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Experiments With Oats

By

J. F. DUGGAR,

Director

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EXPERIMENT WITH OATS

By
J. F. DUGGAR.

SUMMARY.

Experiments extending over a period of ten years are summarized in this bulletin.

The oat may be made a much more profitable crop in Alabama than it now is, provided farmers will make the two following innovations in the usual method of caring for the crop; (1) Sowing in the early or middle fall. (2) Applying nitrate of soda as a top dressing in March, or sowing on land where a soil-improving crop like cow peas has recently grown.

In tests of varieties extending over a number of years there was little difference in the yields of Red Rust Proof, Appler, and Culberson when sown in the fall. These three varieties are practically identical.

When sown after Christmas the Burt or May oats averaged 7 per cent. less grain than did the Red Rust proof variety.

Turf or Grazing oats sown in November afforded only 59 per cent. as much grain as Red Rust Proof oats sown at the same time. The order of ripening of the principal varieties sown in the fall was Burt, Red Rust Proof, and Turf.

Red Rust Proof oats may be distinguished from other varieties usually grown in the South by the long beards which are usually present on both grains, by the brownish yellow color, by the plumpness of the grain, and still more positively by the greater length of the tiny hairs or bristles located at the base of the lower grain.

Red Rust Proof and related varieties or strains, Appler and Culberson, constitute the best general-purpose type of oats for this region, being suitable for either fall or February sowing, and having stiffer straw and greater rust-resistance than any other variety tested.

The Burt oat, (synonym May oat), is chiefly valuable for its earliness, and hence for sowing at a rather late date in spring. When sown in November it was almost completely winter killed in the severe winter of 1904-5, but it was uninjured during the mild winter of 1905-6.

Winter killing of oats may be greatly reduced and the crop almost insured against ordinary winters by using one or more of the following methods:

(1) Sowing in deep drills.

(2) Sowing in October.

(3) Sowing with a grain drill.

(4) Use of a roller after the plants have been heaved and their roots exposed.

(5) The use of Turf oats in the northern part of the cotton belt.

The average of seven experiments made in seven different years shows that Red oats sown in November averaged 11.3 bushels per acre more than when sown in February. This is a profit of $5.65 per acre, or an increase of 73 per cent. as the result of sowing in the fall. October is advised for fall sowing, and the first few days in February for spring sowing in this latitude.

Oats sown in deep furrows, about two feet apart, yielded more than broadcast sowing, the increase being 3.2 bushels per acre when the deep furrows were only partly filled, and 2.3 bushels when the furrows were almost completely filled. Planting in deep furrows only partially filled is recommended only for well-drained soils.

Smut of oats can be entirely prevented by moistening the

seed in a mixture of one ounce of formalin and three gallons of water.

Nitrogenous fertilizers have been much more profitable than phosphate or potash on the sandy and loamy soils at Auburn, but it is recommended that on such soils at least 100 pounds of acid phosphate be applied at the time of sowing oats.

Among the various nitrogenous fertilizers a pound of nitrogen or a dollar of investment has been most effective in nitrate of soda, and somewhat more effective in the form of cotton seed meal than of cotton seed. When either cotton seed or cotton seed meal is used it should be applied at the time of sowing, but nitrate of soda is most useful when used in March after growth begins.

Barnyard manure greatly increased the yield of the crop of oats to which it was applied, and exerted some effect on the next crop. In one experiment it required 43.1 pounds of nitrate of soda and 103 pounds of acid phosphate (costing together $1.93) to afford the same increase as one ton of fine, fresh, unleached horse manure.

In thirteen experiments with nitrate of soda the yield and total profit per acre increased with the amount of nitrate applied up to 200 pounds per acre. However, the smaller applications were more economical. The cost of nitrate of soda required to produce one additional bushel of oats was 14.5 cents from the use of 63 pounds per acre; 17.7 cents when nitrate was applied at the rate of 100 pounds, and 21.1 cents when 200 pounds of nitrate of soda was used per acre. The smallest application afforded a profit over the cost of fertilizer of 249 per cent.; the use of 100 pounds of nitate per acre returned a profit of 206 per cent. on the cost of the fertilizer, while the heaviest application resulted in a net profit of 140 per cent. The three different amounts of nitrate of soda gave profits per acre of $4.73 for the light application, $6.19 for the 100-

pound application, and $8.40 for the 200-pound application. Sixty to 100 pounds of nitrate of soda is recommended to be applied as a top dressing to oats in March.

No nitrogen need be purchased for oats, provided the oats be sown after a crop of cow peas, velvet beans, peanuts, or soy beans, all of which crops, whether only the stubble or the entire growth was plowed under for fertilizer, afforded an increase in the succeeding oat crop of from 6.2 to 33.6 bushels per acre. From 5 to 15 bushels increase in the succeeding oat crop is considered an average result of the use of the stubble or vines of leguminous crops employed as fertilizer.

THE OAT CROP OF ALABAMA.

Official estimates credit Alabama with only 197,787 acres of oats in 1904, as compared with 2,791,811 acres of corn. Is there any adequate reason why the farmers of Alabama should plant only one acre of oats for every fourteen acres of corn? For the ten-year period ending with 1904, the average yield of corn in Alabama was 12.7 bushels, and the average yield of oats was 13.9 bushels. Reducing both to pounds, we have a yield of 714 pounds of shelled corn and 445 pounds of threshed oats per acre.

The small production of oats per acre in Alabama would be a sufficient reason for the neglect of this crop were no improvement in yield practicable. However, it is a comparatively easy matter to double or treble this yield, and at very slight expense, as indicated in the experiments described in this bulletin.

In view of present and prospective agricultural conditions in Alabama there is urgent need for a very great extension of the area devoted to oats. A decreasing supply of labor calls for an increasing proportion of crops that, like oats, can be handled largely by machinery, and that require little labor per acre. The continual impoverishment of the soils of the Southern States argues for the more general in-

troduction of crops that will improve the soil. This improvement can be effected universally by the growing of cow peas, but most cotton farmers will not grow any considerable area of cow peas except on the land from which a crop of small grain has been harvested. Hence the extension of the culture of the small grains means an increase in the acreage of cow peas, soy beans, velvet beans, and peanuts, and hence the upbuilding of the soil.

YIELD OF OATS COMPARED WITH THAT OF CORN.

We have seen from a preceding paragraph that corn and oats average respectively in Alabama 714 and 445 pounds per acre. This comparison is scarcely fair to oats, for the reason that this crop is usually assigned to the poorest land on the farm, and is seldom fertilized. To ascertain the relative yields of oats and corn on adjacent plots, a careful study has been made of the results of an unpublished rotation experiment that has been in progress on the station farm at Auburn during the past ten years. We are able to make a satisfactory comparison for three years when all conditions of fertilization, season, and time of sowing were normal or identical for the two crops.

The average yield of oats from fall sowing (October 16 being the average date of sowing) was 24.6 bushels per acre, as compared with 13.8 bushels of corn planted April 6 to 8 each year. No uitrate of soda was used.

Reducing both crops to pounds of grain per acre we have 787 pounds of threshed oats and 772 pounds of shelled corn. This indicates that the yields under these conditions were practically identical in the following rotation:

1st year: Cotton.

2nd year: Corn, with cow peas between the rows.

3rd year: Fall sown Red oats, followed by cow peas.

In this rotation corn has a slightly more favorable position than oats, but this is doubtless offset by the fact that

the fertilizer used was not the one which affords the largest yield of oats.

In one experiment in which oats were compared with other small grains, all sown in the fall, the yields were as follows:

Oats versus wheat versus barley for hay and for grain in 1904.

CROP.	Yield per acre,		
	Unthreshed.	Grain.	
	Lbs.	*Lbs.*	*Bus.*
Alabama Blue Stem Wheat	2620	990	16.5
Red Rust Proof Oats	1950	1150	36.0
Bearded Barley	1400	600	12.5
Culberson Oats	1400	700	21.9

This shows a greater number of pounds of grain yielded by oats than by wheat or bearded barley. However, the weight of unthreshed grain and straw combined was greater with wheat, which indicates that wheat affords a larger yield of hay than does oats.

In a comparison of Red Rust Proof oats and Beardless barley both sown February 25, the yield of oats was 25 bushels (800 pounds) and of Beardless barley 18.7 bushels (880 pounds), the yield of barley being greater than we ordinarily secure.

VARIETIES.

While the list of varieties of oats grown in the Northern States and in Europe is a long one, there are but few kinds that thus far have proved suitable for the Gulf States. Our tests of varieties have been concerned almost entirely with the standard southern kinds, namely: **Red Rust Proof, Appler, Culberson, Burt, and Turf or Winter Grazing oats.** The first table that follows gives the yields of varieties sown in the fall. The average date of sowing has been November 14, which is too late for maximum yields, and especially much too late for the Turf oats. The next table gives the

yields resulting from sowing oats in February or March, the average date of these spring sowings being February 20, which is several weeks later than the date preferred by the writer for oats sown after Christmas.

The third table following is calculated from the other two and is the most important of the tables, giving the relative yields of varieties in terms of percentage and average results of experiments extending through a number of years.

Tests of varieties of oats sown at Auburn in the fall.

Variety	Per ct. Grain	Yield per acre	
		Straw	Grain
Sown Nov. 6, 1897		*Lbs.*	*Bus.*
Red Rust Proof	41.3	1,800	30.8
Hatchett's Black	38.7	1,057	20.8
Beardless Red	42.9	1,155	27.1
Early Siberian	28.5	1,129	13.9
Gray Winter or Turf	29.6	1,232	16.1
Deleware Winter	30.4	783	10.6
Sown Nov. 23, 1899.			
Red Rust Poof	48.6	869	13.5
Gray Winter or Turf	31.2	769	7.5
Hatchett's Black	45 9	675	14.0
Sown Nov. 13, 1903.			
Red Rust Proof	32.6	1,320	30.0
Appler	37.8	1,720	32.7
Culberson	38.3	1,440	28.0
Gray Winter or (Va. Gray)	32.5	1,400	21.0
Sown Nov. 10, 1904.			
*Red Rust Proof(spring strain).	44.4	1,120	28.0
*Appler	52.0	836	28.3
*Culberson	45.1	1,144	29.4
Sown Nov. 18, 1905.			
Appier	48.9	2,080	52.6
Burt	37,4	2,784	52.0
Culberson	45.7	2,088	48.0
Red Rust Proof (fall strain)	47.7	1,974	48.4
Sown Nov. 14, 1905.			
Burt (av.fall and spring strains)	44.9	1,784	46.1
May	46.9	1,880	51.9
Red Rust Proof (av. fall and spring strains)	46 8	1,575	58.2

*Partly winter killed.

Tests of varieties of oats sown at Auburn in the spring.

Variety.	Percent Grain.	YIELD PER ACRE	
		Straw	Grain
Sown Feb. 17, 1898.		*Lbs.*	*Bus.*
May	39.9	1,790	35.9
Burt	41.7	1,658	41.4
Gray Winter or Turf	20.0	690	5.5
Red Rust Proof	42.9	1,276	30.6
Sown Mar. 7, 1902.			
Burt	27.6	616	7.3
Culberson	43.1	620	14.7
May	47.1	370	10.3
Red Rust Proof	33.6	870	13.7
Sown Feb. 5, 1903.			
Burt	25.7	896	9.7
Culberson	34.3	557	9.1
May	40.9	605	13.1
Red Rust Proof	33.3	880	13.7
Sown Feb. 23, 1905.			
Red Rust Proof	42.1	1,384	31.5
May	36.4	1,929	35.0

Relative yields of grain of varieties of oats at Auburn, taking yield of Red Rust Proof oats as 100.

	1898	1900	1902	1903	1904	1905	*1906	**1906	Average
Sown in November.									
Red Rust Proof	100	100	....	....	100	100	100	100	100
Beardless Red	88	....	....	....	....	....	....	....	88
Appler	....	....	....	....	109	100	109	....	106
Culberson	....	....	....	....	*93	106	100	....	100
Early Siberian	45	....	....	....	....	....	....	....	45
Gray or Turf	52	56	....	....	70	....	....	....	59
Burt	....	....	....	....	....	....	108	78	93
May	....	....	....	....	....	....	....	81	81
Av. Burt and May	....	....	....	....	....	....	....	....	**89**
Hatchett's Black	68	104	....	....	....	....	....	....	86
Delaware Winter	31	....	....	....	....	....	....	....	31
Sown in February.								....	
Red Rust Proof	100	....	100	100	....	100	....		100
Burt	135	..	53	66	....	....	....	....	85
May	117	....	75	100	....	111	....	....	101
Av. Burt and May	....	....	....	....	....	....	....	....	**93**
Culberson	....	....	107	66	....	....	....	....	87
Gray or Turf	15	....	....	....	....	....	....	....	15

*Yield reduced by smut.

**Different fields and different dates of sowing.

The last table deserves careful study.

The variety Red Rust Proof, also known as Texas Rust Proof, Texas Red, and simply as Red oats, has in these tests, as usual, proved worthy of its position as the most popular or standard variety for the Gulf States. It has been relatively satisfactory whether sown in the spring or the fall, though fall sowing is decidedly preferable in the central and the southern parts of Alabama.

Appler, a selection from the Red Rust Proof, cannot be distinguished from its parent, but in the three tests made at Auburn, the Appler has afforded 6 per cent. more grain than the Red oat.

Culberson is also like Red oats in appearance of grain, and the yield when sown in the fall has averaged the same. With us it proved a little more hardy than the Red oat, a slightly larger proportion of the Culberson plants surviving the trying winter of 1904-5. It is apparently a strain of the Red Rust Proof variety. Both Culberson and Appler are at least equal in merit to the parent strain.

Winter Turf, also variously known as Gray Winter, Virginia Gray and Myers' Turf, has been relatively unproductive here, averaging only 59 per cent. as much grain as Red oats when sown as late as November 14, and apparently not equaling Red oats when sown at its proper season, September or October. Sown here in the spring, the Turf oat is an entire failure. It ripens about two weeks later than Red oats sown at the same date, and hence is especially liable to fail to fill out well, either because of rust or of drought. This oat is only to be considered for grazing or hay, or for grain on the very best land, or in those localities in the northern part of the cotton belt where Red oats are usually winter killed. It has been recommended as a good variety to sow for hay with hairy vetch, but this is only true on rich land, for on our poor sandy uplands at

Auburn, Turf oats do not throw up seed stems in time to support the slender vetch plants. Here we find that a beardless variety of wheat or the Red Rust Proof oat makes a more satisfactory combination with hairy vetch.

Burt and May are apparently the same variety, the latter being the local name near Auburn. This is a spring variety and is seldom sown in the fall; however, it passed without any winter killing whatsoever through the mild winter of 1905-6, and afforded an average yield of 89 per cent. as much grain as the Red oat. In the severe winter of 1904-5 only 5 or 10 per cent. of a stand survived from a sowing made November 10, 1904. When sown in the spring the grain yield of Burt or May oats averaged 93 per cent. of that of Red oats, some years the advantage being with one variety and some years with the other. It is generally believed that Burt can safely be sown later in the spring than Red oats, and while our sowing of March 7, 1902, does not support this opinion, yet the view seems reasonable and correct because of the quicker maturity and longer straw of the Burt.

DESCRIPTIONS OF STANDARD SOUTHERN VARIETIES OF OATS.

Red Rust Proof:—Plants medium height; straw large and strong; berries or "grain" bearded, beards borne on both grains in most spikelets; beards large and long, usually inserted low down on the larger grain, that is, half way between the base and the extreme tip, but nearer the tip on the small grain; color of berries yellowish-brown, darker near the base, and darkening on exposure to moisture. A characteristic of Red Rust Proof oats is the greater length of the slender bristles or hairs at the base of the spikelet (that is at the lower end of the larger grain), which bristles in other varieties commonly grown in the South are either wanting, or occur on only a few of the spikelets, or are shorter than on Red, Appler, and Culberson oats. The

grains are very large and very plump. This variety is sometimes attacked by rust, but is less injured by this disease than the other varieties tested.

Appler:—This is a selection from the Red Rust Proof oats, and most of the spikelets are not to be distinguished from the parent variety. As grown at Auburn in 1906 it was even less uniform than the Red, containing a large admixture of black grains and a considerable proportion of spikelets of which only the larger grain was bearded.

Culberson:—This appears to be a strain of Red oats. The straw is perhaps a little taller. The grains are strongly bearded, both grains being usually bearded. In color, size and plumpness the grain is not distinguishable from the Red oat. The bristles at the base of most spikelets are relatively long, as in Red oats.

All three of the above varieties, constituting the Red Rust Proof group, are decidedly mixed, or lacking in uniformity of grains, which indicates the need of breeding for pure strains, a work that this station now has in progress. In the Red Rust Proof group about half the weight of sheaf oats consists of straw and half of grain, though the proportion of straw exceeds this on rich land.

Burt:—The majority of spikelets bear one bearded and one beardless grain, but some are doubly bearded and a few entirely beardless. The grains are more slender than those of Red Rust Proof oats, of a paler cream or brownish-yellow color. Most spikelets have only short bristles, or none. The straw is taller and weaker than that of Red oats, and the date of ripening is earlier. This variety is tender and is adapted to spring sowing.

Turf:—This variety is beardless. The grains are slender, light cream or gray in color, of a lighter shade than Burt oats, and the two berries usually break apart in threshing. The percentage of grain is small, there being usually about twice as much straw as grain.

Since there are so few varieties of oats adapted to the Gulf States, it is important that some distinguishing marks be found by which Southern farmers may be able to identify seed oats of a few leading varieties. With this end in view careful examination has been made of the four most popular varieties in the South, and we have found what seems to be a means of positively distinguishing the seed of the Red Rust Proof group from the other well-known southern varieties. The greater plumpness of grain of the Red oats and the larger proportion of spikelets in which both grains are bearded will serve to separate the Red oat group. A still more positive indication that a sample of oats is the genuine Red Rust Proof is the presence of a bunch of fine hairs or bristles at the base of the lower grain and the *greater length* of some of these bristles in this variety than in other varieties in which bristles occur.

WINTER KILLING OF OATS.

Oat plants from sowings made in the fall are liable to be killed by cold weather at any date between December 1 and March 1 in the central part of Alabama. As illustrating the earliest and the latest dates on which severe winter killing has occurred within the memory and observation of the writer, I would say that March 1, 1890, was one of the coldest days of the winter, and oats growing on rich land, which had already thrown up tender seed stems, were entirely killed, while other plants at an earlier stage of growth were severely injured.

The earliest date recalled on which oats were injured was on December 15, 1901, when the temperature suddenly dropped below the freezing point, following a period of heavy rains. There were severe freezes at night and complete thawing during the day for nearly a week, thus affording extremely favorable conditions for the heaving and destruction of oat plants.

The lowest temperature ever recorded in Alabama, and

probably the most complete destruction of oats by cold was experienced in February, 1899, when on the station farm practically all Red oats were killed except near woods or protecting fences, where a part of a stand survived. That cold weather, during which the minimum temperature was —6 Fahrenheit, not only killed Red oats, but Turf oats as well.

The following precautions used singly or together will greatly reduce the danger of winter killing and practically insure in this latitude the survival of a fair stand of oats, except in unusually severe winters:

(1) Sowing the seed in deep drills not completely covered, as discussed in a later paragraph.

(2) Sowing in October so as to give the plants time to form a strong root system as an anchor before severe freezes occur.

(3) Sowing with a grain drill, which leaves the land slightly ridged and the plants close together, thus apparently furnishing a small amount of mutual protection.

(4) Passing a roller over a field on which the plants have been heaved and the white roots exposed by alternate freezes and thaws.

(5) The sowing of Turf oats, which are hardier than Red oats, but are not to be preferred where the Red oats ordinarily succeed.

Cold weather may kill oat plants in either of two ways, directly by the action of the cold on the foliage and crown or indirectly by the heaving or lifting effects of alternate freezes and thaws. The first method of prevention mentioned above is effective against both results of cold, but is chiefly useful in preventing heaving. The use of the roller just after a succession of freezes is intended to counteract the results of heaving, since the roller presses the exposed crowns into contact with the soil, thus favoring the development of new roots. We have repeatedly used this method

with good results. It should, however, be remembered that the use of the roller while the land is still wet may result in unduly compacting the surface.

Before deciding whether it is best to rely chiefly on fall sown or on spring sown oats it is worth while to recall how many complete failures due to winter killing and how many partial killings have occurred within one or two decades in any given locality. Applying this test to the fall sown Red Rust proof oats on the Station farm at Auburn we find that during the past eleven years there has been but one winter in which practically all red oats have been killed, namely in 1899. In 1902 in spite of the trying weather of the preceding December, a part of the oats on the Experiment Station farm afforded a fair yield. The winter of 1904-5 was perhaps the third most unfavorable year as regards winter killing. Although the stand was very much thinned, yet the yields of our variety plots that year averaged about 28 bushels per acre. It is believed that farmers overestimate the danger of winter killing of oats or the frequency with which the stand is reduced to a point where the yield would be less than with oats sown in the spring. This tendency is natural, since few have put in effect the above-mentioned measures that may be taken to reduce the amount and frequency of winter killing.

TIME TO SOW OATS.

A large proportion of the oats grown in Alabama are sown in February. While this may perhaps be considered necessary for Red and Burt oats in those parts of the state in which experience indicates that fall sown oats are usually winter killed, yet this is the wrong time to sow most fields of Red oats in the central and southern parts of the State. Our experience, which is partly tabulated below, indicates that the yield from fall sowing is far greater than from sowing Red oats after Christmas. In all the experi-

ments tabulated below the same amount of fertilizer was used for the February sowing as for the November sowing, and all conditions were equal except the date of putting the seed into the ground.

Average results of fall sown vs. spring sown oats.

DATE OF SOWING	Percent grain in sheaf oats	Yield of grain per acre	Yield of straw per acre	Increase of grain from fall sowing
Experiment No. 1.	*Percent.*	*Bus.*	*Lbs.*	*Bus.*
November 18, 1896	45	21.7	895	**7.9**
March 1, 1897	43	13.8	587	
Experiment No. 2.				
November 23, 1897	38	18.2	958	**11**
February 9, 1898	47	6.4	228	
Experiment No. 3.				
November 26, 1897	43	23.8	994	**9.7**
February 9, 1898	51	14.1	440	
Experiment No. 4.				
November 13, 1902	40	27.2	1328	**13.5**
February 5, 1903	34	13.7	1024	
Experiment No. 5.				
November 19, 1903	57	15.9	384	**2.6**
February 23, 1904	55	13.3	416	
Experiment No. 6.				
November 10, 1904	44	*26.9	1068	—***5.1**
February 23, 1905	43	32.0	1360	
Experiment No. 7.				
November 14, 1905	52	53.8	1560	**38.8**
February 16, 1906	....	15.0	.....	
Average 7 Experiments				**11.3**

*Fully 25 winter killed.

The average of seven experiments shows a gain of 11.3 bushels or 73 per cent from sowing Red oats in November as compared with sowing them in February. Who can afford such a loss? Who would not arrange to pay his notes three months ahead of maturity if thereby he could have 43 per cent deducted from their face? The two cases are arithmetically the same. If the "turning out" of cattle by common consent in winter prevents the sowing of grain in the fall, is the few months' winter range worth the sacrifice?

Other experience, often repeated, has shown us that the average date of fall sowing in the table above, November 17, is too late for maximum yields of fall sown oats. We have found that sowing in October gives a larger yield and the plants endure cold better than do plants from sowings made in November. I would recommend October sowing, while realizing that any date between September 1 and November 15 may afford satisfactory yields. We find it advisable to discontinue entirely the sowing of oats about the first of December. For such fields as must be sown after Christmas I prefer on the uplands in this latitude to sow about February 1. For oats sown after Christmas only the richest lands are suitable and these are needed for other crops. On the other hand, oats sown in the fall may make a profitable crop on land that is quite poor, provided they be judiciously fertilized. Thus the advantages of fall sowing consist of (1) a much larger yield, even after deducting the losses from partial winter killing; (2) the utilization of poorer land by the fall sown crop, (3) the employment of teams at a time when they are not needed in preparation of land for cotton or corn, and (4) earlier maturity of fall sown oats, permitting the use of the crop and the use of the land at least two weeks earlier than when oats are sown after Christmas.

METHODS OF SOWING OATS.

A method of sowing oats that has proved highly satisfactory as the most effective known means of avoiding winter killing consists in opening deep furrows at intervals of 18 to 24 inches and drilling the seed and fertilizer in the bottom of these furrows, barely covering the seed with such earth as falls in as the one-horse planter and fertilizer distributor passes along. The primary object is to reduce the amount of killing by placing the plants in a position where they will not be heaved by alternate freezes and thaws.

For four years we have compared this method with a modification of the same, in which the deep furrows were covered nearly or quite full after the sowing of the seed, and with broadcast sowing.

In 1900 a harrow was run over all plots and dragged in more dirt than was intended. That year the "covered" drills were filled and the oats covered by the use of scooters on a double stock. In 1899-1900 the drilled oats were scarcely injured by cold, while the broadcast plots lost about 25 per cent of their plants, and yielded far less grain than either method of drilling. In 1904 the broadcast plots lost about 20 per cent of their plants from winter killing, while the loss from cold in the drilled plots was insignilcant; some plants in the deep, partially filled furrows were injured by sand washing in.

In 1905 there was some loss from cold on all plots, this being estimated at 20 per cent on the broadcast plots, 10 per cent on the plots sown in filled furrows, and only 5 per cent in furrows only partially filled.

In the average results and in three out of four years drilling oats in furrows two feet apart yielded decidedly more than did the sowing of the seed broadcast on the plowed ground and covering with a disc harrow or other similar implement.

No very severe winter occurred while this test was in progress, which probably accounts for the practical equality in resistance to cold of the plants in the filled and in the partly filled furrows.

For well drained soils there are decided advantages in drilling fall sown oats in deep furrows, especially when the winter proves severe. It is advisable where practicable to run the rows perpendicular to the line of the coldest winds, which would give the rows a direction from southwest to northeast, or east and west.

This method of sowing oats in deep unfilled furrows is

evidently not adapted to prairie or other very stiff, poorly drained soil, where standing water in the furrows would drown the young plants, and it is slower than sowing broadcast or using a grain drill.

Yields of oats sown broadcast and in deep furrows, or entirely drilled.

Year	Yield per acre.			
	Broadcast	8 in. drill	Deep furrow, slight covering	Deep furrow, covered
	Bus.		*Bus.*	*Bus.*
1900	19.9		24.3	29.1
1903	26.4		33.7	25.7
1904	16.0		19.2	20.5
1905	34.6	31.0	32.3	31.5
Average	24 2		27.4	26.7

INCREASING THE HARDINESS OF OATS.

In a severe winter the oat plants that survive the winter are either those best protected by their location or else those possessing in themselves a special degree of hardiness. If we could plant seed only from plants possessing this inherent hardiness we should doubtless be able within a few years to breed up a variety hardy enough to endure the severest winters. The Alabama Experiment Station has for several years been engaged in this attempt to increase the hardiness of our ordinary Red Rust Proof oats towards cold. Since we cannot separate those plants whose survival of winter's cold is merely accidental, or due to their environment, from those planst that have in themselves special hardiness, our task will doubtless take many years for its accomplishment. For though we select each year from plants that survived the previous winter and whose ancestors survived still earlier winters, yet among these continuously hardy plants are many tender plants that have endured the

cold merely because of favorable environment. It will require the recurrence of several severe winters to eliminate all the tender plants.

In thus breeding the oat plant for improvement in hardiness we also had an opportunity to ascertain whether seed oats for sowing in the fall should come from a strain sown each year in the fall or indifferently from either fall or spring-sown ancestry. The following table presents the results of this inquiry to date.

Yields of oats from sowing in the fall seed from fall-sown vs. spring-sown ancestry.

Year	Variety	Date of sowing	Yield per acre			
			Fall strain		Spring strain	
			Straw	Grain	Straw	Grain
			Lbs.	*Bus.*	*Lbs.*	*Bus.*
1898	Red Rust Proof	Nov. 6	1050	25.3	996	28.6
1903	Red Rust Proof	Nov. 13	1110	21.3	505	11.3
1904	Red Rust Proof	Nov.	960	30.0	888	27.7
1905	Red Rust Proof (Broadcast)	Nov. 5	1352	35.5	1160	33.7
1905	Red Rust Proof (8-in. drills)	Nov. 5	1256	31.0	1128	31.0
1006	Red Rust Proof (8-in. drills)	Nov. 18	1936	50.9	2112	51.0
1906	Red Rust Proof (8-in. drills)	Nov. 14	1560	53.8	1590	62.5
1906	Burt	Nov. 14	1676	45.6	1892	46.5
	Average		1223	36.7	1283	36.5

Thus far the difference in yield is slight and accidental between a strain of oats that for several years has been continuously sown in the fall and other oats descended from crops alternately sown in fall and in spring. In the above table the fall strain of Red Rust Proof oats has been continuous, having been sown in the fall of 1902, 1903, 1904, 1905; in 1902 the fall sown seed were from the station farm where nearly all the oats are sown in the fall, and hence the habit of growing in winter extends back at least five years prior to 1902. The "spring strain" seed oats does not represent a continuously spring-sown ancestry, but usually only one generation of spring-sown oats. This experiment with Red

oats will be continued. Until we can accumulate conclusive data we can advise only on theoretical considerations. These suggest the probable advisability of sowing in the fall seed from a strain that for several years has been sown in the fall. This is another argument for saving one's own seed oats, for we seldom know whether purchased seed oats are accustomed to fall or to spring planting nor whether grown in or near this latitude.

PREVENTION OF SMUT.

Smut is almost universally present in the oat fields of Alabama, blackening many of the heads and reducing the yield from 5 to 30 per cent. It can be prevented easily and cheaply. Several methods may be used, the most convenient being the use of formalin. Unfortunately this useful material is not generally found in the smaller drug stores but may be ordered from wholesale drug stores through local druggists. The cost should not exceed one dollar per pound including express charges, and in large amounts the cost is much lower. Pour one ounce of this liquid formalin into three gallons of water. Into this liquid the oats may be dipped and then drained and spread out to dry, or the liquid may be sprinkled over the pile of oats until the grains are thoroughly moistened. Then the pile of treated seed should be kept covered from two to ten hours, so that the gas generated may destroy the germs or "seed" of smut, which are present on the oat kernel. One ounce of formalin will treat a number of bushels of oats, making the cost only a few cents per acre. The saving or increase in the crop will usually be from 8 to 20 per cent, or say 2 to 8 bushels per acre. We cannot afford to plant oats without this or equivalent treatment.

In case formalin is not quickly obtainable smut in oats may be destroyed by the following method: Obtain an accurate thermometer. A dairy thermometer costing 25 to

50 cents will usually answer. Then dip the bags of seed oats into hot water which must be kept at a temperature of about 132 degrees, not dropping below 130 nor running above 135 degrees Fahrenheit. Keep the oats in this hot water for ten or twelve minutes, stirring them so that every grain becomes heated. Then remove the sack of oats and dip into cold water. After this cooling the oats should be spread out to dry, never spreading them on a floor on which untreated seed oats have been stored.

FERTILIZERS FOR OATS.

It is a custom far too common in Alabama to sow oats without any fertilizer. The experiments here recorded show that it pays to fertilize oats, and that the most profitable fertilizer is one that is rich in nitrogen. Omitting the long table of figures, the conclusions drawn from average results of a number of years' experimentation in Auburn are here given. On our sandy and loam soils rather heavily fertilized with complete commercial fertilizers for a number of years, the results were briefly as follows: Potash was practically useless; acid phosphate was of secondary importance, while nitrogen in whatever form applied, whether as stable manure, cotton seed, cotton seed meal, or nitrate of soda, gave a considerable increase in the yield of oats.

BARNYARD MANURE AS A FERTILIZER FOR OATS.

For several years an experiment has been in progress to determine the increase in various crops due to the application of manure during the current or previous season. Only such of these data as bear on the oat crop are here given. In the winter of 1900 heavy applications of cattle manure, obtained by the use of a ration of cotton seed meal or of cotton seed, were applied to fall-sown oats. The following table shows the results obtained the first year, in which the

increase in yield was 29.6 or 31.5 bushels of oats per acre:

Immediate or first year effect of cattle manure applied to oats.

Manure per acre.	Manure from feeding.	Yield per acre.	Increase per acre.
Lbs.		*Bus.*	*Bus.*
43740	C. S. Meal, etc.,	40.7	31.5
30600	Cotton Seed, etc.	38.8	29.6
No manure		9.2	

The next year oats were again grown on the same field without additional fertilizer.

Manure per acre previous year	Yield per acre second year.	Increase per acre second year.
Lbs.	*Bus.*	*Bus*
43740	37.5	26.
30600	28.	16.5

Even on this sandy soil a heavy application of stable manure gave a large increase in the second crop of oats, as well as in the crop to which it was directly applied. The important matter is to determine what increase in crop was afforded by each ton of manure, and this information is contained in the following table, which deals not only with this experiment, but with two others in which very light applications of horse manure were employed.

Increase in first and second crops of oats per ton of manure.

Manure per acre	Kind of Manure	Increase per ton of manure		
		First year oats	Second year Oats	Total 2 years Oats
Tons		*Bus.*	*Bus.*	*Bus.*
21.87	Cattle; from feeding c. s. meal, etc.	1.4	1.2	2.6
15 3	Cattle; from feeding cotton seed,etc.	1.9	1.1	3.0
6.2	Cattle; from feeding c. s. meal, etc.	1.6	.5	2.1
2.⁰	Horse manure.....	8.8		
2.⁰	Horse manure	9.8		

From the above table it will be seen that where heavy applications of rich cattle manure were made to oats the aggregate increase in yield of the two following crops was 2.8 bushels per acre and that of this the second year's increase accounts for more than one bushel. On the other hand, when only two tons per acre of horse manure was used the increase the first year averaged 9.3 bushels per acre. This illustrates the greater efficiency per ton of the smaller applications, though the broadcast application of less than four tons per acre is scarcely practicable even by the use of the manure spreader. This expensive piece of farm machinery is needed where large amounts of manure are to be distributed, for it greatly reduces the amount of labor in handling manure, pulverizes the material finely, and enables a lighter application to be made where this is desired, the lighter application and the finer pulverizing making a given amount of manure go further and afford a larger increase in crop yield.

COTTON SEED VERSUS COTTON SEED MEAL.

In three experiments made in as many different years we have compared 200 pounds of cotton seed meal with 434 pounds of cotton seed, both furnishing equal amounts of nitrogen and both being applied at the time of planting in the fall. In every case cotton seed meal has given larger yields, the excess resulting from the use of meal as compared with seed being in different years respectively 2.1, .7 and 11.8 bushels of oats per acre, which would give an average advantage of 4.9 bushels per acre to the meal. If we reject the last figure as being so large as to excite suspicion of error we still have an average advantage of 1.4 bushels per acre in favor of the cotton seed meal.

While cotton seed has long been recognized as an excellent fertilizer for oats, especially when used in large amounts, the increased price of cotton seed and the superior effects of an equal value of nitrate of soda on oats

make it unadvisable to apply cotton seed to the oat crop if nitrate of soda can be purchased.

Since the fertilizer requirements of wheat and oats are presumably about the same, I would add that in similar experiments with wheat cotton seed meal gave a slightly larger yield than cotton seed, both used in the amounts mentioned above.

NITRATE OF SODA AS A FERTILIZER FOR OATS.

Numerous experiments made under the writer's direction both on sandy loam soil at Auburn and on stiff lime lands at Uniontown show that this is by far the most effective commercial fertilizer for oats. The following table affords means of comparing nitrate of soda with cotton seed meal, cotton seed, and stable manure, which are the principal sources of fertilizer nitrogen available to the southern farmer.

Cotton seed meal, cotton seed, nitrate of soda, and manure as fertilizers for oats.

Amount per acre.	FERTILIZER	Yield and increase per acre						Average increase per acre due to Nitrogen.
		1901			1906			
		Yield straw	Yield grain	Increase in grain due to Nitrate.	Yield straw	Yield grain	Increase due to Nitrate	
Lbs.		*Lbs.*	*Bus*	*Bus.*	*Lbs.*	*Bus*	*Bus.*	*Bus.*
200	Cotton seed meal	827	24.9	8.0	1788	42.9	13.0	10.5
240	Acid Phosphate							
434	Cotton Seed	774	24.2	7.3	1136	32.1	2.2	4.8
240	Acid Phosphate							
240	Acid Phosphate	532	16.9	0.0	1160	29.9	0.	
100	Nitrate of Soda (in spring)	1130	36 3	19.4	1776	55.8	25.9	22.7
240	Acid Phosphate							
100	Nitrate of Soda (at planting)	1222	36.0	19.1	2128	54.4	24.5	21.8
240	Acid Phosphate							
4000	Manure	1152	34 4	17.5	2152	51.5	21.6	19.6

Referring to the figures in the preceding table, we have the following comparison between the results of 2 tons of

fine horse manure and an application of 100 pounds of nitrate of soda together with 240 pounds of acid phosphate, the phosphate being applied at time of sowing in the fall and the nitrate being applied as a top dressing in March.

With two tons of fine horse manure applied in the fall the average increase was 19.6 bushels of oats per acre; with the commercial fertilizer mixture the average increase was 22.7 bushels of oats. In other words equal first-year results were obtained from the use of one ton of manure as from 43.1 pounds of nitrate of soda aided by 103 pounds of acid phosphate. With nitrate at $60 and phosphate at $12.50 per ton these amounts of commercial fertilizer cost $1.93. Hence the farmer could afford to invest at least this amount in the production or purchase and very thin distribution of one ton of fresh unleached horse manure, and still be ahead by the greater effect of manure than of chemicals after the first year. We have seen in a preceding paragraph that the second year effect of a ton of manure on our sandy loam soils is equivalent to more than one bushel of oats per acre.

While the application of stable manure to oats on poor land is to be commended, yet the limited supply of this material makes it necessary for the farmer to purchase nitrogen in commercial fertilizers. Probably even better use for manure can be made than to apply it on oats, thus making it necessary to purchase nitrate of soda for oats and other small grain.

The following table shows the results of 13 different experiments conducted under the writer's direction at Auburn and Uniontown, Ala., and bearing on the effects of nitrate of soda applied in March as a top dressing for oats:

Year	Date of sowing oats	Amt. of nitrate per acre	Date of applyIng nitrate	Yield per acre	Increase due to nitrate	
Fall sown		*Lbs.*		*Bus.*	*Bus.*	*Percent*
1904	Nov. 4,	200	March	49.5	32.3	188
*1903	Oct.	200	March	43.8	25.3	137
Av.		**200**		**46.7**	**28.8**	**163**
1906	Nov. 20	120	March 13	34.2	21.8	176
1901	Nov. 15	100	March 18	36.3	19.4	116
1906	Nov. 15	100	March 13	55.8	22.7	69
*1903	Oct.	100	March	34.0	14.8	77
*1904	Nov. 4	100	March	42.3	17.0	67
Av.		**100**		**42.1**	**18.5**	**82**
1896	Oct.	80	March 28	29.3	12.9	79
1906	Nov. 20	60	March 13	28.0	15.6	126
1904	Nov. 4	50	March	29.0	11 3	64
Av.		**63**		**28.78**	**13.3**	**90**
Spring sown						
1896	Jan. 27	120	March 28	20.3	9.9	95
*1903	March 19	80		29.0	8.0	38
1900	Feb. 20	76	March 25	19.7	7.4	60
Av.		**92**		**23.**	**8.4**	64

*On stiff lime land at Uniontown; from Bul. 22, Ala., Canebrake Exp. Station, by J. F. Duggar and J. M. Richeson.

In the following table the preceding data are so arranged as to show average results from the use of different amounts of nitrate of soda on oats:

Increase and profit from nitrate of soda and cost of fertilizer per bushel of increase.

Nitrate of soda per acre	Inc'ase due to nitrate per acre	Profit per acre from nitrate	Inc'ase due to nitrate	Lbs nitrate per bushel of increase	Cost per bu. of increase	Year	Soil
Lbs.	*Bus.*	*$*	*Per ct*	*Lbs.*	*$*		
Fall sown							
200	32.3	10.15	188	6.2	0.186	1904	Lime
200	25.3	6 65	137	7.9	0.237	1903	Lime
Av. 200	**28.8**	**8.40**	**163**	**7.0**	**0.211**		
120	21.8	7.60	176	5.5	0.165	1906	Sandy loam
100	19.4	6 70	115	5.2	0.156	1901	Sandy loam
100	22.7	8.35	69	4.4	0.132	1906	Sandy loam
100	14.8	8.40	77	6.9	0.207	1903	Lime
100	17.0	4.50	67	7.1	0.213	1904	Lime
Av. 100	**18 5**	**6.19**	**82**	**5 9**	**0.177**		
80	12.9	4.05	79	6.2	0.186	1896	Sandy loam
60	15.6	6.00	126	3.9	0.117	1906	Sandy loam
50	11.3	4.15	64	4.4	0.132	1904	Lime
Av:50to80	**13.3**	**4.73**	**90**	**4.8**	**0.145**		
Spring S.							
120	9.9	1.35	95	12.1	0.363	1896	Sandy loam
80	8.0	1.60	38	10.0	0.300	1903	Sandy loam
76	7.4	1.42	60	10.3	0.309	1900	Sandy loam
Av. Sp. S.	**8.4**	**1.45**	**64**	**10.8**	**0.324**		

In the above table the figures representing the averages are highly significant and worthy of careful study. They show that from 200 pounds of nitrate of soda the average increase was 28.8 bushels of oats per acre; from an appliing 63 pounds of nitrate of soda), the increase was 13.3 bushels; and from the application of smaller amounts (averaging 63 pounds of nitrate of soda, the increase was 13.3 bushels of oats per acre. It is notable that when nitrate was applied to spring sown oats the results were less favorable than when used on fall sown oats, the application of an average of 92 pounds of nitrate on spring-sown oats giving an

increase of only 8.4 bushels. The percentages of increased yield were respectively 163, 82, 90, and 64.

The fifth column of the table shows the number of pounds of nitrate of soda required per bushel of increase of yield, namely 7.1 pounds where 200 pounds per acre was employed, 5.9 pounds where the application was 100 pounds of nitrate of soda. and 4.8 pounds when an average of only 63 pounds of nitrate of soda per acre was used on fall sown oats. These figures again show the greater relative efficiency of the smaller applications. Notice again that it takes more fertilizer to add a bushel to the crop in the case of spring sown oats, namely, 10.8 pounds of nitrate of soda per bushel of increase, or nearly twice the fertilizer necessary to the same results on fall sown oats. The average cost of nitrate of soda to make one bushel of increase was 21.1 cents for the very heavy application; 17.7 cents when 100 pounds of nitrate of soda was applied, and only 14.5 cents when a very light application was made to fall-sown oats. When, however, a light application of nitrate was made to spring-sown oats each bushel of increase cost for nitrate of soda, 32.4 cents, a further proof of the greater profit from fall sown oats. If we will think of oats as worth 50 cents per bushel we will notice that after deducting the cost of the fertilizer, each bushel of increase made by fall-sown oats and due to nitrate of soda afforded a profit of from 28.9 cents to 35.5 cents, the greater profit per bushel being obtained from the smaller applications.

After all, profit is the important consideration, therefore, let us examine the financial returns per acre from the use of nitrate of soda. After deducting the cost of nitrate of soda at the rate of $60.00 per ton we have left a profit of $8.40 from an application of 200 pounds per acre; a profit of $6.19 from an application of 100 pounds; and a profit of $4.73 from a light application, averaging 63 pounds of

nitrate of soda per acre. Surely farmers cannot afford to withhold this fertilizer when profits like these can be had by its judicious use.

These facts appear in still more striking form when we figure the percentage of profit on the amount invested in nitrate of soda. When this fertilizer was used at the rate of 200 pounds per acre the profit on the fertilizer investment was 140 per cent; 206 percent when the fertilizer was used at the rate of 100 pounds per acre; and 249 percent when a lighter aplication was made on fall-sown oats. These last figures illustrate the general tendency of fertilizers to return the largest percent on the investment in fertilizers when used in small amounts. But this alone should not govern, for preceding figures have shown that heavier applications afford a greater aggregate profit per acre, and hence are advisable for the farmer who has abundant capital to invest in fertilizers.

I recommend that nitrate of soda be used at the rate of from 60 to 100 pounds per acre, according to the amount that the farmer can afford to invest in fertilizers. From such an investment he should expect to realize a profit of $4.00 to $6.00, provided the application be made to fall sown oats. If the nitrate be used on spring sown oats the profit may be only about half of the above figures, but even here fertilization with nitrate of soda is advisable.

WHEN TO APPLY NITRATE OF SODA.

The experiments conducted in Auburn, and recorded in Bulletin No. 95 of this Station, indicate that nitrate of soda should be applied early enough to give at least 55 days before the time of application and the probable date of harvesting the grain. Any time in March is suitable. We have found nitrate of soda applied as a top dressing in March more effective with oats and wheat than when put into the ground with the seed in the fall. This superiority of the spring application has been greater with wheat than

with oats and much greater on quite sandy soil than on gravelly soil containing considerable clay, on which stiffer soil both fall and spring applications have greatly increased the yield of oats.

All lumps in the nitrate of soda must be carefully pulverized. The fertilizer is strewn by hand, and distributed as evenly as seed oats or seed wheat would be. No covering or harrowing is necessary. This fertilizer is so readily soluble that a small amount of moisture in the soil will dissolve it and carry it downward to the plant roots. It is best to sow nitrate of soda when the ground is somewhat moist, but one should avoid applying it just before a rain, which might wash away a large part of the nitrogen. Hence if practicable we prefer to apply nitrate of soda just as the weather clears after a period of rainy weather. We usually apply this fertilizer to oats about the middle of March, though application at any date within that month is satisfactory.

LEGUMINOUS PLANTS AS FERTILIZERS FOR OATS.

Cowpea or velvet bean stubble or entire growth as fertilizers. We have seen that of the commercial fertilizers the one best adapted to oats is nitrate of soda, but since the use of this material involves a cash expenditure, we may well inquire whether some fertilizing material produced on the farm may not act as a substitute. The principal materials that might thus be used are barnyard manure, which has already been discussed, and leguminous plants, such as cowpeas, soy beans, velvet beans, etc. Both the entire plant and the roots and stubble alone of these legumes are rich in nitrogen and hence useful as nitrogenous fertilizers. The following table, quoted from Bulletin No. 95 of this Station, gives the result of an experiment in which the use of either the stubble or entire plant of cow peas or velvet beans afforded an enormous increase in the yield of the

succeeding crop of oats, an increase larger than we can usually count on. The Red Rust Proof oats were sown in the fall of 1897 and the crop was cut May 18 following.

On all plots oats were fertilized with 220 pounds per acre of acid phosphate and 44 pounds of muriate of potash, no nitrogen being supplied except that contained in the remains of preceding crops of cowpeas, velvet beans, etc.

Yield per acre of oats grown after stubble or vines of cowpeas, velvet beans, etc.

Plot No.		Yield per acre	
		Grain	Straw
		Bus.	*Lbs.*
1	Oats after velvet bean vines	28.6	1206
6	Oats after velvet bean stubble	38.7	1672
	Average after velvet bean vines and stubble	**33.6**	**1439**
4	Oats after cowpea vines	28.8	1463
3	Oats after cowpea stubble	34.4	2013
	Average after cowpea vines and stubble	**31.6**	**1738**
2	Oats after crab grass and weeds	7.1	231
5	Oats after German millet	9.7	361
	Average after non-leguminous plants	**8.4**	**296**

From early spring there was a marked difference in the appearance of the several plots, the plants being much greener and taller where either the stubble or vines of cowpeas had been plowed under.

When the oats began to tiller, or branch, the difference increased, the plants supplied with nitrogen, through the decay of the stubble or vines of cowpeas and velvet beans, tillering freely and growing much taller than the plants following German millet or crab grass.

May 18, 1898, oats on all plots were cut.

In this experiment the average yield of oats was 33.6 bushels after velvet beans, 31.6 bushels after cowpeas, and only 8.4 bushels after non-leguminous plants (crab-grass, weeds and German millet.)

Here is a gain of 24.2 bushels of oats and nearly three-fourths of a ton of straw as a result of growing leguminous

or soil-improving plants, instead of non-leguminous plants during the preceding season.

Undoubtedly this is an extreme, and not an average, case.

An unexpected result of this experiment is the larger crop on the plots where only the stubble was left than on those where the vines of cowpeas and velvet beans were plowed under. The writer thinks that the difference in yield was almost wholly due (1) to the fact that the vines (especially those of the velvet beans) were not properly buried by the small plow employed, and (2) that the seed bed for oats was more compact where only stubble was plowed under, a point of advantage, doubtless, in such a dry winter as that of 1897-'8. In Bulletin No. 120, of this station, we have shown that the residual fertilizing effect of the entire growth of legumes is greater than that of vines and stubble. For example, the average increase in the second crop after plowing under *stubble* of velvet beans and cowpeas averaged 12 per cent, while the increase of the second crop was 24 to 54 per cent where the *entire growth* of legumes was plowed under.

When spring sown oats follow leguminous plants the increase due to the legume is smaller than is indicated above. For example, in one of our experiments the yield of spring sown oats following German millet was 12.4 bushels per acre, while on an adjacent plot where cow pea vines had been plowed under the yield was 22.8 bushels. This gives an increase of 10.4 bushels per acre, worth $5.20, as the fertilizing effect of a crop of cow pea vines of which the pods had been previously picked, yielding 11 bushels of cowpeas per acre. Thus the total value of the cow pea crop was about $16 in addition to any fertilizing effect that may have extended to the second crop.

Cowpeas, peanuts and soy beans as fertilizers for oats.

The following table shows the yield of oats in 1906 on one of the poorest tracts of land on the station farm, which

would be classed as a poor grade of Norfolk sandy loam. It is a deep sandy soil, light gray in color. The table shows the yields of unfertilized oats when grown after each of the following crops: Sorghum, sweet potatoes, soy beans, chufas, corn, Whippoorwill cow peas, Spanish peanuts, and running peanuts.

Effects of preceding crop on yield of fall sown oats in 1906.

Preceding crop	Part plowed under	Oats per acre	
		Yield	Increase compared with oats after corn
		Bus.	*Bus.*
Sorghum, drilled	Stubble	12.4	—1.3
Sweet potatoes	Vines	12.4	—1.3
Chufas	Tops only	11.7	—2.0
Corn	Stubble	13.7	
Whippoorwill cowpeas (drilled, picked)	Vines after picking	19.9	6.2
Spanish peanuts	Shed leaves, etc	26.7	13.0
Running peanuts	All except nuts	30.0	16.3
Soy beans, drilled	Stubble	21.4	7.7
Soy beans, drilled	Entire growth	42.2	28.5
Sorghum; 60 lbs. nitrate of soda	Stuble on oats.	28.0	14.3
Sorghum; 120 lbs. nitrate of soda	Stuble on oats.	34.2	20.5

From this table we learn that a preceding crop of drilled Whippoorwill cow peas plowed under after the pods were picked and removed (yielding 17.5 bushels of cowpeas per acre), increased the crop of oats 6.2 bushels per acre as compared with the preceding crop of corn. This makes the crop of drilled cowpeas worth for seed and fertilizer at least $20.00 per acre. Where peanuts were grown the increase was 13 to 16.3 bushels per acre; when soy beans, sown in drills, were cut and used for hay the remaining stubble increased the following oat crop 7.7 bushels per acre. When the entire crop of soy beans was plowed under the increase was 28.5 bushels.

It is interesting to notice that so far as measured by the first crop of oats 60 pounds of nitrate of soda was worth more than the stubble of soy beans or the picked vines of cow peas and worth nearly as much as the picked vines of running peanuts; 120 pounds of nitrate of soda gave a larger immediate result than any of the leguminous plants except soy beans where the entire growth was plowed under.

From all the experiments detailed above and from others it seems safe for a farmer by growing a crop of cowpeas before oats, to expect to increase the yield of oats by from 5 to 15 bushels or more per acre, whether the peas are simply picked or cut for hay.

In another experiment oats constituted the second crop after the plowing under of the picked vines of drilled cowpeas on a good grade of reddish loam soil, with retentive sub-soil. The increased yield on plots where cowpeas had grown two years before was 9.75 bushels of oats per acre, as compared with adjacent plots on which cotton had grown continuously for several years.

OATS AS A HAY CROP.

Good hay is made from oats cut when in the early dough stage.

On deep, gray, sandy soil (Norfolk sandy loam) two plots of Hatchett's Black oats were sown October 24. Both were fertilized at the time of sowing with 360 pounds of acid phosphate and 48 pounds of muriate of potash. The plots receiving no nitrogen yielded 678 pounds of cured hay per acre. The plots fertilized March 20 with 80 pounds of nitrate of soda per acre yielded 2,120 pounds of hay, or about 3 1-2 times as much as the plots without the nitrogen. From this late variety of oats the hay was ready to cut May 15. With Red oats the date for cutting oat hay is usually earlier.

PLACE OF OATS IN THE ROTATION ON THE COTTON FARM.

The small acreage devoted to oats on most cotton farms makes this crop a negligible factor in the farm rotation. Un-

doubtedly as the supply of labor decreases and the presence of the boll weevil makes it necessary to reduce the acreage and to intensify the fertilization and cultivation of cotton, oats will be grown on a more extensive scale. Even under present conditions it will be profitable to greatly extend the acreage in oats. Among the arguments for this increase is the fact that farmers seldom reserve any large acreage for cow peas except the land occupied during the earlier part of the year by a crop of small grain. More oats means more cow peas and more cow peas means a larger crop of cotton on this land the following and succeeding years. A desirable rotation for a cotton farm on which it is considered necessary to devote half of the land to cotton is the following:

1st year: Corn, with cow peas between the rows.

2nd year: Oats, followed by cowpeas, which may be cut for hay, picked, or grazed, or simply plowed under in December, January, or February, as fertilizer for the succeeding crop of cotton.

3rd year: Cotton.

4th year: Cotton.

A still more rapid improvement of the land would result from sowing crimson clover, properly inoculated, or other suitable winter growing leguminous plant in September among the growing cotton plants, covering with a one-horse harrow used just after the first or second picking, when little or no injury would be done to the cotton.

On a farm where stock is kept and where cotton requires only one-third of the cultivated area the rotation would be that given above for the first, second and third years, that is, corn, with cow peas; then oats, followed by cow peas; then cotton, and the fourth year corn again.

HOME GROWN SEED OATS.

While this Station has made no experiments comparing southern seed oats with those grown further north or west,

our experience shows that oats grown continously for a number of years in Alabama do not "run out."

We use our own seed of Red Rust Proof oats year after year and our average yield in recent years has been greater than it was ten years ago. On farms where fair crops of oats are grown it is far better to save one's own seed than to buy seed of unknown origin, which may contain Johnson grass or other seed, and which may be otherwise objectionable.

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T. U. Culver, formerly Superintendent of the Farm; C. M. Floyd, Superintendent of the Farm during the past three years; and L. N. Duncan, Assistant in Agriculture, who has aided in the preparation of the tables in this bulletin.

FIG 1.—*Burt oats, April* 23, 1906; *right sown in November; left sown in February.*

FIG. 2.—*Red oats, April* 23, 1906; *right sown in November; left sown*

FIG. 3 .—*Burt oats, May* 10, 1906*; left sown in November; right sown in February.*

FIG. 4.—*Red oats, May* 10, 1906*; left sown in November; right sown in February.*