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**ALASKA AGRICULTURAL EXPERIMENT STATIONS**

**JUNEAU, ALASKA**

Under the supervision of the  
**UNITED STATES DEPARTMENT OF AGRICULTURE**

**BULLETIN No. 10**

**OAT PRODUCTION IN ALASKA**

BY

**F. L. HIGGINS**

*Agronomist*



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**UNITED STATES DEPARTMENT OF AGRICULTURE**  
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ALASKA AGRICULTURAL EXPERIMENT STATIONS, JUNEAU, SITKA,  
AND MATANUSKA

[Under the supervision of the Office of Experiment Stations, United States Department of  
Agriculture]

JAMES T. JARDINE, *Chief, Office of Experiment Stations.*

WALTER H. EVANS, *Chief, Division of Insular Stations, Office of Experiment  
Stations.*

---

STATION STAFF

H. W. ALBERTS, *Director, Juneau.*

F. L. HIGGINS, *Agronomist, Matanuska.*

J. C. WINGFIELD, *Horticulturist, Matanuska.*

W. T. WHITE, *Associate Animal Husbandman, Matanuska.*

C. CORDY, *Assistant Horticulturist, Sitka.*<sup>1</sup>

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<sup>1</sup> Appolatment effective Apr. 16, 1931.

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CONTENTS

	Page		Page
Introduction .....	1	Seed-bed preparation .....	13
Historical .....	2	Germination tests .....	14
Climate .....	4	Smut control .....	14
Comparison of the oat-growing season in Alaska and in some of the States .....	7	Seeding .....	15
Soils .....	7	Time of seeding .....	15
Rotation .....	8	Rate of seeding .....	15
Green manuring .....	9	Method of seeding .....	16
Commercial fertilizers .....	10	Harvesting .....	16
Varieties .....	11	Weed control .....	17
		Rabbit injury .....	18
		Summary .....	18

INTRODUCTION

The oat crop occupies an important place on the farms in interior Alaska, especially in the Matanuska Valley and the Fairbanks region of the Tanana Valley. The crop is used chiefly for hay. It is one of the more important grain crops in the system of diversified farming recommended for Alaska by the Alaska Agricultural Experiment Stations.

Good yields for hay and silage can be produced in southeastern Alaska, but production is limited (1) by the small areas of suitable land available for farming, (2) by the high cost of clearing the land, and (3) by cool, wet weather in the fall which makes difficult the work of harvesting. Southeastern Alaska is rough, rugged, and heavily timbered and has comparatively little land available for cultivation.

Oats can not be depended upon to mature at Kenai, on Cook Inlet, because of the unfavorable weather prevailing there. However, oats can be grown in that region for hay and silage. The cool, rainy weather in the fall is more favorable for silage making than for haymaking.

A small area of oats is grown for forage in the Homer region on Cook Inlet. This region is well suited to oats and vetch, and also to oats and peas for hay and silage. Weather conditions there, as in the Kenai region, are adverse to the ripening of oats.

Oat growing in the Tanana Valley, near Fairbanks, began about 1907 with the production of hay for horses, shortly after the establishment of a mining camp in the valley. A number of horses were used in the region for freighting, and as timothy hay had to be shipped in from the States at a cost of more than \$100 per ton, some of the teamsters decided to clear their lands and grow oat hay for the local market. Oat hay of good quality brought from \$60 to \$90 per ton, depending upon market requirements. Oats for forage is an important crop in this region. The native bluetop grass (*Calamagrostis* spp.) is found growing only in certain localities, and then in irregular patches. Experience has shown that it does not withstand cutting in successive years. Hardy, high-yielding biennial or perennial legumes have not yet been found which will produce as high tonnage per acre as do oats, in interior Alaska.

Oats seeded with peas or with vetch for hay have been found to make an efficient silage material. The addition of legumes to the ration improves the feeding value of the hay and is especially desirable for dairy cows and young stock. Because of inadequate threshing facilities, oats were not grown for grain for some time. However, with the introduction and development of early-maturing varieties of oats and the purchase of a threshing machine by the station for station and community use, farmers began seeding oats for grain.

Alaska farmers follow different methods in growing oats. Some plow in the fall, others in the spring, and still others not at all. Those who do not plow prepare the seed bed by disking and harrowing in the spring. Again, some farmers follow a definite scheme of rotation to conserve and increase soil fertility and to lessen loss from crop diseases, whereas others broadcast their grain seed without being reasonably sure that it is free from disease. As a result of general poor management much of the land under cultivation is low in fertility and badly infested with weeds, making it necessary to give attention to weed control.

This bulletin, based on observations and experiments in different parts of Alaska, has been prepared for the purpose of assisting farmers of the Territory to grow oats successfully.

#### HISTORICAL

Oats were grown by the Russians at Sitka in 1805 but failed to mature and could not be cured for hay because of the rainy weather. The Alaska Agricultural Experiment Stations tested oats for the first time at the Sitka station in 1899. A second test was made in 1900. Very favorable weather prevailed during these two seasons, and the early varieties matured. Tests made since 1900, however, have proved conclusively that oats can not be relied on to mature in southeastern Alaska.

Tests with oats have been made also by the experiment stations at Rampart, Kenai, Copper Center, Fairbanks, and Matanuska. Rampart, on the Yukon River, was found to be well adapted to early-

maturing varieties. Successful improvement work with grains was done at this station under the immediate supervision of G. W. Gasser.

At Copper Center early varieties of oats were tested from 1902 to 1908. Profitable yields were limited by frequent frosts in midsummer and by drought. During the 6-year tests only one crop of oat-matured well, whereas two crops were slightly damaged by frost, and three crops failed.

Most of the oats in Alaska are grown by the farmers in the Matanuska Valley and by those of the Fairbanks region in the Tanana Valley. In 1930 the Matanuska Valley produced approximately 30<sup>0</sup> acres of oats, and the Fairbanks region approximately 200 acres.

The Matanuska Valley is located at the head of Knik Arm, on



FIGURE 1.—Threshing oats

Cook Inlet, and is about 300 miles south of Fairbanks. The first oat crop in this region was grown by O. G. Herning at Knik in 1906. During that year and for several years thereafter he grew upwards of 2 acres of oats for hay for his pack horses. In 1911 Peter Murray on Wasilla Creek began growing oats for hay. About 1914 several new settlers came into the valley, began clearing, and grew several kinds of crops, including oats. The oat crop was used for hay for the animals belonging to the Government pack train which went over the trail from Knik to Chickaloon. In 1919 the Matanuska station purchased a threshing machine and threshed 870 bushels of grain, the larger part of which was oats. The next year the station threshed approximately 2,000 bushels of grain, and since that time oats have been threshed in the region every year. In 1930 two local farmers, A. A. Shonbeck and John Bugge, purchased a threshing machine and began growing oats for grain. (Fig. 1.) Results obtained at the sta-

tion show that early varieties can be depended on to ripen in this region. A number of farmers in the Matanuska Valley are now growing oats for grain and for hay. Dairy cows, hogs, sheep, and poultry are kept on several farms, and a large proportion of the crop produced is fed to them.

#### CLIMATE

Oats are well adapted to the comparatively cool growing season of the Matanuska and the Tanana Valleys. Only occasionally does the summer temperature rise above 90° F. at Fairbanks. In the Matanuska Valley the growing season is cooler than at Fairbanks, the temperature seldom rising above 80°.

In the Fairbanks region the last killing frost in the spring occurs in late May, and the first killing frost in the fall about the first of September. The frost-free period on south-slope land from 1908 to 1920, inclusive, averaged 96.9 days. The shortness of the growing season is partly compensated for by many hours of daylight. During June and July daylight is practically continuous.

The precipitation is light, the annual amount for an 18-year period averaging 11.2 inches. Profitable crop production with this small amount of precipitation is possible because the amount of evaporation is small. The average precipitation for the five months, May to September, inclusive, for the period 1908 to 1920, inclusive, was 7.22 inches. Occasionally drought causes a partial crop failure, but usually the rainfall during the early part of the season is sufficiently heavy to enable the crops to get a good start. Hot, dry weather during late July sometimes retards vegetative growth but has the distinct advantage of hastening maturity. Crops grown on newly cleared land may receive a considerable amount of moisture from the underlying stratum of ice. This gradually thaws after the moss covering is removed and the soil is exposed to the sun and cultivated. This frozen stratum, however, soon recedes to a depth from which the moisture can not rise by capillary action. The crop must then depend upon rain for moisture.

Summer frosts very seldom injure the oat crop. In the lowlands where the danger of frost injury is greater than on the highlands, the crop should be grown for hay or for silage. South-slope land is very desirable for growing oats for grain, as such exposure always hastens maturity.

The growing season in the Fairbanks region varies from hot and dry one year to cool and rainy the next. Usually, much cool rainy weather occurs in fall and interferes to a considerable extent with harvesting. The Alaskan farmer must be prepared to take advantage of all favorable weather if he would seed his crops early, harvest them in good condition, and fall plow the ground.

A condensed meteorological report for the Fairbanks station for the period July 1, 1911, to December 31, 1928,<sup>1</sup> is given in Table 1. The daily range in temperature for the same period is shown graphically in Figure 2.<sup>1</sup>

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<sup>1</sup> The stations gratefully acknowledge the cooperation of the Weather Bureau officials at Fairbanks and at Juneau, and the Fairbanks Exploration Co., in assembling and preparing this report for publication.



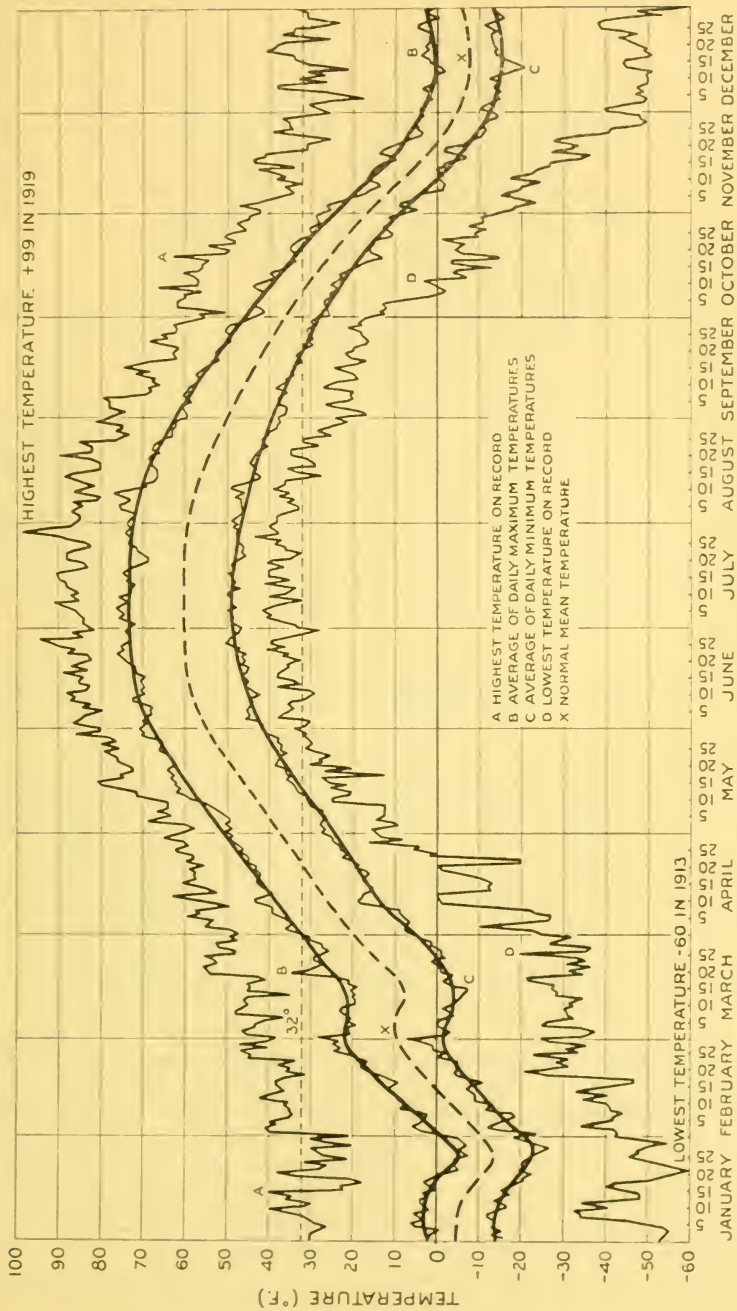


FIGURE 2.—Daily temperature range at Fairbanks from July 1, 1911, to December 31, 1928

TABLE 1.—Condensed meteorological report for the Fairbanks station for the period July 1, 1911, to December 31, 1928

Month	Temperature					Precipitation			Number of days—			
	Maximum	Minimum	Average daily maximum	Average daily minimum	Average daily mean	Average precipitation	Maximum in 24 hours	Average snow fall	Clear	Partly cloudy	Cloudy	With 0.01 inch or more precipitation
January.....	40	-60	-0.3	-17.7	-9.0	0.00	0.47	7.8	12	7	12	7
February.....	47	-47	12.6	-8.4	2.1	.50	.64	6.0	13	5	10	6
March.....	56	-38	24.4	-2.1	11.2	.91	.80	6.1	13	8	10	6
April.....	65	-27	42.4	16.8	29.6	.24	.41	2.0	13	9	8	2
May.....	86	9	60.3	33.8	47.0	.61	.80	.5	11	12	8	5
June.....	95	28	71.6	45.6	58.6	1.40	.93	0	9	12	9	10
July.....	99	32	73.1	48.3	60.7	1.94	1.31	0	10	11	10	11
August.....	90	21	68.1	43.6	55.8	1.68	1.01	.2	7	11	13	11
September.....	80	16	54.4	33.5	44.0	1.51	2.02	.7	5	10	15	10
October.....	67	-18	35.9	18.3	27.1	.72	.80	4.3	8	9	14	7
November.....	48	-54	12.4	-4.1	4.2	.48	.47	5.6	11	8	11	5
December.....	41	-59	1.5	-14.6	-6.6	.61	.48	8.1	12	7	12	7
Average annual.....			38.0	16.1	27.1	11.20	2.02	44.3	124	109	132	87

Table 2 gives the hours between sunrise and sunset at Fairbanks.

TABLE 2.—Number of hours between sunrise and sunset at Fairbanks

[Latitude 64° 51', longitude 147° 52'; 500 feet above sea level]

Month and day	Hour of sunrise	Hour of sunset	Time between sunrise and sunset	Month and day	Hour of sunrise	Hour of sunset	Time between sunrise and sunset
	<i>A. m.</i>	<i>P. m.</i>	<i>Hrs. min.</i>		<i>A. m.</i>	<i>P. m.</i>	<i>Hrs. min.</i>
Jan. 1.....	9.54	1.54	4 00	July 1.....	1.09	10.40	21 31
Jan. 15.....	9.28	2.34	5 06	July 15.....	1.51	10.03	20 12
Feb. 1.....	8.37	3.33	6 56	Aug. 1.....	2.50	9.04	18 14
Feb. 15.....	7.50	4.20	8 30	Aug. 15.....	3.37	8.14	16 37
Mar. 1.....	7.02	5.07	10 05	Sept. 1.....	4.31	7.12	14 41
Mar. 15.....	6.10	5.49	11 39	Sept. 15.....	5.13	6.21	13 08
Apr. 1.....	5.07	6.42	13 35	Oct. 1.....	6.01	5.22	11 21
Apr. 15.....	4.16	7.26	15 10	Oct. 15.....	6.43	4.30	9 47
May 1.....	3.18	8.19	17 01	Nov. 1.....	7.38	3.32	7 54
May 15.....	2.27	9.07	18 40	Nov. 15.....	8.26	2.45	6 19
June 1.....	1.32	10.06	20 34	Dec. 1.....	9.19	2.00	4 41
June 15.....	12.59	10.43	21 44	Dec. 15.....	9.52	1.40	3 48
June 21.....	12.56	10.50	21 54	Dec. 21.....	9.58	1.38	3 40

In the Matanuska Valley weather conditions are somewhat different from those in the Tanana Valley. Heavy rains, especially in the fall, cause oats to mature later at the head of Cook Inlet than is the case at Fairbanks. The growing season is considerably longer than in the Fairbanks region, the length of the frost-free period averaging around 114 days. Summer temperatures are slightly lower also, but summer frosts do not occur. The annual rainfall is normally about 14 inches. Much cloudy weather prevails during the growing season, especially in late summer and early fall, and may interfere with harvesting. Windy weather is common, and in some places soil blowing is a serious problem. Weather conditions in the spring usually are favorable for soil

preparation and for seeding. Dry weather in the spring may cause the seed to germinate slowly, but generally the soil contains sufficient moisture for the early growth of the crop. Oats for grain should be seeded as soon as possible in the spring if the crop is expected to mature early in the fall. Oats and peas for silage can be harvested when the weather is unfavorable for drying. A condensed meteorological report for the Matanuska station for the period January 1, 1917, to December 31, 1930, is given in Table 3.

TABLE 3.—Condensed meteorological report for the Matanuska station for the period January 1, 1917, to December 31, 1930

Month	Temperature			Average precipitation	Number of days—		
	Maximum	Minimum	Average daily mean		Clear	Partly cloudy	Cloudy
	°F.	°F.	°F.	Inches			
January.....	47	-34	12.0	0.81	12	5	14
February.....	59	-27	18.2	.70	12	5	11
March.....	54	-22	23.4	.68	13	6	12
April.....	63	-8	34.8	.53	11	8	11
May.....	76	22	46.7	.55	11	9	11
June.....	84	30	55.0	1.12	10	9	11
July.....	83	34	57.4	1.92	9	9	13
August.....	83	32	55.4	2.74	7	8	16
September.....	69	22	47.2	2.78	8	7	15
October.....	69	-2	36.0	1.63	7	8	16
November.....	57	-22	22.0	.76	9	7	14
December.....	53	-34	12.3	1.01	11	7	13
Annual.....			35.0	15.23	120	88	157

#### COMPARISON OF THE OAT-GROWING SEASON IN ALASKA AND IN SOME OF THE STATES

In a group of Southern States, the northern boundary of which runs through southern Maryland, central Tennessee, central Arkansas, and southern Oklahoma, oats are seeded in the fall, make their best growth in the early spring, and are harvested at the beginning of hot weather.<sup>2</sup>

In the Northern States, oats are seeded in the spring, make their best growth in the early summer, and are harvested before hot weather begins. Hot weather is favorable for the proper curing of the grain.

In Alaska the growing season is short. Oats are seeded in the spring, make their best growth during the warm summer, and are harvested at the close of the growing season in the fall. The weather is cool in the fall, and the process of curing is slow. In addition to the low curing temperature following harvesting, frequent cool drizzling rains and cloudy weather make it difficult to obtain oat hay and grain having a desirable white color.

#### SOILS

All unused land in Alaska which might prove to be suitable for grain growing is timbered and must be cleared. This work involves slashing trees, piling them in windrows, burning trees and moss when they are dry, and pulling up and removing stumps and roots. The

<sup>2</sup> WARRBURTON, C. W. WINTER OATS FOR THE SOUTH. U. S. Dept. Agr. Farmers' Bul. 436, p. 4. 1916.

cost of clearing depends upon the region, as some regions are much more heavily timbered than others. Usually, however, a heavy growth of timber indicates good agricultural soil. A good growth of birch and spruce, occasionally interspersed with cottonwood, is also indicative of good soil.

The soils in interior Alaska are comparatively new and supplied with little available plant food for the growing crop. Yields are poor for the first few years of cropping. The moss should be completely burned on such land, and the land should be plowed for the first time in the early summer but not seeded until the following spring. This method of procedure will aid in bringing the soil into a high state of productivity. Areas of new land on which the trees and stumps have been piled and burned give strikingly superior yields to adjacent unburned areas. Superior growth apparently is due to thorough burning of the moss, to the fertilizer supplied by the ashes, and finally to the warming of the soil by burning and thus to forcing the crop to some extent. Rotting stumps and logs also very probably enrich some areas which therefore make ranker growth than do others. Proper methods of cultivation aerate and warm the soil, favor nitrification and other beneficial bacterial action in the soil, and increase the immediately available plant food for the crop.

In the Fairbanks region the soil is frozen for approximately seven months of the year. Even during the growing season the soil temperature remains low as compared with that of regions farther south. There is little bacterial action for the greater part of the year because of the low prevailing temperature, a fact which partly explains the low fertility of the soils in this region. The soils vary from sand and sandy loam along the rivers, to silt loam on the slope land. The sandy soils of the lowlands are generally underlain with gravel. The best agricultural soil is the Fairbanks silt loam which is found on the slightly rolling uplands and is underlain with clay.

Conservation of soil moisture is important in interior Alaska. The farmer should manage his soil so that it will absorb and hold as much moisture as is needed for seed germination and for crop growth. Keeping the soil well supplied with humus and practicing fall plowing will aid much in these respects.

In the Matanuska Valley the land lies in a series of benches that extend back from the river. Most of these benches are comparatively level and therefore easy to cultivate. The prevailing type of soil is the Knik silt loam. It is similar to the Fairbanks silt loam and is well suited to agriculture. It is a medium light soil varying from yellow to brown and is underlain with gravel. A large part of the cultivated land has been continuously cropped with grain and with potatoes, and as a result the soil is becoming low in fertility.

#### ROTATION

The use of a systematic rotation is as essential to profitable crop production in Alaska as elsewhere. In a region where the soil is comparatively new and is frozen for approximately seven months of the year, the results from improved farming methods would be expected to be striking.

A good rotation scheme should include a cultivated crop and a leguminous crop. The cultivated crops grown in the Matanuska and

the Tanana Valleys are potatoes, and roots, such as turnips and beets. The leguminous crops that have done best are peas and vetch. Perennial legumes have not been found to be successful. A crop of peas should be plowed under, or the tops hogged off before it is plowed under, to maintain the humus content of the soil. A suitable 4-year rotation might include, in the first year, peas for plowing under or for hogging off; in the second year, potatoes, or root crops; in the third year, oats and vetch, or oats and peas for hay or for silage; and in the fourth year, wheat, oats, or barley for grain. Such a scheme requires the use of four fields of approximately equal size for four years. By using the Alaska variety of peas the farmer can grow his own pea seed and thereby considerably reduce the cost of production. Seed from the States is high in price. When grown under proper soil conditions, Alaska peas can be depended upon to mature seed in interior Alaska.

Bromegrass may be used when a pasture crop is needed in the rotation and should be seeded in the spring at the rate of 20 pounds per acre with a companion crop, such as wheat, barley, or oats. The grain should be more lightly seeded than usual in order to give the grass a good chance to grow. During the year of seeding the stand should be allowed to become well established. In the fall of the second year the sod, including a top growth 6 to 8 inches high, should be plowed under preparatory to seeding oats and vetch, or oats and peas, for hay and silage. Potatoes should not follow bromegrass sod, because they are likely to be damaged by wireworms. The hay or the silage crop should be followed by potatoes or by root crops, and these, in turn, by a grain crop, such as wheat, barley, or oats with which the grass is seeded. Five fields will be needed for such a rotation for five years.

#### GREEN MANURING

On many farms in interior Alaska the soil is too low in humus for profitable crop production. The soil is compact and difficult to cultivate, dries out quickly, and is low in available plant food. Such soil may be improved by plowing under a green-manure crop to add organic matter. Barnyard manure produced on the farm is usually needed for root crops and for the garden. Peas alone, or sown with oats, make excellent crops for plowing under. When sown with peas, only enough oats should be used to prevent the former from lodging.

A large proportion of the nitrogen found in leguminous crops comes directly from the air through the aid of nodule-forming bacteria on the roots; hence, nitrogen from the air is added to the soil when a leguminous crop is turned under. All the nitrogen utilized by nonleguminous plants is taken from the soil; hence, only that nitrogen that was originally in the soil is returned to it when a nonleguminous crop is plowed under.

The leguminous crop to be plowed under should be well inoculated with the proper kind of bacteria in order that it may take a maximum amount of nitrogen from the air. Most soils in interior Alaska are well supplied with the proper bacteria for peas. The farmer can readily determine whether or not his soil contains these bacteria by examining the roots of the pea plants. If the roots do not show a large number of nodules, the seed should be artificially inoculated. Pure culture inoculating material may be had free of charge from the

United States Department of Agriculture, Washington, D. C., or may be purchased from any reliable seedsman. In many instances the growth of both legumes and nodules is increased by application of lime and commercial fertilizers to the soil in which the plants are growing. Peas for green manure should be plowed under when they have made their maximum growth but are still green and succulent.

### COMMERCIAL FERTILIZERS

In the Fairbanks region the use of commercial fertilizers has been found to be profitable for oats under certain conditions. Among the factors governing the use of commercial fertilizer for oats are soil fertility, the scheme of rotation, and the cost of the fertilizer. In a rotation in which commercial fertilizer is used for potatoes preceding oats, the residual effect of the fertilizer very probably will make it



FIGURE 3.—Oats and vetch for hay

unnecessary to fertilize for oats. Likewise, when a green-manure crop, such as the pea, is plowed under, it will add a large amount of nitrogen to the soil.

A commercial fertilizer for use on oats for hay or for silage should be high in readily available nitrogen and should also contain some phosphorus and some potash. The phosphorus content of the fertilizer should be increased when the crop is to be grown for grain, as too much nitrogen tends to retard ripening. From 200 to 400 pounds of fertilizer per acre may be applied to oats, depending on the concentration of the fertilizer and on soil conditions.

In the Matanuska Valley, as in the Fairbanks region, commercial fertilizers may be used profitably for oats in some instances. Land that has become generally low in natural fertility by continuous cropping with grain and with potatoes markedly responds to treatment with fertilizers containing available plant nutrients.

Proper cultural methods and a good crop rotation should accompany treatment with commercial fertilizers. Proper soil management will enhance the value of the fertilizer and result in increased yields.

## VARIETIES

The Alaska stations have been largely concerned with the introduction and the development of early varieties of small grains. Earliness is an important factor, because the season is always short and oats for grain must mature in approximately 90 days. Canadian, the variety recommended for the Fairbanks region for grain or for growing in combination with vetch (fig. 3) or with peas for hay and silage, is a high-yielding white oat that can be depended on to mature under favorable conditions. This variety was introduced into Alaska by the stations, from California in 1914. Tests over a number of seasons have proved it to be a high yielder and well adapted to Fairbanks. Table 4 gives the results of a 4-year variety test with oats at the Fairbanks station.

TABLE 4.—Results of varietal tests of oats at the Fairbanks station for the period 1926–1929, inclusive

Variety	Length of time from—									
	Seeding to heading					Heading to ripening				
	1926	1927	1928	1929	Average	1926	1927	1928	1929	Average
	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>
Hybrid No. 25a.....	43	41	53	49	47	44	21	32	52	37
Kanota.....	42	42	53	48	46	46	28	35	45	39
Kherson (white).....	42	42	53	49	47	47	26	35	44	38
Kherson (yellow).....	43	42	53	49	47	46	26	35	44	38
Canadian.....	45	43	56	52	49	46	27	32	44	37
Hybrid No. 25.....	43	41	53	49	47	46	22	32	58	40
Twentieth Century.....	44	43	56	55	50	47	27	37	46	39
Wisconsin Wonder (Wisconsin No. 1).....	(1)	43	57	59	53	(1)	25	33	52	37
Leader.....	50	46	58	59	53	41	24	35	52	38
Alaska Black.....	50	45	59	60	54	41	25	36	51	38
State Pride (Wisconsin No. 7).....	47	43	57	59	52	44	27	41	52	41
Victory.....	(1)	44	58	(2)	(2)	(1)	26	37	(2)	(2)
Heavyweight.....	44	44	56	(2)	(2)	47	26	42	(2)	(2)

Variety	Length of time from seeding to ripening					Yield of grain per acre				
	1926	1927	1928	1929	Average	1926	1927	1928	1929	Average
	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Days</i>	<i>Bu.</i>	<i>Bu.</i>	<i>Bu.</i>	<i>Bu.</i>	<i>Bu.</i>
Hybrid No. 25a.....	87	62	85	101	84	54.7	20.0	28.1	48.8	37.9
Kanota.....	89	70	88	93	85	51.2	20.0	24.8	53.6	37.4
Kherson (white).....	89	68	88	93	85	52.5	32.5	30.9	53.8	42.4
Kherson (yellow).....	89	68	88	93	85	53.6	28.7	32.5	52.5	41.8
Canadian.....	91	70	88	96	86	67.5	36.2	31.5	63.8	49.8
Hybrid No. 25.....	89	63	85	107	86	23.4	25.0	23.5	53.7	31.4
Twentieth Century.....	91	70	93	101	89	71.2	28.7	37.7	68.1	51.4
Wisconsin Wonder (Wisconsin No. 1).....	(1)	68	90	111	90	(1)	37.5	38.6	71.8	49.3
Leader.....	91	70	93	111	91	77.5	33.7	37.3	73.4	55.5
Alaska Black.....	91	70	95	111	92	65.0	28.7	35.9	68.9	49.6
State Pride (Wisconsin No. 7).....	91	70	98	111	93	68.7	40.0	36.5	77.2	55.6
Victory.....	91	70	95	(2)	(2)	(1)	32.5	40.0	(2)	(2)
Heavyweight.....	91	70	98	(2)	(2)	(2)	(2)	(2)	(2)	(2)

<sup>1</sup>Data not available.

<sup>2</sup>Did not ripen.

The varieties are listed in order of earliness. The number of days from seeding to ripening ranged from 84 for Hybrid No. 25a to 93 for State Pride (Wisconsin No. 7). Victory and Heavyweight ripened in 1926, 1927, and 1928, but failed to ripen in 1929. The number of days from seeding to heading varied from 46 to 47 for the earlier varieties to 52 to 54 for the later varieties. The number of days from heading to ripening ranged from 37 to 41.

Hybrid No. 25 made an average yield of 31.4 bushels. Canadian yielded at the rate of 49.8 bushels per acre, which is somewhat less than were the yields of Twentieth Century, Leader, and State Pride (Wisconsin No. 7). However, because Canadian is considered earlier than any of the three higher-yielding varieties, it is recommended in preference to them for this region. Bushel-weight determinations made in 1929 showed Canadian to be heavier than any other hulled



FIGURE 4.—Shadeland Climax (Swedish Select) variety of oats at the Matanuska station

variety, or 43 pounds per bushel. Hybrid No. 25a weighed 32 pounds per bushel, which was the lightest weight. The two hull-less varieties Disco and Hybrid No. 51 weighed 46 and 45 pounds per bushel, respectively.

The season of 1927 was hot and dry, and the effect upon the oat varieties is clearly shown in the data for that year. The number of days from seeding to heading ranged from 41 to 46 as compared with the 4-year average from 46 to 54. The yields were materially reduced and ranged from 20 bushels for Hybrid No. 25a and Kanota to 40 bushels for State Pride (Wisconsin No. 7).

The varieties Leader for hay and silage and Shadeland Climax (Swedish Select) and Canadian for grain are recommended for the Matanuska Valley. Shadeland Climax (Swedish Select) is an early,



large-grained, white oat and has consistently produced large yields of well-matured grain at the Matanuska station. (Fig. 4.) It compares well with the Canadian variety in earliness and in yield. Leader is a later variety but is suitable for mixing with vetch or with peas for hay and silage. It is a tall, leafy side oat, and can not be depended on to ripen except during very favorable seasons. The Shadeland Climax (Swedish Select) and Canadian varieties are more desirable for all purposes, because by reason of their earliness they enable the farmer to grow his own grain seed. Oat seed from the States is costly and should not be shipped in except in emergency.

#### SEED-BED PREPARATION

Careful preparation of the seed bed is essential for profitable oat production in Alaska. The method of preparation to be used depends on the length of time the land has been under cultivation and on the character of the soil. Newly cleared land under preparation for the first time should be plowed not more than 4 inches deep in the early summer preceding the year of seeding. There should be no further cultivation until the following spring, when the land should be thoroughly disked and harrowed. Exposure of new land to action of the air makes it sufficiently porous to absorb and hold a large amount of moisture, improves the tilth, and increases the supply of available plant food. Especially designed brush plows are very satisfactorily used on new land. All stumps and roots that remain after plowing should be collected and burned. During subsequent years the ground should be plowed to a depth of at least 8 inches.

Fall plowing is more desirable than spring plowing in interior Alaska except where the soil is very light, or the topsoil is likely to be blown away by the wind. Soil blowing by the wind is a serious problem in certain parts of the Matanuska Valley. Land that is exposed to strong winter winds should not be plowed in the fall. This precaution is important, more especially when the soil lacks moisture in the fall and therefore can not freeze to any depth. When well stored with moisture, fall-plowed land freezes to such a depth that only a minimum amount of soil is blown away by the wind. In the Fairbanks region soil blowing does not occur to any great extent. Fall plowing puts the soil in condition to absorb a large amount of moisture from melting snows in the spring, permits of rapid seed-bed preparation, and enables the farmer to seed his crops earlier than would otherwise be the case. Fall-plowed land settles during the winter and becomes firm. A firm seed bed is free from large air spaces and can more easily be worked than spring-plowed land. Fall plowing must be done before the first week in October, else the ground will have frozen too hard for plowing. Fall plowing with tractor power at the Fairbanks station was found to cost approximately \$2.75 per acre.

In the spring the seed bed for oats should be thoroughly prepared by disking and harrowing. A desirable seed bed is loose and mellow on the surface, but firm beneath. Loosening the soil too deeply in the spring hastens evaporation and causes the seed to germinate poorly. Light sandy soils may be prepared in the spring by thoroughly disking and harrowing. Such soils, however, should occasionally be plowed in the spring.

## GERMINATION TESTS

Oat seed should be tested for germination before it is planted. The test is simple and requires little time. A number of methods may be used satisfactorily. Probably the plate method is the most practical for the farmer. In this method 100 seeds, including good, bad, large, and small to give a representative sample, are placed between squares of moistened blotting paper on a plate. Another plate is placed over the lower one to keep the paper from drying out too quickly. The plates are put in a warm room at a temperature of 70° F., and the blotting paper is kept well moistened. Too much water should not be used because the seed needs air. Every test should be made in duplicate. In the course of a few days the seed will have sprouted sufficiently to show its germinating strength. Since 100 seeds are used in the plate test, the number showing strong germination may be considered to be equivalent to the percentage of seed germinating.

The stations have conclusively shown that oats for seed may be kept in an unheated granary during the winter without being injured by frost. Seed of the recommended varieties has been successfully overwintered at the stations for many years. However, the grain must be dry if it is expected to withstand the extremely low temperatures of the winter in the Fairbanks region. Early seeding, early harvesting, and promptly drying and threshing the crop during favorable weather are indispensable factors in maintaining a low moisture in the seed. In unfavorable seasons oats for seed should be harvested before it is fully ripe so that it may dry sufficiently to overwinter well. To determine how soon after blooming grain can be harvested and whether such grain can be depended upon to germinate in the spring, the Fairbanks station in 1924 tested a series of heads of oats selected at 5-day intervals.<sup>3</sup> The results indicated that oats cut 10 days before maturity will give a high rate of germination the following spring provided that the seed is properly dried before freezing weather begins in the fall. When the season is backward and the grain is in danger of being injured by frost, the farmer should harvest his oat crop before it matures, cure it properly, and store it in a dry place. In this way he may save enough seed for planting the following spring.

## SMUT CONTROL

Smut is the only disease of oats of economic importance in Alaska at present. Oats for seed should be treated for smut even when the grower is almost certain that the seed is free from smut. The use of a formaldehyde solution is recommended for the purpose. In a test at the Fairbanks station in 1925, formaldehyde was the only one of a number of different kinds of treatment that effectively controlled smut. Spraying the oats with formaldehyde has been satisfactorily tried for many years.<sup>4</sup> Equal parts of formalin (40 per cent commercial formaldehyde) and water are mixed and sprayed on the seed with a hand sprayer of 1-quart capacity. The grain is thoroughly turned during the sprinkling to expose all the seed to

<sup>3</sup> GEORGESEON, C. C. REPORT OF THE ALASKA AGRICULTURAL EXPERIMENT STATIONS. Alaska Agr. Expt. Stas. Rpt. 1924 : 22-23. 1926.

<sup>4</sup> GEORGESEON, C. C. Op. cit. (See footnote 3.) ——— REPORT OF THE ALASKA AGRICULTURAL EXPERIMENT STATIONS. Alaska Agr. Expt. Stas. Rpt. 1925 : 22. 1927.

treatment. Each shovelful is given a thorough spraying. A dirt shovel of oats requires only one stroke of the sprayer, whereas a scoop shovel of oats requires four strokes. The oats should be piled immediately following spraying, covered with canvas or similar material, let stand for four hours, and then seeded. When the formaldehyde treatment is used the operator should take care not to let the fumes irritate his nose and eyes. Spraying offers an advantage over immersing the seed in a weak solution of formaldehyde, because it does not cause the oats to swell, and they can be seeded at once, as is done with dry, untreated oats. The treatment does not lessen vitality.

### SEEDING

#### TIME OF SEEDING

The importance of early seeding of oats in this region can not be overemphasized. This is true especially when the crop is to be grown for grain. Because of the short growing season the farmer should make every effort to get his oats seeded as soon as the weather warms up in the spring. Oats for hay or for silage may be harvested later, but those grown for grain should be seeded as early as possible to enable the resultant crop to be harvested before time for fall plowing.

On land that has been fall plowed, the seed bed may be prepared quickly in the spring by disking and harrowing, and the oat crop seeded without delay. The work of overhauling machinery, and seed testing for germination and treatment for smut control should be attended to during the winter or the early spring, so as not to delay seeding. The earlier seeding is done in the spring, the earlier the crop can be harvested. Grain that is harvested late in the fall dries very slowly and is likely to be damaged by rains or by frost.

At the Fairbanks station in 1915 spring grain was planted in the fall, just before the ground froze, to determine whether the seed would germinate early in the spring.<sup>5</sup> The experiment was tried as the result of finding occasional excellent stands of volunteer grain in the early spring. Most of the seed was found to have rotted in the ground in the fall; the rest gave only a small percentage of germination in the spring. Fall seeding of spring grain can not be recommended.

#### RATE OF SEEDING

The proper rate of seeding oats in Alaska depends upon the use to which the crop is to be put, and upon soil conditions and size and vitality of seed. The Canadian and Climax varieties for grain should be seeded at the rate of 3 bushels per acre. Rate of seeding varies somewhat with different conditions. Grains that are large and heavy should be seeded at increased rates in order that the right number of seeds may be planted per acre. The rate of seeding should be increased also when germination tests show the seed to be low in vitality. In fields seeded with a mixture of oats and peas for silage, 2 bushels of oats should be used to every 2 bushels of peas per acre. A mixture of oats and vetch in the ratio of 3 bushels of oats and 10 pounds of vetch should be seeded per acre when the crop is intended for hay.

<sup>5</sup> GEORGESEON, C. C. REPORT OF THE ALASKA AGRICULTURAL EXPERIMENT STATIONS. Alaska Agr. Expt. Stas. Rpt. 1915 : 14, 46. 1916.

The farmer should carefully calibrate his drill so that it will sow the requisite amount of seed per acre. Calibration may be easily done by placing some seed in the drill box, raising one wheel of the drill, giving the wheel a definite number of turns, and then measuring the amount of seed fed for the number of turns given the wheel. Provided the circumference of the wheel and the width of the drill are known by the grower, the fractional part of an acre represented by the particular number of turns can be determined. After a few trials the drill can be made to sow the amount of seed desired per acre.

During the winter oats for seed should be run through a fanning mill to cleanse it of chaff, weed seeds, and other foreign material. Well-cleaned seed will efficiently feed through the drill and assure protection of the crop against weed competition.

#### METHOD OF SEEDING

Oats should be seeded with a grain drill because it distributes the seed evenly at a uniform depth, enables it to germinate quickly, and gives a uniform stand. "Cultipacking" should immediately follow drilling. The proper depth of seeding depends on the character of the soil in which the crop is to be grown. In heavy clay soils having a tendency to remain cold, the seed should be sown rather shallow or to a depth of about 1 inch. In ordinary loam soils containing a good supply of humus, the depth of seeding should be about  $1\frac{1}{2}$  inches. In loose sandy soils that have a tendency to dry out, the seed should be sown 2 inches deep.

#### HARVESTING

In interior Alaska the oat crop is usually harvested from August 15 to September 15, the date depending on weather conditions and on the purpose for which the crop is grown. Weather conditions during late summer and early fall usually are unfavorable for drying; hence, the farmer must be ready to take advantage of any good weather to harvest in good condition oats intended for hay or grain. On the other hand, oats grown in combination with peas for silage may be harvested during rainy weather, if necessary.

Oats for grain should be dried in the field in small, uncapped shocks consisting of six to eight bundles. (Fig. 5.) As soon as it is sufficiently dry, the crop should be stacked either in the open or under a shed. (Fig. 6.) If the crop is to be stacked in the open the top should be protected with waterproof canvas. Occasionally favorable weather permits threshing from the shock.

Oats for hay should be cut with a grain binder, if possible, when the kernels are in the medium dough stage. The crop can then be dried in small, uncapped shocks consisting of six to eight bundles. This method is much quicker and less expensive for drying and handling than is that of cutting with a mower, and usually it results in a hay of much better quality. Vetch, seeded in the proper proportion with oats, will not interfere with this method of harvesting.

Hay crops when cut with a mower should be dried in tall, narrow cocks. This type of cock is made by piling the material on thin peeled stakes that have been sharpened at both ends, capped at the top, and then firmly driven about 14 inches into the ground. A nail

driven through the stake about 12 inches above the ground will help to hold the lower layer of material off the ground. This will prevent molding and allow air to circulate freely through the mass.

#### WEED CONTROL

Control of weeds by proper crop management is as essential for profitable crop production in Alaska as elsewhere. The most trou-



FIGURE 5.—Oats in shock



FIGURE 6.—Stacking shed

blesome weeds in the interior are lamb's-quarters (*Chenopodium album*), chickweed (*Alsine media*), wild buckwheat (*Polygonum convolvulus*), and horsetail (*Equisetum arvense*). These weeds can be controlled by the use of a judicious rotation containing a cultivated crop and a hay and a silage crop, by preventing the spread of weed seeds in barnyard manure, and by using only thoroughly cleaned seed.

On land that is foul with lamb's-quarters, planting should be delayed until a number of cultivations have been given at regular intervals in the spring. The first cultivation should be made as early as soil conditions permit. A second cultivation should be given as soon as weeds emerge following the first cultivation. In fact, cultivation should be frequent to destroy as many weeds and weed seeds as possible. Oats even when planted late on such fields produce fair hay and silage crops. In some cases a smother crop such as buckwheat, or a sod crop such as bromegrass, may be grown to advantage. Spraying with calcium chlorate may be effective on small areas infested with quackgrass. The cost of calcium chlorate, however, practically prohibits its use on large areas.

#### RABBIT INJURY

Occasionally rabbits are destructive to oats as well as to other crops. Fortunately, they make their appearance in great numbers only at intervals of approximately 7 to 10 years. When present in great numbers they cause heavy losses in local fields and gardens and destroy all crops that are not protected by a woven-wire fence. Rabbit-proof fences for the protection of the oat crop would in most instances be too expensive for practical purposes. Rabbits caused much damage to crops in 1913, and again in 1924. In 1929, 1930, and 1931 the number was practically negligible in both the Tanana and the Matanuska Valleys.

#### SUMMARY

The Matanuska Valley and the Fairbanks region of the Tanana Valley are the principal oat-producing areas. The crop is grown chiefly for hay, although a small area is threshed annually. In 1930 approximately 300 acres in the Matanuska Valley and 200 in the Fairbanks region were seeded with oats.

Weather conditions in southeastern Alaska and in the Kenai region are unfavorable for maturing oats. At Copper Center summer droughts and frosts are the limiting factors in oat growing. At Rampart, Fairbanks, and Matanuska, weather conditions are more favorable than elsewhere in Alaska, and certain early varieties can be successfully matured at these places.

Rainy weather in the fall interferes with harvesting in the Fairbanks and the Matanuska regions, and farmers find it necessary to take advantage of the few clear days prevailing during this season to harvest the crop in good condition.

Good soils for oat growing are to be found in the Matanuska, Yukon, and Tanana Valleys. The soils of the interior are comparatively new, and frequently give low yields for the first few years following clearing. Proper cultural methods, including green manuring and crop rotation, are essential for the successful maintenance of soil fertility and for weed control.

Essentials for successful oat production include use of early varieties, careful preparation of the seed bed, germination tests and treatment of the seed for smut control, early seeding, proper rate and method of seeding, control of weeds, and harvesting at the right time.



