in a few seasons it is possible to have a perfect stand.

A Johnson grass meadow needs no annual treatment. Once in every three or four years the meadow should be thoroughly plowed and smoothed down with harrows. It is better to do this work in the winter or early spring.

It is not advisable to plant Johnson grass on clean fields; yet when it is once started it can be made a profitable crop.



FIG. 1.—JOHNSON GRASS AFTER OATS—READY TO BE CUT SECOND TIME.

One of the most profitable ways of handling a Johnson grass meadow is to break it after the last cutting of hay in the fall and sow a crop of oats on it. The oats are ready to be harvested in the spring before the Johnson grass has made much growth. However, the growth will be large enough for some of it to be cut by the binder,

and this mixture of grass and straw after threshing makes a fairly good rough cattle feed. In 1913 on one of the Station fields this combination gave a yield of 46.7 bushels of oats with some grass, which was cut with the oats and baled with the straw after threshing. The first cutting of Johnson grass from the land gave a yield of 2900 pounds of dry hay per acre. The second cutting yielded 2200 pounds of dry hay per acre. On account of the exceedingly dry weather during the late summer we did not get a third cutting. In 1914 a mixture of oats and red clover was planted in a field heavily infested with Johnson grass. The yield of oats was 53 bushels per acre; and the mixture of straw, red clover, and Johnson grass averaged one ton per acre. This mixture was baled; farm stock of all kinds eat it very readily. After the oats were harvested, there were only two cuttings of Johnson grass obtained, which gave a yield of 1½ tons per acre. Again the dry weather during July and August kept us from getting a third cutting. We kept accurate data on the growing of these crops. The following are the results for one acre:

Breaking the land.....	\$ 1.00
Harrowing50
3 bushels of seed oats	2.25
Planting with drill50
Harvesting with binder.....	.50
Hauling, threshing, and sacking.....	2.00
Baling one ton of mixed straw and clover.....	1.50
Cutting, baling, and hauling 1½ tons of hay.....	4.50
	<hr/>
Total cost	\$12.75

VALUE OF CROPS.

53 bushels of oats @ 60 cents.....	\$31.80
1 ton of mixed straw and clover.....	6.00
1½ tons of Johnson grass and clover hay.....	15.00
	<hr/>
Total	\$52.80
Profit on one acre.....	\$40.05

If properly handled, the saving of a hay crop need not be expensive. During July, August, or September if the weather happens to be very dry, it is unnecessary to put it into stacks. After two or

three days in the windrow the hay may be carried to the press by means of "bull rakes," or buck rakes, such as are seen in illustration number 3. We have baled Johnson grass from the windrow with fine success here for a number of seasons. Of course, the bales need not be packed quite as hard as if the hay had gone through the "heat" and should not be closely stacked afterwards, but should be so stacked that there will be air spaces around them. The result will be a better colored and cheaper hay.



FIG. 2.—THIRD CUTTING OF JOHNSON GRASS AFTER OATS.

There is one objection to planting oats in Johnson grass meadows; and that is, the two crops draw so heavily on the fertility of the soil that in time it will not give very good returns. In fertile valleys and on the black prairie soils where Johnson grass grows best, this combination will grow for a number of years without any noticeable decrease in the yields. And, too, on stock farms there is plenty of manure, and an application to the meadow of a few tons per acre every few years will keep up the fertility. This rotation has been run continuously on one of the Johnson grass meadows here at the Station for ten years without any treatment, and the yields are apparently as good now as when the first crop was grown. This meadow, however, is in a very fertile valley.

Planting melilotus in a Johnson grass meadow improves the quality of hay as well as increases the yield. Melilotus will grow up early in the spring, and a cutting may be had from it before the Johnson grass has made much growth. The subsequent cuttings will be a mixture of the two. While Johnson grass hay looks a little coarse, stock eat it readily and chemical analysis shows it to be richer in protein than timothy.

The proper time to cut Johnson grass for hay is when it is just heading out.



FIG. 3.—“BUCK RAKE” METHOD OF GETTING HAY TO THE PRESS OR STACK.

It is not an easy matter to eradicate Johnson grass thoroughly, but when the work is gone about in the proper manner, it can be done. Several shallow plowings in the fall and winter, leaving the land rough each time, will destroy a large part of it. By planting a clean cultured crop on the land the following season and again repeating the shallow plowings during the fall and winter, the grass will be practically destroyed.

Johnson grass is unsuited for permanent pasture purposes; in fact, pasturing is one of the methods that will help control it. By

continuous and close grazing for several seasons the grass can be partially controlled.

SUDAN GRASS.

Sudan is a new grass, having been grown in the United States only for the past few years. It promises to be the equal of Johnson grass both in yield and in feeding value. Because it is an annual, does not have big root stocks, and must be planted each spring, it will very probably become one of the principal hay crops of the State. The appearance of Sudan grass, both in the field and as a hay, is very much the same as Johnson grass. There is some difference in the color of the seed; the seed of Johnson grass being amber colored, whereas the seed of Sudan grass are straw colored. Other-



FIG. 4.—FIRST CUTTING OF SUDAN GRASS. IT WILL BE NOTED THAT THE GRASS IS A LITTLE TOO OLD TO MAKE THE BEST HAY.

wise the seed are very much the same, Sudan grass seed being a little larger than the seed of Johnson grass. Unlike Johnson grass, Sudan seems to do well on all sorts of soil. Our biggest yields have been obtained from stiff rich valley land.

Plantings may be made any time from March 15 until June 1 with good results. Our test includes earlier and later dates than

these, but the best yields were obtained from April 1 and April 15 plantings.

The following table gives the results from different times of planting:

Table No. 1.—Results from Planting Sudan Grass on Different Dates, 1913.

DATES OF PLANTINGS	Amount of Seed Planted	Number of Cuttings Obtained	Total Yield lbs. Hay per Acre
March 1st	20lbs.	3	5730
March 15th	"	3	7500
April 1st.....	"	3	10750
April 15th.....	"	3	11150
May 1st.....	"	2	7200
May 15th.....	"	2	6900
June 1st.....	"	2	6100
June 15th.....	"	2	5250
July 1st.....	"	2	5150
July 15th.....	Too dry	for seeding	
August 1st.....	" "	" "	
August 15th.....	20lbs.	1	2900

As to the amount of seeding required to seed an acre, the following table indicates that 20 to 25 pounds per acre is the most economical:

Table No. 2.—Rates of Seeding Sudan Grass, 1913.

AMOUNT OF SEED PER ACRE	Total Yield lbs. Dry Hay per Acre
15lbs.	3850
20lbs.	4130
30lbs.	4900
40lbs.	5000

The planting for the above tests was made about May 15 on a soil of less fertility than that on which the test for different times of planting was made.

On account of rapid growth Sudan grass is unsuited for planting with legumes, such as cowpeas and soy beans. A mixture of Sudan grass and sweet clover will give good results. It requires about 90 to 100 days for cowpeas and soy beans to mature for hay. During this time the Sudan grass will need cutting from two to three times. In a test that was made here with Sudan grass, cowpeas, and soy bean mixtures in 1913, there was but little hay obtained from the legumes after the first cutting. The cowpeas and soy beans obtained in the first cutting did not amount to much because these

plants had had but about 60 days growth. The following table gives the results from these mixtures:

Table No. 3.—Legume Mixtures with Sudan Grass.

RATE OF SEEDING THE MIXTURE	Total Yield lbs. Dry Matter per Acre
12lbs. Sudan grass 60lbs. cowpeas.....	3800
20lbs. " " 60lbs. "	4750
12lbs. " " 40lbs. "	3600
12lbs. " " 60lbs. soy beans	3700
20lbs. " " 60lbs. " "	4750
12lbs. " " 40lbs. " "	4500

The time and method of cutting Sudan grass for hay are the same as for Johnson grass. The cutting should be made before the seed are formed or when the first heads begin to appear. It is possible to get three to four cuttings each season. The number of cuttings and the yield will depend on the fertility of the soil and the weather conditions.

BERMUDA GRASS.

Unlike Johnson grass and Sudan grass, Bermuda is not only a good hay, but also a good pasture grass. It is more profitable to handle this crop as a pasture proposition and plant one of the grasses mentioned above for hay. Bermuda grass should be the foundation for all permanent pastures in this State. When once set, it is not easily killed, and will furnish more grazing than any other grass that can be planted. So persistent and vigorous is its growth that very nearly a ton of hay may be cut from pastures which have been grazed all the summer.

There are two methods of propagating Bermuda grass, viz.: by the seed and by transplanting the roots. If the seed are used, a finely pulverized seed bed should be made, and the seed planted in April. About 6 pounds of seed per acre is enough to secure a stand in case a stand is to be had; it is a very difficult matter to get a good germination, especially on stiff soils. The seed should be broadcasted and covered with an iron roller. If covered with a harrow or some other implement of that kind, the covering might be too deep, in which case the seed would fail to germinate. Bermuda seed are usually high in price and very unreliable. It is, therefore, advisable to plant the sod, or roots. There are several methods of making these root plantings. The cheapest method is to plow and harrow the land, broad-

cast over it a few wagon loads of the roots cut in small tufts, and cover with a disk harrow. Other methods—such as digging holes three feet apart with a hoe and covering; and the plowing of small furrows and putting the sod in and covering—are expensive. The furrow method is better than digging the holes with a hoe.

The table below gives the cost of different methods of propagation:

Table No. 4.—Different Methods of Propagating Bermuda Grass.

METHODS	Kind of Stand Secured	Cost to Plant One Acre
Properly prepared and planted 6lbs. seed per acre.....	Very poor	\$ 4.50
Properly prepared and sod covered with disk harrow.....	Fairly good	6.20
Properly prepared, manured, and sod covered with disk harrow	Fairly good	9.10
With hoe, holes 3 ft. apart and covered with hoe.....	Medium	13.20
Furrows 3 ft. apart and sod covered with hoe.....	Medium	9.50

The expense of planting an acre of Bermuda grass is rather high when every thing is figured in at a price of hiring it done. On the average farm, however, this expense need not necessarily be so much, since this can be made a "wet weather job" and the regular labor on the farm can do it. In our estimates in the above table, \$.80 per day was allowed for the men; \$3.00 a day for a team and driver.

RED TOP, OR HERD'S GRASS.

In the tests we have made with Herd's grass, the results have been very good. This grass is suited better for pasture than for hay; however, it yields a hay of fair quality. It grows better on low moist soils than on uplands. It is a good grass for early spring grazing. A mixture of Herd's grass with alsike clover and orchard grass, both of which do well on moist soils, makes a valuable combination for either hay or pasture.

SORGHUM.

For large yields of forage there is no crop that will excel sorghum. It will grow well on all types of soil and is not as much affected by weather conditions as other cultivated crops. Sorghum is more valuable as a silage or a soiling crop than as a hay crop.

The greatest objection to growing it for hay is that it is difficult to cure, especially if the crop is late and is not cut till the weather is cool in the fall. If it is grown for hay at all, it should be planted early in order that it may ripen and be ready to cut in August.

As a silage crop sorghum will yield more and can be grown more cheaply than corn. While sorghum silage is not quite as good as corn silage, yet it is a valuable cheap succulent feed.

If sorghum is grown for hay, a mixture with cowpeas or soy beans gives excellent results. The yield of hay is increased and the quality improved.

Table No. 5.—Yield of Mixtures of Sorghum with Cowpeas and Soy Beans.

METHODS	Total Yield Tons Dry Hay per Acre
2½ bushels of sorghum broadcasted.....	3.5
2 bushels of sorghum and 1½ bushels of cowpeas broadcasted.....	4.75
2 bushels of sorghum and 1½ bushels of soy beans broadcasted.....	4.6

A heavy seeding broadcast gives a better hay than seeding in the drill. The stalks will be smaller and the crop less difficult to cure for hay. For a silage or soiling crop, the seed should be put in drills and the crop should be cultivated.

TEOSINTE.

Though it is impossible to grow a large amount of forage from teosinte, it is more difficult to harvest and cure than sorghum. The stalks grow larger than sorghum. In one of the tests made here, the crop was cut the first week in September and lay on the ground ten days before it was dry enough to put in the barn. Sorghum is a cheaper and more profitable crop than teosinte.

MILLET.

Millet is a valuable crop for quick growth. It is suited to a warm rich soil, and in the test made here we obtained three tons of dry hay per acre. In harvesting the crop of hay, it should be cut before the seed are ripe, especially if the hay is to be fed to horses. Just after the crop is "headed out" is a good time for harvesting.

SOME OTHER GRASSES TESTED.

Rhodes grass, rye grass, and orchard grass have also been tested. These grasses are better for pastures than for meadows. On rich

warm soil Rhodes grass will yield some very good hay. This grass grows better in the southern part of the State. A mixture of rye grass and bur clover or alsike clover gives good winter and early spring grazing.

ALFALFA.

Alfalfa is one of the most valuable of the leguminous plants for forage, both from the standpoint of yield and of feeding value. On land suited to its growth a normal yield of four to five tons per acre is obtained annually.

SOILS FOR ALFALFA.—A deep well drained soil containing plenty of lime is necessary for the successful growing of alfalfa. This plant requires, in addition to large quantities of lime, plenty of phosphoric acid, magnesium, and potash. There are three sections in Mississippi where this plant grows well without the addition of these materials when the soils have been properly drained. These are the northeast prairie section, the central prairie section, and the "buckshot" soils of the Delta. As for the other sections of the State, it is necessary to add the materials that are deficient in the soil. Our circular on growing alfalfa at the Holly Springs Branch Experiment Station gives a successful method of growing it in the brown loam region. This circular may be had by writing the Director of the Experiment Station, Agricultural College, Miss.

PREPARATION OF THE SOIL.—Better results are obtained when preparation begins several months before planting. The soil should be comparatively free from grass and weeds. To accomplish this the crop should be preceded by some clean cultured crop or some crop, such as cowpeas, planted thick which will completely cover the ground and prevent the growing of grass and weeds. It is often a good plan to plant nothing on the soil, but to keep it broken and harrowed through the summer before planting in the fall. Our results are just as good where the land grew a crop of cowpeas as where the land was kept bare and constantly plowed. In any case, the breaking of the soil must be done long enough before seeding to insure a good, firm, well pulverized seed bed. Good deep plowing where there is good drainage has given us as satisfactory results as subsoiling with dynamite or with a subsoil plow.

Table No. 6.—Deep Preparation in Fall of 1911.

HOW TREATED	First Cutting lbs. Dry Hay per Acre	Second Cutting lbs. Dry Hay per Acre	Third Cutting lbs. Dry Hay per Acre	Fourth Cutting lbs. Dry Hay per Acre	Total lbs. Dry Hay per Acre
Plowed 7 inches deep	2416	2100	1600	1390	7506
Subsoiled with plow 18 ins. deep..	2390	2016	1560	1360	7326
Subsoiled with dynamite 18 to 24 inches deep.....	2350	2000	1580	1380	7310

In the above experiment good stands were secured on all of the plats, and the results as shown above are from cuttings made in 1913. In 1914, only four cuttings were secured, there being at least one cutting short on account of the extremely dry weather in July and the first week in August. The total yields were as follows: on the plowed plat the total yield was 8026 pounds; on the subsoiled plat, 8116 pounds; and on the dynamited plat, 8134 pounds.

SEEDING AND INOCULATION.—Alfalfa will not do well in soils which do not contain certain bacteria which assist the plant in assimilating nitrogen. Where these bacteria are not present the soil must be inoculated before alfalfa can be successfully grown. The inoculation can be done by using the pure cultures, which may be obtained from the U. S. Department of Agriculture or purchased from the manufacturers. The seed are moistened with the solution containing the bacteria. The inoculation can also be done by using a few hundred pounds of soil from a field where alfalfa is growing. This soil is broadcasted over the field and mixed in the soil there with a harrow. Throughout the northeast prairie section where there is plenty of melilotus growing, inoculation is unnecessary since melilotus and alfalfa require the same bacteria for inoculation.

From 20 to 25 pounds of seed per acre have given us the best results. A smaller amount of seed will give a stand if the soil has been made into a perfect seed bed and the moisture conditions are right, but when one has gone to the expense of preparing the land, it is wise to use a few pounds extra in seeding to be sure of getting a proper stand. On the whole, fall seedings have given better results than spring seedings. Any time between September 1 and November 1 will do for planting. Spring plantings grow off so slowly that grass and weeds often interfere with the growth of the young crop, whereas fall plantings are so far ahead of the grass and weeds that there is no danger of the alfalfa being crowded out. Planting in the spring can be done from March 15 to April 15.

There are two methods of seeding alfalfa; namely, seeding with a drill and broadcasting. The drill is probably better in many respects, but unless the operator is careful and sees to it that the seed are properly put in, there is danger of covering them too deep. Broadcasting with a wheelbarrow seeder and covering with a corrugated iron roller has never failed to give us a fine stand, and this method is recommended for the farmer who cannot give the seeding his special attention.

TREATMENTS FOR ALFALFA.—On the rich soils that are suited to alfalfa there is not much to be gained from manuring or liming before planting, as will be seen from the following:

Table No. 7.—Different Treatments of Alfalfa, 1912.

TREATMENT	First Cutting lbs. Dry Hay per Acre	Second Cutting lbs. Dry Hay per Acre	Third Cutting lbs. Dry Hay per Acre	Fourth Cutting lbs. Dry Hay per Acre	Total lbs. Dry Hay per Acre
10 tons manure per acre.....	2300	2000	1508	1490	7298
10 tons manure and 500lbs. lime per acre.....	2350	2175	1700	1545	7770
500lbs. lime per acre.....	2100	1980	1500	1390	6970
Check plat	2050	1900	1500	1380	6830

On soils that are not naturally suited to alfalfa, the treatments given in the above table will produce good results.

After the first year an annual disking of the alfalfa field is a paying proposition. The work is done with a common disk harrow, and the more thoroughly the work is done the better. We have tried different implements that are on the market under the name of alfalfa harrows, alfalfa renovators, etc., but none of them has been as satisfactory as the disk harrow. The disking, besides being a cultivation, has the effect of thickening the stand because the crowns of the alfalfa are split and throw more shoots. The spike tooth alfalfa harrow neither splits the crowns nor thoroughly cultivates the soil, requires more horse power to operate it than the round disk, and does not do as good work. If the cultivation with the harrow is done in the fall, it will give a good chance to thicken the stand by adding new seed, should it be necessary. This new seeding is sometimes a failure when the work of putting the seed in has not been properly done or the seed have been put in too late in the spring. Our results have been satisfactory when the work has been done in

October. Of course, this method is recommended only where there are thin patches. If the stand is thin over the whole field, it will probably be more economical to plow up the whole crop and plant the land to some clean cultured crop for a year before seeding again to alfalfa. It is a difficult matter to get the land in proper shape for fall planting when the crop has been plowed under in the fall. The young alfalfa does not seem to thrive, and so much of it dies that there is no stand left. This is probably caused by the soil becoming acid from the decay of the roots and other vegetable matter. We have had two failures out of three attempts to follow alfalfa with alfalfa. It is more profitable to follow the alfalfa with oats and follow the oats with a heavy seeding of cowpeas; then the soil will be ready for a new seeding of alfalfa.

ALSIKE CLOVER.

On account of its ability to thrive on wet lands, alsike clover is very valuable for planting on the low lands in pastures. It does not grow large enough to be of much value as a hay crop; however, on a very rich cultivated soil it will give a good yield of first-class hay. A mixture of alsike and Herd's grass makes an excellent combination for damp places in a permanent pasture.

BUR CLOVER.

Bur clover is valuable only as a pasture plant. It should be planted in September or October. The plant matures seed about the first of May and dies down, and for this reason is an excellent plant in a Bermuda pasture. The seed, matured in the spring, germinate in the fall, and in this way bur clover reseeds itself.

CRIMSON CLOVER.

The advantage in growing crimson clover for hay, grazing, or soil improvement is that it makes its growth early in the spring and is off the land in time to plant regular cultivated crops. For this reason crimson clover can be used in rotation with crops to which other clovers are unsuited.

Crimson clover makes a valuable hay if cut at the proper time and properly cured. The trouble we find in making hay out of it is that it is ready to cut before hot weather so it is difficult to cure properly a heavy growth of this crop, especially if the weather is not good. The proper time for cutting crimson clover hay is when

it is in full bloom. Care should be taken that none of the heads are too old, as the hairs on the ripened stems and heads are likely to cause trouble when the hay is fed to horses or mules.

As a crop for soil improvement, crimson clover is one of the most valuable crops that can be grown in the State. It grows well on all types of soil when they have once been inoculated and the moisture conditions are right. It will not grow on wet seepy soils or on soils that are extremely sour. On rich soils the crop will often yield as much as 10 to 12 tons of green matter per acre. Our best yield is 10.2 tons.



FIG. 5.—FIELD OF CRIMSON CLOVER.

In the preparation of a seed bed for crimson clover, it is very necessary to have a well pulverized surface with a firm, compact sub-surface.

INOCULATION.—If the soil has never been inoculated, it will be necessary to inoculate it before attempting to grow crimson clover. This can be done by harrowing into the soil a few hundred pounds of soil from some field where the clover has been growing, or by

treating the seed with cultures. We have had good results here where large quantities of stable manure were used, but it is possible that some of the bacteria necessary for inoculation were either in the manure or in the soil, although the soil had seemingly never had a chance to become inoculated.

The seeding of crimson clover may be done in a number of ways, but in our work the most successful method is broadcasting with a wheelbarrow seeder and covering with a corrugated iron roller. If the soil has been properly prepared, 15 pounds of seed per acre is about the right rate of seeding. The seeding may be done either in September or in October, and should be done as soon after a rain as the soil will permit of being worked.

At this Station crimson clover has been grown in rotation with ensilage corn for a number of years, the crimson clover being plowed under each time. The clover is plowed under when in full bloom, which is usually about the first of May. The land is put in shape for planting any time after this when a good rain has fallen. The corn is planted about June 1, and is ready for the silo about September 10. As soon as the corn is harvested, the land is thoroughly prepared for the clover, which is planted whenever there is plenty of moisture in the soil, but not later than October.

RED CLOVER.

Red clover grows well on all of the rich stiff soils of the State containing plenty of lime. The results here with red clover have been good. When planted alone red clover has yielded as high as $2\frac{3}{4}$ tons of dry hay per acre. It has also given fine results when planted with oats or wheat. In the harvesting of the grain crops, the clover is cut and bundled up with the grain, and, after threshing, the mixture of straw and clover is baled and fed to cattle with excellent results. After the crop of grain and clover has been harvested, we frequently get two more cuttings of clover hay.

On a well prepared seed bed, 10 to 12 pounds of seed per acre will be required for a good stand. If the clover is planted in a mixture with oats, 8 pounds of seed per acre is about the right amount. The

seeding should be done either in September or in October, preferably in September.

LESPEDEZA (JAPAN CLOVER).

Lespedeza grows well on all of the different types of soil but seems to do better on the loam soils. It grows wild in all sections of the State. When a rich soil has been well prepared and planted in lespedeza, a yield of 2 to 2½ tons per acre is often obtained. The hay is readily eaten by farm animals and is equal in feeding value to alfalfa. As a grazing crop, lespedeza is exceedingly valuable.

The planting of 15 pounds of seed per acre on a well prepared seed bed the latter part of February or early in March will give a good stand. Lespedeza planted on oats which were seeded in the fall gives good results. An inexpensive and reliable method of doing this is to broadcast the seed over the oat field and cover them with a smoothing harrow, its teeth set slanting backwards so that the oats will not be injured. The lespedeza does not make very much growth until the oats are harvested, and the harvesting will not injure the lespedeza.

Lespedeza in Johnson grass meadows has not given us very good results. The lespedeza seems partially, and in places almost wholly, to crowd out the Johnson grass.

MELILOTUS (SWEET CLOVER).

When cut at the proper time, melilotus makes a good hay. It resembles alfalfa, being somewhat coarser, but will grow on poorer soils than alfalfa. On the bald lime-rock spots in the prairie district, it seems to be about the only plant that will thrive. The large roots, which penetrate deep into these hard places and decay, help disintegrate the soil and add fertility.

A mixture of melilotus and Johnson grass on a meadow gives fine results. The first cutting will be almost pure melilotus; the two other cuttings, a mixture of the two, make a very nutritious feed.

We have found that melilotus combines better with oats than with any other crop. The whole crop may be handled as a hay proposition, or it may be cut and threshed for grain, and the mixture of straw and melilotus be used for hay.

As a pasture crop, melilotus is good. It comes up early in the spring and furnishes good grazing throughout the season.

WHITE CLOVER.

White clover is suited only for pasture. Our results with it on Bermuda pasture have been good, but ordinarily it is an unreliable crop.

THE VETCHES.

Neither the hairy nor the smooth vetch is a first-class hay crop on account of the difficulty in harvesting and curing, but they are valuable as winter grazing crops, or as cover and green manure crops.

The seeding should be done in the early fall. At this Station spring seeding has never been satisfactory. A mixture of oats and vetch is a valuable crop for grazing or for hay, or it may be plowed under for soil improvement. If the vetch in the mixture is in excess of the oats, the harvesting will be difficult. When the crop is to be cut for hay or for grain, the best proportion of the seed is one-fourth vetch and three-fourths oats by measure. If the crop is intended for grazing or soil improvement, the amount of vetch should be more. The yield of hay from this mixture was as high as $3\frac{1}{2}$ tons per acre at this Station in 1912. A mixture of vetch and oats is not to be recommended for grain, as the harvesting and threshing is too difficult. The growth of vetch is oftentimes so great that the oats are pulled down and the mixture is hard to cut even with a mower. The crops should be planted separately when grown for seed.

COWPEAS.

This is one of the best forage plants that the Mississippi farmer can grow. Cowpeas grow well on all of the different types of soil and

make better growth on poor soils than any other legume we have tested. They give good results from plantings made from the middle of April to the middle of July. There are quite a number of varieties of cowpeas, some giving better results for forage than others. The brown Whippoorwill has given us the best results for hay. The Unknown, or Wonderful, is the best variety for planting in corn. The following table gives the results of our variety tests:

Table No. 8.—Varieties of Cowpeas.

VARIETY	1911		1912		1913	
	Lbs. seed per Acre	Lbs. Dry Hay per Acre	Lbs. seed per Acre	Lbs. Dry Hay per Acre	Lbs. seed per Acre	Lbs. Dry Hay per Acre
Unknown	91.7	3333	420	3500	325	3800
New Era	100	5000	260	4850	180	3820
Taylor	717	1666	1060	1860	650	1960
Red Ripper	75	3750	920	3800	660	3410
Black	33 1-3	4500	720	4300	290	4000
Clay	58	3833	540	3660	216	3510
Brabham	8 1-3	3333	500	3325	625	3020
Large Black Eye.....	83	4583	720	4320	550	3950
Iron	16 2-3	5000	100	4220	150	3875
Ramshorn Early	700	3333	1080	2616	915	2020
Grant	183	3333	680	3140	410	2990
Whippoorwill	417	4583	940	4718	830	4120

Cowpeas are easily grown and can be planted in several ways, any of which will give good results. As to the time of planting, our results show that plantings from May to June 15 give larger yields of seed and hay than plantings made before and after these dates.

In a two-year test of different amounts of seed per acre, the results showed that 2 to 2½ bushels when broadcasted gave the most economical yields. While 3 bushels per acre gave a larger yield of hay, the increase over the 2 to 2½ bushels per acre was not enough to pay for the extra seed. The most economical method of planting is with some kind of a drill. When the planting is done with a drill, 1¾ bushels per acre give as good results as 2½ bushels broadcasted. Even in planting peas in corn at laying-by time, it is much better and more economical to put down the seed with a one-horse drill than to broadcast them by hand. A small drill that plants three

rows of peas in corn is better where the corn rows are wide apart. A two-row drill is recommended where the corn rows are 3½ feet apart.

For seed we have gotten best results when the peas were planted in drills 24 to 30 feet apart and cultivated once or twice.

The crop gives the best returns when it is cut for hay and fed to stock and the manure returned to the soil. The whole crop may be plowed under for soil improvement, but when it is fed to live stock and the manure returned to the soil, practically all the fertilizing elements are returned, and in addition the live stock have received a valuable lot of feed.

At this Station in 1914, a field of cowpeas having some Johnson grass mixed in was cut, and the mixture of cowpeas and Johnson grass put into one of the silos. This mixture made a good silage, which was relished very much by cattle. By planting peas on Johnson grass land, an immense amount of the mixture can be cut for the silo; but the putting of it into the silo is troublesome and slow since the handling of the tangled mass of green pea vines is very difficult.

SOY BEANS.

The soy bean is a valuable forage plant, being richer in protein than the cowpea. It is a good hay plant when cut at the proper time, which is when the first pods and leaves begin to turn yellow. The yield of seed is usually much larger from the soy bean than from the cowpea.

The table below gives the results of variety tests of soy beans:

Table No. 9.—Varieties of Soy Beans.

VARIETY	1911		1912	
	Lbs. seed per Acre	Lbs. Dry Hay per Acre	Lbs. seed per Acre	Lbs. Dry Hay per Acre
Hollybrook	866	3666	1000	3100
Black	1000	3000	1200	3200
Brown	2400	4500	1440	3680
Small Yellow	2600	5500	1600	4200
Mammoth Yellow	2117	3333	1500	4160
Early Dwarf Green	1560	2500	1000	2608

Unlike cowpeas soy beans need much attention for results. The seed bed should be carefully prepared, and the crop must be well cultivated. It is much more difficult to secure a stand of soy beans than of cowpeas. It is necessary to plant this crop in drills not closer together than 30 inches. The following table gives the results of soy beans and cowpeas planted in drills of different width:

Table No. 10.—Cowpeas and Soy Beans in Drills of Different Width.

PLAT	Yield in Hay per Acre from Cow Peas	Yield in Hay per Acre from Soy Beans
12-inch drill	3788 lbs.	4129 lbs.
20-inch drill	3562 lbs.	4166 lbs.
30-inch drill	3333 lbs.	4924 lbs.

VELVET BEANS.

This crop is more valuable in the southern part of the State than in this section. Velvet beans make a good growth here and in a few instances have matured seed. They make a good forage to be grazed off and are valuable as a soil improver. The Lyon velvet bean has given us better results than the original Florida velvet bean. It matures seed at this place, giving a fairly good yield. The Yokohama is another good variety that we have tested, giving a good yield of both hay and seed.

MISCELLANEOUS FORAGE CROPS.

Such crops as peanuts and rape and a few others have been tested more for grazing than anything else. A mixture of rape and red clover is most excellent for hog grazing practically the whole year, the rape furnishing grazing during the late fall and winter and the clover during spring and summer.

As a hog crop, nothing has given us better results than the Spanish peanut. In addition to the peanuts, in 1912 we harvested 1½ tons of hay per acre. This hay is equal to cowpea hay in feeding value. Peanuts make the best growth on a sandy loam soil, and may be planted any time from April 15 to June 15.