

CIRCULAR No. 48

AUGUST, 1923

Alabama Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

DAN T. GRAY, *Director*



Legumes in Relation to Soil Fertility

By
M. J. FUNCHES

SUMMARY

1. The chief needs of Alabama soils, from a fertility standpoint, are nitrogen and organic matter.

2. These needs can be supplied most economically by the addition of both summer and winter legumes to the cropping system.

3. The maintenance of an adequate supply of phosphorus and, on many soils, the use of lime, are necessary for the most successful growth of most winter legumes.

4. A cover crop of vetch has returned a net profit of approximately \$10.00 per acre in experiments at Auburn. (See Table 1.)

5. The yield of corn planted continuously on the same land has been approximately maintained for 27 years by planting peas in the corn middles at the last cultivation, and the peas turned under for the next crop of corn. (See Table 1.)

6. Corn planted continuously on the same land, but without peas at the last cultivation, has declined in yield to approximately 50 per cent of the yields obtained in earlier years. (See Table 1.)

7. Cotton yields have been more than doubled, and corn yields nearly doubled, by the addition of peas and clover in a three year rotation at Auburn. (See Table 2.)

8. The use of lime may be very profitable. One dollar invested in lime has returned \$8.50 in the experiments at Jackson, Clarke County. (See Table 3.)

9. Vetch, crimson clover, annual yellow melilotus, and bur clover are the best cover crops for Alabama conditions. A full discussion of these as winter cover crops may be found on pages 12-19.

LEGUMES IN RELATION TO SOIL FERTILITY

By M. J. FUNCHESS*

One of the most important problems confronting the farmers of Alabama is that of increasing the fertility of their farms. Rural communities which secure low crop yields are not in a position to maintain good homes, good roads, good schools, and good churches. All of these are necessary for a healthy and contented rural population. It is obvious, therefore, that the general welfare of the State is quite largely dependent upon the fertility of her farms.

A fertile soil must contain a good supply of nitrogen, phosphorus, and potassium available to plants. In addition, the soil must not be too acid or sour, for an acid condition is unfavorable to the best growth of many crops. The problem of maintaining or increasing soil fertility may be stated briefly as follows: Which of the fertilizing elements mentioned above are most needed, and how can they be supplied most economically? Experiments conducted in many parts of the State have shown that Alabama soils are most in need of nitrogen and organic matter. Therefore, if the fertility of Alabama farms is to be increased, the first and most necessary thing to do is to provide a sufficient and continual supply of nitrogen and organic matter.

Nitrogen may be added to the soil in two ways. It may be purchased in commercial fertilizers, or it may be added by growing leguminous crops such as vetch, clover, peas, and beans, and plowing these crops under; or by feeding them to livestock, and carefully returning the manure to the land. Leguminous crops, when well inoculated, secure most of their nitrogen from the air. A good crop of hairy vetch or bur clover, when plowed under, will add as much nitrogen to the soil as is contained in 400 pounds of nitrate of soda. It is possible to maintain and increase the amount of nitrogen in the soil by so arranging the cropping system that full use be made of legumes for soil building purposes. In most instances, this will not involve any

*Acknowledgement: Data recorded in Table 1 are taken from the records of experiments planned by Prof. J. F. Duggar in 1896, and were continued under his direction until 1921. The data in Table 3 are taken from the record of experiments planned by Prof. J. F. Duggar and Mr. J. T. Williamson in 1916, and supervised by Mr. Williamson since that time.

radical change in the present cropping system. For example, the farmer who grows cotton and corn chiefly, needs only to follow his cotton with some winter growing soil building crop, and to plant peas or beans in his corn. All that is needed is that full use be made of crops that the climate of Alabama permits to be grown, and rapid progress can be made in building up soils and increasing crop yields.

The position of phosphorus and potash in a soil fertility program should be clearly understood. There is no way to increase the amount of phosphorus and potash in a soil except by additions in the form of some kind of fertilizer material. When a cover crop is grown and turned under, certain amounts of these two fertilizer elements may be changed into forms that are more available for the following crops; but there is no increase in the stock supply of the soil when such a procedure is followed. The experimental work conducted by the Alabama Experiment Station has demonstrated very conclusively that many Alabama soils are too deficient in phosphorus to grow good crops of legumes, and that it is necessary to increase the supply of phosphorus in such soils before a satisfactory crop of legumes may be grown. On the other hand, there is apparently no need for an application of potash fertilizer for such crops.

The use of lime is still another factor in a soil fertility program. Wherever soils are found to be very acid, applications of lime will be necessary for the best growth of any but acid tolerant crops. This topic is discussed on page 10.

Summarizing a soil fertility program, there are the following points:

1. The fullest possible use of both summer and winter legume crops for the purpose of increasing the organic matter and nitrogen content of the soil.
2. Maintenance of a plentiful supply of phosphorus in the soil by additions of phosphatic fertilizers.
3. Applications of lime to those soils that are found to be so acid as to need lime for a satisfactory growth of soil building crops.

This program is simple, inexpensive, and makes possible the maintenance of the soil nitrogen which is the most expensive fertilizer element. It also makes possible the maintenance of the supply of organic matter, a material that is impractical to purchase. Commer-

cial fertilizers must play an important part in such a program, but it is hopeless to depend on them alone. The maximum return can be had from manufactured fertilizers only on those soils that are adequately supplied with organic matter, since this material markedly influences the water holding capacity of the soil, and lessens drought damage.

The Alabama Experiment Station has conducted a number of experiments to demonstrate the value of the fundamental principles set forth above. The object of this circular is to present briefly the results obtained in such experiments, and to explain how crop yields may be materially increased, thus producing more profit from the labor expended on each acre of land.

RESULTS OBTAINED IN SOIL FERTILITY EXPERIMENTS

The Value of Legumes in Rotations.—The value of legumes as soil building crops is well shown by long continued experiments conducted on the Alabama Experiment Station farm, the results of which are reported in Table 1. Plot 1 in these experiments is planted to corn each year, with peas planted in the corn middles at the last cultivation. The peas produced are turned under for the next crop of corn. Plot 2 is also planted to corn each year, but no peas are planted in the corn middles. The marked decline in yield on plot 2 shows what may be expected when land is cropped continuously, and no effort made to keep up the fertility of the soil. During the 27 years that this work has been in progress, the yield of corn on plot 2 has steadily declined, until it is now producing but half as much corn as plot 1.

The value of legumes is further shown by the results obtained from other plots in this experiment. Plot 6 has been planted to cotton continuously without legumes for soil building purposes. The yield of cotton has fallen from 803 pounds in the first ten year period, to 360 pounds as the average for the last three years. Plots 3 and 8 are also planted to cotton each year, but vetch is planted on these plots in the fall, to be turned under the following spring as green manure for cotton. During the first 10 year period these two plots produced an average yield of 813 pounds of seed cotton per acre; and an average of 602 pounds in the last

three years. When valued at 6 cents per pound, the seed cotton produced by the plots carrying a cover crop of vetch is worth \$14.52 more than cotton produced by plot 6, which gets no cover crop. The cost of the vetch seed plus the cost of planting would not amount to more than \$4.50 per acre, thus leaving a profit of approximately \$10.00 from the use of a cover crop. Plots 5 and 9 are worked into a two year rotation of cotton and vetch one year, followed by peas to be turned under for cotton the next year. This treatment has produced a yield of cotton that is actually greater than that obtained in the earlier years of the experiments. The accumulated data and the details pertaining to these experiments are given in Table 1.

Table 1.—The Effect of Legumes Turned Under on the Yields of Succeeding Crops

CORN—BUSHELS					
Plot No.	Fertilizers, Lbs. per acre	Cropping system	Average yield of crops		
			1st 10 years	2nd 10 years	Last 3 years
1	Acid phos...160	Corn each year, peas at last cultivation	Bus.	Bus.	Bus.
	Kainit ----160		19.2	16.2	17.4
2	Acid phos...160	Corn each year, no peas	17.1	10.2	8.8
	Kainit ----160				
SEED COTTON—POUNDS					
6	Acid phos...160	Cotton continuously. No legumes	Lbs.	Lbs.	Lbs.
	Kainit ----160		803	573	360
3, 8	Acid phos...160	Cotton continuously. Vetch as cover crop	813	678	602
	Kainit ----160				
5, 9	Acid phos...160	Cotton and vetch. Cowpeas	890	958	1042
	Kainit ----160				

The plots used in the experiments discussed above have been fertilized exactly alike for 27 years, so that the differences in yields now being obtained are due solely to the use of legumes for soil building. Special attention is called to the fact that the vetch crops grown on the plots have never been very satisfactory, but the poor growth is now known to be due to the lack of available phosphorus in the soil. Had these plots been well fertilized with phosphatic fertilizers in-

stead of only 160 pounds per acre each year, doubtless the results would have been more striking.

LEGUMES TURNED UNDER INCREASE CROP YIELDS	
CORN	
8.8 BUS.	PLOT 2. CORN ALONE
17.4 BUS.	PLOT 1. CORN AND PEAS
COTTON	
360 LBS.	PLOT 6. COTTON ALONE
602 LBS.	PLOTS 3 & 8. COTTON & VETCH
1042 LBS.	PLOTS 5 & 9. COTTON & VETCH COW PEAS

The value of legumes when used in the cropping system is clearly shown by the data presented in Table 2. In these experiments cowpeas and crimson clover are used as fully as possible in a three year rotation of cotton, oats, and corn. The reader should note carefully that plots A and B are fertilized exactly alike, the only difference in treatment being the addition of peas and clover in the rotation on plot A. Table 2 follows:

Table 2.—The Effect of Legumes Turned Under, on Yields of Cotton and Corn Grown in a Three-Year Rotation

Plot	Fertilizers, Lbs. per acre	Cropping system	Average yield of	
			Seed cotton 3 yrs. Lbs.	Corn 9 yrs. Bus.
A	Acid phos...240 Kainit200	Three year rotation peas and clover for soil improvement	531	25.3
B	Acid phos...240 Kainit200	Three year rotation No peas or clover	227	14.2
C	None	Three year rotation No peas or clover	142	15.7

The peas and clover turned under for soil building purposes on plot A have more than doubled the yield of cotton, and nearly doubled the yield of corn, when compared with the yields obtained on plot B. In recent years the corn crop has been more than doubled by turning under legume crops.

The Value of Lime.—The value of lime in a soil fertility program can scarcely be overestimated. While many soil building crops may be grown with a fair degree of success without the use of lime, it is true that lime benefits, to a profitable extent, most of these legumes. The possible profits to be derived from the application of lime is shown by the crop yields obtained in experiments conducted at several places in Alabama. Some of the results obtained in experiments at Jackson, Clarke County, are given in Table 3.

Table 3.—*The Effect of Lime on the Yields of Cotton and Corn Grown in a Three-Year Rotation*

No. Plot	Fertilizers, Lbs. per acre	Cropping System	Seven year average yield of	
			Corn	Seed Cotton
1,5,9 13	None	Three year rotation Peas and clover for soil improvement	Bus.	Lbs.
			18.6	425
6	Acid phos...240 C. S. meal ..200 Kainit ----200	Three year rotation Peas and clover for soil improvement		
			23.8	619
10	Acid phos...240 C. S. meal ..200 Kainit ----200 Lime ----2 tons	Three year rotation Peas and clover for soil improvement		
			25.4	781

The fertilizer applied each year to plot 6 would cost approximately \$5.25, while the increase in yield of seed cotton at 6 cents per pound for seed cotton would be worth \$11.64. Thus the annual profit from this amount of fertilizer would be \$6.39. The two tons of lime applied to plot 10 in 1916 cost approximately \$8.00. No lime has been applied since the initial application was made. A comparison of plots 6 and 10 shows that the lime applied to plot 10 has produced an annual increase of 162 pounds of seed cotton, which at 6 cents per pound was worth \$9.72 per year, or \$68.04 as the gross return for eight dollars worth of lime applied in

1916. Still more interesting is the fact that the effect of this one application of lime is greater in the seventh year after application than it was in the earlier years of the experiment. For example, lime applied in 1916 increased the cotton crop of 1922 by 248 pounds of seed cotton, which, at 6 cents per pound, was worth \$14.88. The increase in this one cotton crop was worth nearly twice as much as the original cost of the lime.

LIME INCREASES COTTON YIELD BY BENEFITING LEGUMES	
425 Lbs	CHECKS. NO FERTILIZER
619 Lbs	PLOT 6. 640 LBS. COMPLETE FERTILIZER
781 Lbs	PLOT 10. 640 LBS. COMPLETE FERTILIZER & LIME

The increasing benefit that is being derived from the lime applied should not be attributed to its direct effect on cotton and corn, but to its indirect effect on these crops through increased crops of legumes that are worked into the three-year rotation of cotton, corn, and oats. Crimson clover is planted in both the cotton and the corn middles in the fall; and cowpeas are planted on the stubble land. The maximum benefit can be derived from the use of lime only when full use is made of legumes in the cropping system. It is very doubtful if lime will give profitable returns through its direct effect on such crops as cotton, corn, and oats.

The results obtained in similar experiments conducted near Atmore, Escambia County, indicate fully as great returns from lime as those obtained at Jackson. However, since only a partial record of this experiment is available, the results will not be discussed in detail.

In similar experiments conducted at Albertville, Marshall County, lime has not produced as much profit as

is being obtained in the Atmore and Jackson experiments, but is very profitable. The effect of lime on crop yields at each of these three points is greater at the end of the seventh year than it was the first year. The results indicate, therefore, that an application of two tons of lime per acre will show beneficial effects over a long period of years, thus making the annual cost of lime less than a dollar per acre.

It is not intended to convey the impression that lime is needed on all the soils of Alabama; but on all soils that are medium or strongly acid, lime will pay very large profits when used as a means of increasing the growth of soil building crops.

COVER CROPS ADAPTED TO ALABAMA CONDITIONS

The discussion given in the following pages is limited quite largely to a few winter legume cover crops since numerous experiments conducted at Auburn and at other points in Alabama show that while it is possible to grow many different kinds of winter legumes only vetches, crimson clover, bur clovers, and annual yellow melilotus have enough outstanding good points to warrant serious consideration at this time. Such well known crops as cowpeas, velvet beans, soybeans, etc., are not discussed in detail in this publication.

Annual yellow melilotus (or sweet clover) is a relatively new winter cover crop in Alabama, and has been tested by the Experiment Station but two years. All discussions dealing with this crop are based on a few experiments conducted in 1921-22, and a large number conducted in 1922-23. The conclusions drawn, therefore, should be considered as tentative, and subject to change with later experimental work.

Varieties.—The four varieties of vetch that deserve mention at this time are hairy, dasycarpa or Woolly pod, Oregon, and Purple. Of these, hairy vetch has been found to be generally adapted, and is recommended for all sections of Alabama. Woolly pod or dasycarpa vetch is a relatively new variety that appears to be satisfactory in all parts of the State also. It makes an earlier growth than hairy vetch, but appears to be more susceptible to disease. In severe winters, Oregon and Purple vetches will very likely be severely damaged by cold in the northern half of the state; but both of these may do well in the southern part of Alabama.

Southern or spotted bur, and California bur clover are the two varieties of bur clover commonly grown. California bur clover is not sufficiently cold resistant to warrant its general use in the northern half of the State; but in the southern part of the State it has given very satisfactory results. There is but one common variety of crimson clover and of annual yellow melilotus.

Need for Lime.—Vetch, crimson clover, and bur clover, like cowpeas and velvet beans, may be grown on most Alabama soils without the use of lime. In many instances, however, lime increases the yield, and can be used profitably. Of these three crops, vetch is less likely to need lime, while bur clover is most likely to respond to applications of lime.

The need for lime by annual melilotus is greater than for either of the other crops under consideration, and on many soils the crop will very likely fail unless lime is applied. However, a farmer should have his soil tested for acidity before planting yellow melilotus*.

Need for Phosphatic Fertilizers.—Vetch, crimson clover, and yellow melilotus give only a slight response to phosphatic fertilizers on the sandy soils of the southern part of the State, and good crops may be grown without applications of such fertilizer made for the direct benefit of these winter legumes. This is especially true on lands that have been well fertilized for preceding crops. But when winter legumes are to be planted on land that has not been well fertilized for other crops, it is highly desirable that a broadcast application of 400 pounds of acid phosphate or basic slag be made for the specific effect on the cover crops. On the other hand, on most of the heavy soils of the upper half of the State, especially those of the Piedmont, Appalachian Plateau, and Limestone Valleys and Uplands, phosphatic fertilizers are much more likely to be needed. An application of 400 pounds per acre of acid phosphate or basic slag may mean the difference between success and failure on soils of this kind.

*Those who wish to have their soils tested should write to the Department of Agronomy at Auburn, or apply to their county agent, for printed instructions to guide them in collecting soil samples. After collecting samples in accordance with the instructions, they should be sent to the Department of Agronomy by parcel post or prepaid express. No sample will be tested unless it is collected according to instructions.

Bur clover is more in need of phosphatic fertilizers than any other of the winter legumes. In the light of experiments conducted in recent years, it is now known that many bur clover failures have been due to a deficiency of available phosphorus. Consequently, liberal applications of acid phosphate or basic slag should be made for bur clover unless it is planted on land that has been very well fertilized for preceding crops.

Time of Planting.—Best results are obtained with either of the crops under consideration when the planting is done sufficiently early to secure a good "plant" and thorough inoculation before cold weather begins. In the northern part of Alabama, planting should be done between the 15th of September and the 10th or 15th of October if moisture conditions permit. Plantings made as late as the latter part of October or the early part of November may succeed in mild winters, although a heavy crop is not likely to result from such late planting.

In the southern part of Alabama, planting should be done between the first and the last of October if suitable moisture conditions are obtained during this period. Plantings made as late as the middle of November may succeed in the extreme southern part of Alabama, but there is considerable risk involved when these crops are planted this late.

Methods of Planting.—Seed of vetch, crimson clover, and yellow melilotus are commonly sown broadcast without any special preparation of the land. Either clean cultivated cotton middles, corn middles, or stubble land is a satisfactory place for planting these crops. Vetch seed may be covered with a disk harrow, sweep, scrape, or spring tooth cultivator, covering the seed half inch to an inch in depth. The small seed of crimson clover and yellow melilotus should not be covered deeper than about half an inch. Very satisfactory results have been obtained from open furrow plantings of bur clover. Small furrows 12 to 18 inches apart are opened by means of a shovel or scooter, and the seed sown in these furrows; the seed may be left uncovered or very lightly covered. If the covering is done with a light application of well rotted stable manure, a successful crop almost invariably results. Another method is to thoroughly disk the land and sow bur clover seed broadcast, covering with a drag harrow or cultipacker.

Rate of Seeding.—The usual rate of seeding vetch, crimson clover, and yellow melilotus varies from 16 to 20 pounds. It is advisable to seed at the heavier rate when these are being planted for the first time. After the soil has been thoroughly inoculated, the lighter rate is satisfactory for crimson clover and yellow melilotus, but it is best to sow vetch seed at the rate of 20 pounds per acre under all conditions.

It is almost impossible to secure a good stand of bur clover the first year unless very large amounts of seed are sown. The most practical way to start this crop is to sow the seed in the bur at the rate of 30 or 40 pounds per acre, and, from the thin stand thus secured, grow on the land a sufficient amount of seed to insure a good stand the next season. The seed crop will normally mature about the middle of May, after which the land may be prepared and planted to any crop that is suitable for planting at this date.

Seed Production on the Farm.—Vetch is the poorest seed producer of the four crops being considered. Consequently it is not feasible to produce a home grown supply of vetch seed; and the relatively high cost of seed is the chief objection to this crop. Crimson clover is a fairly good seed producer, but the seed are not easily harvested. By means of a seed stripper seed may be harvested satisfactorily on a small scale, provided the clover is almost entirely free from weeds. A stripping machine may be made by any farmer who can handle tools well.* Another method of harvesting crimson clover seed is to cut the crop with a mower just as the seed are full ripe, and thresh the seed with a common grain threshing machine.

One of the most desirable qualities of annual yellow melilotus is its ability to produce seed under Alabama conditions; and the ease with which the seed may be harvested. The method of harvesting the seed is simple. When most of the seed are ripe the crop is cut with a grain binder and the seed threshed with a grain thresher from which most of the concaves have been removed. While there are no exact records of the amount of seed that may be made on an acre of land, there are indications that 600 to 1000 pounds per acre are possible yields. A simple calculation will show

*Blue prints and instructions for making a seed stripper may be had from the Department of Agricultural Engineering at Auburn.

that the seed needed for a large farm may be harvested at an expense of a relatively few hours of labor.

Bur clover also produces large amounts of seed, but there is no satisfactory method for harvesting the seed on a large scale. Usually the vines are raked off the field as soon as the crop is fully ripe, and the shattered burs collected by means of stiff brooms.

Reseeding.—Crimson clover will not reseed even though a full crop of seed is allowed to mature on the land. Vetch will usually reseed itself, but no very satisfactory procedure has been worked out for handling the crop so as to insure reseedling. Very little is known of the ability of yellow melilotus to reseed the land, but it is believed by those who have had most experience with this crop, that it will reseed if a full crop of seed is ripened and left on the ground where it was grown.

After a full crop of bur clover seed has been produced on an area, reseedling should not be necessary if the land is properly handled. Bur clover produces a high percentage of hard seed and it is necessary to grow a seed crop only every other year, or possibly every third year, to insure a stand each year. Corn or some other crop that may be planted after the middle of May should be planted after the seed are ripe. The following spring the bur clover may be turned under as green manure for cotton before any seed are ripe, since the hard seed present insures a stand the following fall as explained above. This being true, bur clover fits well into a two year rotation of cotton and corn, the seed supply for the two years period being matured on the land before corn is planted.

Soil Adaptation.—Vetch is adapted to a wider range of soils than either crimson clover or bur clover. It has been grown successfully on almost every important soil type in Alabama. Poorest crops have been obtained on thin sandy soil infested with root knot. Crimson clover has a fairly wide soil adaptation but it is not well adapted to very poor land of any character, especially poor, sandy soils. Bur clover has made its best showing on relatively heavy soils. Gray sandy soils over yellow subsoils of the Coastal Plain have produced rather poor crops of bur clover, and it is doubtful if this crop will give satisfactory results on soils of this character. Good crops of annual yellow melilotus have been produced on many different types.

of soil, especially when lime was used as a part of the soil treatment. The experimental results obtained indicate that it may be grown on most Alabama soil types, provided lime is applied where it has been found to be needed. Since it is relatively free from disease and root knot troubles, yellow melilotus appears to be especially well adapted to the sandy soils of the southern part of Alabama.

Use as Hay Crops.—Bur clover should not be considered as a hay crop under normal conditions. Vetch and crimson clover have been tested many times as hay crops in the experiments at Auburn. In the experiments of 1921, vetch planted alone produced 3953 pounds per acre, while oats and vetch mixed produced 3568 pounds of hay. Crimson clover, in the same experiments, produced 3360 pounds of hay. Corn planted on this land after the hay crop was harvested produced the following yields:

	Bushels
Corn on land idle in winter -----	28.4
Corn after vetch -----	36.6
Corn after vetch and oats -----	32.1
Corn after crimson clover -----	40.0

The land that produced no winter crop yielded only 28.4 bushels of corn, while the land that produced hay at the rate of more than a ton and a half per acre actually made more corn than did the area that was idle during the winter. The increase in corn yields following the legume hay crop is attributed to the nitrogen left in the roots and stubble when the hay was cut and taken off the land.

Farmers who are interested in the use of legumes for soil improvement should remember that at least 90 per cent of the nitrogen contained in a crop of vetch, or other similar crop, is in the part of the plant above the ground, and that if the crop is cut for hay not more than 20 per cent of the nitrogen contained in the entire plant is left on the land in the roots and stubble. Therefore, it is necessary to turn under the entire growth of such crops in order to get the full benefit of cover crops planted for soil improvement.

IMPORTANCE OF INOCULATION

Many winter cover crops fail because of a lack of proper inoculation. When planted for the first time,

and on land not already inoculated, the utmost care should be taken to insure thorough inoculation.

Method of Inoculation.—Inoculation may be secured by one of two common methods. Commercial cultures may be bought at a nominal price, if inoculated soil is not available. When such cultures are used, the printed instructions on the container should be followed very carefully.

Well inoculated soil is usually surer and cheaper than bought cultures. Soil for inoculation purposes should be collected and air dried. At planting time the seed to be inoculated should be thoroughly moistened with water that is well sweetened with sorghum or sugar cane syrup, after which the dry soil should be dusted over the seed and thoroughly mixed. A sufficient amount of the dry soil should be sown very early in the morning or late in the afternoon; or, better still, the sowing may be done on a cloudy day. In either case the seed should be covered immediately, as a few minutes of strong light will kill the bacteria applied to the seed. When unhulled bur clover seed are sown artificial inoculation is unnecessary because a sufficient amount of inoculation adheres to the burs, or is carried in the dirt and trash accompanying the seed.

TIME TO TURN UNDER COVER CROPS

Legumes planted for soil building purposes should not be turned under too early. Either of the cover crops discussed in this circular will make its most rapid growth between the 20th of March and the last of April. It is necessary, therefore, to leave the crop on the land until it has had time to make a growth sufficient to justify its use. In central Alabama this stage is reached between the 10th and the 20th of April, under average conditions. The data collected by the Experiment Station indicate that a sufficient growth of vetch or crimson clover may be produced by this time to contain 40 to 60 pounds of nitrogen per acre.

PLANTING COTTON OR CORN AFTER A COVER CROP

It is somewhat risky to plant cotton immediately after a heavy cover crop has been turned under, since the rotting green manure may cause the seed to rot also. It is safest, therefore, to allow at least ten days to elapse between the turning of the green manure and

the planting of the cotton seed. However, a number of farmers who are turning under green manure crops each year are planting cotton immediately after plowing under the cover crops, and have had reasonably good success in securing stands.

The stand of corn may be seriously injured by bud worms, if corn is planted immediately after a green manure crop is turned under. This trouble may be avoided if planting is delayed about three weeks after plowing under the cover crop. It should be stated that bud worm injury is not very common and those who care to take the slight risk of having to replant should plant corn as soon as convenient after turning under a green manure crop. If serious bud worm injury develops, the crop should be plowed up and replanted.