

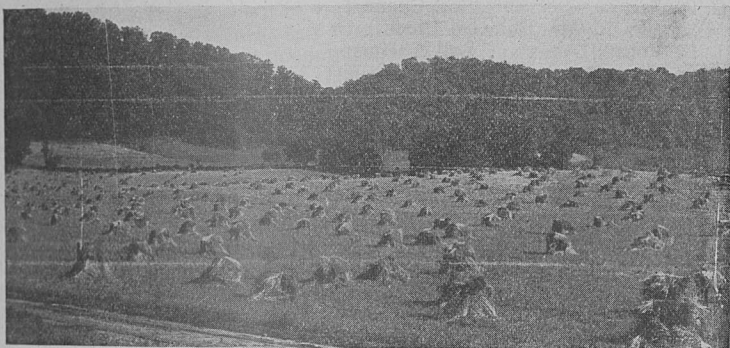
UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
Knoxville

BULLETIN No. 136

DECEMBER, 1926

THE OAT CROP

By
C. A. MOOERS
Director and Agronomist



Grain field at Cherokee Farm, Knoxville Station

Printed by
S. B. Newman & Co.,
Knoxville, Tenn.

UNIVERSITY OF TENNESSEE AGRICULTURAL EXPERIMENT STATION Knoxville

H. A. MORGAN, President

AGRICULTURAL EXPERIMENT STATION COMMITTEE

W. S. SHIELDS	W. P. COOPER	T. W. HUNTER
---------------	--------------	--------------

STATION OFFICERS

C. A. MOOERS, Director and Agronomist
M. JACOB, Veterinarian and Animal Husbandman
W. H. MACINTIRE, Soil Chemist
S. H. ESSARY, Botanist
C. E. ALLRED, Agricultural Economist
C. D. SHERBAKOFF, Plant Pathologist
J. A. MCCLINTOCK, Horticulturist and Associate Plant Pathologist
S. MARCOVITCH, Entomologist
W. M. SHAW, Associate Soil Chemist
G. A. SHUEY, Associate Soil Chemist
MARGARET B. MACDONALD, Biochemist
J. B. YOUNG, Assistant Soil Chemist
K. B. SANDERS, Assistant Soil Chemist
L. S. MAYER, Assistant Agronomist, cooperative with Office of Cereal Investigations, U. S. D. A.
H. P. OGDEN, Assistant Agronomist
H. L. FACKLER, Associate Entomologist
J. O. ANDES, Assistant Plant Pathologist
MRS. HELEN B. HUTCHENS, Assistant Plant Pathologist
ESTHER M. CRAWFORD, Assistant Biochemist
S. A. ROBERT, Supt. West Tenn. Exp. Station, Jackson
L. R. NEEL, Supt. Middle Tenn. Exp. Station, Columbia
REX. E. MARTIN, Assistant in Cooperative Experiments, Crossville
H. W. JONES, Assistant, Tobacco Exp. Station, Clarksville
J. H. BAYER, Assistant in Cooperative Experiments, Murfreesboro
F. H. BROOME, Secretary
ELIZABETH CHEATHAM, Assistant Librarian
CARRIE B. CARTER, Stenographer
NEDA SWANNER, Stenographer

The Agricultural Building, containing the offices and laboratories of the Experiment Station, the College class rooms, and the headquarters of the Agricultural Extension Service, is located at the University Farm, on Kingston Pike, about one mile west of the main campus. Farmers are cordially invited to visit the building and the experimental grounds.

Bulletins of this Station will be sent, upon request, free of charge to any farmer in the State.

THE OAT CROP

By

C. A. MOOERS

Director and Agronomist

IMPORTANCE

Oats rank third in importance of the cereals grown in Tennessee. According to the reports of the U. S. Department of Agriculture, the average annual acreage in the State for the 5-year period 1921-1925 was 218,400, with an average yield of 20.7 bushels per acre. Much of the crop, however, is not threshed, but fed in the sheaf or as hay. The estimated value of the crop varied from \$2,300,000.00 to over \$3,000,000.00, the average for the period being \$2,625,000.00.

WINTER VERSUS SPRING OATS

Most of the crop is sown in early spring, and is known as spring oats, as distinguished from fall-sown, or "winter" oats. Winter damage of the latter is not uncommon, and comes from freezing and thawing weather, which causes the plants to be thrown out of the soil; from extreme cold weather; and from the attacks of aphids, which may be abundant during mild weather, even in midwinter. These insects also attack spring oats, sometimes severely. In 1907 both February and March plantings at the Knoxville Station farm were destroyed by them. Soils that heave badly in the winter are not well suited to winter oats. Partly for this reason and partly because they do not fit into the cropping system, they are little grown in the Central Basin section. On the other hand, winter oats are successfully and not uncommonly grown in some of the Highland Rim counties and in portions of East Tennessee.

On account of the lateness at which cotton and corn are usually harvested, it is customary to follow them with spring oats rather than winter oats. This seems to account for the prevalence of spring oats in West Tennessee, where soil and climatic conditions are more favorable to winter oats than elsewhere in the State.

WINTER OATS OUTYIELD SPRING OATS

Table 1 gives the comparative yields of spring and winter oats for 10 years in trials at the Knoxville Station. The evidence is highly favorable to winter oats, which made an average yield of 41.1 bushels of grain and 0.95 ton of straw per acre, in comparison with 33.6 bushels of grain and .64 ton of straw for spring oats. This comparison does not take into consideration the practically complete failure of winter oats in both 1917 and 1924, because such failures

mean in farm practice minor and not complete losses, on account of the readiness with which spring reseeds can be made.

TABLE 1—*Spring versus winter oats—trials at the Knoxville Station*

Year of harvest	Yields per acre			
	Spring oats (chiefly Burt)		Winter oats (Culberson and Grey Turf)	
	Grain	Straw	Grain	Straw
	Bu.	Tons	Bu.	Tons
1902	61.3	1.02	68.0	1.65
1903	25.0	0.63	65.4	2.57
1911	14.9	0.37	21.1	0.59
1912	47.7	0.83	50.8	0.66
1913	22.5	0.43	35.9	0.56
1915	23.1	0.60	33.0	0.58
1916	20.3	0.50	24.1	0.70
1921	23.9	0.41	25.8	0.67
1925	58.1	1.11	18.8	0.30
1926	39.1	0.52	68.0	1.14
10-year av.	33.6	0.64	41.1	0.95

WINTER OATS EARLIER THAN SPRING OATS

A further advantage of winter oats is that they mature earlier than spring oats. At the Knoxville Station farm the earliest and best spring varieties were harvested, on the average, about June 22. Culberson, Red Rust Proof, and Appler when fall-sown were harvested nearly two weeks earlier, or about June 8. Even the Virginia Grey Turf, which is the latest of all, matures nearly a week earlier, or about June 15.

SPRING OATS

Accurate data as to the proportions of winter and spring oats grown in this State are not available, but according to G. L. Morris, U. S. Department of Agriculture Statistician, at Nashville, winter oats constitute only from 10 to 25 per cent of the total crop, the former figure being a high estimate for the acreage sown in the fall of 1926. It is evident, therefore, that spring oats are by far the more important crop. They have, moreover, practically no competition among the cereals that can be sown at that season of the year.

VARIETAL TRIALS

COMMENTS ON THE VARIETIES

For many years Burt was the standard spring variety in this State. It is supposed to have been brought to the Central Basin of Middle Tennessee from Alabama in the 80's. It then spread gradually over the State, and for many years was recognized both by the farmers and by the Experiment Station as the best variety for spring planting. It was rust- and smut-resistant, extra early, and less apt to be injured by the dry weather of May than a later variety, such as Red Rust Proof. Until recently the Station had tried only one other



Varietal trial of oats at the Knoxville Station

variety which appeared to be somewhat more desirable than Burt, and that was the Kherson, which had found favor in some of the northern and western states. Kherson was almost as early as Burt and more nearly uniform in character; the grain weighed better to the bushel, and the acre yield was equally good. Its favorable qualities were not sufficient, however, to cause it to displace Burt. In fact, little effort was made to bring it to the farmers' attention. About 1912 the farmers of Georgia were beginning to grow a winter oat known as Fulghum. It proved to be a high-yielding and attractive variety and soon became popular. By 1920 it was recognized as a high-yielding spring oat by the Kansas Station, which has distributed a superior strain under the name of Kanota.

TABLE 2—*Varietal trials of spring oats—Fulghum versus Burt—at the Knoxville Station*

Year	Date of seeding	Date of harvest	Yields per acre			
			Fulghum		Burt	
			Grain	Straw	Grain	Straw
1921	Mar. 4	June 18	Bu.	Tons	Bu.	Tons
1922	Feb. 22	June 12	23.9	0.41	17.2	0.44
1924	Mar. 4	June 28	12.7	0.47	10.3	0.42
1925	Mar. 6	June 17	47.7	0.78	38.7	0.97
1926	Mar. 5	July 2	48.2	0.91	34.1	0.97
			39.1	0.52	28.9	0.55
5-year average.....			34.3	0.62	25.8	0.67

FULGHUM SUPERIOR TO BURT

Although Fulghum survives most of our winters, it is not a reliable variety for fall seeding in Tennessee, but as a spring oat it has proved to be outstanding and is gaining rapidly in popularity. Table 2 gives the yields of Fulghum in comparison with Burt for a 5-year period at the Knoxville Station; the two varieties having been grown under like conditions of soil and seeding. The striking result is shown that Fulghum far outclassed Burt in yield every year, without exception; the average annual yield of Fulghum being 34.5 bushels per acre, while that of Burt was only 25.8 bushels.

In 1926 a series of trials of spring oats was made at the Middle Tennessee Station, at Columbia. Burt, Kherson, and Kanota (the Kansas strain of Fulghum) were included. The trial was made triplicate; that is, there were 3 sets of plots from which comparisons could be made with equal fairness. The results are as follows:

	Bushels per acre
Burt	19.3
Kherson	22.8
Kanota	28.4
Fulghum	27.5

As in the Knoxville trials, Fulghum gave an appreciably higher yield than either Burt or Kherson; the average for these 2 varieties being 21.1 bushels, as compared with 28.0 bushels for the average of Kanota and Fulghum.



Oat field at the Columbia Station

KANOTA A SUPERIOR STRAIN OF FULGHUM

The Fulghum oat is a well-defined variety, but like most varieties it can be separated into strains, which would be expected to differ in value. Kanota is claimed by the Kansas Station to be a superior strain under their conditions. It has been tested in comparison with southern-grown Fulghum for 3 years at the Knoxville Station and one year at the Columbia Station. The yields are given in table 3.

TABLE 3—*Varietal trials of spring oats—Kanota versus Fulghum*

Place	Date of seeding	Yields per acre			
		Kanota		Fulghum	
		Grain	Straw	Grain	Straw
		Bu.	Tons	Bu.	Tons
Knoxville	Mar. 4, 1924	54.3	0.94	47.7	0.75
Knoxville	Mar. 6, 1925	56.1	0.99	52.9	1.00
Knoxville	Mar. 5, 1926	39.1	0.54	39.1	0.50
Columbia	Jan. 26, 1926	28.4	.....	27.5	.....
Average..	.....	44.5	0.82	41.8	0.75

The average yield of Kanota for the 3-year trial at Knoxville and the one year at Columbia was 44.5 bushels per acre, whereas the average for common Fulghum was only 41.8 bushels. Although a longer term of trials would be desirable, the evidence must be construed as favorable to Kanota, which at this time can be obtained in commercial quantity and makes a desirable source of seed for use in Tennessee.

HOME-GROWN VERSUS WESTERN-GROWN SEED

Experiments designed to furnish information as to the comparative merits of home-grown and western-grown seed oats were begun at the Knoxville Station in 1908, in cooperation with the Office of Cereal Investigations of the U. S. Department of Agriculture. A single lot of Rust Proof oats was bought from a Knoxville seedsman in the spring of that year. This lot was divided into three parts. One part was sent away to be grown at the Texas Experiment Station at Amarillo, another was sent to the Arkansas Station at Fayetteville, and the third was kept for seeding at the Knoxville Station. In the spring of the following year seed grown in each of the three places was planted under the same conditions at the Knoxville Station. Thereafter for a total of 8 years, seed from both of these places was planted along with home-grown seed. The yields are given in table 4.

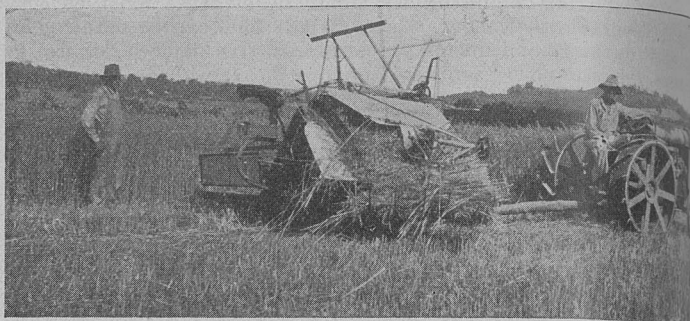
TABLE 4—Yields per acre of Red Rust Proof oats from seed grown in three different states—trials at the Knoxville Station. (Original seed in 1908 the same for all three places)

Year	Sources of seed and yields per acre						Remarks
	Knoxville, Tenn.		Amarillo, Texas		Fayetteville, Ark.		
	Grain	Straw	Grain	Straw	Grain	Straw	
	Bu.	Tons	Bu.	Tons	Bu.	Tons	
1909	23.3	0.73	21.9	0.63	23.4	0.65	Yield from Fayetteville seed reduced by smut, which appeared for the first time in the 1912 crop.
1910	35.2	0.83	33.3	0.75	29.7	0.80	
1911	11.5	0.30	14.1	0.33	12.7	0.30	
1912	44.2	0.92	46.1	0.91	35.6	0.97	
1913	18.8	0.40	18.8	0.48	12.5	0.35	
1914	9.4	0.34	8.2	0.32	6.7	0.27	
1915	22.6	0.66	26.1	0.65	21.1	0.60	
1916	22.7	0.62	22.7	0.55	16.3	0.65	
8-yr. av.	23.5	0.60	23.9	0.58	19.9	0.57	

Although the conditions under which the oats were grown in Amarillo, Texas, were widely different from those at Knoxville, the yields from seed derived from the two sources were almost identical, and there was no indication of any change in either habit of growth or time of maturity. The seed from the Fayetteville Station gave an appreciably lower yield than the others, but this was probably due to the fact that it became badly infected with smut, which was noticeably present for the first time in 1912, and which was abundant thereafter in seed from this source.

Kanota, the Kansas strain of Fulghum, was found, as previously shown, to be superior to common Fulghum. This result is considered to be due to a difference in strain or variety rather than to the source of the seed.

The experimental evidence, therefore, indicates that in time of scarcity of home-grown seed western- or southern-grown seed may be safely substituted.



Harvesting 50 bushels to the acre of Fulghum oats at the Columbia Station

DATE OF PLANTING SPRING OATS

Date-of-planting trials of spring oats were conducted for 9 years at the Knoxville Station. The main object was to get the comparative yields from early and medium-late plantings. Owing to the variations in the seasonal conditions of different years, it was found to be impossible to make the plantings at any fixed date. As a rule the early plantings were made as soon as the soil and weather conditions would allow after January. The late plantings were made the middle of March, or as soon thereafter as possible. There is a rather wide range in the dates from year to year, but the results as given in table 5 are considered to be fairly indicative of the average expectancy.

TABLE 5—*Date-of-planting trials of spring oats at the Knoxville Station*

Year	Date of early planting	Yield per acre of early planting		Date of late planting	Yield per acre of late planting	
		Grain	Straw		Grain	Straw
1900	Mar. 12	Bu. 29.4	Tons 1.20	Apr. 2	Bu. 22.8	Tons 0.28
1903	Mar. 20	25.0	0.63	Apr. 2	14.1	0.30
1906	Feb. 20	27.4	0.61	Mar. 12	36.0	0.80
1908	Feb. 29	26.2	0.62	Mar. 16	26.2	0.65
1909	Mar. 1	22.9	0.48	Mar. 17	23.7	0.77
1910	Mar. 4	47.2	1.28	Mar. 17	38.9	0.73
1911	Feb. 25	13.1	0.33	Mar. 16	15.0	0.34
1913	Feb. 1	10.7	0.30	Mar. 20	18.8	0.44
1915	Mar. 2	24.8	0.65	Mar. 24	21.9	0.63
9-year average		25.2	0.68	.....	24.2	0.61

DISCUSSION OF THE DATA

The dates of the early plantings varied from February 1 to March 20, and of the late plantings from March 12 to April 2. The average yield for the 9-year period was 25.2 bushels of grain and

ton of straw per acre for the early plantings and 25.2 bushels of grain and .63 ton of straw for the late plantings. Analysis of the data indicates, however, that extra early planting is inadvisable; the average yield for the 4 years when the early planting was made in February being only 19.4 bushels per acre, as compared with 24.0 bushels for the March plantings of those years. On the other hand, the early March plantings made for 5 years gave an annual average yield of 29.9 bushels per acre, as compared with 24.3 bushels for the later plantings of the same years.

EXTRA EARLY PLANTING SHOULD BE AVOIDED

Both experience and observation bear out the conclusion that there is considerable risk in planting extra early, or, say, any time before the first of March at Knoxville. Earlier plantings may, of course, be advisable in the warmer parts of the State, but on the Cumberland Plateau and at similar elevations seeding may well be delayed until the middle of March. The chief danger from extra early planting lies in the failure to get a full and uniform stand, because of delayed germination and decay of the seed.

WINTER OATS

Winter oats have a strong competitor in winter barley. The facts are that on land of good quality barley is much superior as a grain producer, and the beardless winter varieties now available produce larger and better hay crops. Also barley is superior for pasture purposes and fits better into farm practice because it can be sown somewhat later. Wheat and rye are competitors which are widely grown and utilized for winter pasture as well as grain. They have the advantage of being the hardiest of the small grains and of not requiring the early seeding which is important to both oats and barley.



A heavy crop at the Jackson Station

VARIETAL TRIALS

COMMENTS ON THE VARIETIES

The standard winter oat is the Virginia Grey Turf. It is recognized as hardy, uniform in type, but late in maturing, and as producing a large amount of straw in proportion to grain. In the varietal trials, a good strain of Grey Turf, known as Snoma, was used at Knoxville and at Jackson. The Culberson oat used was the short-growing strain obtained by selection at the Knoxville Station some

twenty years ago. This variety is better adapted to fertile land than the Grey Turf because much less liable to lodge; also it is ten days or more earlier, which is of decided advantage. In winter hardiness it is considered to be on an equality with Grey Turf. A third variety was the Yellow Peruvian, which was included because of the attention it attracted at the State Fair on account of the plumpness and high weight per bushel of the grain. Fulghum was included originally because of its being widely advertised as a valuable winter variety in the South, but its hardiness under Tennessee conditions was seriously questioned.

TABLE 6—*Varietal trials of winter oats at the Jackson Station*

Year of harvest	Date of seeding	Varieties and yields per acre							
		Fulghum		Snoma		Culberson		Yellow Peruvian	
		Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
		Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons
1915	Oct. 18	27.5	0.37	42.5	0.92	49.3	0.93	38.1	0.58
1916	Sept. 10	32.8	0.87	33.1	0.87	34.4	0.69	27.5	0.50
1917	Sept. 20	27.5	0.47	25.0	0.66	22.5	0.54	21.8	0.50
1918	Sept. 19	68.1	1.61	67.2	1.59	80.6	1.53	78.1	1.71
1919	Sept. 14	33.8	1.00	30.4	1.19	33.1	0.87	27.5	0.89
1920	Sept. 26	21.3	0.70	36.6	0.84	38.8	0.66	30.6	0.61
1921	Sept. 16	33.8	1.87	50.0	1.70	...	...	38.8	1.11
1922	Sept. 12	40.6	0.97	33.8	0.93	28.1	0.61	38.1	0.97
1923	Sept. 19	60.6	1.43	46.3	1.42	39.7	1.18	...	...
1924	Sept. 17	36.9	0.84	57.5	1.36	48.8	0.72	...	...
Average...		38.3	1.01	42.2	1.15	41.7	0.86	37.6	0.90
Comparative Av. of Snoma†..		42.2	1.15	...	...	41.4	1.09	40.0	1.00

TABLE 7—*Varietal trials of winter oats at the Knoxville Station*

Year of harvest	Date of seeding	Varieties and yields per acre					
		Fulghum		Snoma		Culberson	
		Grain	Straw	Grain	Straw	Grain	Straw
		Bu.	Tons	Bu.	Tons	Bu.	Tons
1911	Oct. 5	....	....	31.7	0.90	36.1	0.70
1912	Oct 25	....	....	41.0	0.96	50.8	0.68
1914	.....	....	....	43.2	1.07	44.6	0.64
1915	Sept. 28 and Oct. 9	....	....	30.8	0.62	41.0	0.64
1916	Sept. 25	19.5	0.44	22.2	0.82	28.0	0.70
1917*	Oct. 2	....	....	....	....	....	....
1918	Sept. 26	....	....	15.6	0.50	9.4	0.20
1919	Sept. 21	....	....	24.6	0.93	22.2	0.20
1920	Oct. 9	....	....	18.0	0.68	17.2	0.40
1921	Oct. 1	17.2	0.56	21.5	0.56	16.0	0.50
1922	Sept. 29	5.0	0.35	6.7	0.42	10.8	0.54
1923	Sept. 28	15.7	0.32	21.5	0.52	9.0	0.20
1924*	Oct. 16	....	....	....	....	....	....
1925	Oct. 18	18.8	0.30	17.2	0.30	14.5	0.21
1926	Sept. 28	61.7	0.89	72.3	1.39	66.1	0.97
Average		23.0	0.48	28.2	0.74	28.1	0.55
Comparative average of Snoma†.....		26.9	0.67	....	....	28.2	0.74

*Winterkilled

†In the comparisons shown in tables 6 and 7 the averages of Snoma are taken from the 10, 9, 8, and 6 years, respectively, that the other varieties were grown.

DISCUSSION OF THE DATA

Table 6 gives the results obtained at the Jackson Station with all 4 varieties for the 10-year period 1915 to 1924, inclusive. Table 7 gives the data obtained at the Knoxville Station for 15 years, in two of which, 1917 and 1924, no data were obtained because of winterkilling. In this series, only Snoma (Virginia Grey Turf) and Culberson were included for the entire period, and the yields of the third variety, Fulghum, were obtained for the 6 years.

RESULTS AT THE JACKSON STATION

Winter oats have done especially well at the Jackson Station, the soil and climatic conditions being favorable. That part of the State would be selected as best suited to the less hardy varieties, such as Rust Proof, Appler, Yellow Peruvian, and Fulghum. It is of interest to note, therefore, that Fulghum as a winter oat did not yield as well as Snoma. The 10-year average for Snoma was 42.2 bushels per acre, but Fulghum under the same conditions of season, soil, and planting averaged only 38.3 bushels. In a 9-year trial Culberson and Snoma gave almost an identical average yield of a fraction over 41 bushels of grain to the acre, but Snoma produced more straw by 460 pounds per acre. The Yellow Peruvian was outyielded by Snoma in an 8-year trial to the extent of 2.4 bushels of grain and 380 pounds of straw per acre.

RESULTS AT THE KNOXVILLE STATION

At the Knoxville Station Fulghum as a winter oat proved to be inferior to Snoma; the 6-year average yield for the 2 varieties being 23.0 bushels of grain and .48 ton of straw per acre for Fulghum and 26.9 bushels of grain and .67 ton of straw for Snoma. As in the Jackson trials, Culberson and Snoma produced practically identical yields of grain, but Snoma produced more straw by 380 pounds per acre.

DATE OF PLANTING WINTER OATS

Table 8 gives the results of date-of-planting trials at the Knoxville Station for 8 years. The data are assembled by half-months, beginning the first of September and extending into November. In some respects the evidence is quite satisfactory. September seedings proved to be the best without question; the 8 seedings made the latter half of the month outyielding, on the average, the same number of seedings made the first half of October by 5.2 bushels of grain per acre. Also the seedings made the first half of October outyielded those made the latter half of that month in 4 of the 6 trials. In fact, one of the seedings made in late October failed completely. Two of the 5 seedings made the first week in November were failures, and only inferior yields were obtained at best. Although September proved to be the best month for seeding winter oats in these trials,

much more evidence would be required to prove which part of the month is better on the average; but in farm practice the latter half of the month would appear to be the more convenient time.

TABLE 8—*Date-of-planting trials of winter oats at the Knoxville Station (Varieties used: Cuberson and Virginia Grey Turf)*

Year of harvest	Dates of planting and yields per acre									
	Sept. 1-15		Sept. 16-30		Oct. 1-15		Oct. 16-31		Nov. 1-7	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
	Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons
1902	Not sown	...	69.8	2.26	50.0	1.70	39.7	1.25	38.2	1.25
1903	62.5	1.50	73.4	1.87	37.5	0.90	Failed	...	Failed	...
1904	70.3	2.20	58.6	2.51	64.1	2.98	59.4	3.06	Failed	...
1906	Not sown	...	56.8	2.07	50.0	1.80	58.8	2.42	26.9	0.49
1909	20.6	0.59	27.5	0.82	25.0	0.75	25.3	...	...	...
1910	33.8	1.36	15.6	0.62	42.5	1.64	19.4	0.80	7.5	0.36
1914	Not sown	...	47.1	0.96	40.1	1.02	Not sown	...	Not sown	...
1915	Not sown	...	35.1	0.71	33.0	0.58	Not sown	...	Not sown	...
Average	46.8	1.41	48.0	1.48	42.8	1.42	40.5	1.88	24.5	0.70
Comparative yields for Sept. 16-30	43.8	1.46	...	...	48.0	1.48	50.3	1.87	54.8	1.87

Table 9 gives the results of 12 years, 1913-1924, of date-of-planting trials at the Jackson Station. The growing season at Jackson is longer and the average temperature higher than at Knoxville.

TABLE 9—*Date-of-planting trials of winter oats at the Jackson Station (Cuberson variety)*

Year of harvest	Dates of planting and yields per acre							
	Sept. 15-30		Oct. 1-15		Oct. 16-31		Nov. 1-7	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
	Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons
1913	64.0	1.43	60.0	1.18	27.0	0.58	50.6	1.28
1914	17.5	1.27	22.5	2.16	31.2	1.25	42.5	2.00
1915	46.8	1.11	17.5	0.29	33.7	0.60	Not sown	...
1916	37.8	1.03	27.5	0.64	38.1	0.77	Not sown	...
1917	41.2	0.75	52.5	1.08	71.2	1.05	Failed	...
1918	80.6	1.53	108.8	2.04	85.3	1.33	69.4	1.11
1919	30.0	0.75	32.2	0.84	Not sown	...	43.8	0.75
1920	31.3	0.50	37.5	0.72	Not sown	...	Failed	...
1921	27.5	0.90	26.3	1.00	37.2	1.27	Not sown	...
1922	37.5	0.84	36.3	0.82	66.4	1.29	45.0	1.44
1923	53.1	1.28	61.9	1.10	66.2	1.57	39.4	1.77
1924	36.3	0.70	61.3	1.20	Failed	...	Not sown	...
Average	42.0	1.01	45.4	1.09	45.6*	0.97	36.3	1.04
Comparative yields for Oct. 1-15	45.4	1.09	...	...	47.5	1.15	51.5	1.28

*Failed crop included.

hence, it is not surprising that seedings made there the first half of October are the best. They are found to produce on the average 3 bushels of grain per acre more than seedings made the latter half of

September and 1.9 bushels more than seedings made the latter half of October. It should be noted, however, that the majority of the seedings made the latter half of October were superior to the earlier seedings, and that only the failure of the late October seeding for the 1924 crop brings the average below that for the first half of the month. Apparently, any time in October is highly favorable, but the rapid falling off of the yields obtained from early November seedings indicates that very late October seedings should be avoided if possible.

RATE OF PLANTING OF WINTER OATS

Rate-of-planting experiments with fall-sown oats were carried out for 9 years at the Jackson Station. The data are given in table 10.

TABLE 10—*Rate-of-seeding trials with fall-sown oats at the Jackson Station*

Year of harvest	Rates of seeding and yields per acre											
	2 pecks		4 pecks		6 pecks		8 pecks		10 pecks		12 pecks	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
	Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons	Bu.	Tons
1916	...	...	38.1	0.61	36.8	0.55	35.0	0.64	25.9	0.48	26.8	0.63
1917	...	...	31.8	0.57	31.8	0.60	33.7	0.54	43.1	0.75	41.2	0.72
1918	50.6	0.94	56.6	1.02	56.6	1.08	56.6	1.10	50.6	1.00	58.6	1.23
1919	51.8	1.11	56.3	1.29	63.0	1.33	57.4	1.27	47.3	1.00	51.8	1.15
1920	36.0	0.65	49.5	0.79	58.5	0.86	36.0	0.50	36.0	0.50	45.0	0.79
1921	38.3	1.18	42.8	1.18	33.8	0.93	36.0	0.93	40.5	1.00	40.5	1.08
1922	49.5	1.26	56.3	1.04	50.6	1.17	49.5	1.15	45.0	1.08	45.0	1.00
1923	72.0	1.65	81.0	1.73	58.5	1.44	87.8	1.86	63.0	1.80	67.5	1.47
1925	43.8	0.94	48.1	0.98	52.5	1.16	61.3	1.22	65.6	1.19	65.6	1.19
Average	48.9	1.10	51.2	1.02	49.1	1.01	50.4	1.02	46.3	0.98	49.1	1.03
4-peck rate	55.8	1.15	....	....	....	....	....	....	....	....	....	....
1918-25												

The rates varied from 2 to 12 pecks per acre. The rather surprising result obtained was that the 4-peck rate gave, on the average, as good a yield as any higher rate. On the other hand, the 7-year average yield for the 2-peck rate was 6.9 bushels of grain per acre less than that of the 4-peck rate.

Although a seeding of only a bushel to the acre proved to be ample in these trials, attention may well be paid to the fact that the experiments were conducted under favorable soil and climatic conditions, which undoubtedly would admit of a low rate of seeding. Under less favorable conditions a greater loss of stand during the winter and early spring would be expected. For these reasons from $1\frac{1}{2}$ to 2 bushels of seed per acre may be nearer the right amount for average conditions throughout the State.

COMBINATIONS OF ALFALFA, CLOVER AND GRASS WITH WINTER OATS

The early seeding desirable for winter oats comes at a time that is favorable for clover and grass, so that all may be sown together. If successful, the resultant crop is most valuable for hay, the clover making a large part of the crop. For use in this way, oats are considered superior to either wheat or rye, which are generally planted too late for clover to be sown with them in the fall. If clover and grass are to be sown with the oats, the seeding should be as early as possible in September. Early and thorough soil preparation, and especially a good moisture supply at seeding time, are highly important. If the soil be dry, light showers may germinate the clover and grass seed, but the stand may be greatly reduced or even lost before sufficient rain comes. A good rule is not to make the seeding until the soil is well supplied with moisture to considerable depth.

According to the results of various trials made by the Station alfalfa may well take the place of red clover, but attention must be paid to the possible need of both inoculation and liming. At the present time, due to the scarcity of American-grown red clover seed of a desirable kind, alfalfa is especially important.

WITH SPRING OATS

Clover and grass may be sown to advantage with spring oats. As with fall-sown oats, alfalfa may take the place of red clover in the spring seeding. In fact, there is considerable experimental and practical farm evidence showing that alfalfa is much more certain to come to a stand than red clover, provided, of course, that the soil is well supplied with lime. Under favorable conditions, as little as 10 pounds of alfalfa seed to the acre has been known to give a good stand. If desired, sweet clover may be used as a substitute for alfalfa. Also if the sufficiency of lime for alfalfa or sweet clover be doubted, Alsike clover may well take the place of red clover, at least until the red clover seed situation has been greatly improved.

VETCH WITH WINTER OATS

A seeding of hairy vetch and oats for hay may be made advantageously on a soil too poor in lime to produce either red or Alsike clover. The seeding should be done as early in September as possible. The resultant crop is found to vary greatly from year to year as to the proportions of vetch and oats; some years being more favorable to one and some to the other. It should be kept in mind that vetch is a very undesirable crop wherever wheat or other winter grain crop is to be grown, because it usually appears for some years after a seeding and the plants tangle and pull down the grain in spots; also the seed are harvested and threshed with the grain.

RAPE AND OATS

Rape may be sown with either winter or spring oats for pasture. In the former case, early fall seeding is desirable. In the latter, medium-early seeding is probably best. From 3 to 4 pounds of rape seed per acre is sufficient.



Experiments near Crossville, season of 1926

Upper picture—oats well fertilized

Lower picture—oats not fertilized

FERTILIZERS

Based on experiments conducted in various parts of the State, recommendations are given below in regard to the use of fertilizers.

Under certain conditions, fertilizers for the oat crop can be used to considerable advantage. The kind of fertilizer will depend largely

on the kind of soil, in particular its response to phosphate. For those portions of the State where commercial fertilizers are in common use, the following recommendations are made:

1. For oats alone—150 pounds of acid phosphate to the acre to be applied at seeding time; and 50 pounds or more of nitrate soda, usually to be top-dressed in early March for fall-sown oats, but if the seeding was late and there is need of increasing the fall growth to enable the plants to go safely through the winter, the nitrate may well be applied in the fall soon after the plants come up. A spring application of nitrate may be of much value in overcoming injury from aphids, which are appreciably less destructive on nitrated than on unnitrated oats, unless the soil be rich, in which case nitrate is inadvisable. In the case of spring-sown oats the nitrate should be applied as a top-dressing as soon as the plants are up.

2. For oats with alfalfa or clover and grass—when either alfalfa or a mixture of clover and grass is to be sown with the oats, the amount of phosphate may well be increased to 300 pounds per acre, on account of its value to the hay crops which follow the oats. Also, if the soil belong to the poorer class, which is somewhat in need of potash, 50 pounds of muriate of potash, or its equivalent of other potash salt, is advised, to be mixed with the acid phosphate. The addition of the potash salt is not expected to increase the oat yield, but to be of value to the clover and grass crops. No change is advised in the nitrate application, especially as a too heavy growth of oats is unfavorable to the clover and grass.

Certain portions of the State, such as a large part of the Central Basin of Middle Tennessee and a considerable part of West Tennessee, are so well supplied with phosphate that the usual fertilizer mixtures have not proved profitable for farm crops. This may not mean that the soil is rich and well supplied with all the elements of plant food. In fact, such soils may be poor, owing to a need of nitrogen or some plant-food element other than phosphorus, which is the prominent constituent of the commercial mixtures. For a soil of this kind, nitrate of soda alone can be used as previously directed.

SUMMARY

1. The results of a 10-year trial at the Knoxville Station show that fall-sown, or winter, oats mature earlier and outyield spring oats. But spring oats fit into the average cropping system much better than winter oats.

2. Fulghum as a spring oat was found in a 5-year trial to be decidedly superior to Burt, which was formerly recognized as the best for Tennessee conditions.

3. Kanota, a Kansas strain of Fulghum, can be highly recommended for use in Tennessee.

4. Fulghum is not recommended for fall seeding anywhere in the State. Virginia Grey Turf is the most dependable winter oat on the market at the present time. Culberson, in long-continued trials at both the Knoxville and Jackson Stations, was found to yield equally with Grey Turf on good land, and to be 10 days earlier, and less apt to lodge.

5. Experiments carried out for 8 years to determine the comparative worth of home-grown, Texas-, and Arkansas-grown oat seed from the same original strain of Rust Proof gave no indication of superiority in any case, except as contamination with smut reduced the yields of the Arkansas-grown seed.

6. In a 9-year trial at the Knoxville Station, early March was found to be the most dependable time of seeding spring oats. February seedings were found not to be dependable, but may be advisable in the warmer parts of the State. On the Cumberland Plateau, and at similar elevations, seeding should be delayed until after the middle of March.

7. In 8 years of date-of-planting trials with winter oats at the Knoxville Station, September proved to be the best month. October seedings proved best in a 12-year trial at the Jackson Station, but seeding late in October should be avoided.

8. One bushel of seed per acre was found to be sufficient for fall-sown oats in a 9-year trial under favorable soil and climatic conditions at the Jackson Station. Under average or unfavorable conditions, a heavier seeding, $1\frac{1}{2}$ to 2 bushels per acre, is advised.

9. Alfalfa, clovers, and grass may be sown to advantage with either winter or spring oats, but a soil well supplied with lime is important. On limed land alfalfa is generally much superior to red clover.

10. For land too poor in lime for either alfalfa or clover, hairy vetch may be used with fall-sown oats, but it is liable to become a pest on a farm where wheat or other small grain is raised.

11. Rape may be advantageously sown for pasture with either winter or spring oats.

12. Fertilizers can be used profitably for the oat crop, but regard should be had to the soil needs. Directions are given for the use of fertilizers under various conditions.