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Oats Production in Western Oregon

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS

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SUMMARY

Oregon produces from 200,000 to 300,000 acres of oats for grain and approximately 200,000 acres of oats for hay. Western Oregon produces about 85 percent of the total oat crop for grain and almost all of the oat hay.

The oat and wheat acreage of Western Oregon has declined during the past ten-year period, and the barley acreage has increased.

Oats are adapted to cool, moist growing conditions. Oats will produce better than wheat or barley on most of the cold, heavy, wet soils of Western Oregon. Because much of the oat crop is grown on land too poor to produce wheat and barley profitably, the average yield of oats is low.

Oats will produce good yields on fertile soils.

The climatic conditions in Western Oregon are favorable to the production of winter oats. Winter oats will usually outyield spring oats.

The seed-bed for fall-planted oats should not be too finely pulverized, as the heavy soils will tend to become too compact during the winter. Plowing may be done before or after the first fall rains, but best results are obtained from fairly early plowing. For spring-planted oats the plowing should be done as early as weather conditions permit. If plowing must be delayed until late spring, disking early in the spring is desirable. Thorough cultivation of the spring seed-bed is recommended.

Smut is the most injurious disease of oats in Oregon. Oats should always be treated before planting. The liquid formaldehyde treatment is recommended. Dust treatments with Ceresan and Smuttox show considerable promise.

Rust is the most destructive oats disease in the Coast area. The production of resistant varieties is suggested as the best method of reducing losses from rust.

Weeds seriously reduce yields and quality of oats. Weed infestation can be reduced by using clean seed, good tillage methods, and crop-rotation systems.

Oregon grows too many oat varieties. A variety survey of the 1929 crop showed 37 varieties grown in Oregon. Victory, Three Grain, and Eclipse are the highest-yielding spring-oat varieties in the oat-variety trial at Corvallis. These three varieties could well replace most of the other spring-oat varieties now being grown in Western Oregon. Gray Winter is the only recommended winter-oat variety. In the north Coast area, Gray Winter gives the highest yields from both fall and spring planting.

The oats produced in Western Oregon are of a good quality and high test weight. The average test weight of the better spring-oat varieties is about 37 pounds per bushel; of Gray Winter oats, about 40 pounds per bushel.

Analyses of spring-oat varieties grown in different years and on different soil types show few significant differences in composition. Victory has a lower crude-fiber content and a slightly higher total energy value than Three Grain or Eclipse.

The winter-oat varieties have a significantly higher energy value than the spring oats. They are much lower in crude fiber and higher in total fat. Analyses indicate that the feeding value of Gray Winter oats is approximately 10 percent greater than the average spring oats.

Large quantities of oats are used for milling purposes. Good milling oats should be plump, well filled, and have a low percentage of hull. Millers using a precooking process object to oats with a high fat content.

Oats Production in Western Oregon*

By

D. D. Hill

THE IMPORTANCE OF OATS

Oats have long been an important crop in Oregon. Next to wheat, they are the most widely grown cereal in the state. During the past forty years from 200,000 to 300,000 acres of oats have been harvested for grain each year, and in addition a like amount has been grown for hay purposes.

Western Oregon the important oat area. The acreage devoted to oats in the various counties for the period 1889 to 1929 is shown in Table I. This Table is so arranged that the total acreage for Western Oregon and for Eastern Oregon is given separately. The western part of the state is the most important oat-producing area with approximately 85 percent of the total acreage. Most of the oats produced east of the Cascade Mountains are produced in irrigated sections, mainly in Baker, Union, and Wallowa counties. Only a small acreage of oats is grown on the dry lands of Eastern Oregon, as wheat and barley are much better adapted to production there.

Oat acreage declining. As shown in Table I, the peak of oat production was reached in Oregon about 1909. The census report for that year shows a total acreage of 339,162 acres of oats harvested for grain. Production declined steadily until in 1929 only 213,944 acres of oats were harvested for grain. In addition to the oats harvested for grain, about 200,000 acres are grown in Western Oregon each year for hay purposes. A large area is sowed alone although a substantial acreage is winter oats planted as a companion crop with vetch or peas for forage or for seed.

Oats important for hay and forage in Coast counties. The oat acreage of the Coast counties as shown by Table I is rather misleading, as oats are mainly used for hay, silage, and green feed, either alone or in combination with vetch or peas. Accurate data are not available as to the exact acreage of oats grown for these purposes, but such acreage constitutes an important part of the total. Data on hay and forage production in five Coast counties—Clatsop, Tillamook, Lincoln, Coos, and Curry—are presented in Table II. In 1919, 45,000 acres were devoted to hay and forage production and 23,000 acres to the production of cultivated hay, of which 14,000 acres was grain hay consisting mainly of oats. By 1929, the production of cultivated hay had increased to approximately 43,000 acres, and it is assumed the proportion of grain hay remained about the same. This would mean the production of approximately 26,000 acres of grain hay in these counties. This figure more nearly represents the importance of oats in this section than the 734 acres cut for grain as reported in Table I.

*Credit is due C. C. Ruth, who was in charge of the oat experiments from 1922-1926, for data presented in this Bulletin. Acknowledgment is also made to Professor G. R. Hyslop for earlier data and for assistance in the preparation of this Bulletin.

TABLE I. OATS PRODUCTION IN OREGON BY COUNTIES

County	1890	1900	1910	1920	1930
	Acres	*Acres*	*Acres*	*Acres*	*Acres*
Benton	12,929	16,690	18,532	14,602	10,196
Clackamas	13,902	8,100	24,533	26,732	20,964
Clatsop	225	321	612	534	415
Columbia	316	862	1,231	2,314	1,806
Coos	792	630	556	470	128
Curry	478	277	281	112	.....
Douglas	14,937	16,948	14,593	10,185	6,219
Jackson	2,712	2,021	686	665	997
Josephine	1,387	1,284	544	690	569
Lane	20,393	24,734	27,288	20,116	15,514
Lincoln	.....	186	469	963	191
Linn	37,299	39,438	49,756	49,735	34,546
Marion	33,710	41,137	52,337	41,856	35,406
Multnomah	1,289	2,687	3,119	3,649	2,239
Polk	16,368	20,590	31,091	25,395	17,454
Tillamook	134	460	.....	.....	.....
Washington	16,203	21,059	29,358	26,204	21,226
Yamhill	22,819	24,126	28,231	27,148	16,536
Total (Western Oregon)	195,893	221,550	283,217	251,910	184,406
Baker	2,633	4,431	11,279	6,439	6,558
Crook	945	1,562	5,633	826	1,048
Deschutes	.....	.....	.....	927	1,007
Gilliam	754	448	615	322	183
Grant	702	569	2,000	655	1,098
Harney	484	264	2,305	549	2,816
Hood River	.....	.....	25	231	136
Jefferson	.....	.....	.....	731	62
Klamath	1,013	1,044	2,823	3,308	2,122
Lake	185	90	421	252	242
Malheur	548	462	1,523	1,032	1,796
Morrow	865	590	204	95	119
Sherman	315	1,718	2,279	1,329	316
Umatilla	2,946	2,005	1,077	795	578
Union	9,455	11,747	16,087	8,943	6,869
Wallowa	1,323	1,967	5,751	4,890	3,452
Wasco	1,215	2,424	3,364	1,163	583
Wheeler	.....	274	559	295	103
Total (Eastern Oregon)	23,383	33,556	55,945	32,782	29,088
Total (State)	219,276	255,106	339,162	284,152	213,944

TABLE II. HAY AND FORAGE PRODUCTION IN FIVE COAST COUNTIES IN 1919 AND 1929

County	Total hay and forage, 1919	Total cultivated hay, 1919	Grain hay 1919	Total cultivated hay, 1929
	Acres	*Acres*	*Acres*	*Acres*
Clatsop	4,863	3,294	768	6,028
Coos	16,155	6,134	6,020	13,440
Curry	4,629	2,081	2,011	4,008
Lincoln	8,701	4,162	3,274	8,384
Tillamook	10,994	7,565	2,050	11,017
Total	45,342	23,236	14,123	42,877

Shift in cereal acreage. A comparison of the acreage devoted to cereals in both Western and Eastern Oregon is given in Table III. This Table shows a declining oat acreage in Western Oregon from 1909 to the present time and an increase in wheat acreage to 1919. Since then there has been a pronounced decline in wheat and a steady increase in the acreage of barley.

The total acreage devoted to cereals in 1929 is only slightly less than that grown in 1909. In Eastern Oregon both the oat and barley acreage has declined, while the wheat acreage has increased steadily. The total acreage devoted to cereals in Eastern Oregon was approximately 200,000 more in 1929 than in 1909.

TABLE III. CEREAL ACREAGE IN OREGON

Cereal	1909	1919	1929
Western Oregon	*Acres*	*Acres*	*Acres*
Oats	283,217	251,910	184,406
Wheat	137,278	261,748	175,564
Barley	10,405	13,736	39,891
Total	430,900	527,394	399,861
Eastern Oregon			
Oats	55,945	32,782	29,088
Wheat	625,411	766,108	896,413
Barley	98,442	52,855	45,459
Total	779,798	851,745	970,960

THE ADAPTATION OF OATS

Oats adapted to cool, moist climatic and soil conditions. The general adaptation of oats is to a cool growing season with sufficient moisture at certain periods in the growth of the plant, particularly during heading. Certain types and varieties of oats are adapted to growth under rather warm, dry conditions, but the highest yields of the best quality of oats are obtained from temperate-season varieties grown in the northern states. Neither the early-maturing oats usually grown in warm climates nor the late spring oats suited to cool, moist areas produce as good average yields in Western Oregon as the mid-season type. Oats have a higher water requirement than either wheat or barley. They use more water in the production of a pound of dry matter and consequently are not so well adapted to growth under arid conditions.

The oat crop is generally considered to be less sensitive in its feeding habits than either wheat or barley. The ability of oats to grow on the cold or heavy, poorly drained lands is responsible in part for the extensive production of oats in Western Oregon. There are thousands of acres of soil in this part of the state that will produce oats more satisfactorily than either wheat or barley.

Another important factor responsible for the large acreage of oats in Western Oregon is the relatively mild winter climate. The climate in Western Oregon is such that winter oats can be grown satisfactorily. As winter oats are less winter hardy than winter wheat, it is only in regions of mild winters that they can be grown successfully. The yield of winter oats is relatively high in comparison with spring oats and the feeding value is usually excellent. As winter-oat production takes place during the moist winter and spring period, the crop is usually mature before the summer dry period has set in.

SOIL

Oats adapted to many soil types. The oat crop is less particular in its soil requirements than either wheat or barley. Most of the soils in Western Oregon will produce oats and many of them will produce oats to much better advantage than any other cereal. Although the highest yield of oats is produced only on the best soil, there are large acreages of poor soil devoted to the production of this crop. Many of the heavy, low-lying poorly drained soils of Western Oregon are devoted to oat production mainly because satisfactory yields of other crops can not be obtained. In general, the heavy soils which are fairly retentive of moisture are best adapted to oat production. On the better drained, more fertile soils, wheat and barley often produce higher yields than the oats. Oats usually should not be grown on light sandy soils that dry out early, as other crops will usually produce more under those conditions. Good crops of oats can be produced, however, on sandy river-bottom land where there is sufficient moisture and where the crop is planted early. For the entire Western Oregon section, soil conditions are usually not a limiting factor in oat production.

The adaptation of oats to the different soil types is shown in Table IV. Yields of the highest-yielding spring variety of oats, barley, and wheat are given. Victory oats is high yielding for all three soil types. Hannchen barley and Huston wheat are high yielding on the Amity and Willamette series; while O. A. C. No. 7 barley and a selection of Red Chaff wheat are highest yielding on the Chehalis series. The Amity series is a heavy, silty clay soil known locally as half-white land. The Chehalis is a sandy, river-

TABLE IV. YIELDS IN POUNDS PER ACRE OF OATS, BARLEY, AND WHEAT SPRING PLANTED UNDER DIFFERENT SOIL CONDITIONS AT CORVALLIS

	Amity Series 1920-1929	Chehalis Series 1927-1930	Willamette Series 1930
Oats	1,400	2,169	2,099
Barley	1,342	2,136	2,092
Wheat	1,141	2,262	1,788

bottom soil, and the Willamette is good upland loam soil. The oats are consistently high yielding on all three of these very different soil types, as shown by the yields reported. The relatively high yields of both of the Amity series and the relatively lower yields on the Chehalis series support the recommendation to grow oats on the heavy soils and barley or wheat on the more mellow types.

Yields of oats, wheat, and barley obtained from the cereal variety trials on the Experiment Station at Corvallis show most varieties of oats to be less sensitive to changes in soil type than wheat or barley. Table V gives the relative yielding ability of seven wheat varieties, five barley varieties, and three oat varieties grown on two different soil types at Corvallis. Wheat yields are expressed in percentages of the yield of Huston wheat, the barley yields in percentages of Hannchen barley, and the oat yields in percentages of Victory oats. Marquis and Huston wheat are the highest-yielding wheat varieties on the Amity soil, but on the Chehalis soil they are the lowest yielding of the varieties reported. The two highest-yielding

varieties on the Chehalis soil rank only third and fourth on the upland soil. Likewise, O. A. C. No. 7 and Ben Beardless barley, which are the two highest-yielding varieties on the Chehalis soil, are the two lowest yielding on the Amity soil. In contrast to the yields of wheat and barley, the three high-yielding oat varieties have the same relative position on both soil types and practically the same percentage yield. There may be other oat varieties that will react differently to the different soil conditions, but the high-yielding varieties tested thus far indicate less difference than for wheat and barley.

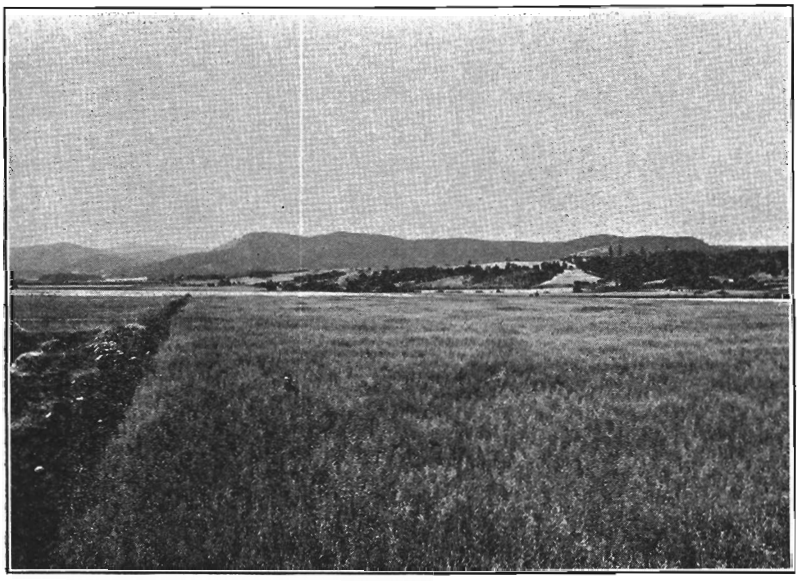

Figure 1. A field of Victory oats growing on the Experiment Station at Corvallis.

Low average oat yields due to unfavorable conditions. The average yields of oats, barley, and wheat produced in Western Oregon are given in Table VI. For purposes of easy comparison, yields are given in pounds per acre. Separate average yields of winter and spring wheat are not available for 1924, 1925, and 1929; hence the average yield of all wheat is given instead. The average yield of oats, which includes both winter and spring forms, is lower than for winter wheat and barley, but higher than for spring wheat. These average yields support the statement that oats production often is confined to the poorer soil and wheat and barley to the better soil. Because much of the oats acreage is on wet soil that can not be prepared early, the oat crop is seeded too late for best results. The relatively high yields of oats on three soil types as reported in Table IV indicate good yielding ability in comparison with other cereals when grown under favorable conditions.

SEED-BED PREPARATION

Finely pulverized seed-bed unnecessary for fall planting. The seed-bed preparation for oats is about the same as for the other small grain crops. When winter oats are to be seeded following a row crop such as corn, beans, or potatoes, a good seed-bed can be prepared by disking. Plowing usually is necessary where oats follow fall wheat or barley or any other uncultivated field crop that has stood through the winter. When winter

TABLE V. RELATIVE YIELDS OF CEREAL VARIETIES GROWN ON TWO SOIL TYPES
1927-1930

Cereal varieties	Amity Series	Rank	Chehalis Series	Rank
	Percentage of Huston			
Wheat varieties	%		%	
Huston	100.0	2	100.0	6
Marquis	104.7	1	98.5	7
Federation	81.0	7	107.0	4
Zimmerman	88.0	5	101.6	5
Red Chaff Selection No. 12	87.5	6	112.8	3
Red Chaff Selection No. 16	91.7	3	114.4	1
Red Chaff Selection No. 154	89.9	4	113.3	2
	Percentage of Hannchen			
Barley varieties	%		%	
Hannchen	100.0	1	100.0	3
O. A. C. No. 7	84.1	4	107.7	1
Ben Beardless	83.8	5	104.8	2
Trebi	89.8	2	83.0	4
Peruvian	86.5	3	75.8	5
	Percentage of Victory			
Oat varieties	%		%	
Victory	100.0	1	100.0	1
Three Grain	95.0	2	95.6	2
Madrid	93.3	3	90.8	3

TABLE VI. AVERAGE YIELDS OF WHEAT, OATS, AND BARLEY IN WESTERN OREGON COUNTIES EXPRESSED IN POUNDS PER ACRE, 1921-1929*

Cereal	1921	1922	1923	1924	1925	1926	1927	1928	1929	Average omitting years 1924, 1925, and 1929	Average 1921-1929
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Oats	1,040	790	1,229	883	1,021	928	1,072	1,142	1,133	1,034	1,027
Barley	1,474	1,301	1,733	1,123	1,368	1,392	1,637	1,718	1,507	1,501	1,474
Winter wheat	1,296	1,284	1,434	.....	.....	1,338	1,422	1,434	.....	1,368	.....
Spring wheat	900	600	1,080	.....	.....	852	1,002	1,032	.....	912	.....
All wheat	1,152	1,146	1,368	1,260	1,248	1,254	1,344	1,350	1,524	1,266	1,290

*Compiled from reports of the Bureau of Agricultural Economics.

oats are seeded a seed-bed may sometimes be prepared following spring-plowed grain stubble by disking in the fall, provided the land is not weedy or full of volunteer grain. On land not plowed the previous spring, fall plowing is usually necessary. It is the belief of many that dry plowing in the late summer or fall will reduce yields. Tillage trials at Corvallis show little difference in yield between plowing before and plowing after the first fall rains. For fall sowing the seed-bed should be prepared fairly early so that opportunity is given the weeds and volunteer grain to germinate prior to final cultivation and seeding. No especial treatment is necessary for fall planting. Good tilth is desirable, but it is not necessary to reduce the seed-bed to an extremely fine state of cultivation, as finely pulverized soils tend to run together during the long wet winter.

Early plowing necessary for good spring seed-bed. The preparation of a good seed-bed for oats in the spring is often more difficult than in the fall, and more attention should be given to soil preparation at this time. Plowing should be done as early in the spring as possible. Early plowing and good seed-bed preparation are the most important factors in producing good yields of spring oats. Other things being equal, better yields will be obtained on heavy, cold soils from late-planted oats on a thoroughly prepared seed-bed that was plowed early rather than an early planting on a poorly prepared seed-bed. On well-drained upland soil not too heavy in texture, often much of the land can be plowed in the winter or very early spring and left until later in the spring for cultivation. Land plowed during the winter and early spring can be left until later for thorough cultivation. When this land is exposed to heavy rainfall and alternate freezing and thawing weather, it becomes mellow and more easily worked. On heavier soils, such as in the Dayton and Amity series, this is not possible. These soil types are often poorly drained and it is not possible to plow them until late in the spring. When it is not possible to plow land early in the spring, early disking previous to plowing is usually a benefit if it is planned to sow oats somewhat late. The soils in Western Oregon dry very quickly during the late spring, and especial care must be exercised at this time. During dry weather, cultivation should usually follow the plow as closely as possible. By disking and harrowing soon after plowing, it is usually possible to prepare the seed-bed at the minimum cost. Unless this is done, a great deal of extra work is required to prepare the seed-bed thoroughly and to reduce clods. On soils that are dry and loose, the use of the corrugated roller or similar implement is necessary to break down the clods and to firm the seed-bed.

DISEASES OF OATS

Smut control important. Smut is the most injurious disease of oats in Oregon. In most of the oat-growing sections of the state it is necessary to treat the seed with a fungicide in order to control smut. In some sections of Eastern Oregon where Markton is the recommended variety, this variety can be planted without treatment, as it appears to be resistant to most of the known forms of oat smut. All other varieties should be treated.

Formaldehyde the standard seed treatment. There are several methods of treating oats for the control of smut. Before the seed is treated,

it should be thoroughly cleaned by passing it through a good fanning-mill or cleaner. After cleaning, a recommended practice is to use the liquid formaldehyde treatment. This treatment may be used either as a sprinkle or as a dip method. The standard strength of formaldehyde solution is 1 pint of formaldehyde to 40 gallons of water. This furnishes sufficient material to treat 50 bushels of grain.

Directions for the sprinkle method. Spread the grain to be treated on a clean floor or on a canvas. Apply the solution from a sprinkling can at a little less than one-half gallon per bushel of oats, while the grain is being shoveled from one pile to another. The grain should be stirred until each kernel is moistened. After treatment, cover the pile with sacks or a canvas for at least five hours, or overnight. The grain should be planted as soon as possible after it is dry.

Directions for the dip method. Use the standard solution of formaldehyde. Place the grain in loosely woven burlap bags or gunny sacks. It is best not to have the sacks much more than half full and to have them tied so that there is plenty of room in the sacks after the grain swells. Dip the grain in solution and drain. If the sacks are piled so that there is air circulation around them the grain will dry satisfactorily in the sacks, but should be planted as soon as it is dry enough to feed through the drill. Any oats treated with formaldehyde that cannot be planted promptly should be spread out and shoveled over until dry and free from the characteristic odor of the formaldehyde. The formaldehyde solution is likely to injure germination if directions are not followed carefully, and even then there is usually considerable germination loss.

New dust treatments promising. Although the liquid treatment for smut control in oats has long been used, two general disadvantages are recognized: first, the necessity for the use of water and drying the grain afterward, and second, the danger of injury to germination by seed treatment. Because of these disadvantages, many new dry treatments for the control of oat smut have been tested. Two of these are promising. Nursery and field-plot trials, both at the Oregon Experiment Station and elsewhere, indicate that the materials Ceresan and Smuttox are effective in the control of smut in oats. More data are needed to determine the effect of these materials on yield. Ceresan and Smuttox are usually applied at about two ounces per bushel of grain. The oats should be thoroughly mixed with the dust in a dusting machine so that every kernel is thoroughly covered with the dust. There are apparently no injurious effects to germination by this treatment with these materials. Data available to date indicate that grain can be treated at any time and stored until seeding time.

Ceresan and Smuttox can be used for the control of smut in barley, but should not be used to replace copper carbonate in the control of wheat smut.

Rust is most serious disease in Coast area. Rust on oats is of minor importance in most parts of Oregon, but in the Coast counties it is the most serious disease. In years of heavy infection, it may cause complete loss of the crop. There are two kinds of rust that may infect oats—crown rust and stem rust. These are caused by entirely different fungi and present different appearances. The crown rust usually shows up on the leaves

as long, narrow lesions under the epidermis. The stem rust, which appears on both leaves and stems, forms pustules which push up through and rupture the epidermis. The stem rust forms two sets of spores, the red or summer spores and the black or over-wintering form. When the rust lives through the winter in the black spore stage it is transmitted to grain only through the medium of the common barberry. In the Coast counties, however, the stem rust will survive the winter in the red spore stage and thus requires no alternate host.

Rust-resistant varieties important. In the Coast area of Oregon, the only control of rust is in the use of resistant varieties. Rust nurseries, furnished by the Office of Cereal Crops and Diseases, United States Department of Agriculture, were grown by Dr. E. N. Bressman, of the Oregon Agricultural Experiment Station, in cooperation with the John Jacob Astor Experiment Station and county agents. These have indicated that some resistant varieties are available. The varieties Green Russian and Green Mountain have shown a high degree of rust resistance in these trials. Joannette and Anthony also carry considerable resistance to the rusts found in the Coast area. Yield data on these varieties in the Coast counties are not available, but their rust resistance and growth in nursery trials is promising enough to warrant further and more extensive trials.

WEEDS

Weeds are plentiful on oat lands. Because oats are commonly grown on land not adapted to a regular rotation, the control of weeds is particularly important. The most common annual weeds infecting oat fields in Western Oregon are wild oats (*Avena fatua*), French pink (*Centauria cyanus*), wild turnip (*Brassica campestris*), darnel or buck cheat (*Lolium temulentum*), and wild radish (*Raphanus sativus*). There are many others more or less local in their distribution.

Clean seed before planting. Control of annual weeds may be accomplished wholly or in part by several methods. Clean seed is of the utmost importance. Many weed seeds can easily be removed from oats, but such weeds as wild oats, wild radish, and darnel are difficult of removal with the ordinary cleaning machinery. Darnel is of importance only in winter oats and on rather wet ground, but wild oats are of importance in all oat fields. French pink, wild turnip, vetch, and most of the other common weeds can easily be cleaned from the seed. Plant no seed that has not been thoroughly cleaned. If the seed contains inseparable weed seed, new seed stocks should be obtained.

Good tillage helps to control weeds. Much can be done toward weed control by adequate tillage methods. When oats are grown in a rotation in which a legume and a cultivated crop appear in regular order, the problem is much simplified. When this is not possible, early plowing, either spring or fall, with sufficient cultivation between plowing and seeding, will help to reduce the weed growth. Occasionally it is necessary to delay planting until the weed seed has had an opportunity to germinate. A heavy weed infestation will reduce the yield of oats materially and will often lower the quality and sale value. In the case of very foul fields, it is sometimes necessary to summer-fallow, but generally it is best to substitute a culti-

vated crop for the summer-fallow. Corn, beans, and potatoes may be grown for this purpose, although it is not always practicable to include any of these crops.

SEEDING OATS

Oats should always be cleaned before planting. As the oats come from the threshing machines, they generally contain considerable trash, oats of various sizes, and weed seeds. Cleaning will eliminate most of the trash and the weed seeds and will also sort out the smaller kernels so that a uniform size of seed is available for planting. Uniform stands of grain cannot be obtained unless clean seed is used.

Seeding is usually done with the grain drill, although oats are occasionally seeded broadcast. Drilling does the best job of planting, assuring a uniform rate and a uniform depth. Less seed is required when the drill is used. When the surface soil is dry the oats can be placed in a moist layer of soil so that prompt germination will result.

Ten to twelve pecks usual planting rate. The rate of seeding oats will vary with the variety, the size of seed, the soil conditions, the moisture conditions, and the time of planting. The normal rate of planting for Western Oregon is from ten to twelve pecks. The winter oats which have a relatively small seed and which tiller profusely can be planted at the lighter rate. Oats seeded late in the spring when soil moisture is a limiting factor are also often seeded at the lighter rate. Under conditions of abundant moisture and fertility oats can be seeded at rates ranging from twelve to fourteen pecks per acre. A heavy stand of oats will help to choke out the weed growth. Winter oats, especially, make a heavy growth and will often keep an abundant weed crop in check.

When oats are seeded for hay purposes, the rate of planting may be varied according to soil conditions and the texture of hay desired. When oats are seeded alone for hay in the spring, a heavy rate of seeding is desirable. When planted for this purpose, they should be seeded as early as the ground can be prepared.

Plant winter oats in October. The best time to plant winter oats is usually about the middle of October. The period from October 10 to 20 appears to give best results. Oats planted earlier than this are more likely to have a heavier weed growth. If the seed-bed is prepared early, a considerable amount of the early weed growth can be destroyed if seeding is delayed until the middle part of October. Spring oats should be planted as soon as a good seed-bed can be prepared. This will vary with the season and with the soil type, ranging from February to May. If planting can be done in February the Gray Winter variety can be grown satisfactorily. If it must be delayed until March or April the white spring varieties should be used instead. On well drained upland planting should be done not later than April 15 for best results. On soils that will retain their moisture well into the summer, planting after this date can be done satisfactorily.

HARVESTING

Most of the oats grown in Western Oregon are harvested with the binder, although the use of the combined harvester is increasing. When oats are cut with the binder, they should be cut at the hard-dough stage. At this stage the plant is in a yellow-ripe condition, but the straw is not dry and brittle. When cut at this stage and cured in the shock, a very high quality of oats can be obtained. The quality of oat straw handled in this way is also better than when allowed to become fully ripe before cutting. Oat straw has a relatively high nutritive value when compared with wheat and barley straw and is often utilized by growers in feeding to livestock. Good oat straw can be fed satisfactorily to dry cows and beef cattle during the winter, and to horses. Feeding trials with beef cattle at the Union Experiment Station indicate that oat straw, supplemented with a protein feed, can be used satisfactorily to carry animals through the winter. A desirable method of handling oat straw when threshed with the stationary thresher is to blow it into a straw shed. In this way, it can be protected from the winter rain and be fed out as desired.

Oats must be fully ripe for combine harvest. When oats are cut with the combine harvester, they must be fully ripe before cutting. Unless the oats can be cut soon after ripening, there may be considerable loss from shattering depending on the varieties grown and the location. If combined before the fully ripe stage, the threshed grain will either heat or will contain enough moisture to cause considerable staining in the kernels. A disadvantage of using the combine for oat harvest on some farms is that the straw is of a poorer quality, and if the straw is to be saved it must be gathered from the field after threshing. The combine is a means of saving much labor, however, and in many cases results in much cheaper harvesting.

Whenever it is necessary to thresh before the grain is thoroughly dry, it should be spread out and allowed to dry. Threshing under-ripe grain is likely to result in a considerable threshing loss, as the tough grain will clog the threshing-machine more easily and more of the grain will be blown over with the straw. In those occasional years when rain occurs during harvesting, special care should be taken with the grain after threshing. Occasionally, when oats are grown in the Coast area, there may be difficulty in maturing the grain properly for threshing, but in most other sections there should be little difficulty, except in seasons of unusual summer rainfall.

VARIETIES OF OATS

Selection of variety important. The selection of the proper variety of oats is just as important as for any other crop, although oat growers pay less attention to varietal names in oats than in wheat or barley. A survey of the 1929 crop was made by means of questionnaires sent to growers. Returns from these questionnaires showed that many growers pay little attention to variety names. Growers generally recognize two distinct types of oats—Gray Winter and white spring. Most of the confusion regarding varieties is in connection with the spring oats.

Oregon grows too many oat varieties. The 1929 survey showed 27 varieties reported from Western Oregon and 18 varieties from Eastern Oregon. This number could well be reduced to 6 or 8 standard varieties. The varieties reported from Western Oregon are shown in Table VII. In Western Oregon 56 percent of all the oats reported were of the Gray Winter variety. The high-yielding varieties, Three Grain, Eclipse, and Victory constituted 13.1 percent, 5.7 percent and 3 percent respectively. In Eastern Oregon, Markton constituted 44.2 percent of the total and Swedish Select 20.5 percent of the total. Of the other 16 varieties reported from Eastern Oregon none represented more than 5 percent of the total production. Thirty-seven distinct oat varieties were reported for the entire state, most of which could be replaced advantageously by standard sorts.

Victory the highest-yielding variety. Yields of oat varieties obtained in the trials on the Experiment Station at Corvallis are reported in Table VIII. This Table covers the eleven-year period from 1920 to 1930 inclusive. Victory and Three Grain are the only varieties included in the trials during the entire eleven-year period. Victory has an average yield of 45.17 bushels for the eleven years and has been used as the check in the variety trials. Yields are shown in percentage of the check yields for the years grown. Of the commercial varieties grown over an extended period, Victory, Eclipse, and Three Grain have given the highest yields. Eclipse has yielded 101 percent of Victory for a five-year period, and Three Grain has yielded approximately 97 percent of Victory for an eleven-year period. No variety has consistently outyielded Victory over an extended period. The 1929 survey shows only 3 percent of the total production for this variety. There are few sections in Western Oregon where Victory will not outyield the varieties now grown.

Victory oats is a mid-season variety which is well adapted to Western Oregon conditions. It has a fairly tall straw, produces a white, plump kernel of good test weight and only an average amount of hull. Three Grain is also a white tree oat, but matures about three days earlier than Victory and produces a straw from two to four inches shorter. The test weight of this variety is approximately that of Victory although analyses show it to have a higher crude-fiber content. Eclipse is a white-side oat producing a short plump grain. Although this variety gives high yields, analyses show it to have a very high crude-fiber content and also a low hulling percentage. These three varieties are all high yielding and are adapted to production in the Willamette Valley section of Western Oregon. They could well replace all other spring-oat varieties being grown in this section.

Many inferior varieties grown. The 1929 oats survey showed 3.3 percent of Kanota and 2.5 percent red oats, most of which were probably Kanota. Kanota oats and other similar red oats are primarily for warmer climates than Western Oregon. They are the leading oats grown in the southern Great Plains and in California but are not so well adapted to the cool growing conditions here. Good yields of Kanota have been reported from growers but these have been obtained under favorable conditions where most varieties would produce good yields. In a two-year trial of Kanota at Corvallis, the average yield was 29.15 bushels per acre, or 72 percent of Victory oats grown under the same conditions. Such other

TABLE VII. OATS VARIETY SURVEY OF WESTERN OREGON COUNTIES*
Expressed in Percentage of Total

Variety	Benton	Clackamas	Columbia	Douglas	Jackson	Lane	Linn	Marion	Polk	Wash-ington	Yamhill	Percent-age of total
	%	%	%	%	%	%	%	%	%	%	%	%
1. Banner	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.3	.....	0.5
2. Black	.....	1.6	.....	.....	9.3	.....	.....	.....	2.1	.....	.....	0.2
3. Black Victor	.....	.....	.....	.....	.....	.....	2.6	.....	.....	.....	.....	0.5
4. Brown	.....	.....	.....	.....	.....	.....	2.1	.....	.....	.....	.....	0.5
5. Climax	.....	.....	.....	11.2	12.2	2.2	2.4	.....	7.5	5.5	.....	3.2
6. Clydesdale	.....	.....	.....	.....	.....	.....	.....	.....	5.4	.....	.....	0.5
7. Eclipse	.....	.....	.....	.....	.....	13.6	.9	.....	.....	14.4	.....	5.7
8. Gray Winter	53.2	72.4	41.6	81.8	8.2	60.4	31.2	82.3	46.6	71.5	14.0	55.9
9. Kanota	.....	.....	.....	.....	38.6	.....	.7	.....	25.0	1.1	.....	3.3
10. LaConner	.....	.....	.....	.....	.....	.....	.....	1.8	.....	.....	.....	0.3
11. Liberty	.....	.....	.....	.....	.....	.....	.2	.....	.....	.....	.....	Tr.
12. Markton	4.9	.....	.....	4.4	.....	.....	.....	.....	.....	.....	.....	0.3
13. Marquein	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	43.5	2.5
14. Mortgage Lifter	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2.8	0.6
15. Ninety Day	.3	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Tr.
16. Red	9.4	.....	.....	2.6	31.7	.5	.....	11.2	.....	.....	.....	2.5
17. Senator	.....	.....	.....	.....	.....	.....	.....	.....	.5	.....	.....	0.1
18. Shadeland Wonder	.....	.....	.....	.....	.....	20.8	1.2	4.7	.....	.....	1.9	2.3
19. Silvermine	.....	1.7	.....	.....	.....	.....	.....	.....	.....	.....	30.8	1.9
20. Swedish Select	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.8	.....	0.4
21. Three Grain	5.7	.....	.....	.....	.....	2.5	58.1	.....	12.9	.....	.....	13.1
22. Victory	6.7	24.3	.....	.....	.....	.....	.6	.....	.....	2.6	.....	3.0
23. Viltoe Side	.....	.....	10.8	.....	.....	.....	.....	.....	.....	.....	.....	0.2
24. White Russian	3.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.2
25. White Shadeland	14.2	.....	47.6	.....	.....	.....	.....	.....	.....	.....	.....	1.6
26. White Side	2.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Tr.
27. Wisconsin No. 1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.8	.....	0.4
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of varieties	8	4	3	4	5	6	10	4	7	8	5	.....

*Data from Station Circular 97.

TABLE VIII. YIELDS PER ACRE OF OAT VARIETIES AT CORVALLIS, 1920-1930

Variety	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	Average	Percentage of victory
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	%
Triumph	.....	.....	.....	48.1	.....	.....	.....	.....	.....	.....	.....	48.13	89.3
Early Mountain	.....	.....	.....	.....	.....	.....	46.6	54.3	40.4	.....	.....	47.09	89.1
Eclipse	.....	59.6	24.2	52.8	.....	.....	.....	.....	.....	36.4	70.6	48.72	101.4
Wisconsin No. 7	.....	.....	.....	.....	.....	.....	45.4	58.3	42.0	28.9	.....	43.39	87.9
Senator	.....	64.6	22.9	60.3	32.6	32.6	45.1	56.0	36.4	40.1	46.9	43.75	94.7
Unidentified No. 2	36.2	60.5	25.4	65.0	31.2	31.6	49.4	58.3	38.7	29.5	.....	42.58	97.3
Idamine	.....	.....	.....	57.0	30.9	27.8	50.3	57.1	41.2	33.9	54.0	44.02	94.4
Victory	33.7	63.0	26.0	53.9	31.7	31.9	49.5	67.3	41.9	38.6	58.3	45.07	100.0
White Russian	32.8	56.7	25.0	45.9	.....	.....	.....	.....	.....	.....	.....	40.12	90.8
Banner	.....	.....	.....	.....	.....	.....	40.1	56.6	37.4	.....	.....	44.71	84.1
Three Grain	31.0	53.6	25.0	50.8	32.9	33.7	51.6	60.8	43.8	32.5	64.0	43.61	96.8
Abundance	.....	.....	.....	.....	.....	.....	45.0	57.4	37.2	47.4	53.5	48.10	94.1
Golden Rain	.....	.....	.....	.....	.....	28.3	44.5	65.9	40.8	34.9	53.6	44.67	93.2
Climax	.....	.....	.....	47.6	26.2	30.5	41.4	54.2	37.7	30.7	.....	38.33	83.0
Black Victor	.....	.....	.....	.....	31.6	27.6	42.4	49.9	.....	.....	.....	37.89	84.2
Markton	.....	.....	.....	.....	31.4	25.1	41.4	53.3	40.6	40.1	54.8	40.96	89.8
Gray Winter (spring planted)	.....	.....	.....	.....	.....	24.3	30.4	.....	.....	.....	.....	29.36	72.2
Madrid	.....	.....	.....	.....	.....	.....	.....	.....	40.4	34.6	60.4	45.13	97.5
Red Indian	.....	.....	.....	.....	.....	24.4	41.9	43.3	.....	.....	.....	36.56	73.8
Kanota	.....	.....	.....	.....	.....	.....	.....	.....	32.3	26.0	.....	29.15	72.5
Iogren	.....	.....	.....	.....	.....	.....	.....	.....	38.7	36.0	53.6	45.13	97.5
Victory Selection No. 28	.....	.....	.....	.....	.....	.....	.....	.....	.....	39.1	66.3	52.70	108.8
Victory Selection No. 29	.....	.....	.....	.....	.....	.....	.....	.....	.....	40.9	62.7	51.80	106.9
Favell	.....	.....	.....	.....	.....	.....	.....	.....	.....	41.1	54.2	47.65	98.3
Joannette	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	47.7	47.70	81.8
Improved American	31.9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31.90	94.4
Hays Favorite	31.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	31.20	92.6
Alberta	30.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	30.60	90.7
Lincoln	29.4	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29.40	87.0
Culberson	28.7	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28.70	85.2
Sensation	28.1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28.1	83.3

varieties as Banner, Black Victor, Markton, Swedish Select, Silvermine, White Russian, and Climax have been shown by experimental trials to be definitely inferior to the recommended varieties. It is believed that growers continuing their culture are doing so at a distinct loss.

Hull-less oats are low yielding. Hull-less oats are grown occasionally, but their production is confined to small areas. Liberty Hull-less is the

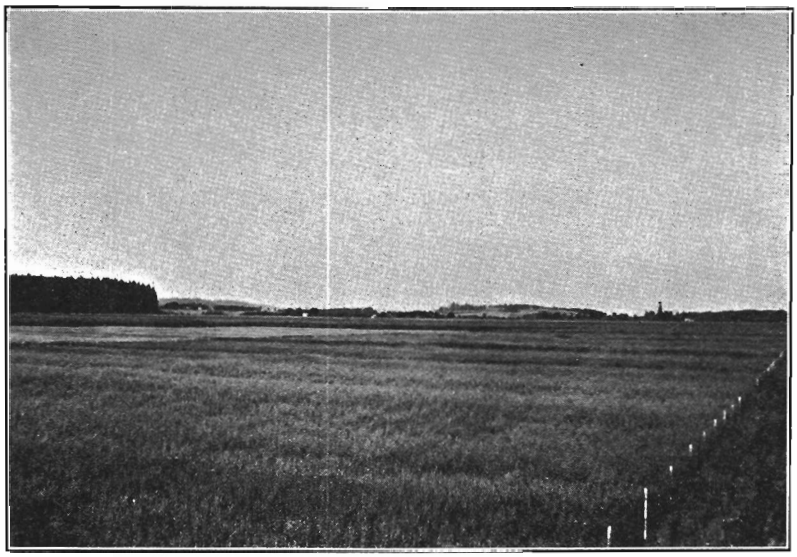

Figure 2. A general view of the oat variety trial, Oregon Experiment Station, Corvallis.

variety most generally grown. In nursery trials with Hull-less oats the yields obtained have not been satisfactory as they usually are less than half that of the hulled varieties. Hull-less oats are often grown in small patches to provide oat groats for feeding young poultry. This is a desirable poultry feed, but it is doubtful whether commercial production of this type of oats is justified because of the low yields obtained.

YIELDS OF WINTER OATS

Winter oats outyield spring oats. Winter oats will usually return a higher yield than spring oats. Yield data are not complete for the same period covered by the spring-oat data, but in Table IX winter-oat yields for six years are given. Earlier tests resulted in proof of the superiority of Gray Winter oats to the other varieties in use prior to 1922. In 1925 and in 1930 the winter-oat trials were so badly winter-killed that yield data were not obtained. No plot trial of winter oats was made in 1927.

The average yield of winter oats for the six years is 76.15 bushels per acre. This is considerably above the average of 45.07 bushels obtained from the highest-yielding spring-oat variety.

Gray Winter, the leading variety. There are not many varieties of winter oats, and few that are adapted to production in Western Oregon. The Gray Winter variety, known elsewhere as Winter Turf, has been superior to the other varieties grown. The winter-oats trial was enlarged in 1928 and now includes some promising Gray Winter Selections and two new varieties, Custis and Lee, both of which were developed for production in the Southern States. These trials have not been continued long enough to justify definite conclusions, but the results to date appear promising.

Gray Winter best in Coast area. The Branch Experiment Station at Astoria reports that Gray Winter oats give the best results in the Coast section for both winter and spring planting. Yields and quality of forage obtained from this variety are superior to other varieties. Red Indian is preferred in this section as a nurse crop because it ripens earlier.

TABLE IX. YIELDS PER ACRE OF WINTER OATS 1922-1929

Item	1922	1923	1924	1925	1928	1929	Average	Percentage of Gray Winter
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*%*
Gray Winter	39.3	58.1	95.7	84.7	72.0	107.1	76.15	100.0
Red Indian	38.6	59.9	87.6	.....	.....	65.0	62.77	83.6
Black Victor	.....	.....	85.4	.....	.....	.....	85.4	89.1
Gray Winter Selection No. 22	.....	.....	.....	.....	74.9	117.3	96.10	107.3
Gray Winter Selection No. 20	.....	.....	.....	.....	71.1	111.1	91.10	101.6
Gray Winter Selection No. 21	.....	.....	.....	.....	84.6	110.5	97.55	108.9
Gray Winter Selection No. 23	.....	.....	.....	.....	68.1	95.3	81.70	91.2
Custis	.....	.....	.....	.....	78.7	90.8	84.75	94.8
Lee	.....	.....	.....	.....	84.4	99.8	92.10	102.9

Winter oats stool heavily. The growth habit of winter oats differs radically from that of spring oats. In addition to the dormant condition during the winter, the gray Winter variety tillers profusely, producing an average from four to six tillers or stalks per plant under favorable conditions. The stems are fine and the straw is rather weak. The vegetative growth is such that a fine type of hay is produced and the straw is considered to have exceptional value as feed. Because of the weak straw, lodging is likely to occur when seeded on extremely rich soil. Under these conditions, Gay Winter oats are often best utilized for hay, as a good vegetative growth can be obtained.

Gray Winter oats are widely grown as a hay plant, usually in combination with vetch or peas. Although it produces a fine quality of hay, it provides very little support for the companion crop. In addition to having a weak straw, it makes very little straw growth at a time when vetch and peas are in need of support. In spite of these disadvantages, Gray Winter oats continue to be the most widely grown hay cereal in Western Oregon. The hay is readily eaten by both cattle and horses. Oat hay, with little or no vetch, is considered a fairly good horse hay.

THE QUALITY OF OATS

Oregon produces heavy, high-quality oats. The oats produced in Western Oregon are of a very good quality as compared to oats produced in

other parts of the United States. The long, cool growing season here is favorable to the development of a plump, well-filled kernel and of oats with a high test weight. Test weight is one of the most important grading factors in oats. The United States grades for oats require No. 1 oats to have a minimum test weight of 32 pounds per bushel. This figure is accepted in most states as the legal weight per bushel of oats. Table X gives the test weight of oat varieties grown at the Oregon Experiment Station at Corvallis during the four-year period 1927 to 1930. The average

TABLE X. SUMMARY SHOWING TEST WEIGHT OF OATS

Item	1927	1928	1929	1930	Average	Percentage of Victory
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*%*
Victory	36.0	38.1	37.2	39.0	37.6	.....
Three Grain	35.4	36.6	36.5	36.6	36.3	96.54
Climax	35.5	36.8	37.3	.....	36.5	98.39
Idamine	35.3	37.2	37.6	37.4	36.9	98.13
Unidentified No. 2	33.9	38.7	35.3	.....	36.6	98.65
Markton	35.6	37.7	38.7	37.5	37.4	99.73
Early Mountain	36.1	37.2	.....	.....	36.6	98.91
Abundance	35.0	35.7	36.1	36.0	35.7	94.94
Banner	34.4	36.0	.....	.....	35.2	95.13
Wisconsin No. 7	33.2	35.5	34.9	.....	34.5	92.99
Golden Rain	36.7	37.8	37.9	39.4	37.9	100.79
Senator	36.1	37.3	38.8	37.6	37.4	99.46
Kanota	.....	33.9	37.8	.....	35.8	95.21
Madrid	.....	38.0	37.3	37.0	37.4	98.16
Iogren	.....	33.9	33.5	35.4	34.3	89.09
Victory Selection No. 28	.....	37.8	37.6	39.1	38.2	100.26
Victory Selection No. 29	.....	36.7	38.0	39.6	38.1	100.00
Favell	.....	.....	37.8	37.8	37.8	99.21
Eclipse	.....	.....	37.8	38.1	37.9	99.47
Gray Winter	.....	39.0	39.9	.....	39.4	103.4
Red Indian	.....	.....	38.4	.....	38.4	103.2
Lee	.....	40.2	41.4	.....	40.8	107.1
Custis	.....	40.1	41.0	.....	40.5	106.3
Gray Winter Selection No. 23	.....	38.0	39.9	.....	38.9	100.2
Gray Winter Selection No. 20	.....	39.0	40.9	.....	39.9	104.7
Gray Winter Selection No. 21	.....	38.9	40.7	.....	39.8	104.6
Gray Winter Selection No. 22	.....	38.9	40.7	.....	39.8	104.6

test weight is given and the test weight in percentage of Victory oats for the years shown. The test weight of spring oats is somewhat lighter than for the winter oats. The average test weight of Victory oats for the four-year period is 37.6 pounds per bushel. Victory has a high test weight and is exceeded only slightly by two other spring-oat varieties; namely, Golden Rain and Victory Selection, Oregon No. 28. The test weight of winter oats is available only for the two-year period 1928 and 1929. Winter oats will probably average from two to three pounds heavier than spring oats. The average test weight of winter oats ranges from 39 to 41 pounds per bushel.

Many varieties analyzed. In order to show the quality of oats more effectively, chemical analyses were made of varieties from the 1928, 1929, and 1930 crops by the department of Agricultural Chemistry, Oregon Agricultural Experiment Station. In 1930, analyses were also made of oats grown on different soil types. These analyses are all given in Table XI. The analyses given are for protein, fat, ash, and crude fiber. These are expressed on a moisture-free basis. The total digestible nutrients for each

variety were computed by using the coefficients of digestibility for crude protein, fat, crude fiber and nitrogen free extract, as given by Henry and Morrison. In addition, the total energy values are shown by a weighted T.D.N. factor, in which the ether extract is given a value of 2.25 in order to convert it to a carbohydrate energy equivalent. These values offer a means of easy comparison of varieties. The total digestible nutrient value is of greatest service in determining nutritive ratios, while the weighted T.D.N. shows more clearly the total energy value of the varieties.

Composition of spring-oat varieties similar. The analysis of spring-oat varieties shows a total energy value ranging from 77 to 80, with an occasional sample above the higher figure. The analysis of the three high-yielding varieties—Victory, Three Grain, and Eclipse—are of particular interest. Victory has an average analysis for the three years of approximately 78. Analysis of Three Grain for 1928 and 1930 shows an average of 76.45. Eclipse has an average analysis for 1929 and 1930 of 77.37. Both Three Grain and Eclipse have a rather high crude-fiber content, ranging from 2 to 3 percent higher than Victory. Two varieties, Joannette and Kanota, which show rather high total-energy values, are low-yielding varieties. The high total-energy value of Joannette is due to a rather high percentage of hulled oats in the sample. This variety is rather easily hulled during threshing, and consequently the analysis shows a low fiber content. Markton also has a high total-energy value, and this is due largely to its high percentage of fat. In general, the spring-oat varieties do not show any marked differences in composition, nor do they vary a great deal from year to year, as grown under Western Oregon conditions.

Winter oats have high energy value. The analyses of the winter oats support the recommendation as to their feeding value. The winter oats have an average of 3 to 4 percent less crude fiber and from 2 to 3 percent more fat than the spring oats. In addition, they are usually higher in protein. As a result, the total-energy value of the winter oats is fairly high, ranging from 79.49 for the rather poor quality and low-yielding Red Indian oats to 83.25 for the high-yielding Gray Winter Selection No. 20. This is a total-energy value of from 8 to 10 percent higher than for the spring oats.

In computing rations in which oats are included, it is necessary to make due allowance for the greater feeding value of the gray oats. The experience of feeders indicates that the winter oats have a fairly high degree of digestibility. It is not likely that the digestibility of the winter oats is less than for the spring oats. These analyses indicate that winter oats may be considered as a desirable feed. They are particularly desirable as part of the dairy ration. For horses, this type of oats probably has no equal. Oats are not satisfactory as a hog feed when fed in quantity although small amounts may be included in the ration.

MILLING OATS

Milling oats should be low in hull and fat. Large quantities of oats are used in the manufacture of rolled oats for breakfast food. The oats miller desires a plump, well-filled kernel with a low percentage of hull. It is also important that the oats be uniform in size and contain a minimum of the very small or "pin" oats. Manufacturers who use a precooking process

TABLE XI. ANALYSIS OF OAT VARIETIES GROWN ON DIFFERENT SOIL TYPES AND IN DIFFERENT YEARS. COMPUTED ON A MOISTURE-FREE BASIS

Variety	Protein	Ether extract	Ash	Crude fiber	Total digestible nutrients	*Weighted T.D.N.
Spring Oat Varieties Grown on Amity Soil 1929						
Joannette	9.88	6.64	3.58	11.12	73.08	80.29
Kanota	13.58	6.92	3.45	10.15	73.54	81.06
Abundance	10.42	5.56	3.15	12.39	72.76	78.79
Climax	12.40	5.42	3.30	11.70	72.88	78.77
Madrid	10.70	5.34	3.83	12.97	71.91	77.71
Idamine	11.89	5.29	3.44	12.78	72.29	78.04
Victory	10.77	5.12	3.25	12.35	72.66	78.22
Favell	10.70	5.51	3.06	12.79	72.64	78.63
Eclipse	10.64	5.15	3.30	14.24	71.77	77.37
White Russian	9.17	6.36	3.41	11.89	72.87	79.78
Senator	10.98	5.62	3.11	11.85	73.03	79.14
LaConner	9.90	5.31	3.80	11.16	72.81	78.56
Spring Oat Varieties Grown on Willamette Soil 1930						
Victory	8.17	5.24	3.75	13.13	71.99	77.69
Three Grain	8.19	4.92	3.99	15.10	70.88	76.23
Idamine	8.63	5.18	4.06	14.87	70.92	76.56
Golden Rain	9.26	5.44	4.04	13.05	71.77	77.68
Madrid	9.23	5.53	4.11	12.44	72.00	78.01
Abundance	8.72	5.09	3.88	14.04	71.44	76.98
Markton	9.01	7.09	3.88	11.77	72.60	80.31
Senator	9.25	5.26	3.88	13.24	71.80	77.52
Iogren	8.27	4.66	3.30	12.86	72.42	77.48
Favell	8.97	5.51	3.75	13.73	71.71	77.70
Victory Selection No. 28	8.34	5.14	3.52	14.52	71.52	77.11
Victory Selection No. 29	8.50	5.50	3.88	12.96	71.97	77.94
Eclipse	9.54	5.46	3.88	14.06	71.43	77.37
Joannette	10.60	6.51	4.05	9.10	73.60	80.67
Rainbow	8.87	4.64	3.73	11.55	72.68	77.73
Wayne	9.61	5.96	4.01	12.97	71.85	78.32
Anthony	9.18	6.18	3.68	12.14	72.53	79.25
Star	9.17	4.97	3.81	12.44	72.20	77.60
LaConner	8.86	5.17	3.90	12.88	71.96	77.63
Odal	9.29	5.50	4.02	12.27	72.14	78.11
Golden Rain II	7.98	5.17	3.97	13.62	71.59	77.21
Golden Rain	9.25	5.56	3.84	11.97	72.43	78.48
Spring Oat Varieties Grown on Chehalis Soil 1930						
Three Grain	7.78	4.63	4.48	14.73	70.58	75.62
Madrid	8.70	5.07	5.09	12.92	70.97	76.48
Victory	8.20	4.91	4.36	13.18	71.45	76.79
Favell	8.48	5.44	4.67	13.00	71.30	77.21
Winter Oat Varieties Grown on Chehalis Soil 1929						
Custis	12.30	7.38	3.76	9.56	73.63	81.65
Lee	12.27	7.76	3.71	9.08	73.92	82.36
Red Indian	12.22	6.82	4.43	11.68	72.08	79.49
Gray Winter Selection No. 22	8.41	8.08	3.38	8.94	74.38	83.17
Gray Winter Selection No. 20	8.26	8.15	3.34	9.00	74.39	83.25
Gray Winter Selection No. 21	8.39	8.07	3.41	8.53	74.15	82.93
Gray Winter	11.67	8.37	3.81	9.64	73.63	82.80
Gray Winter Selection No. 23	11.22	8.29	3.93	9.65	72.73	81.74

*Digestible fat multiplied by 2.25 to convert to carbohydrate-energy equivalent.

object to a high fat content as it is claimed a poorer quality of rolled oats is produced. This objection largely eliminates the Gray Winter oats as a desirable milling oat for those millers using the precooking process. Manufacturers using other processes use Gray Winter satisfactorily. According to the analyses presented in Table XI, Victory oats should be a desirable milling variety. The fat content is low and the percentage of crude fiber is not high. Concentration of production of spring oats of this type should enlarge the oats market materially. Millers complain that adequate supplies of milling oats are not available and that oats must be shipped to Oregon from eastern states. If Western Oregon growers would concentrate on the production of two or three desirable varieties of spring oats, no importations of milling oats would be necessary.