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# Legumes for crop production in the Yazoo-Mississippi Delta

Roy G. Kuykendall

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# Legumes for Crop Production In the Yazoo-Mississippi Delta

Mississippi Agricultural Experiment Station
CLARENCE DORMAN, Director
State College, Mississippi

## SUMMARY AND CONCLUSIONS

The results of 10 years of experimental work with winter and summer legumes consisting of variety comparisons, rates and dates of seeding, dates of turning, method and dates of turning, and comparisons of the soil fertility value of both winter and summer legumes at the Delta Branch Experiment Station and in several Delta counties, may be summarized as follows:

**Seeding winter legumes.** Results indicate that winter legumes should be seeded at the following rates per acre: hairy vetch 25 pounds, Hungarian and common vetch 30 pounds, and Austrian peas 35 pounds, when planted on beds. These rates should be doubled when broadcast. Giant bur clover (unhulled) 10 bushels to 15 bushels, and California bur clover 15 pounds per acre. Winter legumes produce best results when planted in October, except unhulled bur clover, which seemed best planted in August.

**Turning winter legumes.** Best results were obtained when winter legumes were thoroughly disked and completely covered when bedded, and very little difference was obtained from medium, early, and late turnings.

**Cost of winter legumes.** Winter legumes and equivalent commercial nitrogen cost approximately the same per acre.

**Fertility value.** Ten-year average results show hairy vetch was equal to 55.4 pounds of commercial nitrogen on the Delta Branch Experiment Station, and increased cotton more than did 30 pounds of nitrogen every year except one.

In outlying tests, hairy vetch was equivalent to 34 pounds of commercial nitrogen in the Schaefer field, to 33 pounds in the Atkinson field, to 30 pounds in the Hemphill field, to 27 pounds in the Ladd field, and to 45 pounds of commercial nitrogen in the Smith field.

California bur clover was grown to advantage in the Atkinson field, seemed better adapted to the soil in the Hemphill field than other winter legumes, and was superior to other winter legumes in the Ladd field.

Winter legumes in all fields returned an average net profit of 18 cents to 40 cents for each pound of seed planted.

**Fertilizing cotton following winter legumes** was not profitable in the experiment; however, during the year 1939 increased yields were obtained from additional nitrogen on the Heathman field, and from nitrogen, phosphorus and lime on the Gary field.

**Fertilizing winter legumes.** Better crops of winter legumes were obtained in the three outlying fields nearest the loessial hills by applying 500 pounds of basic slag and 100 pounds muriate of potash per acre. Such applications were not found necessary in the West Delta nor in the Tallahatchie-Yazoo basin.

**Summer legumes.** Soybeans interplanted with corn did not decrease corn yields the first year, and gave an increase of nearly 15 bushels per acre the second. The beneficial effects continued into the second year when followed by cotton. Cowpeas and crotalaria also gave good increases in yields.

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# Legumes For Crop Production In the Yazoo-Mississippi Delta

By ROY KUYKENDALL, Agronomist
Delta Branch Experiment Station, Stoneville

Since a sufficient amount of available nitrogen represents the difference between a profitable and an unprofitable crop on most Delta soils, legume production occupies a very important place in Delta agriculture as a source of that much needed nitrogen. Probably a larger acreage of legume crops is grown in the Delta for soil building than in any other equal area in the United States In the Fall of 1938 approximately 15 million pounds of winter legume seed were planted in the Delta counties. This 15 million pounds of seed planted approximately 330,000 acres of cotton land. A total of 765,000 acres of legumes were grown in 1938.

Summer legumes are also grown extensively throughout the Delta. Soybeans, cowpeas, lespedeza, and crotalaria constitute the principal annual summer legume crops for soil building. Very beneficial residual effects are also obtained in alfalfa production on crops following alfalfa.

The purpose of this bulletin is to discuss the production of legumes and the beneficial results obtained therefrom in the Yazoo-Mississippi Delta.

The Delta is fortunate in that winter legumes can be grown in the majority of this area more successfully than in any other section of the South. This is partially due to a sufficient amount of moisture at planting time and to a sufficiency of lime and other bases, as well as phosphorus and potash, that are necessary for successful legume production.

In most parts of the Delta it is not necessary to fertilize winter legumes; however, high yields of cotton are produced following winter legumes, and large quantities of plant food are removed by high cotton yields. Therefore, there is a possibility of depleting the soil of lime and other bases, as well as other plant food elements by a long time continuous legume program. It is to be presumed that lime and other bases, as well as phosphorus and potash, may be applied whenever their need is indicated

On the east side of the Delta, winter legumes have not been grown as successfully, because soils are more acid and, in some instances, deficient in phosphorus and potash. Under good management, winter legumes are being produced profitably in the East Delta area.

Successful production and use of winter legumes depend upon: (1) kind planted, (2) rate of seeding, (3) date planted, (4) method of seeding, (5) date of turning, and (6) method of turning. The value of the winter legume crop is determined by (1) the amount of nitrogen turned under, (2) cost per acre, and (3) the results obtained from the legume nitrogen.

## Austrian Peas, Vetch and Bur Clover Are Winter Legumes Most Commonly Planted in the Delta

The principal winter legumes planted are Austrian peas, hairy vetch, Hungarian vetch, common vetch, early giant bur clover, and California bur clover.

Austrian peas are more susceptible to diseases, winter injury, poor drainage, and plant lice damage; but they can be turned under a week or ten days earlier than the vetches. Hairy vetch is less susceptible to diseases, winter injury, poor drainage, and insect damage than all other winter legumes but makes its maximum growth about a week later than Austrian peas. Hungarian vetch is similar to Austrian peas in its susceptibility to winter injury and poor drainage. Hungarian vetch apparently is not adapted to as wide an area and conditions as hairy vetch and Austrian peas. Some common vetches seem to be very hardy, vigorous growing, and as disease resistant as hairy and Hungarian, whereas others are not.

Early giant bur clover makes an early vigorous growth and can be turned under earlier than the vetches or Austrian peas. Bur clover seems to be gaining preference over other winter legumes, because it affords an opportunity for planters to harvest their own seed for future plantings. There is always a possibility of maturing sufficient bur clover seed for another crop if allowed to stand until the middle of April. This will permit planting cotton the first of May provided the clover is planted early and comes up to a stand in the fall.

California bur clover is similar to giant in earliness of plant growth and can be turned under at about the same date. It is considerably later in maturing seed than giant bur clover and apparently is not as well suited for seed harvesting. Bur clover seems to be more attractive to cutworms than the vetches and Austrian peas. It also adds considerably more nitrogen to the soil when turned under, but has failed to increase cotton yields as much as hairy vetch. Other clovers such as alsike, crimson, red, white Dutch, hop, black medic, Persian, Melilotus alba, Melilotus indica, and Melilotus officinalis can be grown for soil fertility purposes when planted in the early fall but fail to make the tonnage as the other winter legumes mentioned. Most of them can be used advantageously in permanent pastures.

## Rates, Dates, Methods of Seeding Determined In Series of Experiments at Stoneville

### Rates of Seeding

One of the first factors to be considered in growing winter legumes for soil building is how much seed to plant per acre. The method and date of seeding will have some bearing on the rate of seeding. In 1934, work was started at the Delta Station to determine the most economical rate of seeding hairy vetch, Hungarian vetch, and Austrian peas. These legumes were planted with a one-row planter equipped with a duplex hopper with plates to vary the amount of seed per acre and a middle-buster type of plow for covering the seed. The same plates were used every year, but the various rates of seeding fluctuated somewhat, because the size of seed varied from year to year. This test was located on Sharkey loam soil. In 1938 the Austrian peas were damaged severely by diseases, which prevented a completion of the test.

The results of the rate of seeding experiment are presented in table 1, in which are shown the production of nitrogen for four rates of seeding of hairy vetch, Hungarian vetch, and Austrian peas for the four years, 1934-1937.

The results of this experiment indicate that 18-25 pounds of hairy vetch, 25-30 pounds of Hungarian vetch, and 30-40 pounds of Austrian peas per acre are sufficient for maximum yields of nitrogen when the seed are planted in cotton rows during the first half of October. The general opinion is that these rates should be doubled when broadcast, and increased if planted after the first of November.

Experience through observations indicates that clean seed of California bur clover should be seeded at the rate of 10-20 pounds per acre broadcast on old or new seed beds and covered lightly. Giant bur clover should be seeded at the rate of 10-15 bushels per acre the first year.

**Dates of Seeding**

Another important factor to be considered is the proper date to plant winter legumes for most favorable results in succeeding crop yields. In many instances where less than optimum results are obtained from winter legumes, they may often be identified with late plantings in the fall.

The results of the dates of seeding experiment are presented in table 2, in which are shown the amount of growth and pounds of nitrogen produced in the plant tops from six dates of seeding hairy vetch, Hungarian vetch, and Austrian peas for the three years, 1933-1935.

These data show that the above-ground nitrogen decreases rapidly when winter legumes are planted later than November 1 and turned under around the middle of April. However, 62.5 pounds to 97.4 pounds of nitrogen per acre was produced in winter legumes planted as late as December 1. The dates for seeding California bur clover are the same as for the vetches and Austrian peas.

**Method of Seeding**

The most common method of planting Austrian peas and the vetches is with a one-row planter made especially for this purpose, described above. The planter may be run down the old cotton middles in the fall, drilling the seed on each side upon the old row with the middle-buster covering the seed and providing drainage during the winter months. Practically the same results may be obtained by broadcasting the seed and running any type of middle-buster in the old middles that will leave the dirt on top of the old cotton rows. This method of planting is used when the seed are planted before cotton harvesting is completed. It should immediately follow the first picking, in order to prevent damage to the cotton.

On loam soil where cotton picking is finished by the last of October, the land

A Field of Waist-High Hairy Vetch on the Delta Branch Experiment Station should be bedded, harrowed off, and the seed planted in one drill on top of the new beds with either a one or two-row planter with seed hoppers and planter plates that will deliver the desired rate of seeding. This method permits fall plowing, affords clean seed beds, and proper drainage. Austrian peas and the vetches can also be planted with a grain drill on land that has been plowed flat, or they may be broadcast on flat land or in old cotton rows, then stalks cut, and disked in flat. However, under these conditions, the rate of seeding should be increased when this method is used. Favorable results have also been obtained by broadcasting these seed on old cotton middles and bedding on them by plowing the old rows out with tractor or mule-drawn middle-busters. With excessive rain during the planting season, fair stands of Austrian peas and vetches have been obtained by broadcasting the seed and not covering them. Seeding peas and vetch by airplane in wet weather has not proved entirely satisfactory.

Giant bur clover can be scattered by hand or in any other preferable way on cotton land and left uncovered or scratched in lightly. This is usually done when the seed are harvested or about lay-by time or soon thereafter. The most satisfactory way to plant clean California bur clover seed is to broadcast either on old rows or new beds and harrow in lightly. These seed can also be planted with an alfalfa drill on flat prepared land.

**Dates of Turning**

The problem of turning under winter legumes at the proper date is important and has not been satisfactorily solved at present. From information gathered, it appears that turning should be done in time for sufficient decomposition to take place so that the turned under material will not be a hindrance to the succeeding crop production. Delayed turning increases cutworm damage and leaves a poor seedbed. A date of turning experiment was conducted from 1931 to 1936, in which two different turnings were made each year to determine the most satisfactory date of turning winter legumes for maximum succeeding cotton yields. The various winter legumes were planted on the same dates, and cotton was planted on the same date for both turnings. These turnings, however, probably did not begin early enough to answer questions in the minds of winter legume growers today. Recent work indicates that probably winter legumes can be turned earlier than formerly thought, with good results. The results of the dates of turning experiment are presented in table 3, in which are shown the amount of nitrogen turned under in the tops, and the following cotton yields, for two dates of turning Austrian peas, hairy vetch, and abruzzi rye compared with 30 pounds of commercial nitrogen for the six years, 1931-1936.

The difference between the increased yields from the two turnings of the winter cover crops are probably not significant, and more work is needed on this problem to be conclusive.

In 1939 another experiment was begun to compare the effects of turning bur clover at various stages of growth, on cotton yields and on soil reactions. This experiment was started on Sarpy loam soil that had a thick stand of volunteer bur clover which had matured seed the previous year. These turnings were made on March 3, March 16, April 3, and April 10 when the clover was 4, 10, 24, and 34 inches in height, respectively. Nitrogen data and cotton yield records for this one year's work are presented in the following table 4.

There is probably no significant difference in yields due to the date of turning. However, the increased yields due to the bur clover and commercial nitrogen are low, which indicates that even the plats receiving no nitrogen had a sufficient amount for optimum yields. It should be noticed, however, that the earliest turning produced the highest cot-

TABLE 1—ABOVE GROUND NITROGEN PER ACRE AND OTHER DATA FOR FOUR RATES OF SEEDING HAIRY VETCH, HUNGARIAN VETCH, AND AUSTRIAN PEAS

| Winter Legume | Annual 1934 Lbs. Seed per Acre | Inches Growth | Lbs. N. per Acre | 1935 Lbs. Seed per Acre | Inches Growth | Lbs. N. per Acre | 1936 Lbs. Seed per Acre | Inches Growth | Lbs. N. per Acre | 1937 Lbs. Seed Per Acre | Inches Growth | Lbs. N. Per Acre | Average 1934-37 Lbs. Seed Per Acre | Inches Growth | Lbs. N. Per Acre |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Planted—Oct. 2 Turned—April 11 | | | Planted—Oct. 27 Turned—April 15 | | | Planted—Oct. 12 Turned—April 3 | | | Planted—Oct. 11 Turned—April 12 | | | Planted—Oct. 13 Turned—April 10 | | |
| Hairy Vetch | 22 | 36 | 131 1 | 19 | 34 | 67.5 | 17 | 30 | 84.6 | 16 | 34 | 61.2 | 18 | 33 | 86 |
| Hairy Vetch | 22 | 36 | 148.7 | 22 | 34 | 53.0 | 20 | 30 | 70.0 | 21 | 34 | 56.2 | 21 | 34 | 82 |
| Hairy Vetch | 26 | 36 | 134.0 | 27 | 34 | 59.8 | 25 | 30 | 82.4 | 26 | 34 | 63.7 | 26 | 34 | 85 |
| Hairy Vetch | 44 | 36 | 138.2 | 39 | 34 | 83.1 | 40 | 30 | 80.6 | 34 | 35 | 57.6 | 39 | 34 | 90 |
| Hungarian Vetch | 18 | 30 | 125.2 | 22 | 24 | 51.0 | 19 | 20 | 71.8 | 21 | 15 | 72.7 | 20 | 22 | 80 |
| Hungarian Vetch | 26 | 30 | 156.0 | 25 | 24 | 68.7 | 22 | 20 | 89.5 | 26 | 17 | 70.2 | 25 | 23 | 96 |
| Hungarian Vetch | 37 | 30 | 141.2 | 32 | 24 | 63.5 | 30 | 20 | 84.4 | 32 | 18 | 75.0 | 33 | 23 | 91 |
| Hungarian Vetch | 44 | 30 | 132.2 | 45 | 24 | 69.4 | 41 | 20 | 86.3 | 45 | 20 | 65.8 | 44 | 24 | 88 |
| Austrian Peas | 18 | 24 | 93.6 | 20 | 30 | 59.8 | 19 | 24 | 55.4 | 17 | 22 | 68.2 | 19 | 25 | 69 |
| Austrian Peas | 22 | 24 | 119.9 | 20 | 30 | 63.3 | 22 | 24 | 42.8 | 20 | 23 | 71.6 | 21 | 25 | 74 |
| Austrian Peas | 29 | 30 | 120.7 | 31 | 30 | 58.3 | 25 | 24 | 53.1 | 26 | 18 | 46.1 | 28 | 26 | 70 |
| Austrian Peas | 44 | 24 | 147.8 | 42 | 30 | 55.9 | 37 | 24 | 57.7 | 37 | 25 | 77.2 | 40 | 26 | 85 |

ton yields which is an indication that where perfect stands are present, bur clover might be turned when it has four to six inches growth and produce maximum cotton yields without cutworm injury and other unfavorable results due to late turning Since this is only one year's work, the results are not conclusive.

**Method of Turning**

The method of turning winter legume crops influences the benefits obtained from that crop. The method most commonly used with best results in the Delta is to disk the legumes sufficiently to cut them up, and then bed the land with a middle-buster. This completely covers the legume, thus hastening decomposition and reducing cutworm damage. The beds are disked and allowed to stand until planting time. Cotton then may be planted on the bed over the covered and decomposing legume.

TABLE 3—ABOVE GROUND NITROGEN PER ACRE AND YIELDS OF SEED COTTON FROM TWO DATES OF TURNING AUSTRIAN PEAS, HAIRY VETCH, AND ABRUZZI RYE

| Treatment | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | Average Yield | Average Increase |
|---|---|---|---|---|---|---|---|---|
| | | | | First Turning | | | | |
| Date turned | Mar. 18 | Mar. 29 | Apr. 7 | Mar. 22 | Apr. 2 | Mar. 30 | Mar. 28 | |
| Date legume planted | Oct. 20 | Nov. 5 | Oct. 1 | Oct. 2 | Oct. 10 | Oct. 12 | Oct. 13 | |
| Date cotton planted | May 1 | May 1 | May 1 | April 25 | May 4 | May 3 | May 1 | |
| | | | | Pounds of Nitrogen per Acre | | | | |
| No nitrogen | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ..... |
| 30 lbs. nitrogen | 30 | 30 | 30 | 30 | 30 | 30 | 30 | ........ |
| Austrian peas | 57.17 | 88.27 | 33.98 | 73.71 | 60.50 | 39.70 | 58.89 | ....... |
| Hairy vetch | 58.83 | 45.62 | 50.73 | 76.68 | 58.90 | 31.70 | 53.74 | ........ |
| Abruzzi rye | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ...... |
| | | | | Pounds of Seed Cotton per Acre | | | | |
| No nitrogen | 692.7 | 760.5 | 1248.8 | 788.4 | 944.6 | 805.0 | 873.3 | ....... |
| 30 lbs. nitrogen | 850.5 | 679.5 | 1666.8 | 1096.2 | 1062.0 | 936.9 | 1048.7 | 175.4 |
| Austrian peas | 1029.7 | 773.0 | 1635.3 | 1414.2 | 1240.5 | 1176.3 | 1211.5 | 338.2 |
| Hairy vetch | 902.4 | 703.4 | 1779.6 | 1462.5 | 1616.0 | 1250.1 | 1285.7 | 412.4 |
| Abruzzi rye | 654.2 | 468.0 | 1118.9 | 814.2 | 760.7 | 728.6 | 757.4 | —115.9 |
| | | | | Last Turning | | | | |
| Date turned | April 3 | April 13 | April 22 | April 10 | April 15 | April 21 | April 14 | |
| Date legume planted | Oct. 20 | Nov. 5 | Oct. 1 | Oct. 2 | Oct. 10 | Oct. 12 | Oct. 13 | |
| Date cotton planted | May 1 | May 1 | May 1 | April 25 | May 4 | May 3 | May 1 | |
| | | | | Pounds of Nitrogen per Acre | | | | |
| No nitrogen | 0 | 0 | 0 | 0 | 0 | 0 | 0 | ..... |
| 30 lbs. of nitrogen | 30 | 30 | 30 | 30 | 30 | 30 | 30 | ........ |
| Austrian peas | 92.84 | 91.84 | 50.27 | 111.74 | 83.10 | 66.80 | 82.77 | ...... |
| Hairy vetch | 126.59 | 59.04 | 74.93 | 104.21 | 100.60 | 50.80 | 86.03 | ........ |
| Abruzzi rye | ........ | ........ | ........ | ........ | ........ | ........ | ........ | ..... |
| | | | | Pounds of Seed Cotton per Acre | | | | |
| No nitrogen | 723.5 | 587.4 | 1276.0 | 873.5 | 955.4 | 862.6 | 879.7 | ....... |
| 30 lbs. nitrogen | 826.0 | 698.4 | 1850.4 | 1228.5 | 1233.0 | 987.3 | 1137.3 | 257.6 |
| Austrian peas | 872.7 | 838.6 | 1945.1 | 1495.8 | 1653.9 | 1063.2 | 1311.6 | 431.9 |
| Hairy vetch | 695.7 | 876.3 | 1785.9 | 1575.1 | 1790.6 | 1297.7 | 1336.9 | 457.2 |
| Abruzzi rye | 638.0 | 489.0 | 1173.2 | 681.6 | 801.5 | 609.6 | 732.2 | —147.5 |

TABLE 4—DATES OF TURNING BUR CLOVER FOR COTTON PRODUCTION, 1939

| Date Turned | Inches Growth | Pounds Per Acre: Nitrogen | Pounds Per Acre: Seed Cotton Yield | Pounds Per Acre: Seed Cotton Increase |
|---|---|---|---|---|
| No nitrogen | 0 | 0 | 1757.7 | ........ |
| March 3 | 4 | ........* | 1941.3 | 183.6 |
| March 16 | 10 | 109.2 | 1869.3 | 111.6 |
| April 3 | 24 | 130.0 | 1802.7 | 45.0 |
| April 10—Mature | 34 | 148.5 | 1826.1 | 68.4 |
| 30 lbs. nitrogen | 0 | 30.0 | 1897.2 | 139.6 |

*Indications were that 50-100 pounds of nitrogen was added at this stage of growth.

TABLE 2—ABOVE GROUND NITROGEN PER ACRE AND OTHER DATA FOR SIX DATES OF SEEDING HAIRY VETCH, HUNGARIAN VETCH, AND AUSTRIAN PEAS

| Winter Legume | Annual | | | | | | | | | Average | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1933 | | | 1934 | | | 1935 | | | 1933-35 | | |
| | Date Planted | Inches Growth | Lbs. N. per Acre | Date Planted | Inches Growth | Lbs. N. per Acre | Date Planted | Inches Growth | Lbs. N per Acre | Date Planted | Inches Growth | Lbs. N. per Acre |
| | Turned April 19, 1933 | | | Turned April 11, 1934 | | | Turned April 15, 1935 | | | Turned April 15, 1933-35 | | |
| Hairy Vetch | .......... | .... | ...... | Sept. 20 | 36 | 195.9 | Sept. 15 | 30 | 156.7 | Sept. 17 | 33* | 176.3* |
| Hairy Vetch | Oct. 1 | 36 | 157.5 | Oct. 3 | 36 | 213.4 | Oct. 1 | 32 | 149.1 | Oct. 1 | 35 | 173.3 |
| Hairy Vetch | Oct. 19 | 36 | 96.9 | Oct. 16 | 32 | 165.6 | Oct. 15 | 24 | 121.5 | Oct. 17 | 31 | 128.0 |
| Hairy Vetch | Nov. 2 | 36 | 67.6 | Nov. 1 | 30 | 113.9 | Nov. 1 | 20 | 63.3 | Nov. 1 | 29 | 81.6 |
| Hairy Vetch | Nov. 16 | 36 | 67.5 | Nov. 16 | 22 | 74.4 | Nov. 15 | 8 | 65.9 | Nov. 16 | 22 | 69.3 |
| Hairy Vetch | Dec. 1 | 36 | 77.5 | Dec. 1 | 18 | 73.1 | .......... | .... | ...... | Dec. 1 | 27** | 75.3** |
| Hungarian Vetch | .......... | .... | ...... | Sept. 20 | 36 | 177.6 | Sept. 15 | 24 | 120.6 | Sept. 17 | 30* | 149.1* |
| Hungarian Vetch | Oct. 1 | 30 | 193.9 | Oct. 3 | 36 | 183.8 | Oct. 1 | 24 | 138.8 | Oct. 1 | 30 | 172.2 |
| Hungarian Vetch | Oct. 19 | 30 | 125.5 | Oct. 16 | 30 | 180.3 | Oct. 15 | 24 | 99.1 | Oct. 17 | 28 | 135.0 |
| Hungarian Vetch | Nov. 2 | 30 | 95.1 | Nov. 1 | 24 | 108.8 | Nov. 1 | 18 | 99.1 | Nov. 1 | 24 | 101.0 |
| Hungarian Vetch | Nov. 16 | 30 | 75.1 | Nov. 16 | 16 | 92.7 | Nov. 15 | 8 | 87.2 | Nov. 16 | 18 | 85.0 |
| Hungarian Vetch | Dec. 1 | 30 | 111.8 | Dec. 1 | 12 | 82.9 | .......... | .... | ...... | Dec. 1 | 21** | 97.4** |
| Austrian Peas | .......... | .... | ...... | Sept. 20 | 30 | 164.4 | Sept. 15 | 24 | 116.7 | Sept. 17 | 27* | 140.6* |
| Austrian Peas | Oct. 1 | Winter killed | | Oct. 3 | 30 | 134.7 | Oct. 1 | 24 | 91.8 | Oct. 1 | 18 | 75.5 |
| Austrian Peas | Oct. 19 | 30 | 82.2 | Oct. 16 | 24 | 120.1 | Oct. 15 | 24 | 100.7 | Oct. 17 | 26 | 101.0 |
| Austrian Peas | Nov. 2 | 30 | 50.4 | Nov. 1 | 22 | 117.1 | Nov. 1 | 18 | 110.1 | Nov. 1 | 23 | 92.5 |
| Austrian Peas | Nov. 16 | 30 | 50.9 | Nov. 16 | 16 | 71.5 | Nov. 15 | 8 | 85.3 | Nov. 16 | 18 | 69.2 |
| Austrian Peas | Dec. 1 | 30 | 76.9 | Dec. 1 | 14 | 48.0 | .......... | .... | ...... | Dec. 1 | 22** | 62.5** |

*Only 2-year averages, 1934-35.

**Only 2-year averages, 1933-34.

# Cost of Winter Legumes Under Delta Conditions: Seed, Inoculation, Seeding, Plowing Under

The cost of an acre of winter legumes varies in different sections of the country and with different legume crops and method of planting and handling. The calculated cost of an acre of hairy vetch as commonly handled in the Delta is presented in table 5. Bur clover harvested on the plantation would cost much less.

These calculations show that an acre of hairy vetch nitrogen costs approximately $3.61, which is very close to the cost of fertilizing an acre of land with 30 pounds of commercial nitrogen in the Delta. On land where legumes will not make a good growth without lime and phosphorus, 500 pounds of basic slag per acre can be applied once every three years at an added annual cost of about $1.00 per acre, which will make the cost of an acre of winter legumes on this land cost approximately $4.61. Cheaper seed of other legumes would cost correspondingly less.

TABLE 5—CALCULATED PER ACRE COST OF HAIRY VETCH NITROGEN FOR COTTON PRODUCTION IN THE DELTA OF MISSISSIPPI

| | Per Acre | | |
|---|---|---|---|
| Item | Cash Cost | Non-Cash Cost | Total Cost |
| Seed and inoculation | $2.70 | ..... | $2.70 |
| Man labor for planting | ...... | $.20 | .20 |
| Mule labor for planting | ...... | .20 | .20 |
| Implement and machinery charge | | .10 | .10 |
| Extra work for plowing under | ...... | .41 | .41 |
| Total | ...... | ..... | $3.61* |

*Increased yields per acre from hairy vetch on the Delta Experiment Station were equivalent to an average of 55 pounds of commercial nitrogen over a 10-year period. This amount of commercial nitrogen ordinarily costs from $4.00 to $6.00 per acre.

Foreground—California Bur Clover. Background—Abruzzi Rye in Cotton Cover Crops Test. Photographed just before turning under on April 6

## Experiments in Other Areas Indicate Response to Legume Nitrogen Especially Pronounced in West Delta

There is a question in the minds of some research workers as to the value of legume crops for soil building. These workers have studied and analyzed the data obtained throughout the country and are of the opinion that legumes are not as valuable for soil building as was once thought. It seems that legumes do not behave alike in all sections of the country or even throughout the entire state.

According to information published in Mississippi Bulletin 336 (1), legume nitrogen secured from turning under a good crop of winter legumes in the hill sections of Mississippi was apparently equal to 24 pounds of commercial nitrogen in cotton production and 24 to 32 pounds of commercial nitrogen in corn yields. Likewise, according to information published in Alabama Circular 74 (2), vetch or Austrian peas increased cotton yields 628 pounds of seed cotton and corn 15.6 bushels per acre. The increase in cotton yields was worth $3.78 more per acre than the increase from 225 pounds of nitrate of soda, or its equivalent, after considering the cost of the legume seed and the cost of nitrate of soda.

The U. S. Agricultural Technical Bulletin 367 (3) states, "The primary purpose of planting winter legumes in the south is to enrich the land; they are plowed down in the spring to fertilize corn, cotton, and other crops. The secondary use of winter legumes is for hay and grazing and the prevention of soil erosion." This same bulletin shows that on 818 acres in 62 fields in the southeast, hairy vetch increased cotton yields 109 pounds of lint per acre, which was more than the entire production per acre of much land that was being farmed at that time.

It is shown in South Carolina Circular 51 (4) that hairy vetch produced more cotton than other legumes and also more than 30 pounds of commercial nitrogen.

New Jersey Bulletin 609 (5) states, "In many respects green manures are substitutes for farm manure. Vetch produced plant material equal in acre weight to approximately 9.5 tons of fresh farm manure with a normal moisture content of 80 percent. In terms of nitrogen an acre of vetch contained as much as 14.5 tons of farm manure analyzing 0.46 percent nitrogen."

Undoubtedly, all the residual effects of legumes on soils and following crops are not due to their nitrogen-fixing ability alone. The growth habits and nitrogen content of the root system is usually overlooked in appraising the value of legumes to southern agriculture.

New York State Bulletin 596 (6) says, "These two effects of legumes, namely, their distinctive root habits and the effect of their nitrogen content, are quite distinct from their well-known nitrogen-fixing ability and may be overlooked in appraising their comparative value to agriculture." This publication shows that 80.4 percent of red clover root system is between the depth of 10-40 inches, whereas 67.7 per cent of oats root system is between the depth of 1-10 inches. This publication also indicates that probably the incorporation of the easily decomposable organic matter in alfalfa has important effect on soil tilth, aeration and biological and chemical changes in soil constituents, which have been particularly beneficial to the unproductive hill soils of New York.

Since legumes have a deeper root system than most non-legumes, this root penetration possibly has some beneficial effects on the water absorption capacity and plant food availability of soils.

# Vetch Crop Turned Under Equal to 55.4 Pounds Commercial Nitrogen at Stoneville, West Delta

Various experiments have been conducted at the Delta Station and in the East Delta Area to determine the soil fertility value of winter legumes in the Yazoo-Mississippi Delta. The first experiment conducted was begun in the Fall of 1929. The purpose of this test was to compare the fertility value of winter legumes and rye with 30 pounds of commercial nitrogen for cotton yields. This experiment was conducted on Sharkey loam soil. All cover crops were planted during the month of October and plowed under during the first half of April and cotton planted around the first of May annually.

Table 6 presents the annual and average yields of cotton with no nitrogen, the annual and average increase or decrease due to winter legumes, rye, and commercial nitrogen, respectively, and the number of pounds of commercial nitrogen hairy vetch was equivalent to during a 10-year period.

These data show that legume crops failed to increase cotton yields in 1930, which could be partially attributed to a very severe winter in 1929-30 which left only half a stand of legumes, and an extremely dry summer in 1930. Austrian peas were as productive as hairy vetch the first four years but failed to increase cotton yields equivalent to hairy vetch the last six years. The greatest increase from hairy vetch was obtained the tenth year, whereas yields from Austrian peas tended to decrease the last five. Every year except 1930 the increased yield from hairy vetch was equal to more than 30 pounds of commercial nitrogen. A 10-year average shows hairy vetch to be equal to 55.4 pounds of commercial nitrogen. The turning under of rye decreased yields every year during the 10-year period.

During the period of 1933-1939, annual yellow sweet clover (Melilotus indica) and California bur clover were included in this 10-year test. Table 7 presents data indicating the annual and average amount of green and dry crops and nitrogen turned under as well as the following cotton yields.

These results indicate that California bur clover added more plant growth and nitrogen to the soil, but hairy vetch increased cotton yields the most. Figures for the seven-year average show that all legumes increased cotton yields considerably more

TABLE 6—THE INFLUENCE OF WINTER LEGUMES, RYE, AND COMMERCIAL NITROGEN ON COTTON YIELDS, AND THE EQUIVALENT POUNDS OF COMMERCIAL NITROGEN FROM HAIRY VETCH OVER A 10-YEAR PERIOD—1930-39

| | Pounds of Seed Cotton per Acre | | | | | Hairy Vetch |
|---|---|---|---|---|---|---|
| | Total Yield | Increased Yield From | | | | Equivalent to Pounds |
| Year | No Nitrogen | 30 lbs. Commercial Nitrogen | Austrian Peas | Hairy Vetch | Abruzzi Rye | of Nitrogen |
| 1930 | 892.5 | 174.4 | —133.3 | —99.1 | —184.6 | —17.1 |
| 1931 | 708.6 | 129.8 | 239.3 | 156.9 | —62.5 | 36.2 |
| 1932 | 670.3 | 18.7 | 136.3 | 122.3 | —192.0 | 196.3 |
| 1933 | 1262.5 | 496.1 | 528.8 | 519.7 | —116.0 | 31.4 |
| 1934 | 982.1 | 381.1 | 769.2 | 828.5 | —108.7 | 65.2 |
| 1935 | 1267.2 | 265.2 | 650.2 | 1003.5 | —226.6 | 113.5 |
| 1936 | 833.5 | 128.6 | 292.5 | 440.9 | —170.1 | 102.8 |
| 1937 | 1106.4 | 428.4 | 503.1 | 806.1 | —211.1 | 56.4 |
| 1938 | 766.6 | 264.1 | 227.1 | 392.2 | —38.2 | 44.6 |
| 1939 | 941.0 | 577.8 | 488.7 | 1097.3 | —198.4 | 57.0 |
| 1930-39 (Av.) | 943.1 | 286.4 | 370.2 | 526.8 | —150.8 | 55.2 |

TABLE 7—AMOUNT OF WINTER LEGUME AND NITROGEN TURNED UNDER AND SUBSEQUENT COTTON YIELDS OVER A PERIOD OF 7 YEARS

| Treatments | Annual | | | | | | | Av. |
|---|---|---|---|---|---|---|---|---|
| | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1933-39 |
| Pounds per Acre Turned Under When Green | | | | | | | | |
| Austrian Peas | 23658 | 17315 | 15355 | 14201 | 13561 | 3387 | 8166 | 13663 |
| Hairy Vetch | 29403 | 17729 | 14876 | 9322 | 23609 | 19041 | 11811 | 17970 |
| Melilotus Indica | *5880 | 4530 | 11543 | 17904 | 21954 | 7251 | 9819 | 11268 |
| Cal Bur Clover | *6534 | 17969 | 32626 | 27603 | 31871 | 20897 | 29998 | 23928 |
| Pounds per Acre Turned Under When Dry | | | | | | | | |
| Austrian Peas | 2069 | 3376 | 2897 | 2135 | 2323 | 595 | 1472 | 2124 |
| Hairy Vetch | 2962 | 3267 | 2984 | 1423 | 3499 | 2889 | 1835 | 2694 |
| Melilotus Indica | *696 | 849 | 2113 | 2701 | 3847 | 1321 | 1863 | 1913 |
| Cal. Bur Clover | *1023 | 3398 | 4988 | 4821 | 4544 | 2977 | 4270 | 3717 |
| Pounds of Nitrogen per Acre Turned Under | | | | | | | | |
| Austrian Peas | 50.3 | 111.7 | 83.1 | 66.8 | 61.8 | 17.9 | 35.3 | 61.0 |
| Hairy Vetch | 74.9 | 104.2 | 100.6 | 50.8 | 93.8 | 97.1 | 68.6 | 84.3 |
| Melilotus Indica | *23.2 | 29.6 | 68.5 | 73.7 | 95.8 | 37.0 | 51.7 | 54.2 |
| Cal. Bur Clover | *35.5 | 133.2 | 168.6 | 123.4 | 110.4 | 88.4 | 115.3 | 110.7 |
| Pounds of Seed Cotton per Acre Harvested | | | | | | | | |
| No Nitrogen | 1263 | 982 | 1267 | 834 | 1106 | 767 | 941 | 1023 |
| 30 lbs. Commercial Nit. | 1759 | 1363 | 1532 | 962 | 1535 | 1031 | 1519 | 1386 |
| Austrian Peas | 1791 | 1751 | 1917 | 1126 | 1610 | 994 | 1430 | 1517 |
| Hairy Vetch | 1782 | 1811 | 2271 | 1274 | 1913 | 1159 | 2038 | 1750 |
| Melilotus Indica | 1442 | 1311 | 1703 | 1073 | 1669 | 1157 | 1651 | 1429 |
| Cal Bur Clover | 1355 | 1385 | 1996 | 1142 | 1488 | 1275 | 1978 | 1517 |

*Poor stand caused by water and freeze in 1933.

TABLE 8—WINTER LEGUMES, CONTINUOUSLY AND AT VARIOUS INTERVALS, FOR COTTON PRODUCTION

| Treatments | Pounds of Seed Cotton per Acre | | | | | | |
|---|---|---|---|---|---|---|---|
| | Annual Yields | | | | | Average | |
| | 1935 | 1936 | 1937 | 1938 | 1939 | Yield | Increase |
| No Nitrogen every year | 886.8 | 852.6 | 1248.6 | 924.6 | 926.8 | 967.9 | ........ |
| 30 lbs. Nitrogen every year | 1054.8 | 1113.8 | 1587.9 | 1112.7 | 1437.7 | 1261.4 | 293.5 |
| Winter Legumes every year | 1242.2 | 1086.5 | 1575.9 | 842.5 | 1889.1 | 1327.2 | 359.3 |
| Winter Legumes every 2nd year and unfertilized other years | 1145.1 | 907.6 | 1605.4 | 968.3 | 1638.4 | 1253.0 | 285.1 |
| Winter Legumes every 2nd year and 30 lbs. N. other years | 1138.7 | 1199.3 | 1747.3 | 1148.0 | 1581.5 | 1363.0 | 395.1 |
| Winter Legumes every 3rd year and unfertilized other years | 1018.1 | 1124.3 | 1293.3 | 983.2 | 1066.4 | 1097.1 | 129.2 |
| Winter Legumes every 3rd year and 30 lbs. N. other years | 953.0 | 1028.8 | 1658.9 | 995.6 | 1599.4 | 1247.1 | 279.2 |

TABLE 9—RESIDUAL EFFECTS OF WINTER LEGUMES ON COTTON YIELDS

| Treatments | Pounds of Seed Cotton per Acre | | | | |
|---|---|---|---|---|---|
| | Annual Yields | | | Average | |
| | 1937 | 1938 | 1939 | Yield | Increase |
| No Nitrogen every year | 1248.6 | 924.6 | 926.8 | 1033.3 | ........ |
| 30 lbs. of Nitrogen every year | 1587.9 | 1112.7 | 1437.7 | 1379.4 | 346.1 |
| Winter Legumes every year | 1575.9 | 842.5 | 1889.1 | 1435.8 | 402.5 |
| Winter Legumes first year after No Nitrogen one year | 1605.4 | 978.5 | 1638.4 | 1407.4 | 374.1 |
| Winter Legumes first year after No Nitrogen two years | 1731.3 | 983.2 | 1886.4 | 1533.6 | 500.3 |
| No Nitrogen first year after Winter Legumes one year | 1357.9 | 960.1 | 1066.4 | 1128.1 | 94.8 |
| No Nitrogen second year after Winter Legumes one year | 1293.3 | 838.5 | 1109.8 | 1080.5 | 47.2 |

Harvesting Giant Bur Clover Seed by Hand in the Yazoo-Mississippi Delta

than 30 pounds of commercial nitrogen. Austrian peas were severely damaged by diseases in 1938 and 1939.

A good crop of winter legumes adds approximately twice as much nitrogen as a cotton crop can utilize in one year. Apparently, there is a loss of nitrogen when legumes are planted continuously on the same land or else there would be a nitrogen build-up that might be sufficient for several years. With these ideas in mind, an experiment was begun in 1935 in an effort to determine how often winter legumes should be planted for maximum cotton yields and also to compare rotations of winter legumes and commercial nitrogen with each alone. This experiment was conducted on Sharkey loam soil. Austrian peas were used as the winter legume the first four years and hairy vetch the fifth year and thereafter. The legume was planted in October, plowed under the first half of April, and cotton planted around the first of May. Table 8 presents the yields of seed cotton from winter legumes grown at different yearly intervals, compared with yields from no nitrogen and 30 pounds of commercial nitrogen annually.

In 1938 Austrian peas were damaged by diseases and failed to increase cotton yields as winter legume crops usually do. These results indicate that winter legumes progressively increased cotton yields more than did 30 pounds of nitrogen for the five-year average. Winter legumes planted alternate years increased yields just slightly less than 30 pounds of nitrogen annually for the five-year period. The alternate rotation of winter legume and commercial nitrogen produced slightly better average yields for the five-year period.

In table 9 is shown the value of winter legumes on land that has been without legumes and commercial nitrogen for one and two years and the carry-over value for one and two years after the legumes have been grown and no commercial nitrogen used.

These results also show that legumes

planted every year increased cotton yields more than did 30 pounds of commercial nitrogen. Greater responses were obtained from winter legumes planted on land that had no nitrogen for two years. A three-year average increase of 94.8 pounds of seed cotton per acre was obtained the first year after legumes were discontinued and 47.2 pounds the second year. Data in tables 8 and 9 indicate that the beneficial results obtained from winter legumes last more than one year.

## Returns from Winter Legumes Slightly Less in Outlying Tests, Located in East Delta Area

Information showing the value of winter legumes has been obtained in three outlying fields during the past four years, one other field the past three years and another the past two years on the east side of the Delta where the soils are more acid and are usually deficient in nitrogen, potash, and phosphorus.

**Schaefer Field**

Winter legumes had been grown previously with very favorable results on the Schaefer field, which is located on typical Yazoo basin fine sandy loam soil on the west side of the Yazoo River, three miles west of Yazoo City, Mississippi. These soils are acid to the extent that limestone has to be applied for successful alfalfa production. These soils also respond favorably to potash and phosphorus in cotton yields; however, bur clover, hairy vetch, and Austrian peas grow well without the addition of lime, potash, or phosphorus.

In table 10 are presented the yields of seed cotton for all treatments and the amount of commercial nitrogen hairy vetch has equaled for the past four years on this field.

This information suggests that unfavorable results were obtained from all winter

Disking Under Austrian Peas on a Yazoo-Mississippi Delta Plantation

TABLE 10—WINTER LEGUMES FOR COTTON PRODUCTION—SCHAEFER FIELD—YAZOO CITY, MISSISSIPPI

| Treatments | Pounds of Seed Cotton per Acre | | | | | |
|---|---|---|---|---|---|---|
| | Annual Yield | | | | 4-year Average | |
| | 1936 | 1937 | 1938 | 1939 | Yield | Increase |
| No Nitrogen | 1327.8 | 1621.0 | 1277.2 | 1084.2 | 1327.6 | ........ |
| Sodium Nitrate | 1531.5 | 1933.2 | 1824.3 | 1522.8 | 1703.0 | 375.4 |
| Austrian Peas | 1254.7 | 2020.5 | 1949.7 | 1451.5 | 1669.1 | 341.5 |
| Hairy Vetch | 1270.9 | 2055.3 | 2047.4 | 1642.2 | 1754.0 | 426.4 |
| Hungarian Vetch | 1253.3 | 1931.4 | 1843.3 | 1408.8 | 1609.2 | 281.6 |
| California Bur Clover | 1251.4 | 2089.3 | 1854.6 | 1680.1 | 1718.9 | 391.3 |
| Giant Bur Clover* | 1266.8 | 2109.3 | 1741.9 | 1467.5 | 1646.4 | 318.8 |
| Hairy Vetch equivalent to lbs. of Nitrogen | —8.38 | 41.72 | 42.23 | 38.17 | 34.08 | ........ |

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields. As ordinarily handled under plantation conditions, excellent results are obtained from giant bur clover on this type of land.

TABLE 11—WINTER LEGUMES FOR COTTON PRODUTION—ATKINSON FIELD—VALLEY, MISSISSIPPI

| Treatments | Pounds of Seed Cotton per Acre | | | | | |
|---|---|---|---|---|---|---|
| | Annual Yield | | | | 4-year Average | |
| | 1936 | 1937 | 1938 | 1939 | Yield | Increase |
| No Nitrogen | 1269.2 | 951.2 | 1097.2 | 828.3 | 1036.5 | ........ |
| Sodium Nitrate | 1452.2 | 1186.2 | 1330.7 | 1305.0 | 1318.5 | 282.0 |
| Austrian Peas | 1287.1 | 1277.8 | 1365.2 | 1394.9 | 1331.3 | 294.8 |
| Hairy Vetch | 1240.0 | 1357.9 | 1297.6 | 1502.8 | 1349.6 | 313.1 |
| Hungarian Vetch | 1261.9 | 1191.7 | 1274.2 | 1192.1 | 1230.0 | 193.5 |
| California Bur Clover | 1266.9 | 1258.2 | 1202.7 | 703.7* | 1107.9 | 71.4 |
| Giant Bur Clover** | 1389.6 | 1162.1 | 1085.4 | 1336.6 | 1243.4 | 206.9 |
| Hairy Vetch equivalent to lbs. of Nitrogen | —4.79 | 51.94 | 25.76 | 42.45 | 33.31 | ........ |

*Approximately one-half stand of cotton obtained after turning under a tremendous crop of clover.

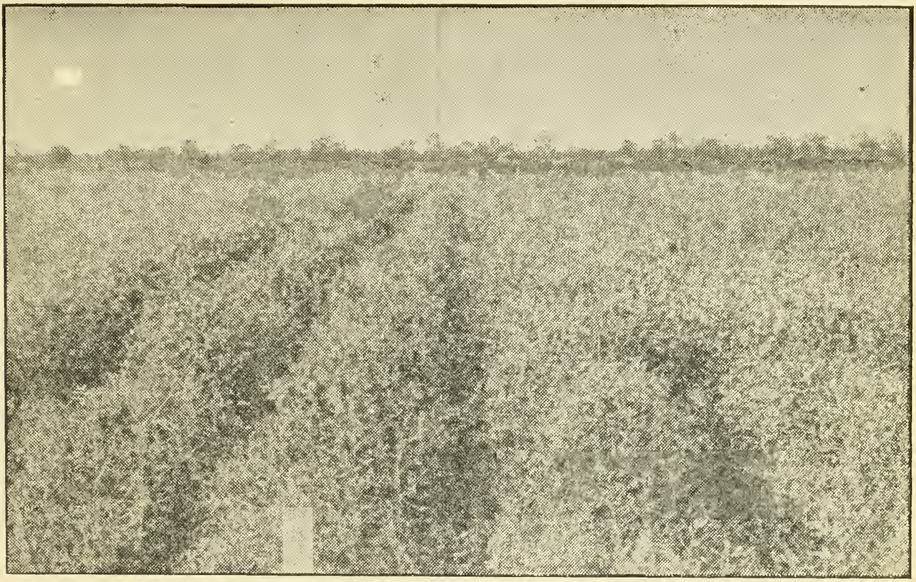
** Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields.

legumes the first year; but since the first year, hairy vetch and California bur clover have increased cotton yields more than 30 pounds of commercial nitrogen. Even with a decreased yield the first year, hairy vetch was equal to an average of 34.08 pounds of nitrogen for the four-year period. Hungarian vetch did not produce as favorable results as other legumes, because it failed to produce an equal crop.

**Atkinson Field**

Winter legumes had never been grown on the Atkinson field previous to 1936 and failed to make sufficient growth to produce favorable results that year. This field is located on typical East Delta fine sandy loam soil, one-half mile from the hills and one mile southwest from Valley, Mississippi, which is on the Yazoo City-Vicksburg highway. Apparently, these soils will not produce a good growth of winter legumes without the addition of certain basic materials. This soil responds readily to phosphorus and potash in cotton production. Applications of 500 pounds of basic slag and 100 pounds of muriate of potash per acre were made the second and third years on all treatments, and good growths were obtained from most of the winter legumes. California bur clover seemed to be adapted better to this soil and made more growth than the other legumes. Bad stands of cotton followed, which probably could have been avoided if properly handled, thus holding up the increase in yield.

In table 11 are presented the annual



Austrian Peas Ready for Turning Under in the Winter Legume Test at the Schaefer Field near Yazoo City

TABLE 12—WINTER LEGUMES FOR COTTON PRODUCTION—HEMPHILL FIELD—VALLEY HILL, MISSISSIPPI

| Treatments | Pounds of Seed Cotton per Acre: Annual Yield 1936 | 1937 | 1938 | 1939 | 4-year Average: Yield | Increase |
|---|---|---|---|---|---|---|
| No Nitrogen | 1387.1 | 824.0 | 610.3 | 797.3 | 904.7 | ........ |
| Sodium Nitrate | 1596.0 | 1189.2 | 1059.6 | 1289.4 | 1283.6 | 378.9 |
| Austrian Peas | 1469.2 | 990.4 | 1237.4 | 1082.4 | 1194.9 | 290.2 |
| Hairy Vetch | 1403.3 | 1120.1 | 1320.4 | 1307.4 | 1287 8 | 383.1 |
| Hungarian Vetch | 1448.6 | 1023.6 | 1121.4 | 1101.7 | 1173.8 | 269.1 |
| California Bur Clover | 1341.5 | 895.5 | 1152.3 | 1649.3 | 1259.7 | 355.0 |
| Giant Bur Clover* | 1317.0 | 955.8 | 889.6 | 1463.3 | 1156.4 | 251.7 |
| Hairy Vetch equivalent to lbs. of Nitrogen | 2.33 | 24.33 | 47.40 | 31.10 | 30 33 | ........ |

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields.

TABLE 13—WINTER LEGUMES FOR COTTON PRODUCTION—LADD FIELD—CHARLESTON, MISS.

| Treatments | Pounds of Seed Cotton per Acre: Annual Yields 1937 | 1938 | 1939 | 3-year Average: Yield | Increase |
|---|---|---|---|---|---|
| No Nitrogen | 1281.4 | 1196.2 | 1224.8 | 1234.1 | ........ |
| Sodium Nitrate | 1724.9 | 1765.4 | 1763.1 | 1751.1 | 517.0 |
| Austrian Peas | 1257.7 | 1374.9 | 1243.0 | 1291.9 | 57.8 |
| Hairy Vetch | 1454.4 | 1979.5 | 1654.6 | 1696.2 | 462.1 |
| Hungarian Vetch | 1444.4 | 1398.9 | 1439.5 | 1427.6 | 193.5 |
| California Bur Clover | 1659.9 | 1409.0 | 1585.8 | 1551.6 | 317.5 |
| Giant Bur Clover* | 1253.7 | 1345.1 | 1500.3 | 1366.4 | 132.3 |
| Hairy Vetch equivalent to lbs. of Nitrogen | 11.71 | 41.29 | 23.96 | 26.82 | ........ |

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields.

Left to Right—Cotton Following No Nitrogen, and California Bur Clover in a Cotton Cover Crops Test on the Delta Station. Photographed early in August

and average yields of all treatments and the number of pounds of nitrogen which hairy vetch has equaled.

In this experiment winter legumes failed to produce favorable results the first year; but hairy vetch and Austrian peas, for an average of four years, increased yields more than 30 pounds of commercial nitrogen. Even with a decreased yield the first year, hairy vetch was equal to 33.31 pounds of nitrogen during the four-year period. Since California bur clover makes better growth on this soil, possibly it could be used under plantation conditions with very favorable results.

A five-acre block of either Austrian peas or hairy vetch was planted each year under plantation conditions across the turnrow, and except the first year, excellent growth was produced.

**Hemphill Field**

Winter legumes had never been grown on the Hemphill field previous to 1936, which is located on a loamy sand soil about half a mile from the hills and six miles east of Greenwood, Mississippi. This soil probably has more sand in it than the average East Delta soil, and cotton has not responded very favorably to applications of phosphorus and potash.

Very little winter legume growth resulted the first year. Applications of 500 pounds of basic slag and 100 pounds of muriate of potash per acre were made on all treatments in 1937 and 1938, and fair legume crops followed. California bur clover seemed to be better adapted to this land than the other legumes; however, hairy vetch made the highest four-year average yield of seed cotton. The results are shown in table 12.

The results of this test show that winter legumes produced very small increases of seed cotton the first year. However, this poor growth did not decrease cotton yields the first year. Hairy vetch and Austrian peas more than doubled cotton yields the third year. The four-year average yields show that hairy vetch again produced more cotton than 30 pounds of commercial nitrogen. The fourth year California bur clover more than doubled cotton yields.

Throughout these tests winter legumes planted broadcast and left flat on this type of land gave best results.

A cotton variety test in this field just across a turnrow has been seeded broadcast with either vetch or Austrian peas for the past four years at 50 to 75 pounds of seed per acre, disked in, and left flat. Good cover crop growth has been obtained every year, whereas the same legume crops failed to make satisfactory growth when planted and left on the side or top of the bed. For the past two years, seed in the regular legume test were broadcast and scratched in with a cultivator, which resulted in fair crops.

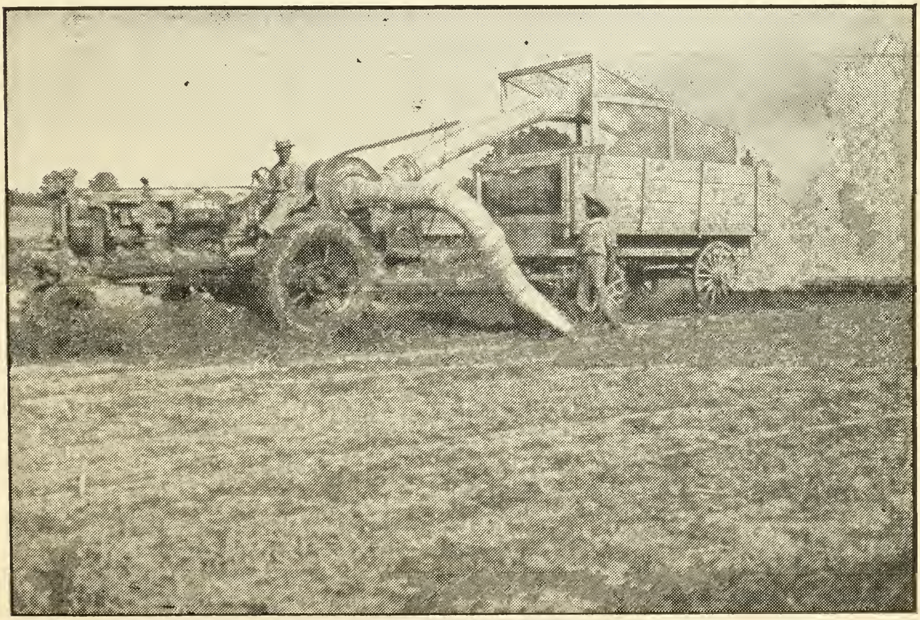
**Ladd Field**

Winter legumes had never been grown on this field before 1937. This is typical East Delta fine sandy loam soil, and the field is located about one-half mile from the hills and three miles southwest of Charleston, Mississippi. There is a distinct deficiency of nitrogen and potash and a slight need for phosphorus in this soil. This land has a heavy infestation of Johnson grass and other obnoxious weeds which interfered with obtaining stands of winter legumes on the small plats in the winter legume test. California bur clover is the only legume that came up to a good stand and grew a good crop each year

In 1938, 500 pounds of basic slag and 100 pounds of muriate of potash per acre was applied to all treatments, which resulted in a good crop of hairy vetch.

Table 13 shows the results of this experiment for a period of three years.

This is the only test conducted in the Delta in which hairy vetch failed to produce more cotton than 30 pounds of commercial nitrogen over a period of years; nevertheless, marked increases were



Harvesting Giant Bur Clover With an Improvised Vacuum Machine in the Yazoo-Mississippi Delta

TABLE 14—WINTER LEGUMES FOR COTTON PRODUCTION—SMITH FIELD—WEBB, MISSISSIPPI

| | Pounds of Seed Cotton per Acre | | | |
|---|---|---|---|---|
| | Annual Yields | | 2-year Average | |
| Treatments | 1938 | 1939 | Yield | Increase |
| No Nitrogen | 856.6 | 817.6 | 837.1 | ....... |
| Sodium Nitrate | 1186.8 | 1339.8 | 1263.3 | 426.2 |
| Austrian Peas | 1167.0 | 1218.2 | 1192.6 | 355.5 |
| Hairy Vetch | 1389.8 | 1573.7 | 1481.8 | 644.7 |
| Hungarian Vetch | 1036.6 | 1209.5 | 1123.1 | 286.0 |
| California Bur Clover | 1009.6 | 757.5 | 883.6 | 46.5 |
| Giant Bur Clover* | 840.0 | 1018.3 | 929.2 | 92.1 |
| Hairy Vetch equivalent to lbs. of Nitrogen | 48.43 | 43.43 | 45.37 | ....... |

*Giant bur clover was planted every year and plowed under before any seed matured; therefore, poor crops of clover were obtained, which resulted in subsequent small increased cotton yields. As ordinarily handled under plantation conditions, excellent results are obtained from giant bur clover on this type of land.

obtained following each legume. Observations indicate that better results would have been obtained on plantings of a larger acreage of either hairy vetch or California bur clover with sufficient fall preparation to prevent weeds, thus obtaining better stands earlier in the fall. A three-acre block of vetch or Austrian peas was planted each year in the same field under plantation conditions and produced a fair growth.

**Smith Field**

This field is located on typical sandy loam soil in the Coldwater-Tallahatchie River basin four miles south of Webb, Mississippi. This soil responds well to nitrogen but only slightly to potash and phosphorus. Winter legumes grow well if the soil is drained sufficiently to prevent standing water.

A legume test was grown in this field in 1937, but insufficient surface drainage

TABLE 15—AVERAGE YIELDS, COST, AND VALUE OF WINTER LEGUMES FOR 17 TESTS IN 5 FIELDS DURING THE PAST 4 YEARS

| | Lbs. Seed Cotton per Acre | | Value Increase | Cost of Nitrogen | Net Value | Net Value per lb. |
|---|---|---|---|---|---|---|
| Treatments | Yield | Increase | at 3c per lb. | or Seed per A. | of Increase | of Seed or Nitrogen |
| No Nitrogen | 1085.4 | ........ | ........ | ...... | ...... | .... |
| 30 lbs. Commercial Nitrogen | 1470.6 | 385.2 | $11.56 | $3.15 | $8.41 | $.28 |
| Austrian Peas | 1355.4 | 270.0 | 8.10 | 1.93 | 6.17 | .18 |
| Hairy Vetch | 1506.9 | 421.5 | 12.65 | 2.63 | 10.02 | .40 |
| Hungarian Vetch | 1328.3 | 242.9 | 7.29 | 1.80 | 5.49 | 18 |
| California Bur Clover | 1339.3 | 253.9 | 7.62 | 2.25 | 5.37 | .36 |
| Giant Bur Clover* | | | | | | |

*The average data for giant bur clover was omitted, because the cost of seeding and results obtained in this work is out of line with the common plantation system of handling this clover.

TABLE 17—THE INFLUENCE OF COMMERCIAL NITROGEN ON COTTON FOLLOWING HAIRY VETCH ON BUCKSHOT SOIL

| | Pounds of Seed Cotton per Acre | | | | | | |
|---|---|---|---|---|---|---|---|
| | Annual Yields | | | | | Average | |
| Treatments | 1935 | 1936 | 1937 | 1938 | 1939 | Yield | Increase |
| No Nitrogen | 1579.7 | 1725.5 | 1648.1 | 796.8 | 1482.1 | 1446.4 | ........ |
| Winter Legume Alone | 1613.2 | 1976.9 | 2101.8 | 1331.2 | 2062.0 | 1817.0 | 370.6 |
| Winter Legume and 30 lbs. of Nitrogen | 1881.9 | 2078.3 | 2183.7 | 1180.8 | 2127.5 | 1890.4 | 444.0 |
| 80 lbs. of Nitrogen Alone | 2048.3 | 2162.9 | 1864.5 | 959.6 | 1936.3 | 1794.3 | 347.9 |

TABLE 16—NITROGENOUS FERTILIZERS ON COTTON AFTER BUILDING UP LAND WITH SUMMER AND WINTER LEGUMES

| Treatment | Pounds of Seed Cotton per Acre | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual Yields | | | | | | | | | Average | |
| | 1931 | 1932 | 1933 | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | Yield | Increase |
| **Corn and Soybeans on Land, 1926-27-28-29-30 and 1934-35-36 Winter Legumes and Sources of Nitrogen at 30 lbs. Nitrogen per Acre on Cotton, 1931-32-33 and 1937-38-39** | | | | | | | | | | | |
| Winter Legumes Alone | 1833.1 | 957.8 | 2139.7 | ......... | ......... | ......... | 2281.5 | 1952.8 | 1990.6 | 1859.3 | ......... |
| Sodium Nitrate Plus Winter Legumes | 1961.2 | 1043.1 | 2381.6 | ......... | ......... | ......... | 2377.8 | 2055.6 | 1984.7 | 1967.3 | 108.0 |
| Calcium Nitrate Plus Winter Legumes | 1938.7 | 1047.4 | 2460.1 | ......... | ......... | ......... | 2446.8 | 2091.7 | 2078.8 | 2010.6 | 151.3 |
| Ammonium Sulphate Plus Winter Legumes | 1812.3 | 1005.9 | 2344.0 | ......... | ......... | ......... | 2390.6 | 2067.8 | 2078.0 | 1949.8 | 90.5 |
| Cyanamid Plus Winter Legumes | 1977.0 | 996.7 | 2438.3 | ......... | ......... | ......... | 2473.5 | 2101.5 | 2188.4 | 2029.2 | 169.9 |
| **Corn and Soybeans on Land, 1931-32-33 and Since Winter Legumes and Sources of Nitrogen at 30 lbs. Nitrogen per Acre on Cotton, 1934-35-36** | | | | | | | | | | | |
| Winter Legumes Alone | ......... | ......... | ......... | 1404.0 | 1327.7 | 698.0 | ......... | ......... | ......... | 1143.2 | ......... |
| Sodium Nitrate Plus Winter Legumes | ......... | ......... | ......... | 1417.8 | 1314.9 | 653.5 | ......... | ......... | ......... | 1128.7 | —14.5 |
| Calcium Nitrate Plus Winter Legumes | ......... | ......... | ......... | 1366.1 | 1245.5 | 700.1 | ......... | ......... | ......... | 1103.9 | —39.3 |
| Ammonium Sulphate Plus Winter Legumes | ......... | ......... | ......... | 1458.5 | 1275.3 | 691.8 | ......... | ......... | ......... | 1141.9 | —1.3 |
| Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1376.0 | 1366.6 | 628.8 | ......... | ......... | ......... | 1123.8 | —19.4 |
| **Corn and Soybeans on Land, 1926-27-28-29-30 and 1934-35-36 Winter Legumes and Rates of Applying Cyanamid on Cotton, 1931-32-33 and 1937** | | | | | | | | | | | |
| Winter Legumes Alone | 1904.6 | 817.2 | 2168.2 | ......... | ......... | ......... | 2386.8 | ......... | ......... | 1819.2 | ......... |
| 34 lbs. Cyanamid Plus Winter Legumes | 1958.1 | 828.4 | 2329.8 | ......... | ......... | ......... | 2485.2 | ......... | ......... | 1900.4 | 81.2 |
| 68 lbs. Cyanamid Plus Winter Legumes | 1943.7 | 867.3 | 2411.2 | ......... | ......... | ......... | 2388.1 | ......... | ......... | 1902.6 | 83.4 |
| 102 lbs. Cyanamid Plus Winter Legumes | 1993.6 | 889.6 | 2371.3 | ......... | ......... | ......... | 2518.1 | ......... | ......... | 1943.2 | 124.0 |
| 136 lbs. Cyanamid Plus Winter Legumes | 1939.5 | 897.8 | 2450.8 | ......... | ......... | ......... | 2422.4 | ......... | ......... | 1927.6 | 108.4 |
| 170 lbs. Cyanamid Plus Winter Legumes | 1916.1 | 849.7 | 2521.3 | ......... | ......... | ......... | 2402.1 | ......... | ......... | 1922.3 | 103.1 |
| 205 lbs Cyanamid Plus Winter Legumes | 2025.6 | 901.0 | 2575.8 | ......... | ......... | ......... | 2430.7 | ......... | ......... | 1983.3 | 164.1 |
| **Corn and Soybeans on Land, 1931-32-33 and Since Winter Legumes and Rates of Applying Cyanamid on Cotton, 1934-35-36** | | | | | | | | | | | |
| Winter Legumes Alone | ......... | ......... | ......... | 1227.6 | 975.6 | 577.8 | ......... | ......... | ......... | 927.0 | ......... |
| 34 lbs. Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1212.6 | 881.1 | 617.0 | ......... | ......... | ......... | 903.6 | —23.4 |
| 68 lbs. Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1199.4 | 970.8 | 664.1 | ......... | ......... | ......... | 944.8 | 17.8 |
| 102 lbs. Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1205.6 | 852.6 | 569.1 | ......... | ......... | ......... | 875.8 | —51.2 |
| 136 lbs. Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1338.7 | 1066.1 | 609.4 | ......... | ......... | ......... | 1004.7 | 77.7 |
| 170 lbs. Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1338.7 | 1070.7 | 656.6 | ......... | ......... | ......... | 1022.0 | 95.0 |
| 205 lbs. Cyanamid Plus Winter Legumes | ......... | ......... | ......... | 1342.4 | 1204.3 | 659.7 | ......... | ......... | ......... | 1068.8 | 141.8 |

damaged the legume crops to such an extent that cotton yields were not recorded. Cotton yields were recorded on three of the six well-drained replications in 1938 and 1939.

Two-year results for this field are presented in table 14.

These results indicate that winter legumes can be grown successfully on this type of soil. Unquestionably, hairy vetch was the best winter legume crop grown in this field for the past two years. Probably the poor results obtained from giant bur clover were due to the method and lateness of planting, since ordinarily, bur clover produces favorable results in this area under plantation conditions. Hairy vetch increased cotton yields equal to 45.37 pounds of commercial nitrogen during the two-year period. The low cotton yields following California bur clover in 1939 resulted from approximately one-half stand of cotton.

**Average All Five Fields**

Results from these five outlying fields on the east side of the Delta vary slightly, but in general there was less response from winter legumes than in the west part of the Delta.

Average results for the five fields for all years are presented in table 15

These data indicate that with proper management winter legumes can be grown successfully producing a worthwhile profit in increased cotton yields even on the East Delta soils which have less lime phosphorus, and potash than West Delta soils.

Again hairy vetch increased cotton yields more than 30 pounds of commercial nitrogen or other legumes used. The average increase due to hairy vetch was equal to 33.93 pounds of commercial nitrogen. After deducting the cost of winter legume seed at 4c to 10.5c per pound there was a profit of 18c to 40c per pound obtained from the seed. The commercial nitrogen cost about 10.5c per pound and returned a profit of 28c for each pound used. The profit per pound of hairy vetch seed used was 40c.

## Fertilizing Cotton After Winter Legumes of Doubtful Value, Except on Most Fertile Soils

Since average Delta cotton crops usually utilize 30 pounds to 50 pounds of nitrogen per acre for maximum yields, it is logical to assume that it is not necessary to apply commercial nitrogen to cotton after turning under a winter legume crop containing 75 to 150 pounds of nitrogen per acre. Ordinarily, it is not necessary to fertilize cotton following a good crop of winter legumes in most parts of the Delta, but results showing the indications of a need of more nitrogen under certain conditions have been observed. Possibly the requirements of 30-50 pounds of nitrogen per acre are increased as the humus level is raised following legumes, which raises the maximum production each succeeding year. Experimental results have been obtained in several locations with and without the use of commercial nitrogen and other fertilizers on cotton following winter legumes.

An experiment was made comparing different sources of nitrogen on cotton production following legume crops. The test was continued at the Delta Station during the nine-year period of 1931-39. An adjoining test comparing different rates of nitrogen from cyanamid for cotton production was conducted during the seven-year period of 1931-37. These experiments were begun in 1931 on Sarpy loam soil on which corn and soybeans had been grown from three to five years previously. Cotton and winter legumes were grown on this land for three years, then alternated with corn and soybeans every three years.

Results of these experiments on both fields are shown in table 16.

First Year Volunteer Crop of Giant Bur Clover on the Delta Experiment Station

The yield data show that where soil conditions were such that cotton yields were only a bale per acre or less, the addition of extra nitrogen after turning under winter legumes did not increase the yields as much as where conditions were favorable for the production of a bale or more per acre. The nine and seven-year averages on both types of land show increased yields too low to make it worthwhile to use commercial nitrogen on cotton following one or more good winter legume crops. The results from this test signify that the plats receiving the most legume crops produced the highest cotton yields. The cotton response to commercial nitrogen was also in proportion to the conditioning or improvement due to previous legume crops.

In 1936 another experiment was begun to measure the value of fertilizing cotton following hairy vetch. This test was conducted at this Station on a Sharkey clay soil commonly called "buckshot" land.

The results of this work are presented in table 17.

These data show that over a period of four years 30 pounds of commercial nitrogen applied to cotton following winter legumes on buckshot soil failed to increase cotton yields sufficiently to pay the cost of the fertilizer. Hairy vetch alone increased cotton yields more than did 30 pounds of commercial nitrogen.

Another test was started in 1939, on the Robertshaw plantation at Heathman, Mississippi, to measure the value of applying different amounts of commercial nitrogen to cotton following winter legumes. The soil in this field is of a light ridge land type and considerably different from that of the two previous experiments conducted on the Delta Station.

This experiment was begun on land on which Austrian peas had been grown for several years. Austrian peas were continued as the legume and sodium nitrate as the source of nitrogen.

The results of one year's work are shown in table 18.

TABLE 18—WINTER LEGUME PLUS COMMERCIAL NITROGEN FOR COTTON—HEATHMAN FIELD

| Treatments | Pounds of Seed Cotton per Acre 1939 Yield | Increase |
|---|---|---|
| No Nitrogen | 1571.0 | ......... |
| 30 lbs. Commercial Nitrogen | 1746.3 | 175.3 |
| Austrian Peas | 1549.0 | —22.0 |
| Austrian Peas and 10 lbs. Nitrogen | 1709.6 | 138.6 |
| Austrian Peas and 20 lbs. Nitrogen | 1907.0 | 336.0 |
| Austrian Peas and 30 lbs. Nitrogen | 1857.8 | 286.8 |
| Austrian Peas and 40 lbs. Nitrogen | 1840.4 | 269.4 |

These results show that the soil contained sufficient plant food to produce a bale of cotton per acre without a winter legume or commercial nitrogen. Commercial nitrogen at 30 pounds per acre increased the yield only 175.3 pounds of seed cotton. Austrian peas alone in 1939 failed to increase yields, but commercial nitrogen alone did. Therefore, increases obtained from the various rates of commercial nitrogen with the winter legumes are not contrary to expectations. Maximum increases were obtained from 20 pounds of commercial nitrogen when ap-

TABLE 19—FERTILIZING COTTON AFTER BUR CLOVER—EAST DELTA—GARY FIELD—MONEY, MISSISSIPPI—ONE YEAR—1939 ONLY

| Treatments | Lbs. Seed Cotton per Acre Yield | In-crease | Value Increase at 3c per lb. $ | Cost of Fertilizer $ | Profit $ |
|---|---|---|---|---|---|
| Bur Clover Alone | 1857.6 | ........ | ........ | ...... | ........ |
| Bur Clover Plus Nitrogen | 2071.6 | 214.0 | 6.42 | 3.30 | 3.12 |
| Bur Clover Plus Phosphorus | 2246.4 | 388.8 | 11.66 | 1.50 | 10.16 |
| Bur Clover Plus Potash | 1846.8 | —10.8 | —.32 | 1.30 | —1.62 |
| Bur Clover Plus Phosphorus and Potash | 1938.4 | 80.8 | 2.42 | 2.80 | —.38 |
| Bur Clover Plus Phosphorus, Potash and Nitrogen | 2387.7 | 530.1 | 15.90 | 6.10 | 9.80 |
| Bur Clover Plus Lime | 1988.1 | 130.5 | 3.92 | 2.70 | 1.22 |

Cotton 5½ Feet High Following Austrian Peas in a Winter Legumes Test—Delta Branch Station plied following a good crop of Austrian peas on this type of soil. One year's results are not conclusive and may change considerably in subsequent years.

Another test was conducted in 1939 with different fertilizer materials applied to cotton following a good bur clover crop on the Wildwood plantation near Money, Mississippi. This test was located on fine sandy loam soil near the east bank of the Tallahatchie River. These soils are deficient in nitrogen and respond fairly well to phosphorus and potash when applied to cotton. Winter legumes, as a rule, make excellent growth without the addition of fertilizers.

A good crop of bur clover was plowed under in the Spring of 1939 and the fertilizers applied on top of the cotton beds and harrowed in before the cotton was planted.

This one year's results are shown in table 19.

Bur clover alone produced 1857.6 pounds of seed cotton per acre, and the addition of 30 pounds of commercial nitrogen increased that yield 214 pounds of seed cotton per acre, 30 pounds of phosphorus 388.8 pounds, and 30 pounds of potash failed to increase the yield. When potash was combined with phosphorus, the increase was 80.8 pounds, and when a complete fertilizer consisting of 30 pounds of each element was applied, the increase was 530.1 pounds of seed cotton per acre. Commercial hydrated lime applied at the rate of 300 pounds per acre increased the yield 130.5 pounds of seed cotton.

After deducting the cost, phosphorus showed a profit of $10.16 per acre. It should be emphasized that this is a one-year result, and should not be considered as indicative unless confirmed by similar returns as the experiment is continued. The lime would have cost less in the form of ground limestone, but these yields were obtained with hydrated lime and might have been different with limestone; therefore, the calculations were based on the cost of the material used.

Left to Right: Hairy and Hungarian Vetch in the Winter Legume Test at the Schaefer Field Near Yazoo City

Nitrogen, phosphorus, and lime increased the yields in 1939 sufficiently to show worthwhile profits, but potash decreased the income in both cases.

## Summer Legumes Interplanted With Corn Increase Yields of Succeeding Corn, Cotton Crops

Since decomposition takes place rapidly in the south, it would appear that very little beneficial results could be expected from turning under a crop of soybeans or other summer legumes for soil improvements. Nevertheless, there is a sufficient nitrogen carry-over when a crop of summer legumes are turned under in the Delta area to obtain beneficitl results on the succeeding cotton or corn crop.

According to Florida Bulletin 301 (7), from the first of February to the middle of June, soils on which summer legumes were turned under had a higher nitrate content than soils in which a non-legume, Florida pusley, had been incorporated. Summer legumes in the hills of Mississpipi interplanted with corn had very little effect in soil improvement, according to Mississippi Bulletin 336 (1). Under Delta conditions, however, Mississippi Bulletin 331 (8) presents evidence that soybeans planted in corn at planting time and turned under when mature produced an average of 500 pounds of seed cotton more per acre the following year than corn alone over a period of seven years at the Delta Branch Experiment Station Stoneville, Mississippi.

In 1936 an experiment was begun at the Delta Station to determine the value of soybeans in cotton production on "buckshot" soil.

This information is shown in table 20.

TABLE 20—RESIDUAL EFFECT OF CORN AND SOYBEANS ON COTTON YIELDS ON BUCKSHOT SOIL

| | Pounds of Seed Cotton per Acre | | | | | |
|---|---|---|---|---|---|---|
| | Annual Yields | | | | Average | |
| Treatments | 1936 | 1937 | 1938 | 1939 | Yield | Increase |
| **4 years—1936-39** | | | | | | |
| Unfertilized cotton every year | 1725.5 | 1648.1 | 796.8 | 1482.1 | 1413.1 | ....... |
| Cotton 1st year after corn and soybeans | 2098.8 | 1479.6 | 1248.3 | 1494.1 | 1580.2 | 167.1 |
| **3 years—1937-39** | | | | | | |
| Unfertilized cotton every year | | 1648.1 | 796.8 | 1482.1 | 1309.0 | ....... |
| Cotton 1st year after corn and soybeans | | 1479.6 | 1248.3 | 1494.1 | 1407.3 | 98.3 |
| Cotton 2nd year after corn and soybeans | | 1962.1 | 781.7 | 1749.9 | 1497.9 | 188.9 |

TABLE 21—SUMMER LEGUMES FOR CORN PRODUCTION COMPARED WITH 30 POUNDS OF COMMERICAL NITROGEN AND CORN ALONE*

| | Bushels of Corn per Acre | | | | | Value | Cost | Net |
|---|---|---|---|---|---|---|---|---|
| | Yields | | | Increases | | of 1939 | of | Profit |
| | Annual | | Average | Annual | | Increase | 1939 | from '39 |
| Treatments | 1938 | 1939 | 1938-39 | 1938 | 1939 | 50c bu. | Increase | Increase |
| Corn Alone every year | 23.4 | 12.0 | 17.7 | ...... | ...... | ...... | ...... | ...... |
| Corn with 30 lbs. Nitrogen every year | 34.9 | 29.2 | 32.1 | 11.5 | 17.2 | $8.60 | $3.40 | $5.20 |
| Corn with Soybeans at planting | 23.7 | 26.9 | 25.3 | 0.3 | 14.9 | 7.45 | .40 | 7.05 |
| Corn with Cowpeas at planting | 21.3 | 25.7 | 23.5 | —2.1 | 13.7 | 6.85 | .40 | 6.45 |
| Corn with Crotalaria at planting | 25.6 | 25.0 | 25.3 | 2.2 | 13.0 | 6.50 | .50 | 6.00 |
| Corn with Soybeans at lay-by | 27.2 | 17.2 | 22.2 | 3.8 | 5.2 | 2.60 | .65 | 1.95 |
| Corn with Cowpeas at lay-by | 27.2 | 17.4 | 22.3 | 3.8 | 5.4 | 2.70 | .65 | 2.05 |
| Corn with Crotalaria at lay-by | 25.3 | 16.0 | 20.7 | 1.9 | 4.0 | 2.00 | .75 | 1.25 |
| 2 rows Corn and 2 rows Soybeans | 15.3 | 19.6 | 17.5 | —8.1 | 7.6 | 3.80 | .50 | 3.30 |

*Corn planted first week in May, which was too late for maximum yields from the variety used

A four-year average increased yield of 167.1 pounds of seed cotton was obtained from cotton following corn and soybeans compared with cotton following unfertilized cotton. The three-year average increase was only 98.3 pounds for the first year following corn and soybeans and 188.9 pounds the second year. The three-year average increase indicates better results the second year following corn and soybeans than the first. Evidently, decomposition of the soybeans was not complete the first year, and there was some nitrogen or other beneficial effects carried over the second year following corn and soybeans.

Since moisture is one of the more important factors in corn production, it is reasonable to presume that when water is limited soybeans interplanted with corn would utilize moisture to the extent that corn yields would be reduced, which is apparently the case in other sections of the south.

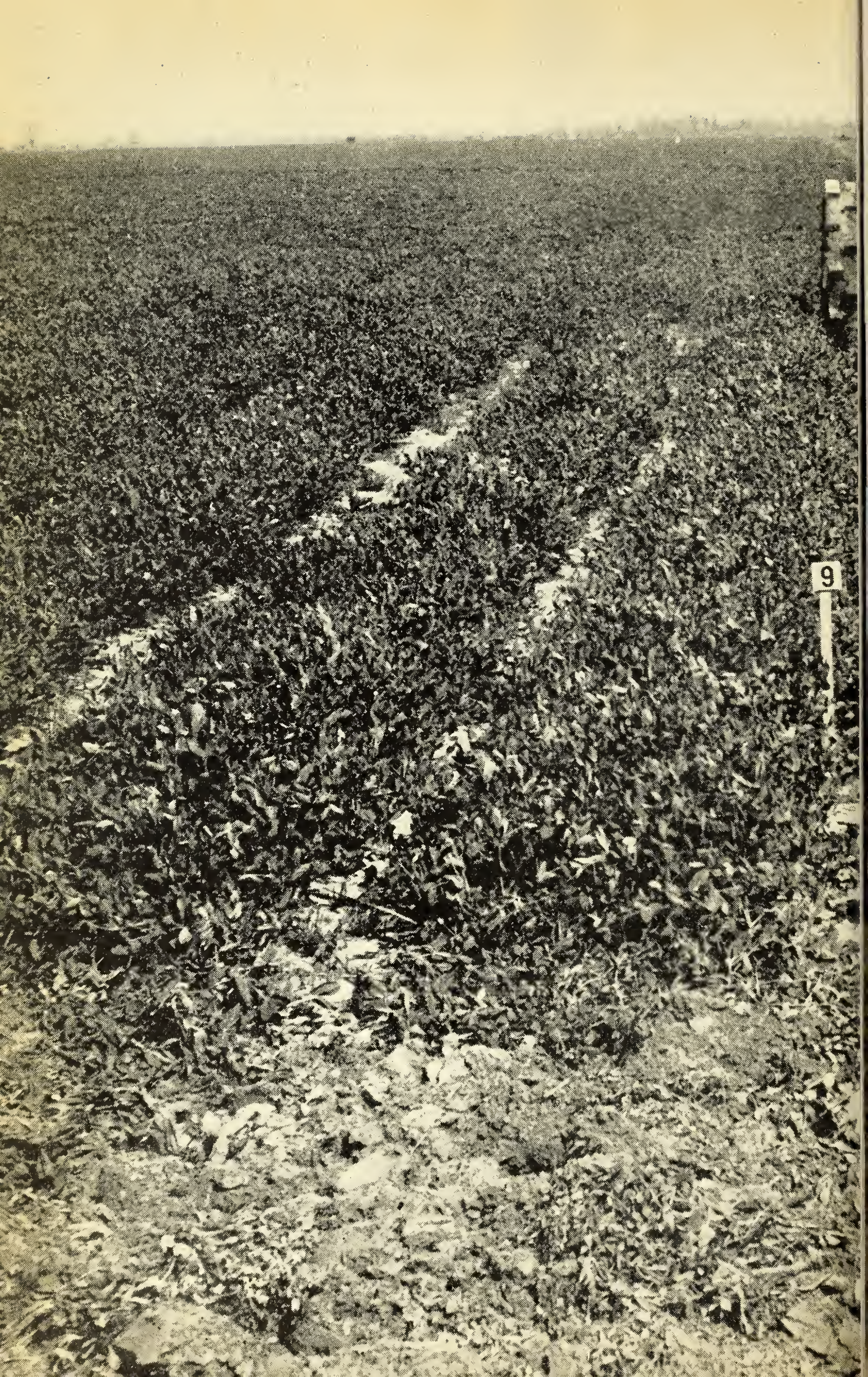
In 1938 an experiment was begun to measure the effects of summer legumes interplanted with corn. Soybeans and cowpeas were planted at the rate of one bushel to five acres, and crotalaria at the rate of five pounds per acre. This test was conducted on Sharkey loam soil and was planted in May each of the two years it has been in progress. Usually April planted corn yields better than that planted in May.

The results of this experiment are shown in table 21.

These results show that soybeans and crotalaria interplanted with corn did not reduce corn yields the first year. These legumes more than doubled corn yields the following year. They failed to increase corn yields equal to 30 pounds of commercial nitrogen the second year, but because of the lower cost of seeding summer legumes, the net profit was greater from the increased yields resulting from summer legumes. The 30 pounds of commercial nitrogen returned a net profit of $5.20 as compared to $7.05 from soybeans interplanted when the corn was planted.

The interplanted soybeans not only increased the corn yields in following crops but according to adjacent yields, eleven bushels of soybeans per acre could have been combined very profitably.

The legumes, when interplanted with corn at lay-by time, made very poor growth both years; therefore, very small increased corn yields were obtained the second year.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