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UNIVERSITY OF WYOMING
AGRICULTURAL
EXPERIMENT STATION

OATS ON THE AGRONOMY FARM, NEAR LARAMIE, WYOMING

OAT PRODUCTION AND
VARIETIES FOR WYOMING

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Oat Production and Varieties for Wyoming

A. F. VASS
GLEN HARTMAN

Oats rank high as a feed crop, especially for work animals. Grown under Wyoming high altitude conditions and on Wyoming soils that are rich in mineral elements, oats are of superior quality, color and weight per bushel over oats grown in the humid regions.

No other grain is so keenly relished by horses of all classes and ages and so prized by horsemen as oats. Oats are the safest of all feeds for horses. They are the standard to which all other horse feeds are compared. This grain, which supplies somewhat more protein than does corn, is an excellent feed for dairy cows. Tests have shown that oats are about equal to corn for fattening steers. They are also an excellent feed for breeding ewes. Oats have been used primarily for feeding horses. This is due to the fact that oats usually sell at a higher price per hundred pounds than barley.

In many parts of Wyoming where corn cannot be economically produced, oats are worthy of trial as a feed crop. This grain is well adapted to many of our dry-land sections and to all of our irrigated regions.

Oats are grown rather extensively in Wyoming and are especially well adapted to the cool summer climate of our high-altitude, irrigated lands. They do especially well in those regions that are too cool for the successful development of corn. Corn requires a long growing season with hot days and warm nights, whereas, oats are better adapted to those areas of the west where the days and nights are cool.

The average mean temperature in the state for the three summer months, June, July and August during the thirty-year period from 1891 to 1920 was 58.2°, 64.8° and 63.6°, respectively. The average daily mean temperatures for the same months at the Wyoming Experiment Station, where the experiments were conducted were 56.6°, 62.8° and 61.6°, respectively. The length of the growing season is sufficiently long to permit the full maturity of the
oat crop in all of the important farming regions of the state. Oats are commonly used as a nurse crop for such crops as alfalfa and the clover, and are, therefore, well adapted to our irrigated lands.

Figure 1 shows the acreage and yield of oats in the United States during the last sixty-two years. There was a rapid increase in the acreage up to 1890. This increase was due to the development of the Middle West. The increase from 1890 to 1918 was more gradual. There has been a slight decrease in the acreage of oats during the last eight years.

Oats have never been considered an important cash crop and probably never will be. The average farm price of oats from 1867 to 1918 was thirty-five cents per bushel. The average wholesale price index of all commodities during this same period was approximately 100. The average price of oats during the eight-year period, 1921 to 1928, was forty and three-tenths cents per bushel. At the same time the wholesale price index of all commodities was 153. The purchasing power of a bushel of oats during the last eight years has been about seventy-five cents on the dollar when measured in terms of what they were worth from 1867 to 1918.
This lower value, which has resulted in a slight decrease in acreage, is due to the general low level of agricultural prices and to the replacement of many farm horses by tractors and trucks.

Oats, as a rule, are produced upon the farm or ranch for feeding on that farm or ranch, and the producer is not, therefore, greatly influenced directly by what the price quotation at a distant market happens to be.

Figure 2 shows the acreage and production of oats in Wyoming from 1866 to 1928. There was a marked increase in the acreage and production of oats from 1866 to 1923, with the exception of the years 1918 and 1919. There was a decrease in acreage for these two years and the production was very low, due to the dry year 1919. Since 1923 the oat acreage in Wyoming has decreased. This indicates that there is less demand for oats for feed. This decrease is probably due to the substitution of barley as a feed crop for livestock other than horses and, also, to the replacement of work horses by tractors.
Some of the mountain-valley cattle ranches in the state devote a certain amount of their hay land to oats. The crop is harvested when in the stiff dough stage and handled in much the same manner as hay. The grain gives the hay a feeding value which enables the stockmen to finish his three-year-old steers better than can be done with the native hay. The yield from the oat-hay and grain is also more than the yield of the native hay.

The enormous yields which can be secured on our high-altitude irrigated soils make oats a crop that might well be given consideration on our irrigated farms.

Figure 3 shows oats which yielded at the rate of 140 bushels per acre at an altitude of 7,200 feet and indicates the possibilities of this crop at our high elevations, where the farmer or rancher needs a grain crop as a supplementary feed for cattle and sheep, as well as the grain ration for horses.

Studies have been conducted at the University of Wyoming Experiment Station at Laramie over a long period of years in order to determine the best methods of culture and the varieties best adapted to Wyoming's conditions. The recommendations given are based upon these investigations.
CULTURAL METHODS

ROTATION

Wyoming, being one of the newer states in point of agricultural development, has not as yet adopted a system of rotation that will give the best yields. In some of our sugar beet areas fairly good systems of rotations are followed, but they are the exception rather than the rule.

Much of the decreasing yield on such crops as alfalfa may be attributed to the poor physical condition of the soil, caused by many years of puddling by heavy irrigation and lack of cultivation. The plant food in the soil under the above conditions becomes more or less unavailable, and the conditions for root growth in the soil have also become very unfavorable. Our irrigated soils need rotations which will permit the stirring of the soil and the breaking up of the puddled clods which form under irrigation.

Oats grow best following a cultivated crop such as potatoes, sugar beets, beans or corn, and serve as a nurse crop with which the alfalfa or clover may be seeded. In the dry-farming sections of the state spring-seeded oats upon disked corn or potato ground have yielded very profitable returns. Corn is a common crop on many of our dry lands. Tests have shown that on the Great Plains the largest returns of oats per acre were obtained after summer fallow, but on account of the cost of summer tillage the crops on disked corn ground were more profitable. Potatoes, where grown, occupy the same place as corn in the scheme of rotation. Under dry-land farming, oats which fail to mature make excellent hay. They are often sown late for the purpose of making hay.

On the irrigated lands of the state oats have given good returns when seeded on potato or sugar beet ground. Spring plowing is not necessary for oats on most farm soils when following the above crops. Disking puts the ground into good condition for oats. Clover or alfalfa may be seeded in the oats, using the latter as a nurse crop. The above system of rotation gives good returns with the minimum amount of labor.

Any well-planned rotation should include deep-rooted and shallow-rooted crops and a legume. A shallow-rooted crop should
follow a deep-rooted one. Where alfalfa is used as the legume, oats may be used as a nurse crop in those sections where a nurse crop is used.

At the Wyoming Experiment Station the following rotation has given very good results and returns: alfalfa 3 years, potatoes 1 year, small grains (wheat, oats, or barley) 1 year, oats as a nurse crop for alfalfa 1 year. In another rotation used successfully, sweet clover 2 years was substituted for alfalfa 3 years in the foregoing. In this rotation the second crop of sweet clover in the second year was plowed under about September first.

A good rotation for our irrigated lands, where sugar beets or potatoes can be grown, is oats as a nurse crop for clover or alfalfa 2 to 4 years, followed by potatoes, and then by sugar beets. Oats or one of the other small grains should follow the beets. Some such rotation as the above will improve our soils and increase our yields without an increase in cost of production.

The yields of oats on the Agronomy Farm at Laramie have been greatly increased by the use of a rotation of alfalfa, potatoes and grains.

SEED BED PREPARATION

All of the oats grown in this state are spring-sown. Some years ago there was a common impression that spring seeding should always be done on fall plowing. Results of recent investigations do not always support this idea. The experiments of the U. S. Department of Agriculture at fourteen stations showed that spring plowing for spring oats gave average results exactly the same as those given by fall plowing. In those sections of Wyoming where soil blowing is not troublesome during the winter season, fall plowing may be economical from the standpoint of labor. Early spring seeding of oats is very desirable. Fall plowing, while it may not be a distinct advantage in itself, permits much of the land preparation to be done at a time when farm work is rather slack. This method is a time saver in the spring and usually permits much earlier seeding than does spring plowing.

Where oats follow a cultivated crop plowing is not necessary. Disking is generally used here instead of plowing. At the Archer station in southeastern Wyoming, the highest yields of oats were
obtained upon summer fallow. The next highest yield was upon disked corn ground. The lowest yields were upon land continuously cropped to oats. Oats on disked corn ground gave the lowest cost of production per unit.

In many localities of this state there still remains considerable new prairie land to be broken, which is usually sown with some of the small grains or flax. Breaking the sod where it is tough and strong should be done in very thin slices, before the early summer rains are over. In August or September it should be plowed again (backset) 1 to 3 inches deeper. If this operation is followed by disk ing and harrowing, the soil is put in excellent condition.

The advantages of a firm seed-bed resulting from early plowing followed by frequently harrowing cannot be emphasized too much. In loose, poorly packed soil, most of the available moisture will be lost by the simple process of drying, thus producing unfavorable conditions for germination and early growth. Early and thorough preparation of the seed-bed not only destroys weeds, which are the worst means of dissipating moisture, but also results in a compact seed-bed. In a compact, early worked seed-bed, there is more available plant food than in soil plowed later and less thoroughly cultivated. When the time between spring plowing and seeding is short, or if the soil is unusually loose, it is advisable to use a packer. The soil may be packed by the use of a drag or a regular roller soil-packer.

Under irrigation excellent results have been secured at this station upon fall-plowed land by disk ing lightly in the spring, harrowing and then following with a drag. This leaves the land smooth for irrigating and at the same time produces a firm, well-packed seed-bed.

Fall plowing for oats is advisable on our irrigated lands, because it permits a better breaking up of the soil by freezing and thawing, thus resulting in a better physical condition, which is especially desirable on irrigated land. Fall plowing also permits earlier seeding of the grains in the spring, and gives better distribution of labor.
SUMMER FALLOW

The method of summer fallow generally used is to plow deep before the last of June and surface-cultivate during the growing season. This results in sufficient moisture for a dry year. There are few weeds to contend with under this system, as the weed seeds near the surface have germinated and been killed. The danger of summer fallow is that the surface soil is apt to blow badly. Plowing for summer fallow should be done in the late spring. Packing the soil after plowing for summer fallow is not necessary, as the long time before seeding allows the soil to become packed.

In southeastern Wyoming the duck-foot or "field" cultivator has been substituted for the plow. This does not turn the soil over, but leaves the trash and clods upon the surface. This tends to check wind-blowing and washing during the time the land is fallow. With the more general use of the combined harvester, the trash remaining on the ground often prevents the use of the duck-foot cultivator by clogging the implement. In some instances the lister has been substituted for the duck-foot cultivator with success.

As stated elsewhere in this bulletin, summer fallow has given the largest average yield of any cultural method. However, it must be borne in mind that it is more costly than other methods.

SEED TREATMENT OF OATS

The smut diseases of wheat, oats, and barley are among the most destructive that attack cereal crops. Several million bushels are destroyed each year by smuts. Besides the actual grain destroyed each year by smuts there is an additional loss due to dockage on smutty grades. Most of these losses can be prevented by seed treatment.

Smuts are caused by parasitic fungi which infect the plant through the seed. The smut grows up through the plant and destroys the seeds or the whole head. Seed treatment kills the smut spores and therefore prevents smuts from infecting the young seedlings.
Oats should be treated regularly for smut. If a little smut is present in the crop it is likely to increase until it becomes very destructive, unless the seed is treated. Sometimes smut gets on the seed from smutty threshers or infected drills or bags.

The cereal smuts are sufficiently different from each other so that no single seed treatment has yet been found which will control all of them. Several seed treatments are in use today. Each one is adapted to control one or a small number of the smuts. The treatment should be varied to correspond to the smuts that cause the most trouble.

The oat is subject to attack by only two smuts which cause very great losses. These need not be distinguished since the same treatment is effective in the control of both. The panicles or heads turn into a black, sooty mass. The dry formaldehyde treatment or formaldehyde sprinkling methods are recommended for the control of oat smut. The dry formaldehyde method should never be used for hulless oats.

Formaldehyde is a fungicidal gas dissolved in water. The solution leaves no trace of its poisonous effect in the grain, although it poisons the spores of the parasitic fungi and brings about their death.

Dry Formaldehyde Treatment

This method is recommended for oats. The treatment avoids soaking the oats and does away with the difficulty of drying. As the seed is shoveled from one pile to another on the granary floor, each shovelful is sprayed at the rate of one quart of solution (made of 1 pint of formaldehyde to 1 pint of water) to each 50 bushels of grain. A small quart sprayer which throws a fine mist is convenient to use in moistening the grain. With an ordinary sprayer, one stroke of the piston will usually give enough mist to moisten one dirt-shovelful of grain, three or four are required for a scoop shovel. After treating, the grain is shoveled into a pile and covered with a canvass for about 5 hours. It is then ready for planting.

Sprinkling Method

The sprinkling method may be used for oats. Mix 1 pint of formaldehyde with 40 gallons of water. Sprinkle this on the
grain which has been spread out in thin layers. Shovel over several times during the sprinkling so as to wet the grain thoroughly. Shovel into a pile and cover with sacks or canvass for 2 to 5 hours. This amount is sufficient to treat about 40 bushels of grain.

**Precautions in Using Formaldehyde**

1. Always see that it is guaranteed full strength, i.e., 37-40 per cent.

2. Do not use more or less formaldehyde than the directions call for.

3. Plant all grain which has been treated as soon as possible after treatment. Do not store it after treatment, as seed injury results.

4. Seed does not have to be dry before planting. Plant as soon as it will pass through the drill.

5. Do not plant treated seed in dry ground.

**Seed Injury Due to Formaldehyde**

It has been found that the injury to seed grain resulting from treatment with formaldehyde is sustained when the grain is allowed to dry after treatment. No seed injury is produced by treating oats with formaldehyde provided the seed is germinated immediately after treatment. Treated seed, if held several days before sowing, is severely injured when allowed to dry without thorough aeration during the storage period. On the other hand, treated seed, held several days before planting, suffers no injury if kept damp. Seed injury resulting when treated grain dries slowly is due to a deposit of paraformaldehyde on the seed. This is a solid form of the formaldehyde which forms as the solution evaporates. The solid substance is, however, also volatile and is constantly being broken down into formaldehyde gas. Being concentrated and in close association with the seed, it penetrates slowly and injury to the seed is brought about.

Again, seed injury will be brought about if the seed coats are broken. The broken seed coats permit the disinfectant to soak through to the embryo and kill it.
In recent years much has been done in developing a dust treatment which will control smut. Copper carbonate is proving quite effective in treating smut on wheats, but not so effective in controlling oat smuts. A percentage of mercuric chloride is added to the copper carbonate for use in treating oats.

The most efficient and convenient method for treating oats with dusts is to use some form of closed container. Some have used a cement mixer and have found it quite suitable. A barrel can very easily be adapted for this work. Several strips should be fastened on the inside to catch the grain and allow it to fall over and thoroughly mix as the container is being rotated. Effective results can be obtained by shoveling grain, spread upon a floor, until the powder is thoroughly mixed with it. This method, it will be found, on the whole, is not satisfactory, because much of the dust will be lost, and the dust arising is unpleasant to inhale.

It cannot be said that the dust methods of seed treatment have entirely superseded the sprinkling or so-called dry formaldehyde treatments.

The dust combinations which are found effective against smuts of oats range much higher in cost (10 to 13 cents per bushel) than the formaldehyde treatments. This higher cost is due to the high price of corrosive sublimate used in the mixture. This increased cost is compensated in part by the fact that there does not appear to be any possible injury to the seed from the use of dust treatments, and in part by the convenience of treatment.

SEEDING METHODS UNDER IRRIGATION

All seeding should be done with a drill. On nearly level land, drilling should be done in the same direction as the slope, to aid in directing the water. On hillsides the drill rows should be at right angles to the slope so as to check the water. Oats should be sown at the rate of 2 to 3 bushels per acre. The lighter rate of seeding is best where it is used as a nurse crop.

The seed should be sown as early in the spring as possible. Oats should be seeded immediately following wheat seeding. The last of March or the first days of April are favorable dates in most irrigated sections. Early seedings give a heavier yield than
the later seeding. Where early seeding is practiced the grain should be drilled to a depth of 1\(\frac{1}{2}\) to 2 inches.

The same methods should be followed in seeding oats which are to be used as a nurse crop for alfalfa. The alfalfa or clover seed may then be drilled just after the oats have come up and should be drilled very shallow.

**SEEDING METHODS ON DRY LAND**

After the seed bed has been prepared, seeding upon dry land is very much the same as upon irrigated land. The oats should be drilled, using from 1\(\frac{1}{4}\) to 2\(\frac{3}{4}\) bushels per acre. The heavier rates of seeding are generally preferable to the lighter rates. The heavy rates do not lower the yields materially during drought years, and they do guard against poor stands under adverse conditions. The depth of seeding should be governed by the depth to moisture supply in the soil. If the oats are seeded early, usually about 1\(\frac{1}{2}\) inches is the correct depth. Seeding in April is desirable.

**IRRIGATION OF OATS**

The proper use of irrigation water is one of the most important problems of every community and of every farmer in an irrigated district. The irrigation farmer has largely under his control one of the most important factors in determining the yield and quality of his crops, the one over which farmers who depend on direct rainfall have little or no control, namely, the amount of moisture in the soil. However, there is generally less available irrigation water than is needed to give the optimum amount to all the land. Consequently, the proper distribution and use of irrigation water is of the greatest importance to the community.

Early irrigations of oats should be avoided as much as possible. Especially is this true before the oats come up. Applications of water after oats are planted and before they come up usually decrease the yield. In those sections where the early spring is dry, late fall irrigation of the land will generally supply sufficient moisture to bring the crop up. Irrigations do not appear to be very effective until the crop has shaded the ground. Applications of water at jointing and flowering time are desirable.
in most sections. Usually 2 to 3 applications of water will be sufficient to produce a good crop of oats. Under the conditions existing at the Wyoming Experiment Station at Laramie, two irrigations are usually sufficient, although a third must be made in certain seasons.

Oats are slightly more tolerant to alkali than wheat, but not as tolerant as barley. Lands which contain an accumulation of alkali at the surface should be plowed to a depth of from 8 to 10 inches and seeded immediately, before the alkali has had time to accumulate at the surface again. This will enable the seeds to germinate and start growth before the excessive accumulation occurs at the surface.

**VARIETIES**

**MARKTON**

Markton is from a head selection made by H. J. C. Umberger at the Sherman County Branch Station, Moro, Oregon, in 1910. The original seed came from Dedeagatch, Turkey, through the efforts of M. A. Carleton. Markton has proved to be a high yielder under western conditions. It is immune to covered smut of oats.

*Botanical description:* It is a midseason plant, light green in color. Culms short to midtall, hairy. Peduncle long, straight, well exserted. Panicle equilateral, erect, long, wide, ovate. Spikelets may be 2-flowered, kernels long and slender; rachis nodes 5 to 7. Glumes greenish white. Lemma yellowish white and rather thin; awns nearly always on lower kernels, coarse, straight to twisted and geniculate. Rachilla usually hairy.

**IOGREN**

The Iogren was developed from a single head of the Green Russian variety. It usually can be recognized by its peculiarly long, drooping uppermost panicle branches, and frequently by the greenish tinge or color at the upper end of the kernel.

*Botanical description:* It is a midseason plant. Culms mid-sized, stiff, glabrous. Sheaths deep green, usually glabrous; culm leaves midsized, margins glabrous. Peduncle midsized, straight,
well exserted. Panicle equilateral, drooping, long, wide, ovate; branches spreading or ascending, uppermost branch long, very drooping, distinct; rachis nodes 5 to 7. Spikelets few to many, usually 2-flowered; kernels slender. Glumes 9- to 10-veined. Lemma yellow to yellowish white with the upper end greenish tinged when mature; basal hairs few to absent; awns few to common, straight to twisted and geniculate, rather long. Rachilla usually glabrous.

**BANNER**

James Wick, seedsman, Rochester, New York, in 1886 introduced this oat under the name American Banner. This oat is purported not to be an old oat renamed, but is said to have been developed from a small stock of seed. The real origin is not known. It is a popular variety throughout the western half of the United States and has given good yields generally. Banner gave the highest average yield over the ten-year test period at the Agronomy Farm of the University of Wyoming.

*Botanical description:* Type very similar to Swedish Select. Panicle open, medium long. Spikelets 2-grained; usually awned but awns not as long as in Swedish Select. Grains medium large and white.

**SWEDISH SELECT**

This variety is of Swedish origin as the name implies and is a selection from Ligowo oat. In time the Swedish Select oat was introduced into Finland and St. Petersburg, Russia. M. A. Carleton introduced this variety into this country in 1899. A later introduction was made in 1903 by E. A. Bessey. This variety has proved to be well adapted to most of our irrigated sections and is used to some extent upon the dry farms. This is a very popular variety.

*Botanical description:* Early growth, erect; medium coarse, fairly stiff. Hairy near nodes. Sheaths and leaves dark green, glabrous, leaves medium wide. Panicles open, medium long, somewhat compact. Spikelets 2- to 3-grained. Grains blunt, large, white, usually carrying dark, slightly twisted awns. Basal hairs wanting, or extremely short and weak.
Figure 4. Varieties of Oats: 1, Banner; 2, Marketon.
The true origin of the Silvermine oat cannot be definitely ascertained. The John A. Salzer Seed Company, LaCrosse, Wisconsin in the late nineties, introduced the variety to the trade as their feature oat. The variety is still very popular in the Corn Belt.

Botanical description: Very similar to Swedish Select. Panicles open, slightly more elongated, and sharply drooping. Spikelets usually 2-grained. Grains medium plump, slightly more elongated than Swedish Select, white to yellowish white. Awns less numerous than in Swedish Select, and not twisted. Basal hairs wanting.

Abundance
Abundance is a product of the Gratons of England. It is said to be the result of a cross between White August and White Swedish oats. It was put on the market for the first time in England in 1892. From there it was introduced into the United States.

Botanical description: Early growth, erect; medium coarse, fairly stiff. Sheath dark green. Leaves acute, medium size, medium broad and dark green. Panicles open, medium size; ascending branches. Spikelets 2- to 3-grained. Grains medium size to large, plump, distinctly concave in the region of the awn, and whitish to yellowish white in color. Awns numerous, coarse, twisted and dark at the base. Basal hairs few or wanting. Rachilla usually without hairs. Abundance very closely resembles Swedish Select.

Richland
Richland is a yellow strain of Kherson oats. It is a pure line selection from Kherson made by L. C. Burnett in 1906 at the Iowa Agricultural Experiment Station. It is the heaviest yielding strain of Kherson yet isolated. It very much resembles Kherson except it is finer and stiffer straw, hence lodging less often.

Botanical description: The plant is very early. In early growth the culms are slender, stiff, glabrous; sheaths deep green, glabrous; culm leaves narrow, margins glabrous; peduncle slender, straight usually well exserted. Panicle equilateral, usually erect; short, narrow to midbroad, ovate; rachis nodes five to six; branches short, usually ascending, scabrous. Spikelets few to numerous, 2-flowered; kernels slender. Glumes 8- to 9-nerved, light green before maturity. Lemma glabrous, bright yellow;
Figure 5. Varieties of Oats: 3, Logren; 4, Swedish Select; 5, Silvermine.
basal hairs few or absent; awns usually few, straight to twisted and geniculate. Rachilla segment glabrous. At maturity the glumes are creamy white and the lemma is a bright yellow.

**GOLDEN RAIN**

This variety was obtained by the U. S. Department of Agriculture from Sweden in 1907. Golden Rain is a pure line selection out of the Probsteier oats, the selection being made in the Plant Breeding Department, Svalof, Sweden. It is similar in type to Victory.


**KHERSON**

Kherson oats were first introduced into the United States by T. W. Taylor, who sent a sample from Kherson, Russia, to Nebraska in 1896. It has proved to be a good yielder in most of the spring oat sections of the United States.

*Botanical description:* Early growth erect. Culms slender, stiff, glabrous. Sheaths deep green, glabrous; culm leaves narrow, fine. Peduncle slender, long, well exserted. Panicle equilateral, short, ovate; rachis nodes 6 to 7; branches short, slender, ascending, scabrous. Spikelets 25 to 50 or more, usually 2-flowered, sometimes 3-flowered. Glumes 9-nerved, grayish green before maturity. Lemma long, narrow, glabrous, yellow to white, yellow predominating; basal hairs few or wanting; awns few or wanting, slender, weak. Kernels short. Rachilla glabrous.

**SIXTY-DAY**

Botanically, the Kherson and Sixty-Day oats cannot be distinguished one from the other. They are both early maturing varieties. Seed of the Sixty-Day variety was received by the Office of Foreign Seed and Plant Introduction of the Bureau of Plant Industry on March 6, 1901, from Dr. S. DeMorzinski, of Proskomov, Russia. This province is adjacent to Kherson and has essentially the same climatic and soil conditions. Probably both Kherson and Sixty-Day come from the same original stock, as the two varieties are practically identical in every way and were obtained from adjoining provinces. Since the varieties are identical, only one description is given here.
Figure 6. Varieties of Oats: 6, Abundance; 7, Kherson; 8, Side Oat.
IOWAR

Iowar is a white strain of Kherson isolated by L. C. Burnett as a pure line selection in 1910 at the Iowa Agricultural Experiment Station. It is taller than Kherson.

*Botanical description:* The plant is early. The culms are slender, weak, glabrous and tall. Sheaths deep green, usually glabrous; culm leaves narrow, margins glabrous. Peduncle, slender, straight, usually well exserted. Panicle equilateral, usually erect, midbroad, ovate; rachis nodes five to six; branches short, ascending, glabrous. Spikelets few to numerous, usually 2-flowered; kernels slender. Glumes 8- to 9-veined, light green before maturity, creamy white at maturity. Lemma white; basal hairs, few or absent; awns rather abundant, straight to twisted and geniculate. Rachilla segment glabrous.

IOGOLD

Iogold is the product of a single plant of the Kherson variety, which was selected from the Iowa Agricultural Experiment Station nursery in 1906. It was not completely tested and offered for distribution until 1926.

*Botanical description:* This variety is very similar to Kherson. It has coarser straw, it is slightly more awned and has a larger percentage of golden yellow kernels. No further description need be given here.

VICTORY

This variety was developed at the Plant Breeding Station at Svalof, Sweden. Victory is a pure line, having been developed from a single plant selected out of Probsteier oats. In Sweden it is the leading white oat. It was introduced into this country by the United States Department of Agriculture in 1908, and has produced very good yields in the northwestern part of the United States.

Burt oats were distributed by the United States Department of Agriculture in the early nineteen hundreds. This oat is prolific in some of the Central States, but it has proved to be one of the lowest yielders of the hulled oats at this station.

Botanical description: Burt is very similar in type to Kher-son. The grain is medium size, white with about 25 per cent of the kernels being black. Awn common.

Cole is a selection from Sixty-Day made at Highmore, S. Dak., in 1907, by the South Dakota Agricultural Experiment Station. It is an early white oat practically awnless and very much resembles Sixty-Day. It has a weaker straw than its parent variety and is very susceptible to smut. Its distribution has been limited primarily to South Dakota.

Idamine is a selection from a commercial strain of Silvermine, known as Funk, made at the Aberdeen (Idaho) substation. It is a typical strain of Silvermine, but has a whiter kernel than most selections of that variety. The variety is not very widely distributed at the present time.

This variety came to this station in 1922. The seed was purchased from the Gem City Grocery Company of Laramie, Wyoming, under the name of Victory. When it grew it was found to be a side oat and has been identified by Mr. Stanton of the United States Department of Agriculture as Tartar King. The yields of this oat are small as compared to the other oats of the test.

Botanical description: Culms, coarse, medium stout, dark green in color. Panicle medium long, compact; rachis nodes 5 to 7; all spikelets hang to one side of panacle. Spikelets 2-grained. Grain large, short, plump, heavy, awnless and white in color. Busom oats, i.e., one kernel large and partly enclosing the smaller kernel of the same spikelet is characteristic of this variety. This causes a comparatively large percentage of hull to kernel.
EXPERIMENTAL METHODS

CLIMATE

As weather and climatic conditions are influenced to a great extent by topography, a brief description of the location and surroundings of the Agronomy Farm of the Experiment Station will be given.

The Agronomy Farm is situated about two and one-half miles west of Laramie. Laramie, the seat of the University and Experiment Station, is situated at the eastern edge of a large, nearly level plateau known as the Laramie Plains. These plains constitute the drainage basin of the Laramie River and its tributaries which have their sources in the mountains to the south and west. Laramie has an elevation of 7,200 feet above sea level.

To the eastward the land rises rapidly to the crest of the Laramie mountains, about eight miles distant, where it reaches an elevation of from 8,700 to nearly 9,000 feet, or from 1,500 to 1,800 feet above the valley. This range has a general north and south direction and connects with a spur of the Medicine Bow range near the Wyoming-Colorado line, about twenty miles to the south.

To the westward some thirty miles lies the Medicine Bow range. This range has an elevation well above 9,000 feet and culminates in Medicine Bow Peak, with an altitude of 12,005 feet above sea level. The Laramie Plains slope downward toward the north and northwest.

Thus Laramie is surrounded on three sides by high elevations. These elevations exert a very noticeable effect upon the climate. They cool the air as it passes over their crests, and in doing so the moisture contained therein is condensed and precipitated before reaching the plains. Therefore, the tendency is to produce a cool, dry climate.

Owing to the fact that the experiment station is situated on a high plateau and nearly surrounded by mountains, some of which are constantly snow-capped, it has a cool climate. Only six times in thirty years has the temperature reached 90°. The sky is nearly always clear and the humidity is low; hence, though the days may be warm, the nights are always cool. The daily range
of temperature is great. Another noticeable effect is the great difference in temperature between the sunshine and the shade. The winters, while cold, are not excessively so, and owing to the low humidity, the temperature seldom becomes disagreeable.

The monthly mean temperatures for the thirty-year period, 1891-1920, were as follows: January 22.1, February 22.4, March 29.7, April 37.7, May 46.7, June 56.6, July 62.8, August 61.6, September 53.5, October 42.1, November 31.7, and December 21.6; mean for the year was 40.7.

The average yearly precipitation at Laramie for the above mentioned period was 10.72 inches. The average snowfall is comparatively small. More than sixty per cent of the precipitation comes during the season April first to September first or what might be called the growing season.

The station being located on a comparatively level plain, with very few obstructions to the free movement of the air currents, naturally the wind velocity is greater than it is in more sheltered regions. However, the average is not as great as might be expected and does very little damage to crops. The winds occur chiefly in the early spring and late fall.

SOIL

The fields of the Agronomy Farm slope to the southwest. The soil is of a rather light brown, fine sandy loam to a loam type. The soil is of medium depth and underlaid with shale strata. These shale layers are at varying depths and have a downward pitch in a direction opposite the direction of the slope of the land. In some places where these shale layers rise to near the surface, the water table is also brought to or near the surface.

The soil contains considerable clay and becomes rather difficult to handle unless quite well supplied with humus. The alkali content is comparatively high, but causes no material damage to the crops grown. The nitrogen content of the soil is low and all crops respond to applications of organic matter. The legume crops in the rotation also give very noticeable results on the succeeding crops.
The Agronomy Farm is divided into fields and a crop-rotation system is maintained. An attempt is made to secure as nearly uniform soil in each field as possible. The plats are arranged within a field to obtain the greatest degree of uniformity in soil conditions. A three-foot alley is left between plats. Figure 7 shows some of these plats.

The plats are from one-tenth to one-twentieth of an acre in size. The drill used sows a strip seventy inches wide, and one width of the-drill constitutes a plat. This width of plat and the three-foot alley between are very convenient for roguing accidental mixtures and preventing mixtures in harvesting. The length of the plat is determined by the size of the field. This size of plat is economical to cut with a binder and to thresh with an ordinary threshing machine.

In variety plats some means of comparing the performance of one variety with another is necessary when the two are some distance apart, because there may be a difference in yield due to soil conditions. To supply a means for thus comparing the plats, check plats are used. Every fourth plat, plats 1, 5, 9, etc., is
planted as a check. The variety used in seeding the checks is a variety which has been grown in the locality and has been sufficiently well graded to insure uniformity in its producing power so that the yields of the checks vary directly with soil conditions. In the tests here reported, Swedish Select oats have been used as the check variety. The varieties being tested are seeded in duplicate.

The land is prepared for all plats as uniformly as possible, and as perfect a seed bed is prepared as the soil conditions will permit. The land is fall-plowed, as this fits in with the labor distribution, and enables earlier spring seeding than does spring-plowed land. The land is harrowed and leveled in the spring with a float as early as the ground can be worked. The plats are seeded with a drill usually during the first ten days in April. Great care is used to thoroughly clean the drill between the drilling of plats. Beginning on one side of the field, plat Number 1, a check plat, is sown, a three-foot alley is left and plat number 2, a variety plat, is sown, then another three-foot alley is left. Thus all varieties are planted in their turn. As the plats are sown a marking sign is placed in the center of one end of the plat, thus identifying it. Heavy rates of seeding are always used. A rate equal to 60 to 90 pounds of seed per acre is used. The seed is sown with a single-disk, chain-drag drill and drilled to a depth of from one and one-half to two inches.

The flooding method of irrigation is used on all plats. Small ditches are made in the alleys between plats just preceding each irrigation. This permits the application of uniform amounts of water to all parts of the plat. These ditches are filled in again in cultivating out the weeds in the alleys. From two to three irrigations per season are used, the number depending upon the amount of rainfall each season.

The fall-plowed ground usually has sufficient moisture in the spring for germinating the seed. Ordinarily there is enough rainfall during the months of May and June to maintain the growth of the crop. Hence, irrigation is generally not necessary until the oats are at least jointing. This is the beginning of the dry season and one or more irrigations are necessary to mature the crop. Late irrigations are not used as they tend to cause lodging and delay ripening.
CARE OF THE OAT PLATS

As soon as the oats are sufficiently headed to permit distinguishing of the varietal characteristics, the plats are thoroughly hand-rogued. This is accomplished by three trained men working together. One walks in the alley on each side of the plat and the third walks up the middle of the plat. Each head or stool of oats showing any characteristics not in conformity with the variety in the plat is pulled and laid in the alley to be gathered up later.

A self-binder is used in harvesting. Great care is taken to remove all straw and heads of oats from the machine after one plat is cut and before another is entered. The sheaves are carefully shocked upon the same plat from which they were cut. They remain thus until threshing time.

The threshing of the plats is done with a small, standard threshing machine of the ordinary type. The machine has been reconstructed slightly so as to permit cleaning. The cases under worm conveyors, the sides and top of the machine have been hinged and made to open easily. An air compressor and a pressure tank are mounted upon the top of the separator. The compressor is belted to a side shaft of the separator. A long rubber hose with air nozzle attached is connected to the air pressure tank. Thus all parts of the separator are thoroughly cleaned by means of air pressure after each plat is threshed and before another is begun. To further prevent mechanical mixing of the varieties, the first seed of each variety coming from the separator is not saved for seed the following year. The grain is placed in clean sacks, weighed and tagged, the weights are recorded and the grain hauled to the granary, where it is later cleaned with a clipper fanning mill and stored.

A limited supply of clean unmixed seed of each variety grown is available each spring for distribution in small lots. This distribution is made largely through county extension agents, to cooperating farmers who agree to test the varieties and save the seed to insure an increase of the available supply of the varieties that are satisfactory.
EXPERIMENTAL RESULTS

Five varieties of oats have been grown in the variety-test plots every year since 1920. Others have been added since that time. Some varieties which did not prove to be adapted have been discarded in the later years covered by this test. A total of seventeen varieties have been tested during this ten-year period. Tables are given to show the comparative yield of any variety with other varieties grown during the same period.

Table I shows the yield of each of the five tested varieties, through the whole period, for each year and the average yield for the ten-year period 1920-1929, inclusive. It will be noticed that Banner gave the highest average yield for this period, 75.2 bushels per acre. Silvermine holds second place in rank, with 3.16 bushels less average yield than Banner. Swedish Select gave an average yield of 4.87 bushels less than Banner. Golden Rain holds fourth place in rank and Kherson fifth. Banner, Silvermine, and Swedish Select are white-kerneled oats. Golden Rain and Kherson are yellow oats.

Abundance, Sixty-Day and Cole oats were in the 1920 tests, but they were later dropped from the tests due to the fact that they did not yield as well as some of the varieties in their group.

The yields of all varieties were rather low the first six years of the test. The maximum yield was 84.46 bushels. Large flocks of blackbirds have given considerable trouble at ripening time. Since 1925 a man with a gun has been stationed in the oat plots in an attempt to keep out the birds. This accounts to some extent for the higher yields in later years.

TABLE I. AVERAGE YIELDS OF OAT VARIETY TEST PLATS ON AGRONOMY FARM FOR TEN-YEAR PERIOD 1920-1929, INCLUSIVE

<table>
<thead>
<tr>
<th>Variety</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>1928</th>
<th>1929</th>
<th>Ten-Year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner</td>
<td>46.62</td>
<td>64.20</td>
<td>52.02</td>
<td>68.01</td>
<td>51.30</td>
<td>64.13</td>
<td>127.53</td>
<td>90.57</td>
<td>106.97</td>
<td>80.65</td>
<td>75.20</td>
</tr>
<tr>
<td>Silvermine</td>
<td>50.20</td>
<td>81.45</td>
<td>41.03</td>
<td>72.24</td>
<td>42.55</td>
<td>58.09</td>
<td>127.53</td>
<td>82.48</td>
<td>92.68</td>
<td>72.12</td>
<td>72.04</td>
</tr>
<tr>
<td>Swedish Select</td>
<td>43.96</td>
<td>61.90</td>
<td>56.10</td>
<td>57.61</td>
<td>38.16</td>
<td>58.09</td>
<td>130.07</td>
<td>77.68</td>
<td>95.94</td>
<td>63.75</td>
<td>70.33</td>
</tr>
<tr>
<td>Golden Rain</td>
<td>41.11</td>
<td>60.35</td>
<td>42.97</td>
<td>59.37</td>
<td>39.34</td>
<td>56.65</td>
<td>139.25</td>
<td>85.96</td>
<td>91.70</td>
<td>72.53</td>
<td>68.28</td>
</tr>
<tr>
<td>Kherson</td>
<td>28.75</td>
<td>72.50</td>
<td>44.16</td>
<td>62.35</td>
<td>29.01</td>
<td>53.14</td>
<td>143.26</td>
<td>70.40</td>
<td>58.93</td>
<td>53.98</td>
<td>61.65</td>
</tr>
</tbody>
</table>
The yields of all crops on the station have been increased by means of a rotation in which clovers and alfalfa have been used to build up the soil fertility.

Kherson is a popular oat in many of the irrigated sections of the state. It is one of the earliest maturing varieties tested. However, it appears not to have high-yielding ability under the conditions of an average season in the Laramie Valley. Kherson did, however, produce the highest single yield of any variety tested, yielding 143.26 bushels per acre in 1926. Conditions were very favorable for oat yields that year. There was no loss due to blackbirds, frost or storms. The yields of all plats in 1929 would have been fully as large as in 1926 had not an early frost and storm caused lodging and loss.

Table II gives the comparative yields of the different varieties for the eight-year period, from 1922 to 1929, inclusive. Iogren, Iowar, and Tartar King were added to the test in 1922. Richland had been added to the test in 1921; however, it was dropped again in 1927 while the others were carried to 1929. Hence, Richland appears in a later table instead of here. The variety Iogren proved to be a high yielder under the conditions of this test. Banner still held the lead, producing an average yield of 80.15 bushels per acre for the eight-year period, with Iogren second, with an average of 77.13. It is interesting to note that the older varieties maintained nearly the same ranking as they did in the ten-year test. Swedish Select did out-yield Silvermine by one bushel per acre. Iowar placed just above Kherson. Tartar King (a side oat) gave

<table>
<thead>
<tr>
<th>Variety</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>1928</th>
<th>1929</th>
<th>Eight-Year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner</td>
<td>52.02</td>
<td>68.01</td>
<td>51.30</td>
<td>64.13</td>
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<td>90.57</td>
<td>106.97</td>
<td>80.65</td>
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<tr>
<td>Iogren</td>
<td>67.38</td>
<td>75.56</td>
<td>54.47</td>
<td>74.67</td>
<td>129.64</td>
<td>65.24</td>
<td>78.21</td>
<td>71.87</td>
<td>77.13</td>
</tr>
<tr>
<td>Swedish Select</td>
<td>56.10</td>
<td>57.61</td>
<td>38.16</td>
<td>58.00</td>
<td>130.07</td>
<td>77.68</td>
<td>95.94</td>
<td>74.68</td>
<td></td>
</tr>
<tr>
<td>Silvermine</td>
<td>41.03</td>
<td>72.24</td>
<td>42.55</td>
<td>58.00</td>
<td>127.53</td>
<td>82.48</td>
<td>92.68</td>
<td>72.12</td>
<td>73.59</td>
</tr>
<tr>
<td>Golden Rain</td>
<td>42.97</td>
<td>52.97</td>
<td>39.34</td>
<td>56.65</td>
<td>139.25</td>
<td>85.96</td>
<td>91.70</td>
<td>72.53</td>
<td>72.67</td>
</tr>
<tr>
<td>Iowar</td>
<td>46.49</td>
<td>66.32</td>
<td>28.64</td>
<td>46.28</td>
<td>142.65</td>
<td>53.38</td>
<td>77.74</td>
<td>67.58</td>
<td>66.14</td>
</tr>
<tr>
<td>Kherson</td>
<td>44.16</td>
<td>62.35</td>
<td>29.01</td>
<td>53.14</td>
<td>143.26</td>
<td>70.40</td>
<td>58.93</td>
<td>53.96</td>
<td>64.40</td>
</tr>
<tr>
<td>Tartar King</td>
<td>41.53</td>
<td>32.47</td>
<td>57.52</td>
<td>125.84</td>
<td>67.17</td>
<td>70.66</td>
<td>52.44</td>
<td>63.95</td>
<td></td>
</tr>
</tbody>
</table>

Yields are given in bushels per acre. One bushel equals 32 pounds.
the lowest average yield of this period. It is also interesting to note that there is a difference of 16.20 bushels per acre in the yielding ability of Banner and the side oat, Tartar King. This variety produces a large, plump grain with a high amount of hull in proportion to kernel. It lacks much in yielding ability as compared to Markton, Banner, Silvermine and Swedish Select.

Iogren ranked high in yielding ability from 1922 to 1927, inclusive, but the yields of this variety were comparatively low in the years 1928 and 1929. There was 7.48 bushels difference in yields between the highest and lowest of the five leading varieties.

Table III gives the yearly and average yields of all varieties in the test during the six-year period 1924-1929, inclusive. Markton was added in 1924 and proved to be the highest yielder during this period of test, with an average of 88.31 bushels per acre. Iogren, the second highest yielder during 1922-1929, fell back to sixth place in the later years of the test. There are also some changes in the ranking of the other varieties. Tartar King is again at the bottom of the list.

Markton was the highest yielder three years out of the six, and Banner was the highest yielder two years out of six. Golden Rain and Swedish Select yielded well but did not top the list at any time.

Banner has held first place until Markton was introduced in 1924. From then on Markton has held first place, with Banner a close second. Silvermine and Swedish Select have proved to be
very well adapted to local conditions and were a very close third and fourth in yielding ability. Swedish Select was used as the check variety throughout the test and the yields given is the average of a larger number of plats than any other variety. The yields shown represent what may be expected from this variety.

The six-year average yields of the leading varieties were considerable higher than the ten-year average yields of the same varieties. This increase in yields is due to crop improvement and rotation methods.

Table IV shows the yields for the 1928 and 1929 seasons. It is necessary to show this table in order to compare the yielding ability of the three new varieties, Idamine, Victory and Iogold, which were added to the tests in 1928.

TABLE IV. AVERAGE YIELDS OF OAT VARIETY TEST PLATS ON AGRONOMY FARM FOR TWO-YEAR PERIOD 1928-1929, INCLUSIVE

Yields are given in bushels per acre. One bushel equals 32 pounds.

<table>
<thead>
<tr>
<th>Variety</th>
<th>1928</th>
<th>1929</th>
<th>Two-Year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Markton</td>
<td>94.67</td>
<td>95.51</td>
<td>95.09</td>
</tr>
<tr>
<td>Banner</td>
<td>106.98</td>
<td>80.65</td>
<td>93.81</td>
</tr>
<tr>
<td>Swedish Select</td>
<td>95.94</td>
<td>83.75</td>
<td>89.85</td>
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<tr>
<td>Silvermine</td>
<td>92.38</td>
<td>72.12</td>
<td>82.25</td>
</tr>
<tr>
<td>Golden Rain</td>
<td>91.70</td>
<td>72.53</td>
<td>82.11</td>
</tr>
<tr>
<td>Idamine</td>
<td>109.35</td>
<td>69.20</td>
<td>79.27</td>
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<tr>
<td>Iogren</td>
<td>78.21</td>
<td>71.87</td>
<td>75.04</td>
</tr>
<tr>
<td>Victory</td>
<td>69.35</td>
<td>78.61</td>
<td>74.33</td>
</tr>
<tr>
<td>Iowar</td>
<td>77.74</td>
<td>67.58</td>
<td>72.66</td>
</tr>
<tr>
<td>Tartar King</td>
<td>70.66</td>
<td>52.44</td>
<td>61.55</td>
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<td>Iogold</td>
<td>56.16</td>
<td>56.74</td>
<td>56.45</td>
</tr>
<tr>
<td>Kherson</td>
<td>58.98</td>
<td>53.98</td>
<td>56.45</td>
</tr>
</tbody>
</table>

Markton, Banner and Swedish Select are the highest yielding varieties of this period, ranking in the order named. The new varieties all placed below the better of the older varieties in the test. The varieties Idamine, Victory and Iogold may not yet have adapted themselves to local conditions since they were introduced. Tests of the next few years may show quite different results in the yielding ability of these varieties.

The varieties Sixty-Day, Cole, Richland and Burt were dropped from the tests during the ten-year period. Tables V,
VI, and VII are given so that each of these varieties may be compared with other varieties during the same season and under the same conditions.

Table V gives the average yields from 1920 to 1925. The yields of all plats were rather low. The average yields from 1926 to 1929 show an increase of almost one hundred per cent above yields from 1920 to 1925. This increase has been due to crop and soil improvement.

**TABLE V. AVERAGE YIELD OF OAT VARIETY TEST PLATS ON AGRONOMY FARM FOR SIX-YEAR PERIOD 1920-1925, INCLUSIVE**

<table>
<thead>
<tr>
<th>Variety</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner</td>
<td>46.62</td>
<td>64.20</td>
<td>52.02</td>
<td>68.01</td>
<td>51.30</td>
<td>64.13</td>
<td>57.71</td>
</tr>
<tr>
<td>Silvermine</td>
<td>50.20</td>
<td>81.45</td>
<td>41.03</td>
<td>72.24</td>
<td>42.55</td>
<td>58.09</td>
<td>57.59</td>
</tr>
<tr>
<td>Swedish Select</td>
<td>43.96</td>
<td>61.90</td>
<td>56.10</td>
<td>57.61</td>
<td>38.16</td>
<td>58.09</td>
<td>52.64</td>
</tr>
<tr>
<td>Golden Rain</td>
<td>41.11</td>
<td>60.35</td>
<td>42.97</td>
<td>52.97</td>
<td>39.34</td>
<td>56.65</td>
<td>48.90</td>
</tr>
<tr>
<td>Kherson</td>
<td>28.75</td>
<td>72.50</td>
<td>44.16</td>
<td>62.35</td>
<td>29.01</td>
<td>53.14</td>
<td>48.32</td>
</tr>
<tr>
<td>Abundance</td>
<td>38.66</td>
<td>56.90</td>
<td>48.37</td>
<td>64.05</td>
<td>31.46</td>
<td>45.04</td>
<td>47.58</td>
</tr>
<tr>
<td>Burt</td>
<td>26.68</td>
<td>65.70</td>
<td>28.49</td>
<td>59.77</td>
<td>46.13</td>
<td>58.72</td>
<td>47.58</td>
</tr>
<tr>
<td>Cole</td>
<td>26.76</td>
<td>60.40</td>
<td>47.46</td>
<td>58.09</td>
<td>34.35</td>
<td>30.38</td>
<td>42.91</td>
</tr>
<tr>
<td>Sixty-Day</td>
<td>29.57</td>
<td>59.65</td>
<td>46.37</td>
<td>59.62</td>
<td>30.20</td>
<td>30.74</td>
<td>42.69</td>
</tr>
</tbody>
</table>

Burt was dropped from the tests in 1926. The yields of Cole and Sixty-Day were even lower for the six-year period, but they were continued two more years for the purpose of making selection studies.

Table VI gives the seasonal and eight-year average yield of the plats which were started in 1920. Banner ranks first with

**TABLE VI. AVERAGE YIELDS OF OAT VARIETY TEST PLATS ON AGRONOMY FARM FOR EIGHT-YEAR PERIOD 1920-1927, INCLUSIVE**

<table>
<thead>
<tr>
<th>Variety</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>Eight-Year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner</td>
<td>46.62</td>
<td>64.20</td>
<td>52.02</td>
<td>68.01</td>
<td>51.30</td>
<td>64.13</td>
<td>127.53</td>
<td>90.57</td>
<td>70.55</td>
</tr>
<tr>
<td>Silvermine</td>
<td>50.20</td>
<td>81.45</td>
<td>41.03</td>
<td>72.24</td>
<td>42.55</td>
<td>58.09</td>
<td>127.53</td>
<td>82.48</td>
<td>69.45</td>
</tr>
<tr>
<td>Swedish Select</td>
<td>43.96</td>
<td>61.90</td>
<td>56.10</td>
<td>57.61</td>
<td>38.16</td>
<td>58.09</td>
<td>130.07</td>
<td>77.68</td>
<td>65.45</td>
</tr>
<tr>
<td>Golden Rain</td>
<td>41.11</td>
<td>60.35</td>
<td>42.97</td>
<td>52.97</td>
<td>39.34</td>
<td>56.65</td>
<td>139.25</td>
<td>55.96</td>
<td>64.82</td>
</tr>
<tr>
<td>Kherson</td>
<td>28.75</td>
<td>72.50</td>
<td>44.16</td>
<td>62.35</td>
<td>29.01</td>
<td>53.14</td>
<td>143.26</td>
<td>70.40</td>
<td>62.95</td>
</tr>
<tr>
<td>Abundance</td>
<td>38.66</td>
<td>56.90</td>
<td>48.37</td>
<td>64.05</td>
<td>31.46</td>
<td>46.04</td>
<td>139.50</td>
<td>71.49</td>
<td>62.06</td>
</tr>
<tr>
<td>Sixty-Day</td>
<td>29.57</td>
<td>59.65</td>
<td>46.37</td>
<td>59.62</td>
<td>30.20</td>
<td>30.74</td>
<td>125.78</td>
<td>66.29</td>
<td>56.03</td>
</tr>
<tr>
<td>Cole</td>
<td>26.76</td>
<td>60.40</td>
<td>47.46</td>
<td>58.09</td>
<td>34.35</td>
<td>30.38</td>
<td>115.45</td>
<td>56.14</td>
<td>53.63</td>
</tr>
</tbody>
</table>
Silvermine second. Swedish Select and Golden Rain ranked third and fourth, respectively.

The average yield of Cole for the eight-year period was at the bottom of the list. Sixty-Day was second from the bottom. It did not seem advisable to carry these two varieties for further tests. They were therefore dropped from the later tests.

The average yields of the plats during the period 1920-1927 were considerably below the average yields for the ten-year period due to the factors mentioned above.

Table VII shows the average yields from 1921 to 1927. Richland was introduced in 1921 and continued in the test until 1928. It ranked fairly well in 1923, but other than that its yield was low. It is a very early variety with a short stem.

Richland ranked next to Cole in yields. They were both dropped from the 1928 test.

TABLE VII. AVERAGE YIELD OF OAT VARIETY TEST PLATS ON AGRONOMY FARM FOR SEVEN-YEAR PERIOD 1921-1927, INCLUSIVE

<table>
<thead>
<tr>
<th>Variety</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>Seven-Year Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banner</td>
<td>64.20</td>
<td>52.02</td>
<td>68.01</td>
<td>51.30</td>
<td>64.13</td>
<td>127.53</td>
<td>90.57</td>
<td>73.96</td>
</tr>
<tr>
<td>Silvermine</td>
<td>81.45</td>
<td>41.03</td>
<td>72.24</td>
<td>42.55</td>
<td>58.09</td>
<td>127.53</td>
<td>82.48</td>
<td>72.19</td>
</tr>
<tr>
<td>Swedish Select</td>
<td>61.90</td>
<td>56.10</td>
<td>57.61</td>
<td>38.16</td>
<td>58.09</td>
<td>130.07</td>
<td>77.68</td>
<td>68.52</td>
</tr>
<tr>
<td>Golden Rain</td>
<td>60.35</td>
<td>42.97</td>
<td>52.97</td>
<td>39.34</td>
<td>56.65</td>
<td>139.25</td>
<td>85.96</td>
<td>68.21</td>
</tr>
<tr>
<td>Kherson</td>
<td>72.50</td>
<td>44.16</td>
<td>62.35</td>
<td>29.01</td>
<td>53.14</td>
<td>143.26</td>
<td>70.40</td>
<td>67.53</td>
</tr>
<tr>
<td>Abundance</td>
<td>56.90</td>
<td>48.37</td>
<td>64.05</td>
<td>31.46</td>
<td>46.04</td>
<td>139.50</td>
<td>71.49</td>
<td>66.40</td>
</tr>
<tr>
<td>Sixty-Day</td>
<td>59.65</td>
<td>46.37</td>
<td>59.62</td>
<td>30.20</td>
<td>30.74</td>
<td>125.78</td>
<td>66.29</td>
<td>59.81</td>
</tr>
<tr>
<td>Richland</td>
<td>55.60</td>
<td>49.92</td>
<td>71.65</td>
<td>39.07</td>
<td>40.57</td>
<td>118.49</td>
<td>63.42</td>
<td>58.39</td>
</tr>
<tr>
<td>Cole</td>
<td>60.40</td>
<td>47.46</td>
<td>58.09</td>
<td>34.35</td>
<td>30.38</td>
<td>115.45</td>
<td>56.14</td>
<td>57.47</td>
</tr>
</tbody>
</table>

A hailstorm occurred in the late summer of 1928. The hailstones were very small and fell without wind. The oat straw was not broken down, but those varieties which were sufficiently ripened shattered badly. Hence, a very high yielding variety may have had a very low yield in 1928, simply due to the fact that it ripened early. This was the first time that a hailstorm of any importance has occurred at the Agronomy Farm since the authors have been in charge of the work.
In 1929 the oat variety plats gave promise of higher yields than had ever before been obtained. Just previous to harvesting, on September sixth, four inches of snow fell. This snow was accompanied with a high wind. During the nights of September sixth, seventh, eighth and ninth temperatures several degrees below freezing were recorded. The straw of the oats was mashed down by the snow, making harvesting difficult. The grain was well filled and nearly matured, but the freezing caused more shattering in some varieties than occurred in those same varieties during a normal year.

The hailstorm in 1928 and the snowfall in 1929 probably accounts for the comparatively low yield of Kherson oats, as shown in Table IV. The unusualness of these two seasons may also have influenced the other yields recorded in this table. It is questionable if the yields of the new varieties added in 1928 (Idamine, Victory and Iogold) can be considered as representative of their yielding ability over a series of years. However, it is interesting to note that the ranking of Markton, Banner and Swedish Select remained unchanged from that of the tables representing yields of earlier years.

Blackbirds may occasionally, at harvest time, cause considerable damage to ripening oats. Figure 8 shows a flock of birds in the oat plats. These birds prefer oats to any of the other small grains, especially is this true just before the oats are fully ma-

Figure 8. Blackbirds in Grain Plats.
tured. Attempts have been made to poison the blackbirds, but this is exceedingly hard to do when there is an unlimited supply of untreated grain near at hand.

The average yield of all oats for the period of test was 72.8 bushels per acre. The highest single yield was 143.26 bushels per acre, produced by Kherson in 1926. The lowest single yield was 19.92 bushels produced by Richland in 1922. This was the first year Richland was grown at the station and the low yield was due to shattering.

The yields for 1926 are worthy of special notice, as showing the yields of oats that may be obtained when nearly all conditions are favorable. The average yield of 13 varieties on test that year was 131.14 bushels per acre, the lowest yield being 115.45 bushels for Cole. It is also worthy of note that in 1926 the oat plats were on ground that had just previously been in alfalfa.

**DISCUSSION**

The acreage and production of oats in Wyoming have fluctuated greatly during the last few years. The acreage is probably decreasing at the present time. This is perhaps because of the substitution of barley as a feed for most classes of livestock and the replacement of work horses by tractors. Oats still hold, and will hold for some time, an important place in the feed-production scheme of our agricultural system.

The better yields the last few years upon the University Agronomy Farm have been due to a rotation of legumes, potatoes and grains and to improved cultural methods. No commercial fertilizers were used. A dressing of barnyard manure is given to the legume crop the year previous to plowing for potatoes. This permits the organic matter to be broken down into available form by the time that the potatoes need it. The best results are secured when potatoes follow fall-crowned alfalfa and are in turn followed by oats. This is the system now being used. A 60- to 85-bushel yield of oats per acre is well within the reach of good practical farm management on irrigated lands.
The time of seeding is influenced to some extent by the climatic condition. The best results have been secured from the early seedings of oats at the rate of 2½ to 3 bushels per acre. Lighter seedings should be used on dry lands and on irrigated lands when used as a nurse crop. The large coarser varieties should be seeded at a heavier rate than the small seeded varieties.

Oats should be irrigated when the condition of the soil and of the plants shows that they need water. Most of our soils have sufficient spring moisture to give the oats a good start. If possible, avoid irrigation of the crop before it comes up. Two irrigations of 6 inches each are sufficient in most cases where the rainfall is 10 inches or more. Late irrigations should be avoided whenever possible.

ACKNOWLEDGMENTS

The authors of this bulletin wish to express their thanks and indebtedness to J. L. Robinson and J. C. Overpeck for their assistance during the first few years of the work, and to D. Rankin McIntyre, station foreman, for his continued assistance in carrying on the field studies.

SUMMARY

The production of oats for a feed crop is perhaps decreasing slightly.

Oats make a good nurse crop for legumes and work well into the rotations.

Fall plowing for oats should be practiced on our irrigated lands in order to permit early seeding. If oats follow a cultivated crop, disk ing and floating are sufficient. Oats should be seeded early so as to take advantage of the early spring moisture. The first or second week in April is preferable.

Oats should be seeded at the rate of 2 to 3 bushels per acre. The lighter seedings are perhaps advisable when seeded on dry lands or when used as a nurse crop.

Banner, with an average of 75.20 bushels per acre, gave the highest yield over the ten-year period. Silvermine was second,
with 72.04 bushels per acre. Swedish Select was third, with 70.33 bushels per acre. Golden Rain was fourth, with 68.28 bushels per acre. Kherson was fifth, with 61.65 bushels per acre.

The relative comparison was not changed except in the eight-year period when Iogren assumed second place in yielding ability. It gave an average yield of 77.13 bushels per acre.

In the six-year period Markton gave the highest average yield. It produced an average of 88.31 bushels per acre.

Banner, Silvermine, Swedish Select, and Markton are varieties recommended for our irrigated lands. If the grower wishes an early maturing small oat, Kherson is recommended. Kherson, as well as Banner, is well adapted to our dry-land farms.

The side oats, while high in quality, have not proven to be as high yielders as the tree varieties.