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BULLETIN NO. B-322
SEPTEMBER 1948

BETTER OATS FOR OKLAHOMA

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
IN COOPERATION WITH
UNITED STATES DEPARTMENT OF AGRICULTURE

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OKLAHOMA AGRICULTURAL EXPERIMENT STATION

Oklahoma A. and M. College, Stillwater

W. L. BLIZZARD, Director **LOUIS E. HAWKINS, Vice Director**

in cooperation with

Bureau of Plant Industry, Soils, and Agricultural Engineering
United States Department of Agriculture

For Successful Oat Production:

(1) *Use certified seed.* It is crop insurance worth far more than the slight additional cost.

(2) *Clean and treat seed.* The cost is usually rather low in comparison with the improvement in yield and quality of the crop.

(3) *Prepare seedbed well.* A desirable seedbed is moist, friable, firm beneath, with two or three inches of loose, mellow soil above.

(4) *Seed early.* One of the most frequent causes of failure is late seeding.

(5) *Choose proper varieties.* Many failures result from attempting to grow highly publicized but unadapted varieties. No variety is recommended by the Experiment Station unless tests show it is adapted in one or more areas of the State. A list of recommended varieties is given on page 6.

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Fall-sown oats produce considerably more grain than spring-sown varieties. Other advantages of fall-sown over spring-sown oats include (1) earlier maturity, (2) less erosion during winter months, (3) winter and early spring pasture, (4) heavier and more plump grain and (5) lower percentage of hulls.

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The Oklahoma Oat Improvement Program aims at developing oat varieties having high yields and otherwise well adapted to various parts of the State. Tests scattered throughout the State give farmers a chance to see how new varieties perform locally. Operation of the Program is described on page 21.

BETTER OATS FOR OKLAHOMA

By A. M. SCHLEHUBER, W. M. OSBORN, and T. H. JOHNSTON*

Oats *of adapted varieties* usually provide dependable feed and pasture in most of Oklahoma. However, the full possibilities of this crop have not always been realized because yields too often are unsatisfactory. These poor yields are frequently due to using seed of an unadapted variety or of uncertain variety or origin.

This bulletin gives the results of Experiment Station tests showing which varieties produce the best yields and are otherwise most satisfactory under Oklahoma conditions.

The tests reported here were made at Stillwater and Lawton from 1925 to 1947.** Numerous varieties have been tested, but only those which have proved best adapted or are otherwise of general interest are discussed here.

This bulletin also includes recommendations as to date of seeding and other cultural practices which Experiment Station research has shown will help increase oat yields in the State.

The Station's research with oats was recently expanded by establishment of the Oklahoma Oat Improvement Program, in cooperation with the United States Department of Agriculture. This work is described on pages 21 to 24.

VALUE OF OATS FOR FEED AND PASTURE

Oats is an important feed crop in Oklahoma. It provides dependability of production, an appreciable amount of fall and spring grazing, and good grain yields frequently produced by volunteer crops. It is well adapted to the harvesting equipment available on small farms.

The oat crop is a valuable substitute for corn, which is poorly adapted to the upland soils of Oklahoma and is frequently damaged by drought and high temperatures. The early maturity of oats—the latter part of May or in early June—provides an early supply

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** For detailed information on all varieties tested, see *Oat Variety and Cultural Tests in Oklahoma, 1925-1947.* Okla. Agr. Exp. Sta. Tech. Bul. T-33. (1948).

of grain for workstock and a good growing ration for young livestock. The straw makes valuable roughage for livestock during the winter.

Threshed oats can be easily stored over a long period of time. There is little loss by shrinkage and practically none by insect damage.

The value of oats as a feed for beef cattle is high. Feeding trials over a 5-year period at the Oklahoma Station show:*

(1) A pound of oats will produce as much gain as a pound of corn.

(2) Oats can be used satisfactorily to replace half the corn in a calf-fattening ration.

(3) Oats are definitely superior to corn for mixing with molasses.

(4) In winter rations, oats are even more valuable than in fattening rations.

(5) After the need for protein is met by a high-protein supplement, oats are fully equal, pound for pound, to 43% cottonseed cake, and are better than corn.

Other Oklahoma tests show oats equal to corn when replacing one-half of the corn in a ration for fattening lambs.**

Winter oats rank with rye and barley as pasture, providing a surprisingly large amount of protein in addition to minerals and the carotene (provitamin A) which is especially needed in winter rations in Oklahoma.†

Oats of good quality are an excellent grain for poultry feeding, Oklahoma Station poultrymen have found in feeding experiments and in experience with the College flocks. The oats should be standard weight per bushel, or heavier if available. The Station poultrymen recommend the use of from 10 to 15 percent of pulverized oats in starting, growing and laying mashes, and whole oats fed free-choice in a hopper or in the regular scratch grain mixture. Winter oats also make good green feed for poultry.

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* Blizzard, W. L., and Taylor, Bruce R., *Oats as a Feed for Beef Cattle.* Okla Agri. Exp. Sta. Bul.. B-270. (1943).

** Briggs, Hilton M. *Oats and Barley for Fattening Lambs.* Okla. Agri. Exp. Sta. Bul. B-272. (1943).

† Staten, Hi W., "Forage Production of Winter Small Grains and Annual Ryegrass, and Effect of Clipping," and Heller, V. G., "Chemical and Nutritive Value of Cereal Grasses." Both in Okla. Agri. Exp. Sta. Bul. B-319, *Oklahoma Crops and Soils 1947* (1948) pp. 94-100 and 100-104; respectively.

OAT VARIETIES

The varieties of oats presently recommended for Oklahoma are:

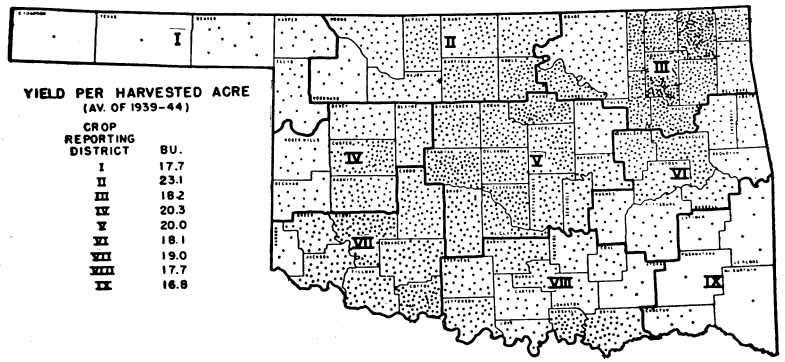
For fall sowing—Wintok, Tennex, Forkedeer, Traveler and Stanton Strain 1 (listed in order of winter-hardiness).

For spring sowing—Kanota, Neosho, New Nortex, and Red Rustproof (Texas Red). Fultex is recommended for early spring seeding in southwestern Oklahoma.

These recommendations are based primarily on the yields and other results obtained in thorough tests on the experiment station farms at Stillwater and Lawton and in less extensive tests at other locations. New oat varieties are being tested continuously, and outstanding ones will be recommended for certification as soon as they prove their worth.

Description and Performance

The two main cultivated groups grown in the United States are the common white or northern oat and the red oat. Before



Oats Is an Important Crop in Oklahoma.

Each dot on the above map represents 10,000 bushels of oats produced in the county where the dot is placed (1939-1944 average). The State's average annual production for 1938-1947 was 26,771,000 bushels grown on 1,339,000 acres. In addition to the grain, oats provide a large amount of fall and early spring grazing. Feeding tests at the Oklahoma Station show that oats rate high as a feed for beef cattle and poultry.

the advent of numerous foreign introductions and hybridizations, the two main oat types were rather easily distinguishable. Red oats are characterized by (1) the persistency of the upper grains to their rachillas (i. e., the "stem" between the "big" and "little" oat remains attached to the "little" oat) and (2) the presence of a "sucker-mouth" scar at the base of the large oat. In common oats, the rachilla usually remains attached to the primary kernel (large oat) and the base of the kernel is more or less solidified. By crossing between the two species, many intermediate types have been developed. Many of these intermediate strains possess characteristics common to both species. In others, many or all of the characters common to the two species are somewhat intermediate. Consequently, the identification of oat varieties, or even of groups, by examining grain samples has become more and more difficult, and in some instances almost impossible.

The most reliable method of identifying oat samples and measuring their varietal purity is to grow them in the field along with seed from known sources. This method is presently followed at the Oklahoma Agricultural Experiment Station. All unknown samples are seeded both in the fall and again in the spring. (See picture page 8). This results in information on their relative winterhardiness as well as on the habit of early growth such as (1) spreading (winter type), (2) semi-spreading (semi-winter), or (3) erect (spring). (See picture page 11.)

The following paragraphs describe the recommended varieties and others of importance in Oklahoma, and give the results of tests of these varieties. Grain yields of important fall-sown varieties are shown in Table I.

WINTOK.

Wintok,* named from "winter (oat)" and "Oklahoma," is the result of a cross between Hairy Culberson and Winter Fulghum. It was selected, named, and distributed by the Oklahoma Agricultural Experiment Station. It is a common oat and is generally conceded to be the most winterhardy variety in the United States. Wintok has a small, slightly gray seed, with good test weight and a low percentage of hull. It is a short, weak-strawed variety that matures early from fall seeding. In some instances, because of this earliness, it escapes serious damage from crown rust to which it is

* Pronounced Wint'-oak.

Part of an Oat Classification Nursery at Stillwater.

Varieties in the foreground were seeded in the fall. Some strains were completely winterkilled, while others show no winter injury. In the background are the same varieties from spring seeding.

TABLE I.—Grain Yields of Seven Fall-sown Oat Varieties at Stillwater and Lawton.

(Bushels per acre)

Variety	C. I.* No.	Stillwater				Lawton				2-station av.
		1945	1946	1947	Av.	1945	1946	1947	Av.	
Fultex	3531	72.0	67.1	**	46.4	82 2	69.4	81.5	77.7	62.0
Fulwin	3168	63.2	56.5	58.7	59.5	45.1	81.7	62.0	62.9	01.2
Stanton Strain 1	3855	77.3	80.6	**	52.6	85.3	73.3	80.1	79.6	66.1
Tennex	3169	64.6	62.8	66.7	64.7	46.9	82.4	54.8	61.4	63.0
Wintok	3424	68.3	59.6	61.3	63.1	37.5	67.5	48.3	51.1	57.1
Forkedeer	3170	73.7	69.2	64.3	69.1					
Traveler	4206	71.1	83.4	48.2	67.6					

* Accession number of the Division of Cereal Crops and Diseases, U. S. D. A.
** Not harvested because of extremely low winter survival.

extremely susceptible. The variety is also susceptible to the smuts, but is resistant to Victoria blight. It has fine leaves and a spreading or winter habit of growth. Wintok is not recommended for spring seeding.

Wintok has been tested for seven years at Stillwater. For a 5-year period it yielded 51.4 bushels compared to 56.6 for Forkedeer and 51.6 for Tennex. Stanton Strain 1 produced only 43.9 bushels for the same period. For the 3-year period, 1945-1947, Wintok yielded 63.1 bushels compared to 52.6 for Stanton Strain 1.

At Lawton, where winters are usually less severe than at Stillwater, Wintok yielded only 51.1 bushels compared to 79.6 for Stanton Strain 1.

Because Wintok is able to withstand severe winters, the yields are more stable than for less hardy varieties.

TENNEX.

Tennex is a sister strain of Fordedeer. Both were selected from Winter Fulghum. Tennex is a red oat with erect, very long, and spreading panicles. In the early stages of growth it has dark bluish-green leaves and a winter or spreading habit of growth. Tennex is a vigorous, medium-early, tall variety with a rather weak straw. It is susceptible to rust and smut but is resistant to Victoria blight.

At Stillwater the yield of Tennex has been about the same as that of Wintok. At Lawton it has outyielded Wintok by about 10 bushels.

Winter survival of Tennex has averaged about six percent less than Wintok. However, in years and in areas where winterkilling is not severe it is usually more productive than Wintok.

FORKEDEER.

Forkedeer is a sister strain of Tennex, selected from Winter Fulghum. It is a vigorous-growing, mid-tall red oat that produces excellent yields in the absence of severe winters and heavy rust infection. It is susceptible to rust and smut but is resistant to Victoria blight.

At Stillwater, Forkedeer has a 7-year average of 53.3 bushels and a 5-year average of 56.6, the highest of any variety tested during the same periods. For the 3-year period 1945 to 1947 it produced 69.1 bushels compared to 64.7 for Tennex, 63.1 for Wintok, and 52.6 for Stanton Strain 1.

Fall-sown and Spring-sown Oats Both Seeded in the Spring.
The variety on the right is a typical spring variety (Neosho) showing erect habit of growth and early heading. The variety on the left is a winter variety (Traveler) with a prostrate type of growth and late or no heading from spring seeding. The fall-sown types seeded in the fall usually yield best in Oklahoma.

Forkedeer has not been grown in yield tests at the Lawton station.

This variety is about five percent less hardy than Tennex and about 10 percent less than Wintok.

STANTON STRAIN 1.

Stanton Strain 1 is the result of a cross between Lee and Victoria. The variety is somewhat intermediate between common and red oats. It is semi-hardy, vigorous, heavy-tillering, and has rather short, stiff straw. The kernels are short, plump, yellowish to yellow-red, with relatively few awns. It has a semi-spreading habit of early growth and the leaves are light green in the seedling stage. The variety is resistant to most races of crown rust and smut but is susceptible to Victoria blight.

At Stillwater, Stanton Strain 1 averaged 51.6 bushels for a 6-year period and 52.6 for a 3-year period (1945-1947). In 1945 and 1946 Stanton Strain 1 outyielded both Tennex and Wintok.

In 1947, a severe winter, Wintok yielded 61.3 bushels and Tennex 66.7 bushels, but the winter survival of Stanton Strain 1 was so poor that the variety was not worth harvesting.

At Lawton, Stanton Strain 1 yielded 79.6 bushels for the 3-year period 1945-1947 compared to 61.4 for Tennex and 51.1 for Wintok. In 1945, a heavy crown rust year, Stanton Strain 1 yielded 85.3 bushels, whereas Tennex and Wintok, both rust susceptible varieties, yielded only 46.9 and 37.5 bushels respectively. Similar results were obtained in 1947, another heavy crown rust year.

TRAVELER.

Traveler, also known as Arkansas Traveler, is the result of a cross between Victoria and Custis. It was bred primarily for grazing and clipping purposes. It is a common winter oat that is apparently being grown quite widely in Arkansas and to a rather wide extent in eastern Oklahoma. It has a fairly stiff straw and the grain does not shatter easily. The grain is fairly large, has a rather high percentage of hull, and only a fair test weight. The variety is somewhat variable in plant characters and may need further purification. Traveler has resistance to many races of crown rust and smut, but is susceptible to Victoria blight.

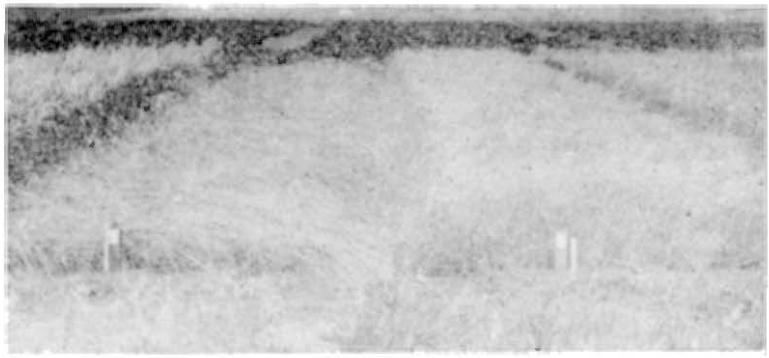
At Stillwater, Traveler has been tested for three years with an average yield of 67.6 bushels. For the same 3-year period it was exceeded only by Forkedeer with 69.1 bushels. In 1947, a severe winter, Traveler yielded only 48.2 bushels compared to 66.7, 64.3, and 61.3 for Tennex, Forkedeer, and Wintok, respectively. It is probably not sufficiently winterhardy for northern Oklahoma.

At Lawton, Traveler has a 2-year average yield of 81.9 bushels, which is about 25 percent more than was produced by the check variety, Winter Fulghum.

KANOTA.

Kanota is a red oat of the Fulghum type which originated as a mass selection from Nicholson's Extra Early Red Rustproof. Kanota is early maturing and produces fair to good yields and test weights. It is susceptible to rust and smut but resistant to Victoria blight. It has a semi-spreading to erect habit of growth and is not adapted to late spring seeding.

At Stillwater for a 16-year period, Kanota yielded an average of 39.2 bushels. During this period the yields have fluctuated



Varieties for Combining Must Have Stiff Straw.
The weak-strawed variety on the left is Fulton. The stiff-strawed variety on the right is Neosho. Resistance to lodging is inherited, and development of varieties with stiff straw for combining is one of the goals of the Station's oat-breeding program.

from a low of 24.3 bushels in 1945 to 63.6 in 1946. For the 3-year period 1945-1947 Kanota produced an average of 44.9 bushels and was exceeded only by Neosho with an average of 46.6.

At Lawton for a 17-year period, Kanota yielded an average of 27.7 bushels, which is approximately 10 percent less than was produced by Texas Red Rustproof.

This variety yields well from early spring seeding and can withstand considerable cold weather.

NEOSHO.

Neosho originated as a selection from a double cross, Fulghum-Markton x Victoria-Richland. It is classed as an early-maturing (light) red oat. In early growth it has exceptionally dark green, very erect-growing leaves. It makes a rapid initial growth in early spring but does not tiller (stool) as profusely as Kanota. It has an exceptionally stiff straw, making it satisfactory for combining. The panicles are small and the light red kernels are occasionally awned. Neosho is resistant to rust and smut but is susceptible to Victoria and halo blights.

This variety has been grown for three years at Stillwater but has not been grown at Lawton. At Stillwater it has yielded an average of 46.6 bushels, approximately four percent above Kanota. In test weight, Neosho has exceeded Kanota by one pound and Texas Red Rustproof by 2.6 pounds. The variety heads several

days later than Kanota but ripens as early or only about one day later. Neosho is from two to three inches shorter than Kanota.

As an average of two years each at Stillwater and Cherokee, Neosho had an average protein content of 13.85 percent, the highest of any variety analyzed for protein. Kanota averaged 12.71 percent protein.

NEW NORTEX.

New Nortex originated as a selection from Nortex, which, in turn was selected from Red Rustproof (Texas Red). It is a mid-season, heavy-hulled red oat that ripens more uniformly and is more uniform in plant type than either Nortex or Red Rustproof. It is resistant to Victoria blight and has some resistance to rust, but is susceptible to smut. It has a semi-spreading habit of early growth.

At Lawton, New Nortex has been tested for six years and yielded an average of 34.1 bushels compared to 35.4 for Fultex during the same period. Fultex also exceeded New Nortex for a 3-year period, the yields being 36.2 and 38.4 bushels, respectively.

FULTEX.

Fultex is the result of a cross between Fulghum and Victoria. It is early maturing, short, stiff strawed, and has a short, plump, red kernel with rather distinct yellowish stripes on the seed. Fultex is resistant to smut and many races of crown rust but is susceptible to Victoria blight. It has a semi-spreading to erect habit of growth and is adapted to spring seeding in northern Texas and southern Oklahoma, where it is frequently grown from fall seeding.

At Stillwater for four years, Fultex has yielded only 31.5 bushels, 12 percent less than Kanota. For three years it yielded only 34.5 bushels, 10.4 bushels less than Kanota and 12.1 bushels less than Neosho.

At Lawton, Fultex has been the highest yielding variety from spring seeding, exceeding Texas Red Rustproof by five percent.

OSAGE.

Osage is the result of the cross Victoria-Richland x Fulton. Osage tillers exceptionally well, has short straw, and resembles Fulghum slightly in general appearance. The kernels are yellow to very light reddish yellow in color, somewhat long and slender, and are usually awnless. Osage has a stiffer straw than Kanota but not as stiff as the straw of Neosho. It is resistant to rust and

smut but is susceptible to Victoria blight. It has an erect habit of early growth.

At Stillwater for four years, Osage has yielded 37.4 bushels, seven percent less than Kanota for the same period. For the 3-year period 1945-1947, Osage produced 41.1 bushels compared to 44.9 for Kanota and 46.6 for Neosho.

This variety has not been tested at Lawton.

VENTURA.

Ventura is a sister selection of Osage, produced from the cross Victoria-Richland x Fulton. It tillers well, has short, stiff straw, and resembles Fulghum somewhat in general appearance. Kernels are yellow to very light reddish yellow and are usually awnless. It has resistance to many races of crown rust and smut but is susceptible to Victoria blight. It has an erect habit of early spring growth.

Ventura has an outstanding yield record at Stillwater, producing an average of 50.2 bushels for the three years 1944, 1946 and 1947. This exceeds the yield of Kanota for the same period by 10 percent. Even though the yield of Ventura has been slightly better than that of Neosho, the latter variety was recommended for certification because of its stiffer straw and higher test weight.

Comparison of Fall and Spring-Sown Oats

Fall-sown oats have numerous advantages in Oklahoma. They mature early, retard erosion during winter months, provide winter and early spring pasture (especially when sown early), and often escape serious rust damage because of their early maturity.

Many of these advantages are reflected either directly or indirectly in grain yield. Table II shows average grain production for the three highest yielding fall-sown varieties as compared with the average grain production for the three highest yielding spring-sown varieties at Stillwater and at Lawton for the 5-year period 1943-1947. *The fall-sown varieties exceeded the yield of the spring-sown varieties every year at both locations.* At Stillwater the average difference ranged from 6.6 bushels in 1943 to 59.8 bushels in 1944, and the 5-year average advantage of the fall-sown varieties was 28.1 bushels.

In southwestern Oklahoma, because of mild winters, one would expect somewhat higher average yields from fall-sown varieties and also a bigger yield difference between fall- and spring-sown

TABLE II.—Comparative Grain Yields of Fall-sown and Spring-sown Oats at Stillwater and Lawton.*

(Bushels per acre)

When Seeded	Year					5-year av.
	1943	1944	1945	1946	1947	
			Stillwater			
Fall	40.5	87.4	77.3	79.9	65.1	70.0
Spring	33.9	27.6	24.8	68.1	55.1	41.9
Difference	6.6	59.8	52.5	11.8	10.0	28.1
			Lawton			
Fall	35.4	79.0	88.9	85.9	87.8	75.4
Spring	**	44.8	37.0	†	51.4	26.6
Difference	35.4	34.2	51.9	85.9	36.4	48.8

* Yields are averages for the three leading varieties each year.
** Crop destroyed by spring freeze.
† Crop destroyed by greenbugs.

varieties than at Stillwater. Results at Lawton confirm these expectations. The 5-year average yield of the fall-sown varieties was 75.4 bushels at Lawton and 70.0 bushels at Stillwater. The spring-sown varieties were killed by a spring freeze in 1943 and by greenbugs in 1946 at the Lawton station, whereas the fall-sown varieties yielded 35.4 ad 85.9 bushels, respectively. The 5-year average yield difference between fall- and spring-sown varieties at Lawton was 48.8 bushels.

Preliminary tests indicate that the test weights, seed size (weight of 100 grains), and percentage of groats of fall-sown oats exceed those of spring-sown oats. Some small-seeded varieties—Wintok, for example—have very thin hulls and consequently a high percentage of groats, thus increasing their feeding value.

PRODUCTION PRACTICES

Sound production practices are as important as the choice of suitable varieties. The following paragraphs discuss various practices and their adaptation to Oklahoma. The information presented is based on both Experiment Station results* and farm experience.

* For a detailed report of oat culture experiments see publication cited in footnote on page 4.

Seedbed Preparation

A desirable seedbed for oats is moist, friable, firm beneath, with two or three inches of loose, mellow soil above. The soil should contain sufficient moisture to insure rapid germination and early growth. For fall-sown oats, prompt germination and sufficient plant growth and root development help to reduce losses from winterkilling.

When either spring- or fall-sown oats follow a row crop such as corn, sorghum, or soybeans, the seedbed can be satisfactorily prepared by disking and harrowing. Land on which fall-sown oats follow a small grain or other solid planted crop should be plowed as early as possible in the summer, similar to seedbed preparation for wheat.

Any tillage method that will produce good, well prepared, firm seedbeds is satisfactory. At the Lawton station, the average yield of spring-sown oats on plowed plots was 32.7 bushels compared to 32.5 bushels on disked plots, over the 23-year period 1923 to 1947.

Place in the Crop Rotation

In much of the State, oats follow either corn or sorghum. At Stillwater a crop sequence of cowpeas, Darso sorghum, cotton, and oats has been followed for 26 years. The average yield of oats in this sequence was 36.0 bushels per acre as compared to 36.3 bushels for oats grown continuously, indicating no yield advantage for the oats in the rotation. The cowpeas did not provide enough nitrogen for the oats following the third year after the legume, but they did produce a beneficial effect on Darso and to some extent on cotton.

At the Lawton station a crop sequence and tillage experiment was started in 1917. Average results for a 23-year period are presented in Table III.

In the 6-year rotation the oats were grown on the alfalfa sod. The oat yields were quite satisfactory, but yields of alfalfa and row crops were poor. This rotation is not well suited to southwestern Oklahoma. It lacks flexibility, does not conserve moisture, and consequently does not provide dependable and satisfactory crop yields on upland soils. The futility of growing corn and alfalfa on the upland soils in southwestern Oklahoma is well recognized. In the 4-year rotation of kafir, cowpeas, cotton and oats, manure was applied to the kafir (10 loads per acre). This rota-

TABLE III.—Average Grain Yield of Spring-sown Oats Grown by Different Methods at Lawton.

(Bushels per acre)

Method of tillage	Previous crop	Rotation	23-year* av. yield
Fall plowed	Cotton	4 years: Kafir, cowpeas, cotton, oats	34.1
Disked	Cotton	2 years: Cotton, oats	34.1
Fall plowed	Wheat	2 years: Wheat, oats	32.3
On sod	Alfalfa	6 years: Corn, cotton, alfalfa 3 years, oats	31.7
Disked	Wheat	2 years: Wheat, oats	30.8

* 1923-1947; crop destroyed by hail in 1938 and killed by greenbugs in 1942.

tion was designed to produce grain for feed, forage, a legume, and a cash crop. It involves good tillage practices and the maintenance of soil fertility.

Rates and Dates of Seeding

FALL-SOWN.

For fall-sown oats, rather heavy rates of seeding usually are necessary to insure a satisfactory spring stand, especially in areas where winterkilling is frequent. To produce satisfactory crops of fall-sown oats, early and timely seeding is necessary. *No doubt one of the most frequent causes of failure has been late seeding.* Fall-sown oats should be sown early enough to give the young plants time to make sufficient growth to be well established before the onset of severe freezing weather.

Average grain yields of fall-sown oats seeded at different rates and dates at Stillwater for the 3-year period 1939-1941 are presented in Table IV. There was no advantage in seeding more than 3

TABLE IV.—Average Grain Yields of Fall-sown Oats Seeded at Different Rates and Dates; Stillwater, 1939-1941.*

(Bushels per acre)

Rate of seeding	Date of Seeding						Av. of all dates	Av. net yield
	Aug. 1	Sept. 1	Sept. 15	Oct. 1	Oct. 15	Nov. 1		
1 Bu./A.	30.2	45.1	58.4	56.8	43.2	35.8	44.9	43.9
2 Bu./A.	36.9	56.4	64.3	64.7	51.7	39.6	52.3	50.3
3 Bu./A.	37.6	60.6	67.7	63.3	53.1	42.9	54.2	51.2
4 Bu./A.	38.7	58.5	63.5	63.6	59.7	44.6	54.8	50.8
Av. of all rates	35.9	55.2	63.5	62.1	52.0	40.7		

* Variety: Winter Fulghum C. I. 2500.

bushels per acre when seeded prior to October 1. Highest yields were obtained from the September 15 and October 1 seedings.

As a rather broad recommendation for north central Oklahoma, fall-sown oats should be seeded between September 1 and October 15. The later the date of seeding, the heavier the rate should be. For example, the 3- and 4-bushel rates produced as much from the November 1 seeding as the 1-bushel rate on October 15. The 4-bushel rate produced as much from the October 15 seeding as the 1-bushel rate from the October 1 seeding.

SPRING-SOWN.

Average grain yields of spring-sown oats seeded at different rates and dates at Stillwater for the period 1931-1937 are presented in Table V. There was no advantage in seeding more than 2 bushels per acre except from the January 16 date. Best dates for spring seeding at Stillwater were between February 15 and March 1. Seeding later than March 15 resulted in a drastic reduction in yield. A broad recommendation would be to seed anytime between February 1 and March 15 when weather and moisture are favorable.

From the results of a rate-and-date-of-seeding test conducted on the thin upland soil of the Lawton station it is possible to compare three rates and three dates for 12 years, as shown in Table VI. The 4-peck rate usually permitted weeds to grow too freely and the average grain yields were less than from the other rates. There was no advantage in seeding more than 6 pecks per acre.

The earlier seedings produced the greatest yields, on the average. Late January seedings are subject to freeze injury. Seedings made as late as the middle of March frequently ripen under high

TABLE V.—Average Grain Yields of Spring-sown Oats Seeded at Different Rates and Dates; Stillwater, 1931-1937.*

(Bushels per acre)

Rate of seeding	Date of Seeding						Av. of all dates	Av. net yield
	Jan. 16	Feb. 1	Feb. 15	Mar. 1	Mar. 15	Apr. 1		
1 Bu./A.	27.2	33.1	37.7	39.8	33.1	12.2	30.5	29.5
2 Bu./A.	31.9	38.3	41.3	42.7	37.5	15.7	34.6	32.6
3 Bu./A.	37.4	40.5	40.3	43.7	37.2	16.1	35.4	32.4
4 Bu./A.	34.4	39.0	41.5	42.3	37.4	16.9	35.3	31.3
Av. of all rates	32.1	37.7	40.2	42.1	36.3	15.2		

* Variety: Kanota.

TABLE VI.—Average Grain Yields of Spring-sown Oats Seeded at Different Rates and Dates for 12 Comparable Years** at Lawton.*

(Bushels per acre)

Rate of seeding	Date of Seeding			Av. all dates	Av. net yield
	Feb. 5 to Feb. 11	Feb. 25 to Mar. 1	Mar. 10 to Mar. 15		
6 pecks/A.	32.8	32.2	29.3	31.4	29.9
8 pecks/A.	33.0	32.1	30.6	31.9	29.9
10 pecks/A.	33.0	32.3	31.2	32.3	29.8
Av. all rates	33.0	32.2	30.4	31.9	29.9

* Variety: Fulghum.
** Data compared for the years 1926-28, 1930-33, 1935-37 and 1939.

temperatures, but the yields and test weights are lowered. Late seedings also frequently result in heavy lodging and stem rust infections.

Use of Certified Seed

Certified seed should be used much more frequently. It is crop insurance worth far more than the slight additional cost involved. Certified seed is true to variety and is practically free of weed seed and seed-borne diseases.

Seed Treatment

All oat seed should be cleaned and treated with New Improved Ceresan or Ceresan M for the control of smuts, root rots, and seedling blights, regardless of whether or not the variety being planted is resistant to smut. Both loose and covered smut can be effectively controlled by applying New Improved Ceresan or Ceresan M as a dust at the rate of ½ ounce per bushel. Cleaning and treating seed oats is always good practice, and it usually pays good dividends. The additional cost involved for cleaning and treating the seed is usually rather low in comparison with the improvement in yield and quality of the ensuing crop.

Manner of Planting

About equal yields are obtained from drilled and broadcast oats under favorable seedbed conditions. However, drilling is the more common practice and has the advantages of covering the seed more uniformly, requiring less seed, and resulting in more prompt and uniform germination. Seven inches is the rather standard

spacing of drill rows, although 10 inches is also quite common and is particularly satisfactory on the drier lands in the western part of the State. When oats are broadcast they should be covered by a light disking or harrowing.

THE OKLAHOMA OAT IMPROVEMENT PROGRAM

The ultimate aim of the Oklahoma Oat Improvement Program is to provide each section of the oat-growing areas in Oklahoma with the variety or varieties of oats best adapted to the area and best fitted to the needs of the grower.

Steps in the Program

The steps in breeding, testing, and final release of superior oat varieties in Oklahoma are:

(1) *Breeding superior varieties.* (Discussed under "Major Breeding Objectives" below).

(2) *Field testing at the state and federal experiment stations.* Strains into which a number of desirable characters have been combined by breeding are tested for yielding ability and adaptation.

(3) *Field testing in the Oklahoma Small Grain Testing Program.** The best strains are advanced to these tests to determine more specifically their sectional performance.

(4) *Production of foundation seed by the experiment station.* Varieties showing good performance in one or more sections are purified and increased.

(5) *Release of foundation seed.* Foundation seed is released to the Oklahoma Crop Improvement Association for increase of registered and certified seed for farmer distribution.

Major Breeding Objectives

Some of the specific objectives in the breeding work of the Oklahoma Oat Improvement Program are:

(1) *Higher and more stable grain yields.* Maximum yields can be obtained only when all the various phases of crop production are favorable. An otherwise adapted variety may produce a high yield in some years but have either a low yield or no yield at all in years when certain diseases or insects are serious. Such varieties may produce rather high average yields over a period of years, but

* For details of this program see Okla. Agri. Exp. Sta. Bul. B-308. (1947).

Oat Test Visitors See for Themselves How Varieties Perform. Oat varieties are tested each year at a score or more locations scattered throughout Oklahoma. These local tests, conducted or sponsored by the experiment station, help find varieties which do well in the different parts of the State. Field days held just prior to harvest give people in each area a chance to see for themselves how each variety has performed. Men in charge of the research are present to answer questions about the work.

their instability is most undesirable. A feed crop must be reasonably dependable from year to year rather than "hitting it lucky" in good years.

(2) *Grain with high test weight, desirable appearance, a low percentage of hulls, and high protein content.* Oats with these characters provide high quality feed.

(3) *Disease resistance.* Adapted varieties with disease resistance produce higher and more stable yields. For example, Wintok and Tennex fall-sown oats, while extremely winterhardy, do not possess resistance to rust; consequently, in sections of the state where rust is frequently present in damaging proportions, the yield of these varieties is considerably less than the yield from rust-resistant varieties. Major oat diseases in Oklahoma include the rusts (leaf, and stem), the smuts (loose and covered), Helminthosporium (including Victoria blight), and various other foliar and root diseases.

(4) *Insect resistance.* The spring-sown oat varieties at the Lawton station were completely destroyed by greenbugs in 1943 and again in 1946. Many areas in southwestern and western Oklahoma experienced similar results, with both spring- and fall-sown oats being damaged. A search for varieties of oats with resistance to greenbugs is one of the projects of the Oklahoma Agricultural Experiment Station.

(5) *Winterhardiness in winter oats.* Wintok is the most winterhardy variety in the United States and is generally thought to possess sufficient winterhardiness for any section of Oklahoma in most years. However, up to the present it has not been possible to combine this winterhardiness with sufficient disease resistance. The same difficulty is being encountered in other states. One of the objectives of the oat improvement program is to attempt to combine a high degree of winterhardiness with other desirable qualities.

(6) *Drought and heat resistance.* Drought damage is one of the major hazards in oat production in Oklahoma. The development of varieties with more resistance requires a search for resistant types to be crossed with well adapted varieties, and the selection and testing of these crosses under drought conditions.

(7) *Resistance to lodging.* Stiffness of straw is of extreme importance, especially when the crop is harvested with a combine. One of the objectives of the oat breeding program is to combine resistance to lodging with other desirable characteristics.

(8) *Resistance to shattering.* Loss of grain in the field just prior to and after maturity is often rather heavy, particularly during high winds such as are frequently experienced in Oklahoma. With more and more of the oat crop being harvested with the combine, shattering is becoming of increased importance. In fact, resistance to shattering and to lodging are features of a "combine" type of oats.

(9) *Value for pasture.* Even though oats are grown in Oklahoma primarily for the grain, the suitability of different varieties for pasturing warrants consideration. A search for varieties with high forage value is included in the program.

(10) *Other objectives.* Such problems as the proper rates and dates of seeding for different varieties need to be studied. A frequent inquiry is "How late can winter oats be seeded in the winter

(or early spring) with reasonable assurance of a profitable yield?" An experiment to help answer this question has been started.

Operation of the Program

The Oklahoma Oat Improvement Program draws upon all the various scientific resources of the Experiment Station in helping reach its objectives. For example, in breeding for disease and insect resistance, plant pathologists and entomologists are helping the agronomists. Also, in the Uniform Regional Oat Improvement Program, cooperative between the Division of Cereal Crops and Diseases of the U. S. D. A. and State Experiment Stations, there is a free exchange of materials and ideas among the states. Thus the several States are benefitted by the oat research in each of the other states.

The problems related to oat production in Oklahoma coincide very closely with the breeding objectives of the Oklahoma Oat Improvement Program. However, problems of major importance in isolated areas may be reduced to minor problems when considered from the State as a whole. On the other hand, seemingly minor problems must sometimes be considered as major problems because of their damaging potentialities. A case in mind is the new disease of oats known as Victoria blight. In 1945, Iowa reported a five percent loss from Victoria blight, but in 1946 the damage was estimated at 25 percent in their Victoria-type oats. Kansas reported only one percent loss in 1946 and 20 to 30 percent loss in the eastern part of the state in 1947.*

* McLaughlin, J. Harvey. 1948. *Victoria Blight of Oats. A Dangerous New Plant Disease.* Okla. Agri. Exp. Sta. Cir. C-127. (1948).

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