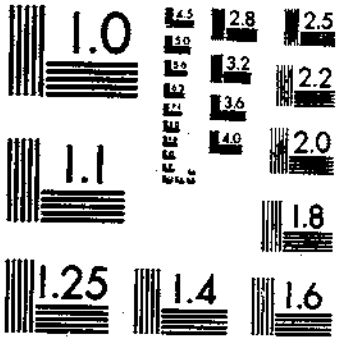
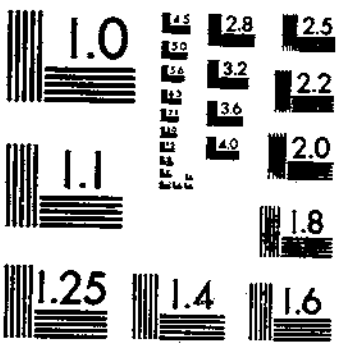
# START




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A




MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Technical Bulletin No. 495 September 1935

UNITED STATES DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.

# ALFALFA EXPERIMENTS AT STONEVILLE, MISS.

By PAUL R. HENSON, *assistant agronomist*, and H. L. WESTOVER, *senior agronomist, Division of Forage Crops and Diseases, Bureau of Plant Industry*[1]

(The Bureau of Plant Industry in Cooperation with the Mississippi State College and Agricultural Experiment Station)

CONTENTS



## INTRODUCTION



In the lower Misssissippi Delta, in the States of Mississippi, Arkansas, and Louisiana, a large percentage of the clay soils that are naturally well drained or else have been drained artificially are well adapted to alfalfa. From time to time failures due to unknown causes have been reported where the crop previously had been grown satisfactorily. The situation became particularly serious in 1928, and the demand for assistance in determining the cause of the failures resulted in a congressional appropriation in 1929. Under this appropriation, the Division of Forage Crops and Diseases of the Bureau of Plant Industry, in cooperation with the Mississippi Agricultural Experiment Station, inaugurated in that same year a series of experiments at Stoneville, Miss., to ascertain if possible the cause of the trouble and to suggest remedies. The results of these investigations are reported in detail in this bulletin and indicate that while some of the failures can be attributed to the use of seed of unadapted varieties, failure to cut at the proper stage of growth, to poor preparation of the seed bed, and to insect and disease injury, the most important factor in the successful production of alfalfa is adequate surface drainage.

[1]Acknowledgments are made to W. E. Ayres, of the Delta Experiment Station, at Stoneville, Miss., for assistance in planning these investigations, and to C. B. Haddon for data furnished from cooperative experiments at the Northeast Louisiana Experiment Station, at St. Joseph.

## ALFALFA SOILS OF THE MISSISSIPPI DELTA

During the winter of 1929–30, a brief survey was made of the soils of the Yazoo-Mississippi Delta for the purpose of determining the relation of soil type to the growth of alfalfa.[2] It was estimated that 90 percent of the alfalfa acreage in the Mississippi Delta is on soils of the Sharkey series, the most extensive type in this series being Sharkey clay, commonly known to Delta planters as "heavy buckshot." Sharkey clay is characterized as having a dark-colored surface soil underlain by a more or less mottled light-drab to bluish-gray stiff clay. Two phases are recognized, one occupying broad, flat, poorly drained basins and the other a better-drained phase, occurring as low ridges or as areas having a billowy relief. The former, which is by far the more extensive, is neutral to slightly acid in reaction. Near the river the "high position" Sharkey clay is usually only slightly acid and is well adapted to alfalfa. At most distances greater than 15 miles from the river this soil becomes more and more acid and is not suitable for alfalfa production.

Alfalfa is also grown to a limited extent on soils of the Sarpy series. These soils are usually more acid than the Sharkey soils, are inclined to be droughty, and as they are good cotton soils only a small percentage of the alfalfa is grown on them. Alfalfa is as productive for 2 to 3 years on Sarpy clay or clay loam that is not too acid as it is on Sharkey clay, but stands survive longer on the Sharkey soils.

### VARIETAL TESTS

When the cooperative alfalfa investigations were started at Stoneville there were evidences that in some instances the use of unadapted nonhardy varieties in the northern part of the Delta in Mississippi and Arkansas was responsible for failures due to winter-killing, or else the stand was thinned out to such an extent that grass and weeds lowered the yield and quality of the hay produced. Also as a relatively large amount of northern-grown common alfalfa seed was being sold in the Delta at prices higher than seed of Kansas or Utah common, there was some question as to whether or not the purchase of seed of these more hardy strains was economical. To obtain definite information on these points the alfalfa variety tests have included varieties and strains having a wide range of adaptability and varying in hardiness from tender varieties such as India and Hairy Peruvian through the intermediate types to the hardy variegated alfalfas.

The first test, sown March 7, 1930, included 21 varieties and strains of alfalfa, each being repeated three times, with every fifth plot a check of Utah Common. The results are given in table 1. In this test the higher yielding strains belong to the southern common group of alfalfas, which can be explained in part by the fact that the winters of 1930–31 and 1931–32 were so mild that very little winter-killing occurred in any of the varieties. In subsequent trials, one sown in the fall of 1932 and another in the fall of 1933, the southern common alfalfas were either winter-killed or were injured

[2] HENDRICKSON, B. H. PRELIMINARY REPORT: RECONNAISSANCE OF SOILS OF YAZOO-MISSISSIPPI DELTA WITH SPECIAL REFERENCE TO ALFALFA GROWING. U. S. Dept. Agr., Bur. Chem. and Soils. 1930. (Unpublished.)

by the colder winters of 1932–33 and 1933–34 to such an extent that they yielded less than most of the hardier varieties and strains.

TABLE 1.—*Annual and average yields of hay on a 12-percent moisture basis and percentage of check of several varieties and strains of alfalfa sown at Stoneville, Miss., Mar. 7, 1930*

| Variety | Accession no.[1] | Acre yield | | | | | Percentage of check |
|---|---|---|---|---|---|---|---|
| | | 1930 [2] | 1931 | 1932 | 1933 | Average | |
| | | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | |
| Argentine | F. C. 15906 | 2,500 | 10,934 | 10,508 | 7,397 | 9,613 | 110.0 |
| Italian | F. C. 15857 | 2,289 | 10,675 | 10,075 | 7,318 | 9,356 | 107.7 |
| South African | F. C. 14204 | 2,188 | 11,015 | 10,508 | 5,618 | 9,247 | 106.4 |
| Argentine | F. C. 14160 | 2,275 | 11,077 | 9,911 | 6,883 | 9,057 | 104.2 |
| Arizona Common | F. C. 15837 | 2,312 | 10,847 | 10,607 | 5,198 | 8,884 | 102.3 |
| New Mexico Common | F. C. 17430 | 2,919 | 10,183 | 9,756 | 6,646 | 8,862 | 102.0 |
| Dakota Common | F. C. 10080 | 2,358 | 10,128 | 9,131 | 7,028 | 8,762 | 100.9 |
| South African | F. C. 14203 | 2,226 | 10,232 | 9,810 | 6,166 | 8,736 | 100.6 |
| Nebraska Common | F. C. 15807 | 2,143 | 10,495 | 8,883 | 6,097 | 8,692 | 100.0 |
| Utah Common (check) | F. C. 15995 | 2,133 | 10,037 | 9,394 | 6,633 | 8,688 | 100.0 |
| California (south) | F. C. 15889 | 2,446 | 10,645 | 10,677 | 4,544 | 8,622 | 99.2 |
| Utah Common | F. C. 15937 | 1,873 | 9,919 | 8,925 | 6,917 | 8,587 | 98.8 |
| Do | F. C. 15980 | 2,185 | 10,205 | 8,831 | 6,650 | 8,585 | 98.8 |
| Hairy Peruvian | F. C. 15836 | 2,724 | 10,322 | 10,535 | 4,372 | 8,410 | 96.8 |
| French | F. P. I. 81489 | 1,600 | 9,942 | 8,355 | 6,468 | 8,255 | 95.0 |
| Grimm | F. C. 10030 | 2,352 | 9,187 | 8,283 | 7,109 | 8,224 | 94.7 |
| French | F. P. I. 81488 | 2,133 | 9,414 | 8,473 | 6,464 | 8,117 | 93.4 |
| California (north) | F. C. 15835 | 2,546 | 9,209 | 9,101 | 5,878 | 8,063 | 92.8 |
| Turkistan | F. C. 15754 | 2,115 | 8,550 | 8,759 | 5,858 | 7,722 | 88.9 |
| Do | Comm. 2074 | 2,085 | 8,960 | 8,037 | 5,112 | 7,370 | 84.8 |
| India | Comm. 1724 | 2,331 | 5,937 | (3) | (3) | (3) | (3) |

[1] F. C. indicates accession number of the Division of Forage Crops and Diseases; F. P. I. of the Division of Foreign Plant Introduction; and Comm. indicates seed purchased from seedsmen.
[2] The 1930 yields are on a field-cured basis. Only 1 cutting was obtained, because of dry weather and spring sowing. Not included in averages.
[3] Winter-killed 1931–32.

The second test, sown October 7, 1932, included 12 of the more promising alfalfas. Each plot was repeated four times with every fourth plot a check of Kansas Common. In this test as shown in table 2, two strains of common alfalfa from Kansas gave slightly higher yields than any other variety. The 1-year results of the third test, sown September 14, 1933, are given in table 3 and are included primarily to show the comparatively low yields of the non-hardy alfalfas after a relatively cold winter.

TABLE 2.—*Annual and average yields of hay on a 12-percent moisture basis and percentage of check of variety test sown at Stoneville, Miss., Oct. 7, 1932*

| Variety | Accession no.[1] | Acre yield | | | Percentage of check |
|---|---|---|---|---|---|
| | | 1933 | 1934 | Average | |
| | | *Pounds* | *Pounds* | *Pounds* | |
| Kansas Common (check) | ..... | 6,774 | 11,525 | 9,150 | 100.0 |
| Kansas Common | 19072 | 6,510 | 11,628 | 9,069 | 99.1 |
| Dakota Common | 16053 | 6,452 | 11,554 | 9,003 | 98.4 |
| New Mexico Common | 19081 | 6,435 | 11,537 | 8,986 | 98.2 |
| Argentine | 15906 | 6,355 | 11,546 | 8,951 | 97.8 |
| Utah Common | 19061 | 6,323 | 11,421 | 8,872 | 97.0 |
| Dakota 12 | 19058 | 6,310 | 11,335 | 8,823 | 96.4 |
| Hardigan | 19010 | 5,910 | 11,499 | 8,705 | 95.1 |
| Ontario Variegated | 19216 | 6,005 | 11,025 | 8,515 | 93.4 |
| California Common | 15899 | 5,691 | 11,381 | 8,536 | 93.3 |
| Grimm | 19067 | 6,047 | 10,975 | 8,511 | 93.0 |
| Arizona Common | 19011 | 3,574 | 10,598 | 7,086 | 77.4 |
| Hairy Peruvian | ..... | 1,966 | 8,174 | 5,070 | 55.4 |

[1] Of the Division of Forage Crops and Diseases.

TABLE 3.—*1934 yields of hay by cuttings on a 12-percent moisture basis and percentage of check of the alfalfa variety test at Stoneville, Miss., sown Sept. 14, 1933*

| Variety | Accession no.[1] | Acre yield | | | | | | Percentage of check |
|---|---|---|---|---|---|---|---|---|
| | | First cutting, May 2 | Second cutting, June 14 | Third cutting, July 16 | Fourth cutting, Aug. 23 | Fifth cutting, Oct. 15 | Total | |
| | | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | |
| Ontario Variegated | 19129 | 3,920 | 4,074 | 2,880 | 333 | 1,538 | 12,804 | 100.4 |
| Kansas Com. (check) | | 3,980 | 3,725 | 2,924 | 444 | 1,677 | 12,759 | 100.0 |
| Hardigan | 20150 | 4,436 | 3,785 | 2,670 | 248 | 1,598 | 12,737 | 99.8 |
| Disco 28 | | 4,188 | 3,712 | 2,846 | 400 | 1,510 | 12,665 | 99.3 |
| Grimm | 22047 | 3,944 | 4,161 | 2,661 | 356 | 1,501 | 12,623 | 98.9 |
| Oklahoma Common | 18994 | 3,953 | 3,703 | 2,853 | 378 | 1,605 | 12,552 | 98.4 |
| Dakota 12 | 19958 | 3,946 | 3,805 | 2,923 | 412 | 1,670 | 12,456 | 97.6 |
| Nebraska Common | 21598 | 3,887 | 3,712 | 2,851 | 319 | 1,622 | 12,391 | 97.1 |
| Kansas Common | 20091 | 3,629 | 3,718 | 2,871 | 332 | 1,703 | 12,313 | 96.5 |
| New Mexico Com | 19081 | 3,740 | 3,685 | 2,857 | 355 | 1,675 | 12,312 | 96.5 |
| Argentine | 15996 | 4,065 | 3,493 | 2,677 | 210 | 1,088 | 12,133 | 95.1 |
| Arizona Common | 21040 | 4,134 | 3,223 | 2,653 | 291 | 1,643 | 11,944 | 93.6 |
| Utah Common | 19961 | 3,743 | 3,523 | 2,737 | 201 | 1,625 | 11,949 | 93.4 |
| Arizona Common | 22027 | 3,675 | 3,376 | 2,682 | 238 | 1,846 | 11,717 | 91.8 |
| California Common | 22035 | 3,736 | 3,229 | 2,509 | 281 | 1,620 | 11,384 | 89.2 |
| Turkistan | 10316 | 3,643 | 3,329 | 2,474 | 324 | 1,414 | 11,184 | 87.7 |
| Hairy Peruvian | 21041 | 3,390 | 3,034 | 2,459 | 274 | 1,058 | 10,806 | 84.7 |
| California Common | 22041 | 3,472 | 3,083 | 2,331 | 177 | 1,528 | 10,591 | 83.0 |

[1] Of the Division of Forage Crops and Diseases.

These trials show clearly the risk involved in sowing nonhardy alfalfas in this portion of the Delta. Alfalfas from Kansas and adjoining States have given consistently good yields.

In addition to the tests at Stoneville, variety trials have also been carried on through cooperative agreement with the Northeast Louisiana Experiment Station at St. Joseph, La., approximately 120 miles south of Stoneville. The results of the first test sown October 27, 1930, are given in table 4. Over the 3-year period, 1931–33, Peruvian and Arizona Common alfalfa have given the highest yields. In a later test, sown November 6, 1931, the strains of southern common alfalfas gave the highest yields.

While these tests cover only a 3-year period, the results indicate that nonhardy alfalfas such as Hairy Peruvian and Arizona Common may be safely grown in this area.

TABLE 4.—*Annual and average yields of field-cured hay of the alfalfa-variety test sown at the Northeast Louisiana Experiment Station, St. Joseph, La., Oct. 27, 1930*

| Variety | Accession no.[1] | Acre yield | | | Average |
|---|---|---|---|---|---|
| | | 1931 | 1932 | 1933 [2] | |
| | | *Pounds* | *Pounds* | *Pounds* | *Pounds* |
| Hairy Peruvian | 18841 | 14,103 | 10,793 | 1,548 | 12,448 |
| Smooth Peruvian | 18827 | 13,915 | 10,994 | 1,415 | 12,455 |
| Arizona Common | 18842 | 13,266 | 11,130 | 1,502 | 12,198 |
| Utah Common | 15086 | 12,973 | 11,371 | 1,760 | 11,722 |
| Disco 28 | | 12,515 | 10,801 | 1,500 | 11,658 |
| Kansas Common | 18826 | 12,937 | 10,193 | 1,481 | 11,564 |
| Dakota 12 | 15997 | 13,047 | 10,345 | 1,132 | 11,696 |
| Grimm | 18840 | 12,503 | 10,411 | 1,132 | 11,457 |

[1] Of the Division of Forage Crops and Diseases.

[2] The third cutting, June 24, was the only cutting saved in 1933, due to continuous rains before and after that date; not included in averages.

## FERTILIZER EXPERIMENTS

At the beginning of the investigations very little information was available regarding the fertilizer requirements of alfalfa on Delta soils. From time to time planters have applied nitrogen and phosphatic fertilizers, with conflicting opinions regarding the effects. Because of this, investigations were inaugurated to determine definitely whether the soils are deficient in any of the elements essential to the successful growth of alfalfa. During the fall and winter of 1929–30, R. E. Uhland, who was in charge of the alfalfa investigations at that time, collected over 300 soil and subsoil samples from different locations in the Delta. These samples were analyzed for acidity, nitrogen, and soluble phosphorus, and the analyses showed that many of the Delta soils are low in nitrogen but well supplied with phosphorus.

In order to obtain further information on this subject a fertilizer test was sown in the fall of 1928 on a field of Sarpy silty clay loam of fair to good fertility, which included triplicate one-twentieth-acre plots of all treatments. The fertilizers were applied and disked in before seeding and reapplied immediately after the first cutting in 1931. As the small initial applications of nitrate of soda did not show any effect it was felt that this might be due to the insufficient amounts applied. Consequently, when the fertilizers were reapplied the amounts of nitrate of soda were doubled so that plots that had received 75 and 150 pounds were increased to 150 and 300 pounds, respectively.

The results, as shown in table 5, do not show any significant increases in yields of alfalfa hay from plots receiving applications of sulphur or nitrate of soda over the untreated checks. The plots receiving superphosphate and ground limestone, superphosphate alone, and ground limestone alone yielded during the 5-year period an average of 700, 685, and 497 pounds per acre, respectively, more than the check plots. While these yields are significantly higher than the yield from the untreated plots, the value of the increase in yield of hay from the use of fertilizers was not sufficient to compensate for the cost and application of the fertilizer.

Three other fertilizer tests are being conducted at Stoneville; 2 on Sharkey silty clay and 1 on Sarpy fine sandy loam. In these tests phosphatic, nitrogenous, and potassic fertilizers have been applied singly and in all combinations. Plots receiving manure and ground limestone have also been included. None of the tests has shown any significant increase in yield of alfalfa on plots treated with nitrogenous or potassic fertilizers. In fact, applications of nitrate of soda have, in several instances, depressed the yield. Applications of superphosphate, manure, and ground limestone have resulted in small increases in yield of alfalfa on Sharkey clay and have given significant increases on Sarpy fine sandy loam, but the increases have not been great enough to pay the cost of the fertilizer and the labor involved in applying it.

In addition to the fertilizer tests at Stoneville, field trials have been located at Clarksdale, Wilmot, and Arcola, Miss., and at St. Joseph, La. From observations of these plots no significant differences could be seen between the fertilized and the unfertilized plots.

TABLE 5.—*Annual and average yields of hay on a 12-percent moisture basis, percentage of check, and increase over check from the alfalfa fertilizer test sown at Stoneville, Miss., Oct. 11, 1928*

| Treatment (pounds per acre) | Acre yield | | | | | | Percentage of check | Increase or decrease per acre on basis of check |
|---|---|---|---|---|---|---|---|---|
| | 1929 [1] | 1930 [1] | 1931 | 1932 | 1933 | Average | | |
| | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | | *Pounds* |
| Check (no fertilizer) | 4,556 | 10,081 | 11,783 | 9,692 | 9,313 | 9,085 | 100.0 | |
| 300 superphosphate and 6,000 ground limestone | 5,221 | 10,486 | 12,320 | 10,472 | 10,428 | 9,785 | 107.7 | 700 |
| 300 superphosphate | 5,280 | 10,796 | 12,581 | 10,594 | 9,590 | 9,770 | 107.5 | 685 |
| 6,000 ground limestone | 5,274 | 10,529 | 11,941 | 10,122 | 10,043 | 9,582 | 105.5 | 497 |
| 300 sulphur | 4,609 | 9,148 | 12,508 | 10,092 | 9,847 | 9,241 | 101.7 | 156 |
| 150 nitrate of soda | 3,767 | 9,815 | 11,994 | 9,970 | 9,668 | 9,043 | 99.5 | −42 |
| 75 nitrate of soda | 4,736 | 8,721 | 11,590 | 10,228 | 9,237 | 8,902 | 98.0 | −183 |

[1] The average yields for 1929 and 1930 were on a field-cured basis. Low yields in 1929 were due to dry weather.

## DATE AND METHOD OF SEEDING

The results of the date-of-seeding tests are shown in table 6. Sowing in the fall from September 15 to October 15 has consistently given good stands. As will be noted from the table, spring seedings in some instances have given fair stands, but the results on a whole indicate the risk involved in spring seeding. Late spring freezes have killed the young alfalfa on plots sown February 15 and March 1, while the invasion of grasses and weeds and periods of hot dry weather during late spring and early summer months usually have markedly reduced the stands on spring-sown plots. In addition to the difficulty in securing a stand of alfalfa in the spring, the yield of hay the first year is usually very low and of poor quality. However it is not uncommon to get relatively high yields of good-quality hay the first season from fall-sown alfalfa. It is a good practice to prepare the seed bed during August or early September and sow as soon as possible after the first good rain.

TABLE 6.—*Estimated annual average and average percentage of stand of alfalfa remaining at the end of the first growing season on plots sown at different dates at Stoneville, Miss.*

| Date sown | 1928–29 | 1930–31 | 1931–32 | 1932–33 | 1933–34 | Average |
|---|---|---|---|---|---|---|
| | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* | *Percent* |
| Sept. 15 | 100.0 | 93.0 | 82.0 | 100.0 | 91.0 | 93.2 |
| Oct. 1 | 100.0 | 94.0 | 83.0 | 100.0 | 91.7 | 93.7 |
| Oct. 15 | 83.0 | 77.0 | 80.0 | 100.0 | 86.7 | 85.3 |
| Nov. 1 | 45.0 | 58.0 | 28.0 | 0 | 70.3 | 42.1 |
| Nov. 15 | 0 | 0 | 33.0 | 0 | 0 | 6.6 |
| Feb. 15 | 0 | 75.0 | 13.0 | (1) | 71.3 | 39.8 |
| Mar. 1 | 0 | 46.0 | 65.0 | 35.0 | 70.0 | 43.2 |
| Mar. 15 | 8.0 | 45.0 | 70.0 | 7.0 | 56.3 | 37.1 |
| Apr. 1 | 73.0 | 83.0 | 13.0 | 4.0 | 36.0 | 42.4 |
| Apr. 15 | (1) | 83.0 | 13.0 | 2.0 | 4.0 | 25.5 |

[1] Plots not sown these years.

The alfalfa drill distributes the seeds evenly and covers them uniformly, and where large fields are to be sown the purchase of this implement would be a sound investment. In using this implement

on loam soils care should be taken to avoid covering too deeply. Excellent stands of alfalfa may also be obtained with the wheelbarrow seeder, if properly operated. In seeding with a wheelbarrow seeder it is advisable to sow half of the seed in one direction and the other half across the first seeding. The seed should be covered lightly with a spike-tooth harrow.

The use of the long box drag in the final preparation of the seed bed for alfalfa has been found to be indispensable on Delta soils. The drag not only smooths the field by filling in small depressions but aids materially in pulverizing the soil. If a corrugated roller or cultipacker is available the field should be rolled before seeding to improve the tilth and compact the seed bed.

## RATE OF SEEDING

The rate of seeding varies considerably in the Delta area. A few fields are sown at rates as low as 12 pounds per acre, many more from 15 to 25 pounds, while the majority of the fields are sown at rates ranging from 25 to 40 pounds per acre. The results of the rate-of-seeding test are shown in table 7. There are no significant differences between the yields of plots sown at the different rates of seeding. Plots sown at the rate of 10 pounds per acre gave yields as high as those sown at the higher rates. The 2-year results of a later test, sown October 8, 1932, are in accord with the test reported in table 7. Although seeding at the rate of 10 pounds per acre gave as high yields as the heavier rates in these tests, it is probable that more care was taken in preparing the seed bed and in seeding than under general farming practices. For these reasons seeding at the rate of 15 to 20 pounds per acre is advisable, depending on the condition of the seed bed and method and time of seeding. Spring seedings should be heavier than fall seedings owing to greater weed competition and to more adverse weather conditions.

TABLE 7.—*Annual and average yields of hay on a 12-percent moisture basis from the rates-of-seeding-alfalfa test sown in duplicate plots, Oct. 11, 1928, at Stoneville, Miss.*

| Rate of seeding (pounds per acre) | Acre yield | | | | | | Average |
|---|---|---|---|---|---|---|---|
| | 1929 [1] | 1930 [1] | 1931 | 1932 | 1933 | 1934 | |
| | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* | *Pounds* |
| 10 | 8,020 | 9,410 | 9,268 | 10,284 | 7,317 | 10,750 | 9,208 |
| 20 | 8,240 | 9,260 | 10,398 | 9,722 | 7,373 | 10,895 | 9,315 |
| 30 | 8,360 | 9,370 | 9,559 | 10,526 | 8,044 | 11,744 | 9,557 |
| 40 | 8,060 | 9,090 | 9,527 | 10,730 | 8,141 | 11,180 | 9,388 |
| 50 | 8,360 | 9,070 | 9,616 | 9,793 | 7,573 | 11,262 | 9,369 |

[1] Yields on a field-cured basis.

## CULTIVATION

Cultivating old or thin stands of unirrigated alfalfa immediately after each cutting or at any other time usually has proved unprofitable, and in this respect the results of two 3-year cultivation tests are in accord with the findings of other investigators. The disk harrow, rotary hoe, and the spring-tooth harrow or alfalfa cultivator

are being used, and the results of the first test sown in the fall of 1928 are shown in table 8. Yields from plots cultivated immediately after each cutting or in the spring and late summer have been consistently lower than the yields from uncultivated plots. There have been no apparent differences in the percentage of grass in the hay from the cultivated and uncultivated plots. The reduction in stand on many of the plots is very apparent, particularly on those plots which have been disked after each cutting.

TABLE 8.—*Annual and average yields of hay on a 12-percent moisture basis, and decrease due to cultivation from the alfalfa-cultivation test at Stoneville, Miss.*

| Implement used | Time of cultivation | Acre yield | | | | Percentage of check | Decrease (per acre) due to cultivation |
|---|---|---|---|---|---|---|---|
| | | 1932 | 1933 | 1934 | Average | | |
| | | *Pounds* | *Pounds* | *Pounds* | *Pounds* | | *Pounds* |
| Check, not cultivated | | 9,268 | 6,055 | 9,728 | 8,550 | 100.0 | |
| Rotary hoe | After each cutting | 9,352 | 6,490 | 9,324 | 8,389 | 98.1 | 161 |
| Do | Spring and late summer | 9,490 | 6,097 | 9,438 | 8,342 | 97.6 | 208 |
| Disk harrow | do | 9,472 | 6,304 | 9,197 | 8,324 | 97.4 | 226 |
| Spring-tooth harrow | do | 9,195 | 6,400 | 9,263 | 8,286 | 96.9 | 264 |
| Disk harrow | After each cutting | 9,312 | 6,501 | 8,940 | 8,151 | 95.3 | 399 |
| Spring-tooth harrow | do | 8,870 | 6,697 | 8,875 | 8,147 | 95.3 | 403 |

## TIME OF CUTTING

While cutting tests have not been conducted long enough to permit definite recommendations for conditions in the Mississippi Delta, the results do indicate the importance of cutting alfalfa at the proper time. In general, the results are in agreement with the conclusions reached by investigators in other alfalfa-producing sections, in that alfalfa cut at the one-tenth to one-half bloom stage produces maximum yields of good-quality hay without appreciably injuring the stands. While cutting at the prebud and bud stage produces high-quality hay, if all cuttings are made early the stands begin to thin out to such an extent that by the end of the second season the field is mostly grass and weeds. Also the annual yields of alfalfa cut at the early bud stage have been lower than when cut at later stages. Slightly lower yields of poor-quality hay have resulted from cutting later than the three-fourths to full-bloom stage. Livestock men have long recognized that hay made from alfalfa cut in the late-bloom stage is a better feed for mules and horses than hay from cuttings made at the earlier stages, and since most of the alfalfa produced in the Mississippi Delta is fed to work stock it should be cut when one-half to three-fourths in bloom.

At certain periods during the growing season, due to adverse climatic conditions, alfalfa does not bloom readily, and under these conditions the stage of bloom is not a satisfactory guide to the time to cut. When this occurs alfalfa should be cut when it begins to take on a yellowish cast, as this condition indicates that the vegetative growth is slowing up or has stopped entirely. Under these conditions, by frequent observations of their fields, alfalfa growers soon learn when to cut.

## DRAINAGE

As the annual average rainfall in the Mississippi Delta varies between 50 and 60 inches, the problem of securing adequate drainage is of major importance. Poor drainage on the broad nearly level basins of Sharkey clay is the cause of more alfalfa failures than any other factor. Experiments have been conducted to determine the effect of tile and surface drainage on yields and survival of alfalfa.

### TILE DRAINAGE

As most of the large areas of Sharkey clay have been drained by primary and secondary dredge ditches, it was thought that tile drains would adequately drain the areas between the ditches. To test this, an area of Sharkey clay was chosen, one-half of which was tiled and the other half left to serve as a check. Equally good surface drainage was provided for both areas. The tile drains were installed in August 1930 and consisted of 4 lines of 6-inch clay tile, each line being 225 feet long and spaced at 30-foot intervals. A good seed bed was prepared on both sections, and the alfalfa was sown October 13, 1930. Yields of hay have been taken on the two areas over the 4-year period 1931–34 and show no significant differences between the yields of the tile-drained area and the untiled area. This failure to obtain any appreciable benefits with tile drainage on Sharkey clay is in accord with observations of planters who have tried tile drainage in this locality.

### SURFACE DRAINAGE

From observations of fields of alfalfa on Sharkey clay it has been noted that wherever good natural surface drainage occurs, good stands of alfalfa are maintained, but where it has been sown on the flat, poorly drained areas the stands are thin, grassy, and unproductive after 2 or 3 years. It is evident that the natural slope of these nearly level lands is not great enough to remove surface water in time to prevent injury to the stands during the winter months when the rainfall is usually excessive. Most of the alfalfa grown at the experiment station at Stoneville is on fields which have been built up into lands providing very good surface drainage. On some of these fields it has remained productive for 5 to 7 years. As such good results were obtained on these fields, it became evident that information as to the height to which fields should be built up was very much needed.

A surface-drainage test was installed on D. T. Wilkins' plantation near Wilmot, Miss., to determine the height to which lands should be built and also the width of land most suitable for general use. Lands were built up from 6 to 14 inches, varying in width from 50 to 130 feet. The ditches between these lands were of the V-type with flat slopes, and may be readily crossed with haying equipment. The fall in the ditches approximated 2 inches per 100 feet. Two lands were left flat to serve as checks. The field was sown to alfalfa in October 1930, good stands being obtained over the entire field. The stands on lands left flat were very poor following the winter of 1930–31, and attempts to reseed these areas in the fall of 1931 met with little success. When last observed in the fall of 1934 the

alfalfa on the flat lands had died out from 80 to 100 percent, while the stands were still good on the other lands. There were no noticeable differences on the lands built up to different heights or of varying widths, the stand being equally as good on those lands built up 6 inches as on the higher ones.

In preparing a field of level or nearly level Sharkey clay for alfalfa, the entire field should be built up into lands to provide adequate surface drainage. The lands should always run with the slope of the field. The width of the lands will depend largely on the equipment the planter has on hand, such as graders, scrapers, etc. On fields having a uniform slope, lands 30 or 40 feet wide may be built up sufficiently by plowing each land to the center and opening up the ditches with a ditcher or grader, care being taken to see that the soil is moved well back from the ditch banks so that the surface water may enter the ditches readily. Further investigations are being conducted with different implements on lands of varying widths, the results of which will be reported later.

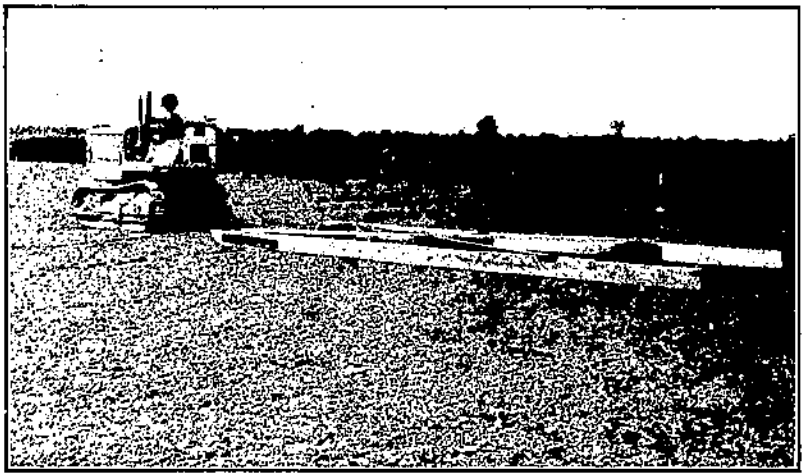


FIGURE 1.—Box drag used in smoothing land for alfalfa.

In the final preparation of the seed bed, the long box drag has been found to be very useful in smoothing the land by dragging off the high spots and filling in the low ones. A box drag that has done satisfactory work on the experiment station is shown in figure 1, the working plan being shown in figure 2.

The following materials will construct such a drag:

2 runners, 2 by 8 inches by 20 feet.
3 cross members, 2 by 8 inches by 7 feet.
2 diagonal braces, 2 by 4 inches by 15 feet 8 inches.
6 angle irons, ¼ by 3 by 3 by 8 inches.
2 iron straps, ⅜ by 6 by 24 inches.
26 bolts, ½ by 2½ inches.
2 eye bolts, ⅝ by 3 inches.

This drag is of inexpensive construction, light in weight, and can be easily moved from one field to another. The runners are extended in the rear to prevent the rear end from scooping out holes

when the front end is elevated. The drag should be at least 20 feet long so that its action on the land will be one of levelling and not of rising and falling with small surface irregularities. Such a drag will do excellent work without any additional weight on light soils, but on the heavy "buckshot" soils it may be necessary to place a sack of soil on each of the four corners of the drag to weight it down. As the drag leaves the soil loose in places it is a good practice to roll the land with a corrugated roller or cultipacker before sowing. Fields plowed or built up into lands should be allowed to settle from 2 to 3 weeks before seeding, as alfalfa requires a firm seed bed.

## INSECTS AND DISEASES

While yields undoubtedly have been lowered in many instances by alfalfa diseases, the stands have not been seriously reduced by any one disease since the investigations were started. In some of the older fields in this section plants infested with bacterial wilt

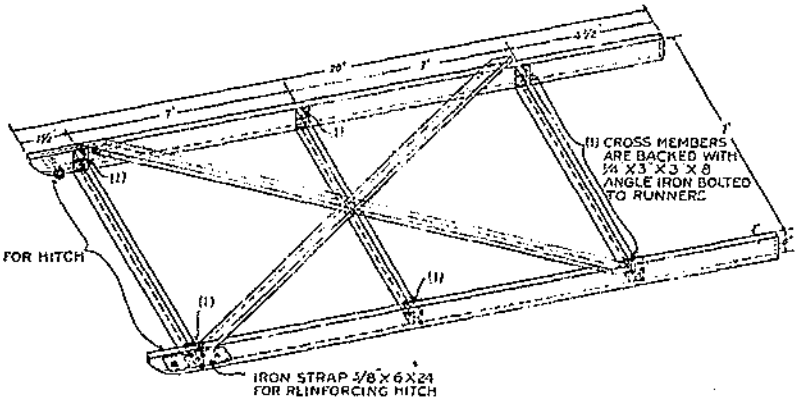



FIGURE 2.—Working plan for constructing box drag, shown in figure 1.

(*Phytomonas insidiosa* (McCulloch, Bergey et al.) are sometimes found, but no serious spread or material reduction in stands has been noted as a result of this disease. Leaf spot caused by the fungus *Pseudopeziza medicaginis* (Lib.) Sacc. is probably the most serious disease of alfalfa in the Delta area. The disease appears as small dark-brown to black spots on the leaves, which cause the badly infected leaves to turn yellow and to drop off. Leaf spot is especially noticeable when the normal rate of growth of alfalfa is retarded by environmental conditions.

Alfalfa fields in the Mississippi Delta are generally infested with numerous insects; the degree of injury from these insects depending largely on seasonal conditions. The pea aphid (*Illinoia pisi* Kalt.) is usually present in large numbers during cool spring months and may cause considerable damage to the first crop if the time of cutting is delayed. The three-cornered alfalfa hopper (*Stictocephala festina* (Say)) is usually present at the time of the third and fourth cuttings and by girdling the stems will cause a yellowing of the foliage. The damage to the hay may be checked and the insect

partially controlled by cutting the alfalfa at the time the first yellowing appears. At midseason, leafhoppers (*Empoasca* spp.) may be present in such large numbers as to cause a yellowing of the foliage, as a result of the insects feeding on the stems and petioles of the plant. The fall army worm (*Laphygma frugiperda* S. and A.) may appear in large numbers and if not controlled will sometimes ruin newly sown fields and in established stands the last cutting may be defoliated by this worm. Many of the Delta planters have been able to control the fall army worm in newly sown stands by dusting with calcium arsenate at the rate of 4 to 6 pounds per acre. Further information on alfalfa insects and their control can be obtained by addressing inquiries to the Bureau of Entomology and Plant Quarantine, Washington, D. C.

## SUMMARY OF RESULTS

In an effort to determine the cause of alfalfa failures in the Mississippi Delta, investigations covering the most important phases of alfalfa production are being conducted at Stoneville. The principal tests included in the investigations are variety and fertilizer trials, rates and dates of seeding, cultivation, time of cutting, and tile- and surface-drainage tests. In addition to the experimental tests, frequent observations are made of fields of alfalfa within short distances of Stoneville, and notes are taken regarding the condition of stands, presence or absence of diseases, etc.

Some of the unsatisfactory results have been due to attempts to grow alfalfa on unadapted soils. The older soils of the Yazoo series and the better drained phase of Sharkey clay in the eastern part of the Mississippi Delta are acid, and alfalfa usually fails on them. In some instances, poor seed-bed preparation has been responsible for the failure to secure good stands of alfalfa.

The results indicate that while the nonhardy strains of alfalfa may be satisfactorily grown as far north as St. Joseph, La., they are not adapted to the northern portions of the Mississippi Delta. Strains of common alfalfa from Kansas and adjoining States have given very satisfactory yields and should be grown in preference to northern cold-resistant alfalfa or Hairy Peruvian and other nonhardy varieties.

Attempts to increase the yield or life of stands by applications of commercial fertilizers have shown little promise.

While plots sown at the rate of 10 pounds of seed per acre have yielded as well as those sown at the higher rates, in general farm practice it is advisable to increase this rate to 15 to 20 pounds per acre.

By far the best results have been obtained from seedings made in the fall from September 15 to October 15.

The quality or yield of alfalfa hay has not been increased by any form of cultivation.

Results of time-of-cutting tests indicate that satisfactory yields are obtained without appreciably injuring the stands when alfalfa is cut at the one-tenth to one-half bloom stage.

From observations of many fields in the Mississippi Delta, and from experimental results, it is evident that the lack of surface

drainage is responsible for most of the unsuccessful attempts to grow alfalfa. The nearly level to level areas of Sharkey clay "heavy buckshot" soils make ideal alfalfa soils if properly surface-drained. However, the tests have shown that the natural drainage on these areas should be supplemented by building up the field into lands with surface ditches, spaced at regular intervals to drain the field more rapidly.

The various insects and diseases found have not been a major factor in the alfalfa failures.

## ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE WHEN THIS PUBLICATION WAS LAST PRINTED

| | |
|---|---|
| *Secretary of Agriculture* | HENRY A. WALLACE. |
| *Under Secretary* | REXFORD G. TUGWELL. |
| *Assistant Secretary* | M. L. WILSON. |
| *Director of Extension Work* | C. W. WARBURTON. |
| *Director of Personnel* | W. W. STOCKBERGER. |
| *Director of Information* | M. S. EISENHOWER. |
| *Director of Finance* | W. A. JUMP. |
| *Solicitor* | SETH THOMAS. |
| *Agricultural Adjustment Administration* | CHESTER C. DAVIS, *Administrator.* |
| *Bureau of Agricultural Economics* | A. G. BLACK, *Chief.* |
| *Bureau of Agricultural Engineering* | S. H. MCCRORY, *Chief.* |
| *Bureau of Animal Industry* | JOHN R. MOHLER, *Chief.* |
| *Bureau of Biological Survey* | J. N. DARLING, *Chief.* |
| *Bureau of Chemistry and Soils* | H. G. KNIGHT, *Chief.* |
| *Bureau of Dairy Industry* | O. E. REED, *Chief.* |
| *Bureau of Entomology and Plant Quarantine* | LEE A. STRONG, *Chief.* |
| *Office of Experiment Stations* | JAMES T. JARDINE, *Chief.* |
| *Food and Drug Administration* | WALTER G. CAMPBELL, *Chief.* |
| *Forest Service* | FERDINAND A. SILCOX, *Chief.* |
| *Grain Futures Administration* | J. W. T. DUVEL, *Chief.* |
| *Bureau of Home Economics* | LOUISE STANLEY, *Chief.* |
| *Library* | CLARIBEL R. BARNETT, *Librarian.* |
| *Bureau of Plant Industry* | FREDERICK D. RICHEY, *Chief.* |
| *Bureau of Public Roads* | THOMAS H. MACDONALD, *Chief.* |
| *Soil Conservation Service* | H. H. BENNETT, *Chief.* |
| *Weather Bureau* | WILLIS R. GREGG, *Chief.* |

This bulletin is a contribution from

| | |
|---|---|
| *Bureau of Plant Industry* | FREDERICK D. RICHEY, *Chief.* |
| *Division of Forage Crops and Diseases* | A. J. PIETERS, *Principal Agronomist, in Charge.* |



U. S. GOVERNMENT PRINTING OFFICE: 1935

For sale by the Superintendent of Documents, Washington, D. C. - - - - - - Price 5 cents

END