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Oregon Agricultural College

Experiment Station

Spring Crops for Eastern Oregon

By

David E. Stephens

Robert Withycombe

Obil Shattuck

CORVALLIS, OREGON

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INTRODUCTION

In the counties of Oregon east of the Cascade Mountains, the cereals —wheat, barley, oats, rye, and corn— constitute one of the chief sources of farm income. In the Columbia River Basin counties of Sherman, Gilliam, Morrow, and Umatilla the income from cereals exceeds that from all other farm products combined. Their value in 1919 in these four counties exceeded 20½ million dollars or about 80 percent of the value of all crops, including hay and forage, most of which was grain hay. The cereals are also important crops in Wasco, Union, Baker, Wallowa, and Jefferson counties.

In Eastern Oregon, wheat and rye generally are fall sown, the winters being too severe in most of the area for the successful production of winter barley or oats. When wheat is fall sown, it generally is preceded by a season of fallow. The production of wheat after fallow is discussed in Oregon Station Bulletin 190. In the present bulletin, the growing of spring-sown crops only is considered.

FALL-SOWN CROPS GENERALLY MOST PRODUCTIVE

When not injured by freezing, fall-sown grains usually are more productive than those sown in the spring. In most parts of Eastern Oregon, wheat and rye are the only safe grain crops to sow in the fall. In limited areas, winter barley, too, will survive. Fall-sown oats cannot be grown successfully.

The experience of farmers on the dry lands of Eastern Oregon, and the results obtained on the Branch Experiment Stations, show that wheat, when fall sown, will produce higher acre yields than when spring sown, especially when grown after summer fallow. Winter barley, also, if not injured by cold weather, will usually outyield spring barley. Winter rye at Moro, when grown after fallow, has not proved quite so productive as spring rye, but neither winter rye nor spring rye has produced seed yields as high as winter or spring wheat. At the Burns Station, spring rye has been the most dependable dry-land crop.

In addition to increased yields, the sowing of grain in the fall, whenever possible, more equally distributes farm labor. The spring is a busy time for the Eastern Oregon farmer, and if he has much spring seeding to do, other important work may have to be neglected. To obtain best results, spring grain must be sown as early in the spring as possible.

NECESSITY OF SOMETIMES SOWING SPRING CROPS

Unfavorable autumn weather, failure to get stands of winter grain, and occasionally the inability to take off in time a growing crop, may make the sowing of spring grain advisable. Spring grain may also sometimes fit better into a crop rotation than winter grain.

In locations so dry that winter wheat will not emerge in the fall, or where late spring or early summer frosts are prevalent, the growing of spring grain may prove more profitable in the long run than growing winter wheat. At Burns, where these conditions exist, Baart, the best yielding spring wheat on dry land, has produced a ten-year average of 6.27 bushels an acre more than Turkey, the best winter variety. When sown after a crop the previous year, or when irrigated, spring grain also may prove more productive than winter grain. Results at Burns show that the best spring varieties, Federation and Dicklow, on irrigated land made a four-year average yield of 64.4 and 61.1 bushels respectively as against similar averages for Turkey and Hybrid No. 128 winter varieties, of 48.7 and 37.8 bushels, or an average difference of 19.5 bushels an acre in favor of spring wheat under irrigation. For most locations in Eastern Oregon, however, the sowing of winter grain, especially winter wheat, is strongly recommended in preference to a spring-sown crop for growing after a season of fallow.

DISTRIBUTION, YIELD, AND ACRE VALUE OF THE SMALL GRAINS IN OREGON

TABLE I. AVERAGE ACREAGE, PRODUCTION, ACRE YIELD, AND ACRE VALUE OF WINTER WHEAT, SPRING WHEAT, OATS, AND BARLEY IN OREGON BY COUNTIES FOR THE FIVE-YEAR PERIOD, 1919 TO 1923, INCLUSIVE

	Acreage	Production in bushels	Bushels per acre	Pounds per acre	Value per acre
Oregon					
Winter wheat	834,406	18,948,878	22.7	1362	$18.16
Spring wheat	263,171	3,981,559	15.2	912	12.16
Oats	283,913	9,241,081	32.4	1037	14.26
Barley	74,311	2,246,034	29.9	1435	17.34
Eastern Oregon					
Winter wheat	640,384	14,507,958	22.5	1350	18.00
Spring wheat	197,070	2,953,788	15.2	912	12.16
Oats	34,133	1,105,382	32.1	1027	14.12
Barley	58,008	1,728,250	29.5	1416	17.11
Baker					
Winter wheat	5,070	93,203	19.2	1152	15.36
Spring wheat	12,847	252,046	19.8	1188	15.84
Oats	5,228	197,725	38.4	1229	16.90
Barley	4,353	159,530	36.0	1728	20.88
Crook					
Winter wheat	813	13,149	16.6	996	13.28
Spring wheat	6,212	121,470	19.2	1152	15.36
Oats	1,280	49,301	35.6	1139	15.66
Barley	838	27,699	29.6	1421	17.17
Deschutes					
Winter wheat	142	2,362	16.4	984	13.12
Spring wheat	1,188	23,429	19.4	1164	15.52
Oats	1,384	41,277	28.6	915	12.58
Barley	214	7,263	30.4	1459	17.63

TABLE I *(concluded)*. WINTER AND SPRING GRAINS IN OREGON

	Acreage	Production in bushels	Bushels per acre	Pounds per acre	Value per acre
Gilliam					
Winter wheat	80,675	1,468,606	17.6	1056	$14.08
Spring wheat	19,826	241,338	13.0	780	10.40
Oats	256	3,722	14.6	467	6.42
Barley	3,984	81,963	20.0	960	11.60
Grant					
Winter wheat	652	12,350	19.0	1140	15.20
Spring wheat	1,109	18,605	16.2	972	12.96
Oats	671	20,614	31.6	1011	13.90
Barley	464	13,626	28.8	1382	16.70
Harney					
Winter wheat	179	2,674	12.4	744	9.92
Spring wheat	992	17,052	16.8	1008	13.44
Oats	650	12,366	18.6	595	8.18
Barley	1,150	29,382	24.0	1152	13.92
Hood River					
Winter wheat	147	3,555	24.4	1464	19.52
Spring wheat	328	6,598	20.2	1212	16.16
Oats	296	11,261	36.4	1164	16.01
Barley	77	2,731	34.4	1651	19.95
Jefferson					
Winter wheat	16,128	206,630	13.2	792	10.56
Spring wheat	31,130	274,410	8.5	510	6.80
Oats	738	11,390	16.0	512	7.04
Barley	741	14,136	19.0	912	11.02
Klamath					
Winter wheat	1,339	20,725	15.4	924	12.32
Spring wheat	10,223	172,051	17.0	1020	13.60
Oats	3,262	108,623	33.6	1075	14.78
Barley	3,978	127,249	31.2	1498	18.09
Lake					
Winter wheat	2,097	32,603	16.0	960	12.80
Spring wheat	10,977	223,872	19.4	1164	15.52
Oats	820	30,804	35.0	1120	15.40
Barley	1,236	37,937	30.4	1459	17.63
Malheur					
Winter wheat	783	22,277	26.8	1608	21.14
Spring wheat	4,677	121,881	25.2	1512	20.16
Oats	1,046	42,882	40.6	1299	17.86
Barley	3,224	133,961	41.2	1978	23.90
Morrow					
Winter wheat	98,542	1,641,560	16.2	972	12.96
Spring wheat	17,149	180,862	11.2	672	8.96
Oats	235	5,192	18.2	582	8.01
Barley	5,044	97,722	19.6	941	11.37
Sherman					
Winter wheat	116,247	2,680,475	23.2	1392	18.56
Spring wheat	9,465	142,372	15.2	912	12.16
Oats	1,192	26,070	21.6	691	9.50
Barley	3,156	74,734	23.6	1133	13.69
Umatilla					
Winter wheat	214,067	5,855,113	27.3	1638	21.84
Spring wheat	16,993	297,585	17.6	1056	14.08
Oats	799	23,587	29.6	947	13.02
Barley	14,444	449,575	31.2	1498	18.10
Union					
Winter wheat	26,190	681,012	25.6	1536	20.48
Spring wheat	28,025	491,818	18.4	1104	14.72
Oats	9,440	306,271	32.2	1030	14.17
Barley	5,265	162,391	31.6	1517	18.33
Wallowa					
Winter wheat	16,844	335,310	19.6	1176	15.68
Spring wheat	18,799	266,852	14.4	864	11.52
Oats	5,258	174,257	32.6	1043	14.34
Barley	5,031	169,309	33.4	1603	19.37

TABLE I *(continued)*. WINTER AND SPRING GRAINS IN OREGON

	Acreage	Production in bushels	Bushels per acre	Pounds per acre	Value per acre
Wasco					
Winter wheat	57,718	1,386,086	23.8	1428	$19.04
Spring wheat	6,106	90,856	14.6	876	11.68
Oats	1,183	32,852	27.4	877	12.06
Barley	3,908	115,954	29.8	1430	17.28
Wheeler					
Winter wheat	2,752	50,270	17.6	1056	14.08
Spring wheat	1,024	10,692	10.4	624	8.32
Oats	394	7,181	17.2	550	7.57
Barley	905	23,097	23.6	1133	13.69
Western Oregon					
Winter wheat	194,022	4,440,920	22.8	1368	18.24
Spring wheat	66,102	1,027,771	15.4	924	12.32
Oats	249,780	8,135,699	32.4	1037	14.26
Barley	16,300	517,784	31.5	1512	18.27
Benton					
Winter wheat	10,345	212,551	20.4	1224	16.32
Spring wheat	4,754	72,696	15.2	912	12.16
Oats	13,976	376,756	27.0	864	11.88
Barley	877	23,170	26.2	1258	15.20
Clackamas					
Winter wheat	18,887	507,147	26.8	1608	21.44
Spring wheat	3,214	64,781	20.0	1200	16.00
Oats	26,966	1,022,098	37.8	1210	16.63
Barley	692	24,821	36.0	1728	20.88
Clatsop					
Winter wheat	52	1,598	30.2	1812	24.16
Spring wheat	25	580	23.2	1392	18.56
Oats	550	26,789	47.8	1530	21.03
Barley	17	630	35.8	1718	20.76
Columbia					
Winter wheat	830	21,775	26.2	1572	20.96
Spring wheat	403	9,197	22.8	1368	18.24
Oats	2,461	113,538	46.2	1478	20.33
Barley	215	8,939	41.0	1968	23.78
Coos					
Winter wheat	93	2,708	28.8	1728	23.04
Spring wheat	265	6,450	24.0	1440	19.20
Oats	1,374	74,378	51.2	1638	22.53
Barley	931	56,252	57.2	2746	33.18
Curry					
Winter wheat	26	606	23.0	1380	18.40
Spring wheat	18	348	18.6	1116	14.88
Oats	93	4,199	45.4	1453	19.98
Barley	51	1,985	38.4	1843	22.27
Douglas					
Winter wheat	9,263	166,534	18.0	1080	14.40
Spring wheat	4,039	59,385	14.6	876	11.68
Oats	10,691	266,033	24.8	794	10.91
Barley	1,669	40,276	24.0	1152	13.92
Jackson					
Winter wheat	8,170	172,925	21.2	1272	16.96
Spring wheat	1,971	32,062	16.0	960	12.80
Oats	1,037	37,341	33.8	1082	14.87
Barley	2,841	94,219	32.2	1546	18.68
Josephine					
Winter wheat	1,535	25,886	17.0	1020	13.60
Spring wheat	589	7,852	13.2	792	10.56
Oats	840	26,308	30.0	960	13.20
Barley	706	18,783	26.6	1277	15.43
Lane					
Winter wheat	16,780	306,090	18.2	1092	14.56
Spring wheat	13,184	178,879	13.4	804	10.72
Oats	21,761	539,125	24.4	780	10.73
Barley	1,444	38,189	26.4	1267	15.31

TABLE I *(continued)*. WINTER AND SPRING GRAINS IN OREGON

	Acreage	Production in bushels	Bushels per acre	Pounds per acre	Value per acre
Lincoln					
Winter wheat	304	5,640	18.9	1134	$15.12
Spring wheat	80	1,222	15.4	924	12.32
Oats	1,043	35,429	34.2	1094	15.04
Barley	21	653	29.6	1421	17.17
Linn					
Winter wheat	24,280	486,481	19.6	1176	15.68
Spring wheat	17,012	241,983	14.0	840	11.20
Oats	47,337	1,333,111	28.2	902	12.41
Barley	2,241	64,980	29.2	1402	16.94
Marion					
Winter wheat	32,899	786,965	23.8	1428	19.04
Spring wheat	10,498	174,499	16.4	984	13.12
Oats	42,233	1,420,372	33.4	1069	14.70
Barley	1,606	52,358	32.8	1574	19.02
Multnomah					
Winter wheat	1,446	39,351	26.8	1608	21.44
Spring wheat	763	17,220	22.8	1368	18.24
Oats	4,230	171,579	39.8	1274	17.51
Barley	429	15,226	35.8	1718	20.76
Polk					
Winter wheat	5,137	600,584	23.8	1428	19.04
Spring wheat	3,696	59,704	16.4	984	13.12
Oats	25,659	807,556	31.2	998	13.73
Barley	1,155	32,664	28.0	1344	16.24
Tillamook					
Winter wheat	.....	.....	.....	.....	.....
Spring wheat	.....	.....	.....	.....	.....
Oats	.....	.....	.....	.....	.....
Barley	.....	.....	.....	.....	.....
Washington					
Winter wheat	19,119	497,251	25.8	1548	20.64
Spring wheat	2,711	51,170	19.4	1164	15.52
Oats	24,961	1,071,390	42.8	1369	18.83
Barley	660	22,410	33.6	1613	19.48
Yamhill					
Winter wheat	24,855	606,827	24.3	1458	19.44
Spring wheat	2,879	49,743	17.4	1044	13.92
Oats	24,568	809,701	33.2	1062	14.61
Barley	743	22,229	30.2	1450	17.52

In Table I acreage and production data are given for Oregon, by counties, for winter wheat, spring wheat, oats, and barley. The figures are averages for the five-year period 1919 to 1923, inclusive, taken from reports compiled by F. L. Kent, Agricultural Statistician for Oregon of the United States Department of Agriculture.

Table I also gives the yields of these crops by counties and the value per acre of each crop based on the ten-year average farm price in Oregon from 1905 to 1914, inclusive. The average farm price per bushel for these crops for this period, according to the 1914 Yearbook of the United States Department of Agriculture, was as follows: wheat, 80 cents; barley, 58 cents; and oats, 44 cents per bushel. The price per ton based on these values would be $26.67 for wheat, $24.17 for barley, and $27.50 for oats. The ten-year average farm price per bushel for the years 1913 to 1922, inclusive (Yearbook, 1922) in Oregon was $1.32 for wheat, $0.88 for barley, and $0.59 for oats. Based on these prices, wheat was worth $44.00, barley $36.67, and oats $36.88 per ton.

Based on five-year average yields and ten-year pre-war average prices, the acre value of winter wheat for the state was $18.16; of barley

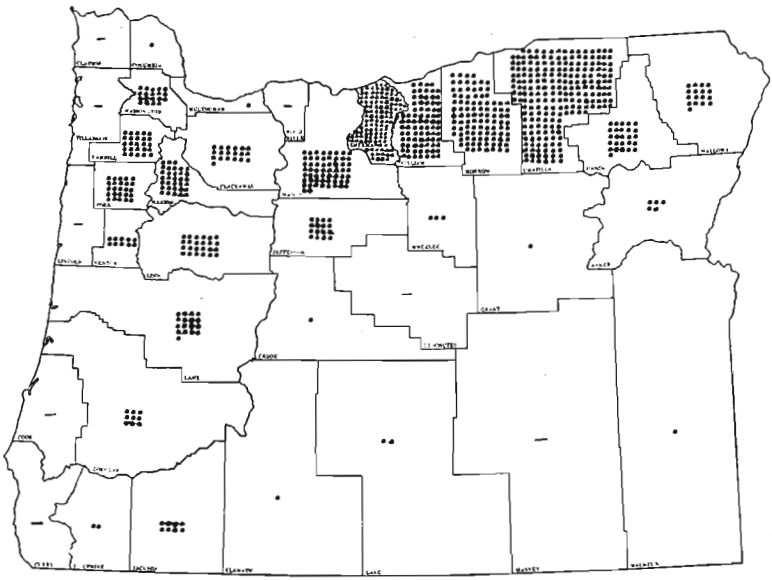

Fig. 1. Winter wheat acreage in Oregon, averages for 1919-1923 inclusive. Each dot represents one thousand acres; each dash represents less than five hundred acres.

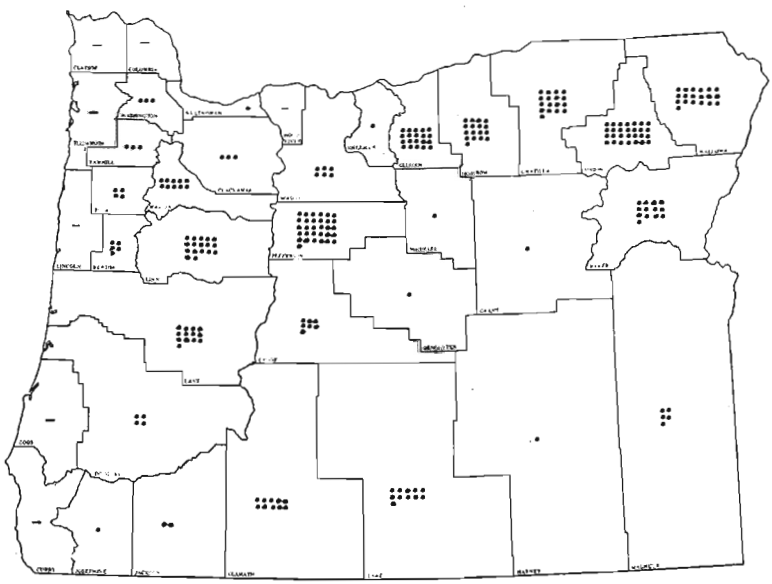

Fig. 2. Spring wheat acreage in Oregon, averages for 1919-1923 inclusive. Each dot represents one thousand acres; each dash represents less than five hundred acres.

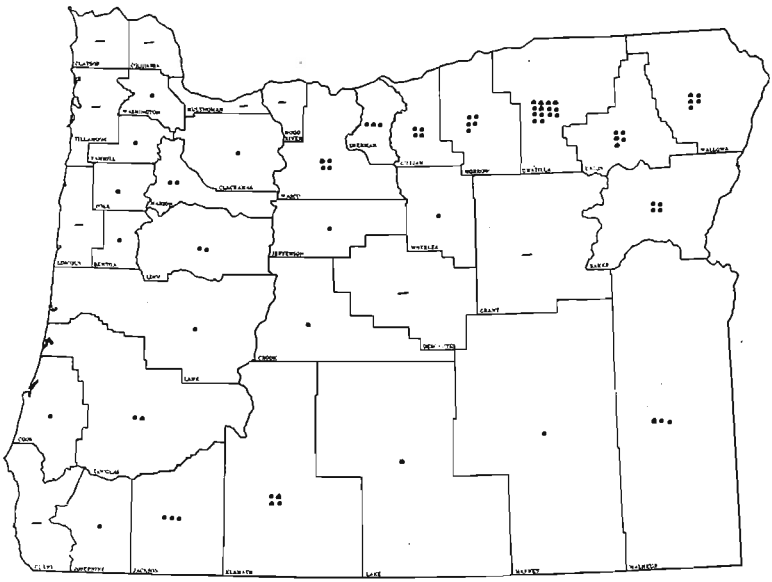

Fig. 3. Barley acreage in Oregon, averages for 1918-1923 inclusive. Each dot represents one thousand acres; each dash represents less than five hundred acres.

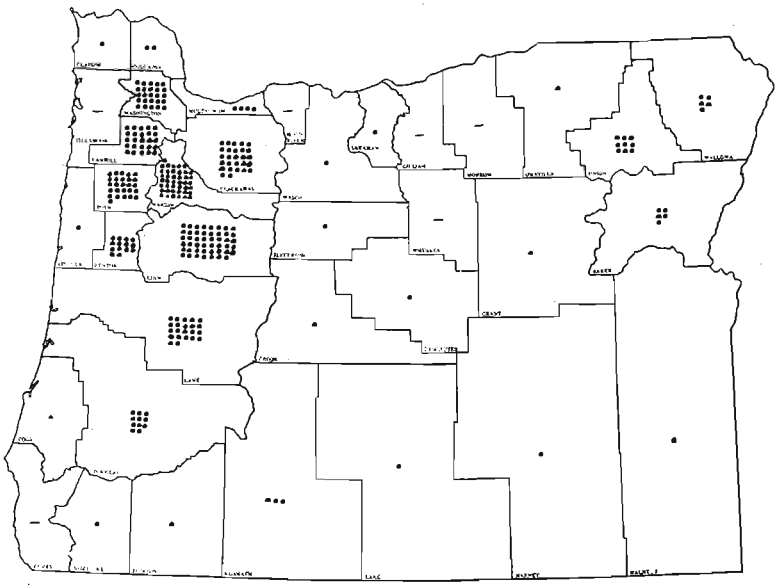

Fig. 4. Oat acreage in Oregon, averages for 1919-1923 inclusive. Each dot represents one thousand acres; each dash represents less than five hundred acres.

$17.34, of oats $14.26; and of spring wheat $12.16. In yield, however, barley ranked first for the state, slightly exceeding the average yield of winter wheat in pounds per acre. In the counties east of the Cascades barley also exceeded the yield of winter wheat, though in value per acre winter wheat was slightly higher, because of the higher average price per pound for wheat.

In Gilliam, Morrow, Sherman, Umatilla, and Union counties the five-year average yield of winter wheat exceeded that of spring barley, which ranked second in yield. In these five counties practically all the winter wheat is grown after fallow, and the barley generally follows a grain crop.

The distribution of winter wheat, spring wheat, barley, and oats in Oregon is graphically shown in Figures 1 to 4 inclusive.

WHEAT

Wheat is the most important farm crop grown in Eastern Oregon. Both winter and spring varieties are raised. The total acreage devoted to winter and spring wheat in Oregon is shown in Table I.

From the standpoint of acreage, spring wheat is the third cereal of importance in the state, being considerably exceeded by the acreage in winter wheat, and also by the number of acres devoted to growing oats. In several counties of the state, spring wheat is an important crop. The average annual acreage for the five-year period, 1919 to 1923, inclusive, exceeded 15,000 acres in each of seven counties: Linn, Gilliam, Jefferson, Morrow, Umatilla, Union, and Wallowa.

In the following Eastern Oregon counties, the average total acreage of spring wheat for the past five years exceeded that sown to winter wheat: Baker, Crook, Deschutes, Grant, Harney, Hood River, Jefferson, Klamath, Lake, Malheur, Union, and Wallowa. Jefferson county's acreage was highest, averaging 31,130 acres. Union county was second with an average acreage of 28,025.

The average acre yield of spring wheat exceeded that of winter wheat in the following six counties of Eastern Oregon, where a large part of the crop was grown under irrigation: Baker, Crook, Deschutes, Harney, Klamath, and Lake. In the other twelve counties, higher average acre yields were obtained from winter wheat.

In Eastern Oregon, most of the winter wheat is grown after fallow and a large part of the spring wheat is grown after a grain crop the preceding year. In sections where irrigation is practiced, much more spring wheat is grown than winter wheat.

On the branch station at Moro the ten-year average yield of Turkey winter wheat, C. I. No. 1571, was 32.5 bushels per acre when grown after summer fallow. Baart spring wheat during the same period averaged 25.5 bushels per acre after summer fallow. For the six-year period during which it has been grown, 1918 to 1923, inclusive, Hybrid 128 winter wheat averaged 34.8 bushels per acre in yield at Moro, and Federation spring wheat averaged 28.5 bushels per acre. When both are grown after corn or after peas, spring wheat has produced as high acre yields as winter wheat on the Moro station.

Experiment station results. Experiments to determine the highest-yielding wheat varieties for Eastern Oregon have been in progress for a number of years at the branch stations* at Moro in Sherman county, at Union in Union county, and at Burns in Harney county. Before the establishment of these stations, the most important varieties of spring

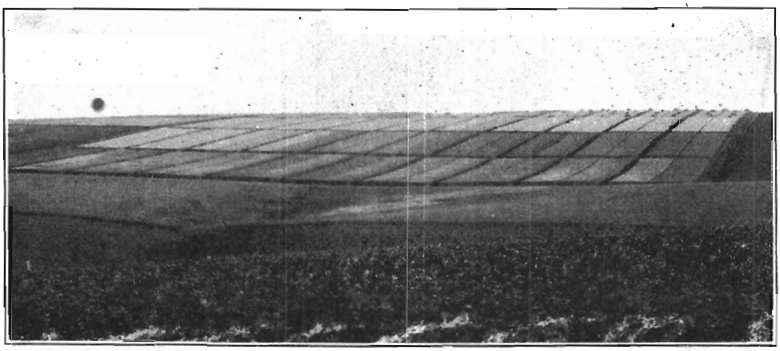

Fig. 5. General view of spring-grown experimental plots on Sherman County Branch Station, Moro.

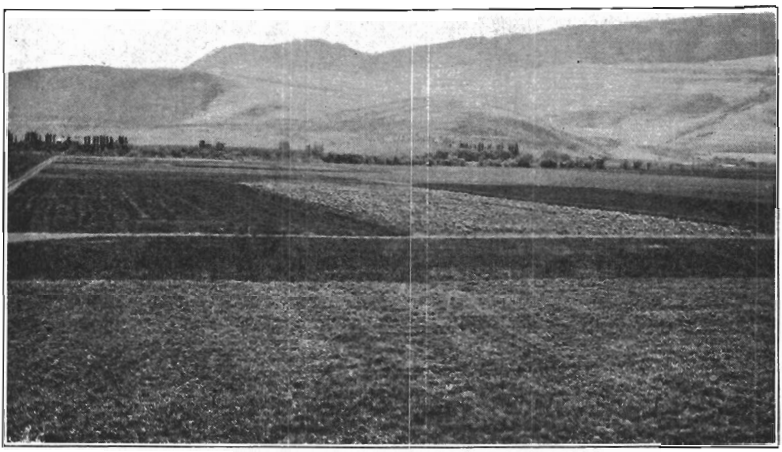

Fig. 6. General view of experimental farm, Eastern Oregon Branch Station, Union.

wheat commercially grown were Pacific Bluestem, Little Club, and Red-chaff. At the present time these varieties have been largely supplanted by Federation, Hard Federation, and Baart. The yields of these varieties in the varietal trials at Moro and Burns, for the years 1918 to 1923, inclusive, are shown in Table II.

*The branch station at Moro is maintained cooperatively by the State of Oregon, through the Oregon Agricultural Experiment Station, and the United States Department of Agriculture, through the Office of Cereal Investigations of the Bureau of Plant Industry. The branch station at Burns was also cooperatively maintained by these same agencies from 1911 to 1920. Since July 1, 1920 the station at Burns has been maintained solely from state funds.

The yields at Moro were obtained under dry-farming conditions on land left fallow the previous year. The average annual precipitation at Moro during this period was 11.37 inches. The yields at Union were obtained on black silt loam soil typical of the southern portion of the Grande Ronde Valley under subirrigated conditions. The average annual precipitation at Union is 14.03 inches. The yields at Burns were obtained under irrigated and dry-land conditions with fallow preceding the wheat on dry land and oats preceding it under irrigation. The average annual precipitation at the branch station at Burns for the four-year period was 8.68 inches.

TABLE II. YIELDS OF SPRING WHEAT IN BUSHELS PER ACRE AT MORO AND BURNS, OREGON, FOR THE YEARS 1918 TO 1923, INCLUSIVE

Yields at Moro

C. I. No.	Variety	1918	1919	1920	1921	1922	1923	Average
1697	Baart	14.9	24.2	22.4	23.5	19.5	37.0	23.6
4066	Little Club	18.0	23.0	20.0	22.2	17.5	31.5	22.0
4067	Pacific Bluestem	13.0	23.7	18.2	21.5	20.5	33.9	21.8
4158	Marquis	15.0	22.7	19.2	19.7	17.0	34.9	21.4
4733	Hard Federation	21.3	28.7	25.9	29.0	21.0	40.8	27.8
4734	Federation	21.0	28.7	24.5	29.9	21.3	45.3	28.5
4981	White Federation	.....	28.3	23.7	27.7	24.2	41.0	29.0

Yields at Burns

C. I. No.	Variety	Dry-land					Irrigation				
		1920	1921	1922	1923	Average	1920	1921	1922	1923	Average
1697	Baart	36.5	28.3	27.4	34.5	31.7	65.0	36.4	.....	.....	.....
3663	Dicklow	.....	.....	.....	.....	.....	77.1	45.4	47.1	74.8	61.1
4158	Marquis	28.5	21.0	.....	28.2	25.9	64.0	36.0	30.8	51.8	45.7
4734	Federation	31.0	23.8	25.3	39.0	29.8	82.9	50.9	50.3	73.5	64.4
4733	Hard Federation	21.2	25.0	21.0	34.1	25.4	55.1	28.5	25.6	48.1	39.3
4981	White Federation	.....	.....	20.3	35.4	.....	.....	23.3	27.7	49.7	33.6
4067	Pacific Bluestem	31.9	25.2	.....	.....	.....	57.5	42.7	.....	.....	.....

Results at Moro. Table II gives the yields of six spring wheat varieties grown at Moro after fallow for the six-year period, 1918 to 1923, inclusive, and seven varieties for the five-year period, 1919 to 1923, inclusive. The highest average yield obtained was from Federation, 28.5 bushels per acre for the six-year period. The yields of the three Federation wheats, Federation, Hard Federation, and White Federation, are quite similar, the average for the five-year period being only slightly higher for Federation and Hard Federation than for White Federation. Each of these three varieties considerably outyielded the next highest yielding spring wheat, Baart. Federation averaged 4.9 bushels and Hard Federation 4.2 bushels per acre more. Baart for this period slightly exceeded the yield of Marquis, Pacific Bluestem, and Little Club.

Results at Burns. Table II also gives the yields of seven wheat varieties grown at the Burns Branch Station for the years 1920 to 1923, inclusive, on both dry and irrigated land. Three varieties, Baart, Federation, and Hard Federation, were grown for the four-year period on dry land, and four varieties, Dicklow, Marquis, Federation, and Hard Federation, were grown for the four-year period under irrigation.

As a dry-land wheat, Baart produced the highest average yield, with Federation second and Hard Federation third. The average yield of Baart exceeded the yield of Federation nearly two bushels per acre for the four-year period.

Federation yields more than Marquis. Under irrigation, the highest yield was obtained from the Federation variety, Dicklow ranking second, and Marquis third. Federation exceeded the average yield of Dicklow by 3.2 bushels per acre. In a fertilizer experiment at Burns for the years 1921 to 1923, inclusive, the average yields of Federation wheat for the various treatments ranged from 59.6 to 75.7 bushels per acre.

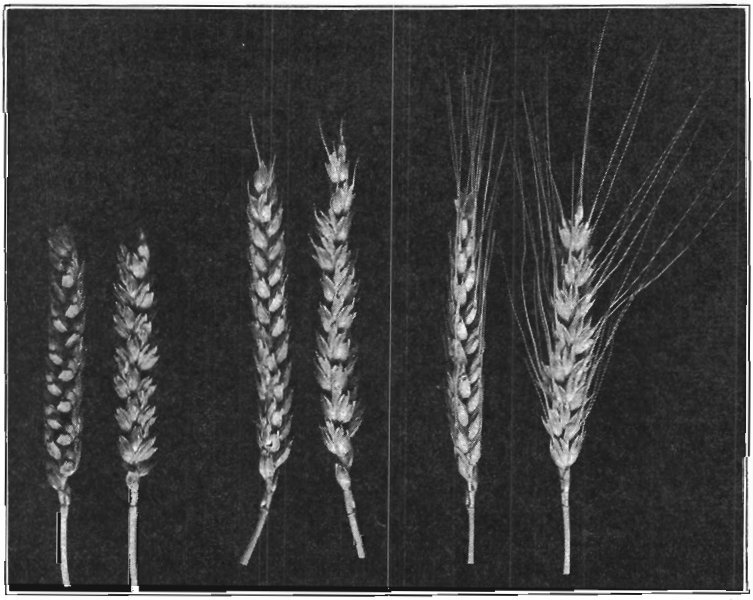

Fig. 7. Heads (from left to right) of Hard Federation, Pacific Bluestem, and Baart spring wheat varieties.

Results at Union. The Hard Federation and White Federation wheats were tried at the Union Branch Station in 1922. In 1923 Federation and Onas, a hybrid with Federation as one of the parents, were added. The yields obtained from Hard and White Federation in 1922 were considerably exceeded by Pacific Bluestem and Little Club. In 1923, the following results were obtained from a varietal trial in duplicate tenth-acre plots:

	Bushels per acre
Onas	59.9
Federation	58.6
White Federation	44.4
Baart	43.9
Pacific Bluestem	42.7
Hard Federation	38.8
Little Club	28.3
Dicklow	27.7

Trials by farmers. Comparative yield trials with spring wheat have been conducted for a number of years by farmers in various counties of Eastern Oregon. Many letters have been received by the Moro Branch Station from farmers regarding the performance of the Federation wheats in comparison with commonly-grown spring wheat varieties. The results for 1923 have been summarized by the county agents in several counties where demonstration trials have been in progress between Federation, Hard Federation, and other spring wheat varieties.

Umatilla county. In Umatilla county in 1923 approximately 1500 acres of Hard Federation spring wheat were grown by twenty-four farmers. Sixteen of these farmers reported yields of from two to ten bushels per acre higher than other spring wheats grown under similar conditions, the average increased yield being about five bushels per acre. No farmers reported lower yields from Hard Federation than from other spring wheat varieties except that one grower reported that Federation slightly exceeded the yield of Hard Federation.

Federation wheat was grown in Umatilla county from fall sowing by five farmers, and from spring sowing by four farmers. Two hundred and thirty-five acres were fall sown and 560 spring sown. Under similar conditions, the fall-sown Federation wheat exceeded by ten bushels to the acre the yield of the highest yielding winter wheat. Seven thousand acres of Federation wheat were sown in Umatilla county in the fall of 1923. Federation is a spring wheat, and too much confidence should not be placed in its performance for a short period of time as a fall-sown variety. Further trials will be necessary to determine in just what localities, if any, in Eastern Oregon Federation can safely be fall sown.

Union county. In Union county two hundred farmers grew Hard Federation wheat in 1923, more than 5000 acres being sown. Twenty of these farmers reported to the county agent that Hard Federation exceeded the yield of other spring wheats grown under similar conditions. Yields of from twenty to fifty bushels per acre were obtained with an average of about twenty-five bushels for the county. No farmer who grew the Hard Federation wheat reported a yield lower than that obtained from other spring wheat varieties. No Federation wheat was grown in Union county by farmers in 1923, but demonstration trials will be carried on in 1924 from both fall and spring sowing.

Wallowa county. In Wallowa county there were approximately 100 acres of Federation wheat grown by two farmers under irrigation. Yields of thirty and forty-five bushels per acre were obtained. Both of these farmers reported higher yields from Federation wheat than from other spring wheat varieties. About 1000 acres of Hard Federation were grown in Wallowa county by thirty-five farmers. The yields obtained ranged from twenty to forty bushels per acre, averaging about thirty bushels. Ten farmers from whom reports were received reported that the yields of Hard Federation were higher than those obtained from other spring wheats grown under similar conditions.

Baker county. More than 1000 acres of Federation wheat were grown under irrigation in Baker county by forty-five farmers. Thirty of the farmers from whom reports were received obtained higher yields from Federation than from other wheats grown under similar conditions, the average being about seven bushels per acre more than for any other

spring wheat. One farmer reported a lower yield from Federation than from Dicklow.

The Hard Federation variety was grown under both irrigated and dry-land conditions in this county by twenty-six farmers. One farmer reported an equal yield from Federation and Hard Federation, and twenty-five farmers reported higher yields from Hard Federation than from other spring wheats.

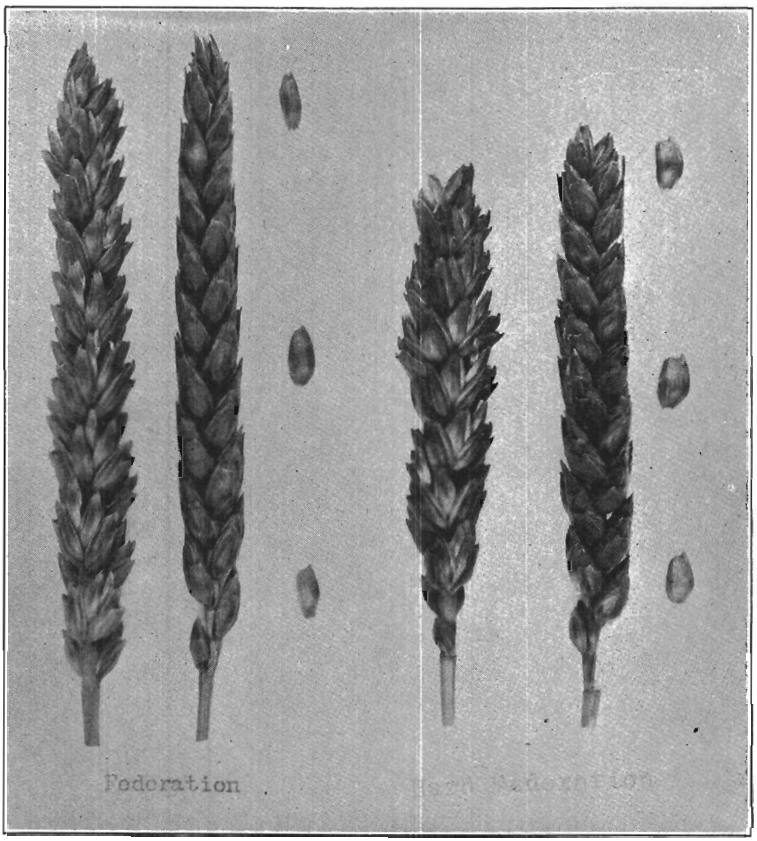

Fig. 8. Heads of Federation and Hard Federation spring wheats.

Malheur county. Five hundred acres of Federation spring wheat were grown in Malheur county under irrigation by about thirty farmers. In twelve carefully conducted demonstration trials by the county agent, this wheat averaged fifty-six bushels per acre in yield or about fifteen bushels per acre higher than the average of other spring wheats with which it was compared. No growers reported lower yields from the Federation variety than from other spring wheats. In these trials the wheat was compared with Jenkin, Baart, and Dicklow—all under irrigation.

Deschutes county. In Deschutes county fourteen farmers grew Federation wheat, about one-half of the acreage being under irrigation and one-half on dry land. Twelve of these farmers from whom reports were received stated that higher yields were obtained from this wheat than from other spring wheat varieties.

Crook county. Twenty-four farmers in Crook county grew 408 acres of Federation wheat under irrigation. Reports received from eighteen of these farmers stated that the yields obtained from Federation wheat ranged from twelve to fourteen bushels per acre higher than that obtained from other spring wheat varieties grown under similar conditions. Three farmers in this county grew Hard Federation and reported an average yield of nine bushels per acre higher than from other spring wheats.

The Federation varieties. The three Federation spring wheat varieties—Federation, Hard Federation, and White Federation—are of Australian origin. The first sowing of these varieties in the United States was made at the branch experiment station at Moro in 1916 from small quantities of seed furnished to the United States Department of Agriculture by the Department of Agriculture of New South Wales, Australia. They were grown in short rows in the plant breeding nursery at Moro in 1916. Because of their promising appearance, seed was increased as rapidly as possible. Two of the varieties were included in comparative trials in nursery rows in 1917 and in larger plots the following year.

Because of their high yields in the station trials in 1918, a limited quantity of seed of Hard Federation and Federation was distributed in 1919 to farmers for further trial. The results secured by farmers in 1919 and the results on the station justified a further distribution of these two varieties to different sections of the state. In several localities in Eastern Oregon, these varieties are now commercially established, and as the preceding reports from farmers indicate, these varieties have proved so promising that they will probably soon replace all other spring-sown wheats in most parts of Eastern Oregon. The varieties have also given good results in other western states.

Each of the varieties is beardless, and the kernels are white. Hard Federation and White Federation mature earlier than Federation and have harder kernels of a slightly better milling quality. The heads of Federation and Hard Federation are brown, and those of White Federation are white. The varieties all have short, stiff straw and do not shatter very readily. They are spring varieties. Federation is more winter hardy than Hard Federation or White Federation but not sufficiently hardy to be recommended for general fall sowing in Eastern Oregon. One year's results in Umatilla county indicate that Federation might perhaps advantageously replace Jenkin and Redchaff, two spring wheats now grown from fall sowing in that county. Numerous hybrids have been made at the Moro Station between the Federation wheats and present commercial winter wheats in order to produce a hardy winter wheat with other desirable qualities now possessed by the Federation varieties. A large number of pure-line selections have also been made from these wheats, especially Hard Federation, with the hope of further improving their yield and quality.

Heads and kernels of Federation, Hard Federation, Baart, and Pacific Bluestem spring wheats are shown in Figs. 1, 2, and 3.

Milling and baking data. The two most important considerations in influencing the farmer's decision as to what wheat variety to grow are acre yield and market price. The milling quality of wheat should be an important factor in determining market price. During recent years in

Fig. 9. Governor Walter M. Pierce in a field of Federation wheat which yielded 82.2 bushels per acre on irrigated land at the Harney Valley Branch Station, Burns, 1923.

the Pacific Northwest, however, wheats of poor milling quality have brought nearly as high, and in some cases a higher, price on the market than high-protein, good milling wheats, so that more attention has been paid by farmers to quantity rather than quality production. The branch experiment stations in Eastern Oregon have been concerned in improving the quality of wheat as well as in producing high yielding varieties. Milling and baking trials are made every year by the Section of Milling

Investigations, Grain Division, Bureau of Agricultural Economics, of the United States Department of Agriculture on a large number of wheat varieties grown at the Moro Branch Station. Similar milling and baking trials were conducted on wheats grown at the Burns Branch Station from 1918 to 1922, inclusive.

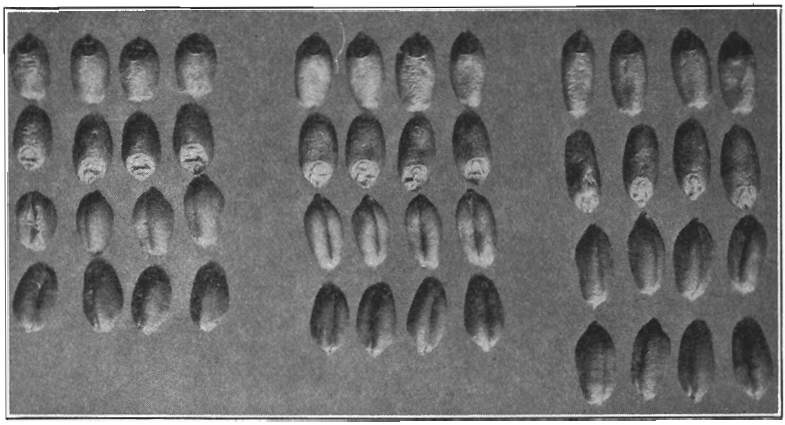

Fig. 10. Kernels (left to right) of Hard Federation, Pacific Bluestem, and Baart spring wheats.

Hard Federation excellent milling wheat. In Table III are given some important milling and baking characteristics of five spring and two commercially-grown winter wheat varieties for the years 1918 to 1923, inclusive, together with the annual and average yields of these varieties for this period. These varieties were grown at Moro under identical soil and climatic conditions. Of the varieties listed in this table, Hard Federation and Marquis rank highest as milling wheats, the average protein content, loaf volume, and score for loaf texture and color being higher than those of the other varieties.

It will be noted from this table that Hard Federation compares very favorably with Marquis, which is considered one of the best milling wheats grown commercially. The bushel weight of Hard Federation every year considerably exceeded that of Marquis, and weight per bushel is an important factor in determining grade and price.

It will also be noted from this table that Federation appears to be a somewhat better milling wheat than Baart, its average loaf volume and the percentage of flour made from the wheat being slightly higher. In average weight per bushel, Baart exceeded Federation as it also did in its average score for loaf color. The acre yield at Moro of Federation for the six years was nearly five bushels higher than that of Baart, while at Burns on dry land Baart was higher in acre yield by 1.9 bushels.

The spring wheats, though averaging less in acre yield, were superior in most respects to either of the two winter wheats for breadmaking, Hybrid 128 making an especially poor showing from a milling and baking standpoint.

In Table IV milling and baking data are given for five wheat varieties grown under irrigation at Burns for the years 1920 to 1922, inclusive.

TABLE III. MILLING AND BAKING DATA FOR WHEAT VARIETIES GROWN AT MORO, OREGON, UNDER SIMILAR CONDITIONS FOR THE YEARS 1918 TO 1923, INCLUSIVE

Variety and Cereal Investigations Number	Year	Acre yield	Bushel weight	Protein	Flour	Loaf volume	Loaf texture	Loaf color
		bu.	*lbs.*	%	%	*c.c.*	%	%
Baart (1697)	1918	14.9	57.0	15.8	68.6	2250	89.5	87.0
	1919	24.2	61.6	10.5	71.8	2000	90.5	94.5
	1920	22.4	59.1	12.7	64.7	1990	88.0	92.5
	1921	23.5	55.6	13.4	67.3	2080	91.0	90.5
	1922	19.5	55.4	11.2	67.7	2020	86.0	90.8
	1923	37.0	61.1	13.5	70.1	2130	87.5	91.0
Average		23.6	58.3	12.9	68.3	2078	88.8	91.1
Marquis (4158)	1918	15.0	55.3	16.6	71.7	2600	91.5	88.5
	1919	22.7	52.4	15.4	69.9	2280	91.5	89.0
	1920	19.2	51.9	16.8	68.7	2140	90.0	86.5
	1921	19.7	54.6	14.0	68.9	2190	92.0	92.0
	1922	17.0	52.4	15.9	73.2	2000	85.0	88.5
	1923	34.9	60.4	13.9	73.7	2250	89.5	90.0
Average		21.4	54.5	15.4	71.0	2243	89.9	89.1
Hard Federation (4733)	1918	21.3	59.8	15.2	72.4	2280	93.0	92.0
	1919	28.7	56.5	14.3	71.9	2110	91.0	92.0
	1920	25.9	55.2	13.7	71.3	1940	92.0	92.0
	1921	29.0	60.9	12.3	69.9	2090	90.8	93.5
	1922	21.0	54.3	14.4	69.7	2110	90.5	94.0
	1923	40.8	60.7	14.0	71.8	2260	90.8	93.5
Average		27.8	57.9	14.0	71.2	2132	91.4	92.8
Federation (4734)	1918	21.0	56.7	14.3	71.5	2200	88.0	84.0
	1919	28.7	54.8	13.6	68.5	2120	88.0	91.0
	1920	24.5	54.9	13.2	70.4	2080	91.5	88.0
	1921	29.9	56.1	12.7	68.5	1930	88.3	86.0
	1922	21.3	52.4	14.0	65.5	2180	84.0	91.8
	1923	45.3	60.4	10.8	70.5	2230	91.3	89.8
Average		28.5	55.9	13.1	69.2	2123	88.3	88.4
Pacific Bluestem (4067)	1918	13.0	56.1	15.7	70.7	2090	86.5	84.0
	1919	23.7	51.0	15.6	66.1	1740	85.0	87.0
	1920	18.2	51.0	15.3	58.6	2220	89.5	86.0
	1921	21.5	54.4	14.4	63.4	1980	89.5	89.0
	1922	20.5	55.1	14.8	67.3	1790	84.0	73.5
	1923	33.9	60.0	12.9	71.2	2030	87.5	90.3
Average		21.8	54.6	14.8	66.2	1975	87.0	85.0
Kharkov	1918	26.2	60.0	11.4	68.8	2100	89.0	89.0
	1919	40.0	61.8	10.7	71.3	1760	88.5	92.0
	1920	33.2	58.1	12.2	71.5	1910	88.5	88.0
	1921	40.1	61.7	8.0	71.9	1820	90.5	92.5
	1922	17.1	56.1	13.2	72.4	1910	86.0	85.8
	1923	35.3	60.1	9.7	71.5	1930	84.3	88.8
Average		32.0	59.6	10.9	71.2	1905	87.8	89.4
Hybrid 128 (4512)	1918	26.5	57.0	13.6	69.5	1970	87.5	89.5
	1919	40.6	59.7	11.7	73.3	1730	87.5	86.5
	1920	36.8	55.4	12.3	63.1	1810	87.5	88.5
	1921	43.0	59.8	12.7	67.0	1670	82.5	85.5
	1922	21.2	53.9	13.7	69.9	1610	84.0	85.5
	1923	40.5	58.5	10.2	70.1	1820	79.3	85.8
Average		34.8	57.4	12.4	68.8	1768	84.7	86.9

These data show that Hard Federation and White Federation are satisfactory milling wheats when grown under irrigation, averaging higher in loaf volume than Marquis. There did not appear to be a great deal of difference in the milling and baking values of Dicklow and Federation when grown under irrigation at Burns. In other experiments by the United States Department of Agriculture, Federation has proved superior to Dicklow in milling quality when grown under irrigation.[1]

TABLE IV. MILLING AND BAKING DATA FOR WHEAT VARIETIES GROWN AT BURNS, OREGON, UNDER IRRIGATION FOR THE YEARS 1920 TO 1922, INCLUSIVE

Variety and Cereal Investigations Number	Year	Acre yield	Bushel weight	Protein	Flour	Loaf volume	Loaf texture	Loaf color
		bu.	*lbs.*	%	%	*c.c.*	%	%
Dicklow (3663)	1920	77.1	57.2	10.1	71.9	1750	84.0	89.5
	1921	45.4	59.0	9.6	72.5	2090	89.0	92.0
	1922	47.1	58.6	11.2	71.8	1980	91.3	91.8
Average		56.5	58.3	10.3	72.1	1940	88.1	91.1
Pacific Bluestem (4067)	1920	57.5	57.7	12.2	70.3	1580	83.0	88.0
	1921	42.7	56.8	12.8	68.9	1825	84.4	84.3
Average		50.1	57.3	12.5	69.6	1703	83.7	86.2
Marquis (4158)	1920	64.0	59.8	13.1	71.2	2020	90.5	92.0
	1921	36.0	61.4	11.2	76.6	2110	86.5	91.5
	1922	30.8	61.1	13.7	77.6	2125	90.0	92.0
Average		43.6	60.8	12.7	75.1	2085	89.0	91.8
Hard Federation (4733)	1920	55.1	58.7	14.5	71.3	2030	89.0	90.5
	1921	28.5	60.6	11.6	73.0	2120	84.5	92.0
	1922	25.6	58.6	13.6	71.1	2180	88.3	87.5
Average		36.4	59.3	13.2	71.8	2110	87.3	90.0
Federation (4734)	1920	82.4	58.5	11.8	73.5	1930	86.0	90.0
	1921	50.9	61.5	10.5	73.8	2000	87.0	88.0
	1922	50.3	59.7	9.5	69.0	2050	87.3	88.5
Average		61.2	59.9	10.6	72.4	1993	86.8	88.8
White Federation (4981)	1921	23.3	59.5	10.2	75.9	2130	88.5	92.5
	1922	27.7	59.7	14.3	73.1	2290	89.8	90.0
Average		25.5	59.6	12.3	74.5	2210	89.2	91.3

[1]Farmers' Bulletin No. 1301, U. S. Department of Agriculture.

That Hard Federation wheat is likely to be in demand for commercial milling is indicated by the following extract from a letter from Mr. E. O. McCoy of the Wasco Warehouse Milling Company, who operates one of the largest flour mills in Oregon.

The Dalles, Oregon, Jan. 12, 1924.

Dear Sir:

Replying to your letter of January 11 regarding Hard Federation wheat, we advise that we have so far milled only a limited quantity of this wheat, but what experience we have had shows that the results have been very satisfactory for making certain quality of flour.

In milling we class the Hard Federation in the same family that we do Bluestem and Baart wheat. The Hard Federation is fully equal to the best Bluestem and Baart that we have been able to obtain anywhere in Oregon, Washington, or Idaho. About half of the wheat we grind is wheat of this family and we use it for making fancy family flour and for blending with eastern hard wheats for extra bakers' flour. By using Hard Federation as a blend with hard wheats, we secure loaf volume, texture of loaf, and color that is much more satisfactory than when using the eastern wheat alone. . . . As far as our experience goes, it is a better wheat for milling than any Marquis we have been able to obtain in either Oregon or Washington.

We consider it highly important that a wheat of the nature of Hard Federation be raised in our immediate territory, particularly in Sherman county, as the soils of that county are adapted to raising strong wheat. For the past two or three years, and at the present time, we are having to ship most of our strong soft wheats from Idaho, which is more or less inconvenient to the mill, and is sending money out of this state.

As this wheat has good yielding qualities, we highly recommend it as a milling wheat, and from what experience we have had would say that it would also bring a premium price along with Bluestem and Baart. If it showed better strength, as it seems to this season, it would bring even better prices than either of those two wheats.

Yours very truly,

WASCO WAREHOUSE MILLING CO.,

E. O. McCOY.

Time and rate of sowing spring wheat. All results on the branch experiment stations in Eastern Oregon emphasize the necessity of sowing spring wheat early in the spring. When sown late, low yields and poor quality wheat usually result, because of late maturity and consequent drought injury.

The rate of sowing for spring wheat should vary somewhat for different varieties, those with large kernels, like Baart, requiring thicker seeding than those with small kernels like Marquis. Some varieties, too, tiller or stool less than others and therefore should be sown at a heavier rate. The rate of sowing also should vary with locality and soil type, the sections of higher rainfall and heavier soil types requiring thicker seeding than the areas of light rainfall and light soils. The rate of sowing, also, should vary according to method of seed treatment for smut, seed treated with copper carbonate requiring a thinner rate than that treated with formalin or bluestone.

Experiments at Moro have shown that on the average the best rate to sow spring wheat when the seed has been treated with formalin or bluestone, is about one bushel per acre. To sow at the rate of one

bushel of dry seed per acre, the drill will have to be set to sow at the rate of about five and one-half pecks per acre of treated seed to allow for the increase in volume of wet seed. Only one year's results are available at Moro for seed of Baart and Hard Federation spring wheats treated with copper carbonate and sown at varying rates. In 1923, the highest yields of Baart were obtained from the four-peck sowing, and

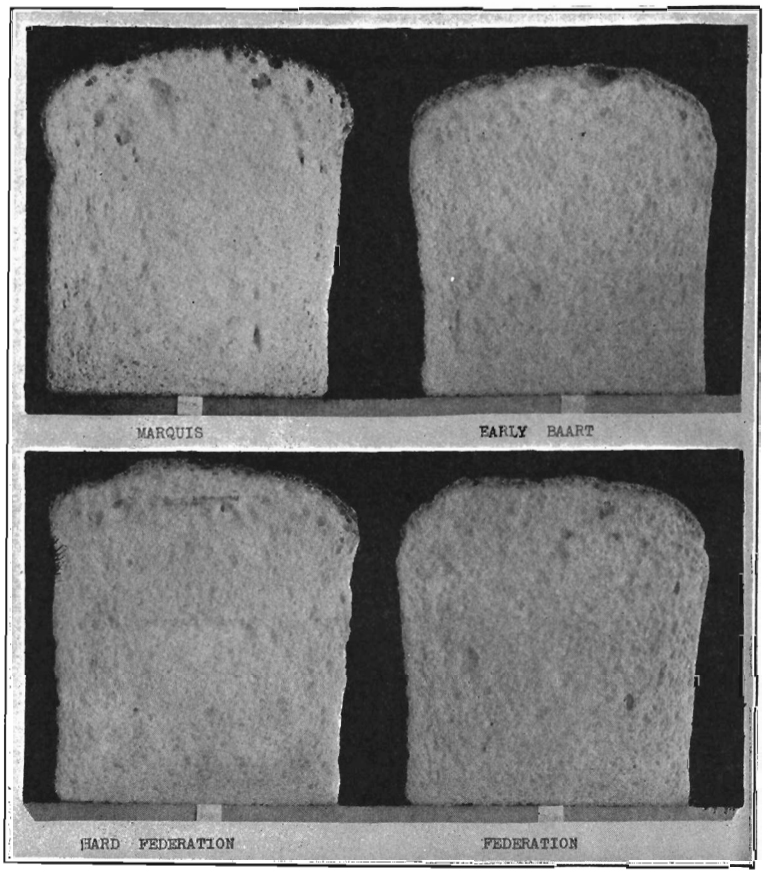

Fig. 11. Cross-section of loaves of bread made from four spring wheat varieties of the crop of 1921 grown at the Sherman County Branch Station, Moro.

identical yields were obtained from Hard Federation sown at the rate of 2, 3, and 4 pecks per acre. Lowest yields from both varieties were obtained from the 7 and 8 peck rates.

Results at the branch stations show that satisfactory smut control in spring wheat is secured by using the dry copper carbonate method. Because of less seed injury and the saving of seed this method is recommended for treating wheat. For treating barley and oats, the formaldehyde or the bluestone treatment should be used.

Seed bed preparation. Wheat, like the other small grains, requires a good firm seed bed for best results. Where wheat is to follow another grain crop, the land should be fall plowed if possible and left rough over winter. A disk or spring-tooth harrowing followed once or twice with a spike-tooth harrow will generally put the soil in ideal condition. If spring plowed, the soil should be firmed with a packer or disk harrow with disks set nearly straight, followed with the spike-tooth or smoothing harrow as many times as may be necessary, once usually sufficing for lighter soil types.

Fig. 12. A plot of Federation spring wheat on the Harney Valley Branch Station in 1923 that yielded 90.6 bushels per acre on irrigated land.

When spring wheat is sown on ground left fallow the previous year, it is generally necessary to use the disk or spring-tooth harrow once and follow with the spike-tooth harrow.

When spring wheat is sown after a cultivated crop like corn, peas or potatoes, plowing generally is not necessary. A double disking and harrowing in most cases will be sufficient cultivating to make a good seed bed.

It is a good practice, especially where weeds are troublesome, to harrow the ground once with a spike-tooth harrow four or five days after sowing spring wheat. Harrowing the crop after it is up is not advisable.

BARLEY

The second most important cereal in Eastern Oregon is barley, though the acreage and production of this crop for the entire state are considerably exceeded by those of oats. Table I shows the average acreage and production of barley in Oregon, by counties, for the five-year period, 1919 to 1923, inclusive.

Both winter and spring barleys are grown in Eastern Oregon. Because of lack of winter-hardiness, the areas on which winter barley is grown are limited to a very few localities where the winters are mild or where the snow covering generally affords protection to the crop during the winter months.

As is shown in Table I, the average five-year farm yield of barley, in pounds per acre, exceeded that of spring wheat or oats in every county of the state. Barley also exceeded the average yield of winter wheat in all counties of the state except five in Eastern Oregon where the winter wheat was grown after fallow, and three in Western Oregon, Clatsop, Polk, and Yamhill.

Spring barley productive. Spring barley is one of the highest yielding dry-land crops. A good spring barley generally will outyield any other spring-sown crop in Eastern Oregon. When grown after fallow in some locations it may produce higher yields than winter wheat. The oat crop is considered by farmers a better one to grow than barley on some of the wet lands in Western Oregon and in limited areas in Central Oregon where barley is sometimes injured by late spring frosts. Experiment station results, however, and the yield statistics given in Table I, strongly indicate that barley should more generally take the place of spring wheat and oats, in nearly every county of the state. In addition to being more productive, barley is higher than oats in digestible nutrients and in proportion of grain to hull. Barley is now extensively used in Oregon for stock feed. It is successfully fed to all classes of livestock, being usually first steamed and rolled. Because of its higher acre yield, barley should further replace oats as a feed crop. When sold on the market, oats may prove more profitable to grow than barley in a few localities where there is a milling demand for the crop. The average farm price in Oregon for the past ten years for barley and oats has been about equal, though the average price for the ten-year pre-war period 1905 to 1914, was $3.33 per ton higher for oats than for barley.

Results at Moro. Many spring and winter barleys have been tried at the three branch experiment stations in Eastern Oregon. Experiments to determine the highest yielding barley varieties were started at Moro in 1911 and 75 varieties have been tested at that station in field plots. Winter barleys were tried in the years 1912 to 1917, inclusive. During two of these years, 1913 and 1917, all varieties of winter barley sown completely winter-killed. The highest average yields were obtained from Wisconsin winter, a six-rowed, bearded variety.

Annual and average yields of eight of the leading barley varieties grown at Moro for the eight-year period 1916 to 1923, inclusive, are shown in Table V. Of the varieties listed in this table, all are bearded types except Meloy, which is a hooded or beardless variety. Smyrna and Hannchen are two-rowed barleys. The highest yielding variety which has been in the trial during the entire twelve-year period was Mariout, its average yield being 43.9 bushels per acre. It yielded 6 percent more than Meloy for the period during which that variety was grown, 1915 to 1923, inclusive. For the eight-year period, Peruvian and Mariout have been the highest yielding varieties. Peruvian exceeded the average yield of Meloy 3.3 bushels and the average yield of Mariout was 2.5 bushels per acre more than that of Meloy.

TABLE V. ANNUAL AND AVERAGE ACRE YIELDS FOR THE LEADING SPRING BARLEY VARIETIES GROWN AT MORO, OREGON, AFTER FALLOW FOR THE YEARS 1916 TO 1923, INCLUSIVE

Variety	C. I. No.	1916	1917	1918	1919	1920	1921	1922	1923	Avg.
Six-rowed										
Mariout	261	69.3	45.4	29.0	40.2	39.2	41.7	37.3	59.5	45.2
Beldi	190	59.9	35.8	21.5	38.1	40.6	42.1	27.3	51.5	39.6
Peruvian	935	77.5	43.7	24.1	44.4	39.3	43.4	28.2	66.5	45.9
Trebi	936	95.8	27.5	24.2	47.3	28.5	34.4	24.4	70.0	44.0
Coast	2301	67.1	40.6	18.8	43.1	31.0	38.4	24.2	62.1	40.7
Two-rowed										
Hannchen	531	68.3	36.8	25.0	39.8	28.5	33.4	19.8	61.5	39.1
Smyrna	658	71.8	38.0	22.8	35.0	30.4	37.7	18.6	52.9	38.4
Hooded										
Meloy	1178	63.9	47.5	18.5	52.5	36.2	34.8	28.9	58.8	42.6

Results at Union. Many spring barley varieties have been tried at the Union Branch Station. Trebi, which has been grown since 1918, has been a consistently high yielder and a barley of splendid quality. Its nearest rival among the six-rowed varieties has been the common "Blue" or Coast variety. Of the two-rowed barleys, Hannchen and White Smyrna have been best. Both are good yielders and usually test 50 pounds or better in weight per bushel. Many new hybrid, hooded varieties have been produced at the Union Branch Station. Of these, Beardless x Blue C. is one of the most promising.

Barley grown with peas for hay and for silage has given excellent results at Union. Green weights of from 8 to 10 tons per acre have been obtained, and the ensilage has been of excellent quality.

In 1923, the following yields were obtained from a varietal test of six spring-sown barley varieties:

	Bushels per acre
Hannchen	96.3
White Club	93.5
Trebi	92.3
Coast	92.1
Smyrna	81.9
Mariout	80.2

Results at Burns. In Table VI are shown the annual and average yields of several spring-sown barley varieties at the Burns Branch Station on dry land after fallow for the years 1913 to 1917 and 1919 to 1921, inclusive. Four varieties were grown for this period. Trebi was grown from 1919 to 1921, inclusive. Hannchen was the highest yielding dry-land variety.

Table VII shows the annual and average yields of two varieties, Hannchen and Trebi, for the years 1919 and 1920, when grown on irrigated land; Trebi exceeded the average yield of Hannchen 3.7 bushels per acre.

TABLE VI. ANNUAL AND AVERAGE ACRE YIELDS IN BUSHELS FOR THE LEADING VARIETIES OF SPRING BARLEY GROWN AT BURNS, OREGON, ON DRY LAND AFTER FALLOW FOR THE YEARS 1913 TO 1917 AND 1919 TO 1921, INCLUSIVE

Varieties	C. I. No.	1913	1914	1915	1916	1917	1919	1920	1921	Avg.
Hannchen	531	41.7	13.3	9.2	49.8	16.5	3.5	31.4	18.0	22.9
Coast	690	32.5	13.7	11.7	44.9	13.5	8.4	27.2	19.7	21.4
Svanhals	187	47.5	10.8	6.3	35.8	19.9	5.1	31.6	12.0	21.1
Utah Winter	592	30.2	8.1	25.2	31.7	8.9	.....	26.7	19.7	21.5
Trebi	936	.....	.....	.....	.....	.....	6.4	22.8	20.7	16.6

Note: The crop of 1918, destroyed by grasshoppers, was not considered in determining averages.

TABLE VII. ANNUAL AND AVERAGE ACRE YIELDS IN BUSHELS FOR TREBI AND HANNCHEN SPRING BARLEY ON IRRIGATED LAND AT THE BURNS BRANCH STATION FOR THE YEARS 1919 AND 1920

Variety	C. I. No.	1919	1920	Average
Trebi	936	52.0	67.3	59.7
Hannchen	531	49.1	63.0	56.0

OATS

Spring oats are not a very important dry-land crop in Eastern Oregon. They have been largely replaced as a feed grain by spring barley. Acreage and production data for this crop are shown in Table I.

Results at Moro. Experiments to determine the highest yielding oat varieties have been in progress at the three branch stations in Eastern Oregon since their establishment. Annual and average yields of the leading varieties at the Moro Branch Station are shown in Table VIII. In these trials at Moro, the two varieties, Markton and Three Grain, have proved superior to all others tried. The Markton variety, a selection developed by the Moro Station, has proved to be immune to covered smut and does not have to be treated before sowing. The Three Grain variety has given unusually high yields for a midseason plump-kerneled variety. Markton is an early maturing variety with rather long, slender kernels.

TABLE VIII. ANNUAL AND AVERAGE ACRE YIELDS IN BUSHELS FOR THE LEADING OAT VARIETIES GROWN AT MORO, OREGON, AFTER FALLOW FOR THE YEARS 1916 TO 1923, INCLUSIVE

Variety	C. I. No.	1916	1917	1918	1919	1920	1921	1922	1923	Avg.
Early										
Markton	2053	102.8	35.3	30.8	61.6	44.1	46.7	32.5	86.3	55.0
Richland	787	86.9	40.3	36.6	58.4	35.9	41.6	26.0	81.3	50.9
Kherson	459	84.4	37.5	33.5	56.9	36.5	51.1	20.3	75.6	49.5
Sixty Day	165-1	80.3	37.2	36.9	52.2	35.9	45.6	23.5	80.3	49.0
Mid-season										
Three Grain	1950	121.9	28.4	35.7	50.4	38.7	47.6	26.9	86.6	54.5
Western Wonder	1951	105.4	23.4	35.3	45.3	28.1	49.1	25.7	81.9	49.3
Swedish Select	134-1	104.7	26.6	34.1	50.4	37.5	36.0	25.7	76.3	48.9

Results at Union. The annual and average yields of several oat varieties grown at the Union Branch Station for the years 1921 to 1923, inclusive, are shown in Table IX. Of the varieties listed in the table Golden Rain produced the highest average yield. Comparable yields, however, are not available for Silvermine, a variety which has been grown on the station for a nine-year period, and the other varieties listed in Table IX, except for the year 1923.

TABLE IX. AVERAGE ACRE YIELDS OF SEVEN OAT VARIETIES GROWN AT THE UNION BRANCH EXPERIMENT STATION FOR THE YEARS 1921 TO 1923, INCLUSIVE.

Variety	1921	1922	1923	Average
	bu.	*bu.*	*bu.*	*bu.*
Golden Rain	68.3	58.4	126.6	84.5
Swedish Select	61.1	45.7	132.3	79.7
Minnesota 295	52.3	54.5	128.9	78.6
Idamine	61.5	51.0	114.2	75.6
Minnesota 281	45.3	40.7	134.3	73.4
Improved American	42.3	42.7	132.3	72.4
Golden Fleece	54.1	50.2	110.6	71.6
Silvermine	-----	-----	126.9	-----

Silvermine has been the most outstanding oat in yield and quality of the varieties that have been grown for a long period of time at the Union Branch Station. It is a variety of splendid color and quality and has averaged 86.2 bushels per acre in yield for a nine-year period.

The results the past three years as shown in Table IX indicate that Golden Rain might be a close second. Unfortunately, however, this variety has a yellow color, hence it is not as popular on the market as some of the better white varieties. It is a good yielder and is worthy of further trial.

Both the Swedish Select and Improved American oats are varieties hard to excel in consistent yields and good quality. During the past three years the Improved American averaged 72.3 bushels in yield and for the past ten-year period averaged 78.7 bushels per acre.

Results at Burns. Table X shows the yields of the leading oat varieties tried at the Burns Branch Statior on dry land. Of those grown for a ten-year period Silvermine and Rustless Selection produced the highest average yields.

In Table XI are listed the oat varieties grown at Burns on irrigated land. Only three varieties were grown for a five-year period. Of these the Rustless Selection produced the highest average yield. This variety, a selection from Sixty Day, has been a high yielding oat, but on account of its long, slender kernel and low bushel weight it is not popular on the Oregon market.

Of the varieties grown for a two-year period, Early Mountain averaged highest in yield.

TABLE X. ANNUAL AND AVERAGE YIELD OF SPRING OATS GROWN AFTER FALLOW AT THE BURNS BRANCH STATION FOR THE YEARS 1913 TO 1917 AND 1919 TO 1923, INCLUSIVE. YIELD REPORTED IN BUSHELS PER ACRE

Variety	C. I. No.	1913	1914	1915	1916	1917	1919	1920	1921	1922	1923	10-year Ave.	3-yr. Ave. 1921-1923
		bu.	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*
Silvermine	720	63.7	14.0	25.0	43.1	9.3	6.8	15.6	53.3	33.3	69.1	33.3	51.9
Rustless	724	56.2	11.2	49.4	45.0	9.3	5.9	13.7	49.8	26.2	63.9	33.1	46.6
Sixty Day	625	55.0	19.7	21.9	42.7	11.2	6.6	17.0	34.0	24.1	63.4	29.5	40.5
Swedish Select	134	33.1	12.8	29.4	43.7	3.8	3.7	15.6	51.8	24.2	68.3	28.6	48.1
Nebraska No. 21	841	.....	.....	.....	.....	.....	.....	18.3	60.0	27.5	73.5	44.8	53.7
Fulghum	708	.....	.....	.....	.....	.....	.....	.....	44.4	25.0	80.1	49.8	49.8
Golden Rain	493	.....	.....	.....	.....	.....	.....	.....	.....	.....	70.4	.....	.....
Idamine	1834	.....	.....	.....	.....	.....	.....	.....	.....	.....	70.5	.....	.....
Early Mountain	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	55.6	.....	.....

Note: The crop of 1918, destroyed by grasshoppers, was not considered in determining averages.

TABLE XI. ANNUAL AND AVERAGE YIELDS OF SPRING OATS UNDER IRRIGATION AT THE BURNS BRANCH STATION FOR THE YEARS 1919 TO 1923, INCLUSIVE. YIELDS IN BUSHELS PER ACRE.

Variety	C. I. No.	1919	1920	1921	1922	1923	Average for period grown	Average for 1922-1923
		bu.	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*	*bu.*
Rustless	724	45.0	127.3	70.8	64.6	101.4	81.8	83.0
Swedish Select	134	38.0	117.1	63.5	61.0	94.4	74.8	77.7
Silvermine	720	35.8	106.8	61.8	55.8	103.8	72.8	79.8
Nebraska No. 21	841	.....	96.4	55.5	47.9	91.3	72.8	69.6
Fulghum	708	.....	87.9	48.2	48.5	83.4	67.0	65.9
Early Mountain	.....	.....	.....	.....	86.6	121.4	104.0	104.0
Golden Rain	493	.....	.....	.....	72.2	97.1	84.7	84.7
Idamine	1834	.....	.....	.....	69.0	112.1	90.6	90.6

RYE

Rye is an important crop in a few counties of Central Oregon, where it is grown for hay and grain. Because of its drought resistance, winter hardiness, and less susceptibility to damage from rodent pests, it will succeed in producing a crop under more adverse conditions than any other grain.

At the Moro Branch Station neither winter nor spring rye has proved as productive as wheat, barley, or oats. At the Burns Branch Station, Vern spring rye has been a consistently good yielder on summer-fallowed dry land. It has averaged 17 bushels per acre for the eight-year period, 1915 to 1923, inclusive.

Considerable plant breeding and varietal testing work has been done with rye at the Union Branch Station, but thus far no variety has equaled the yield of the Rosen, a bearded, winter variety.

A number of new beardless selections are under observation, and it is hoped that some of these, with further selection, will prove sufficiently productive to increase and distribute to farmers. A good beardless rye

would be of immense agricultural value in many parts of Eastern and Central Oregon where this crop has proved to be the most dependable hay crop that can be grown.

PEAS

The field pea is unquestionably a very important annual leguminous crop for Eastern Oregon conditions. All classes of livestock relish peas; in fact hogs will eat them in preference to any other grain. The following figures give the feed requirements per 100 pounds gain, resulting from the various feeding tests with fattening hogs conducted at the Union Branch Station.

Grain	Number of tests	Feed requirements per 100 pounds of gain
		lbs.
Peas	4	356.5
Hull-less barley	11	417.6
Wheat	6	430.8
Common barley	7	434.8
Rye	1	440.2

Not only do peas show a higher feeding value for fattening hogs than barley, wheat, or rye, but they are likewise an excellent sheep feed, especially for fattening lambs. Peas have a high protein content and may be used in balancing dairy cow rations, thus furnishing home-grown protein, the most expensive part in all feed rations. The protein content of field peas is about twice that of the cereals and is equal to that of flax.

Peas for hog pasture. For hogging off, field peas have no equal. The following figures from trials at the Union Branch Station, while not conclusive, will give some indication as to the value of this crop for such purposes.

Crop	No. of tests	Gains made per acre
		lbs.
Field peas (green)	1	480.0
Field peas (ripe)	3	347.0
Field peas and kale	1	452.0
Field peas and hull-less barley	1	190.0

When hogging off the green peas, the hogs were turned in at the time the peas had reached the green pea cooking stage, thus affording considerable green forage, which apparently gives good results as is further indicated when feeding off kale and ripe peas. The kale and peas were sown in separate plots, the hogs having access to both.

The poor showing made by peas and hull-less barley is attributed to the fact that the hogs showed such a preference for peas that they continued to search for more peas after they were gone, and it was some time before they began to work on the barley.

Hogging off peas has also given excellent results at the Moro and Burns stations.

Another important economic factor in favor of field peas is the fact that they are not only an excellent feed for livestock and a profitable

crop to grow, but they are also a leguminous plant and hence nitrogen gatherers for the soil.

The Union Branch Station has grown field peas for the past fifteen years. Of the fifty or more varieties tested, the White Canada comes nearer meeting all requirements than any other variety tried. Under favorable conditions this variety will produce twenty-five bushels of matured seed per acre. As forage it will produce a splendid tonnage. This is an important factor in the production of both hay and silage.

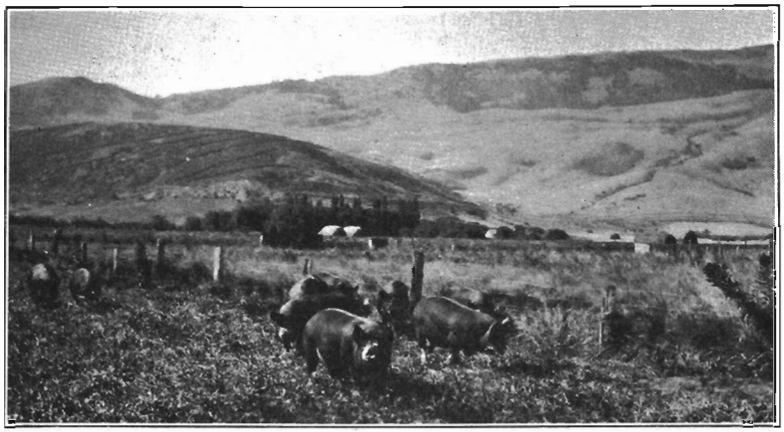

Fig. 13. Hogs pasturing off peas at the Eastern Oregon Branch Station, Union.

At the Moro Branch Station field peas have been grown after grain and not preceded by fallow like the cereals. Several varieties have been tried, and the yields of the leading ones are given in Table XII.

As is seen from this table, the average yields of several varieties have been nearly equal, the three highest being O'Rourke, Lima, and White Canada, all white-seeded, early-maturing varieties. During the four-year period in which it has been grown, Admiral, a wrinkled, blue pea, has given yields slightly higher than those obtained from most of the other varieties.

The yield of spring wheat following peas at Moro has been only one bushel per acre lower than when the spring wheat is preceded by fallow. Winter wheat has been reduced in yield six bushels per acre after peas as compared with growing this crop after fallow. The expense of preparing a seed bed for wheat after peas is much less than after fallow or after a grain crop, as plowing is unnecessary.

At the Burns Branch Station the growing of field peas without irrigation has not proved profitable, mainly because of injury to the crop by red spiders. This pest does not seem to do so much damage when the peas are irrigated. Kaiser, a variety which has proved to be one of the most productive to grow on irrigated land, has yielded from 25 to 35 bushels of seed per acre at Burns during the past three years.

TABLE XII. ANNUAL AND AVERAGE ACRE YIELDS IN BUSHELS OF FIELD PEAS GROWN AFTER GRAIN AT MORO, OREGON, FOR THE YEARS 1915 TO 1923, INCLUSIVE.

Variety	1915	1916	1917	1918	1919	1920	1921	1922	1923	Avg.
O'Rourke White	24.5	26.6	11.5	7.1	13.3	9.5	11.6	8.3	18.3	14.5
Canada	23.0	27.3	9.3	8.3	12.6	7.3	9.3	8.7	16.5	13.6
Lima	20.8	26.7	11.0	9.7	9.0	7.8	9.3	8.8	19.0	13.6
Amaroti	23.3	26.0	9.4	7.6	13.3	7.3	9.3	8.0	15.1	13.3
Cavalier	24.2	26.1	8.1	3.9	12.6	6.7	12.0	7.0	15.7	12.9
Solo	20.7	30.8	8.8	9.7	7.8	4.0	8.6	8.8	16.1	12.8
Carleton	18.2	34.8	7.2	9.2	6.7	5.1	10.2	8.8	14.9	12.8
Bangalia	21.1	18.3	9.6	4.2	14.6	7.8	12.6	7.3	14.4	12.2
Gregory	18.2	28.9	7.7	7.8	6.5	5.1	6.2	6.5	17.1	11.6
Kaiser	18.7	28.9	8.2	7.2	6.0	6.3	3.6	8.5	15.7	11.5
Admiral	.....	.....	.....	.....	.....	13.0	8.7	9.3	19.0	*12.5

*Four-year average yield.

CORN

Early-maturing varieties of dent and flint corn can be grown in many sections of Eastern Oregon. The crop, however, has not proved very popular with farmers except in warm districts where it is grown under irrigation. Corn is one of the best crops to grow for silage, and its use for pasture and for "hogging down" might advantageously be extended by farmers who keep cows and hogs.

More corn needed. There is a place for the commercial production of corn in some of the warm, irrigated sections of Malheur, Umatilla, and Morrow counties and a market in the Northwest for the corn. Enough grain should be grown to replace the present large shipments of corn into the Northwest. Inspection records show that for the year ending September 30, 1922, sixteen hundred and fifty-two car-loads of corn were inspected in Oregon and Washington, and for the next year eighteen hundred and twelve cars were inspected. Many cars went to non-inspection points so that not less than 2000 cars of corn, worth approximately $1,500,000.00, are now annually being shipped to these two states. Practically all of this corn was shipped from states east of the Rocky Mountains.

Trials at Moro with several corn varieties for a period of years have shown that yields of from fifteen to twenty bushels per acre can generally be obtained from early-maturing varieties. Northwestern dent, Minnesota 13, and Walla Walla White dent, have been the three best varieties tried, each of these varieties when sown after wheat averaging about twenty bushels per acre of grain. Because of higher prices and superior quality for dry lot feeding, standardization on yellow varieties is recommended.

Due to early and late frosts during the growing season the branch experiment station at Union has thus far not been able to mature any variety of field corn with any degree of certainty. There are several varieties, however, that will mature sufficiently for silage purposes. Possibly the most dependable of these is Minnesota 13, a very good corn for this section of Eastern Oregon. Under favorable conditions it will yield from eight to ten tons of green fodder per acre.

Corn cannot successfully be grown at the Burns Branch Station because of the prevalence of late spring and early fall frosts.

Winter wheat yields after corn in the rotation experiments at Moro have averaged about nine bushels per acre less than winter wheat after fallow. Disking and harrowing are the only tillage operations required to prepare a seed bed for cereals after corn. The cost of growing grain after corn, like growing grain after peas, is considerably less than growing grain after fallow, because of the expense of plowing and of cultivating the fallow. The successful growing of cultivated crops like corn and peas on the dry lands of Eastern Oregon depends not only on getting high enough yields of corn or peas to pay production costs, but also on securing enough profit from growing these crops to compensate, in part at least, for the usual reductions in grain yields following corn and peas as compared with growing grain after fallow.

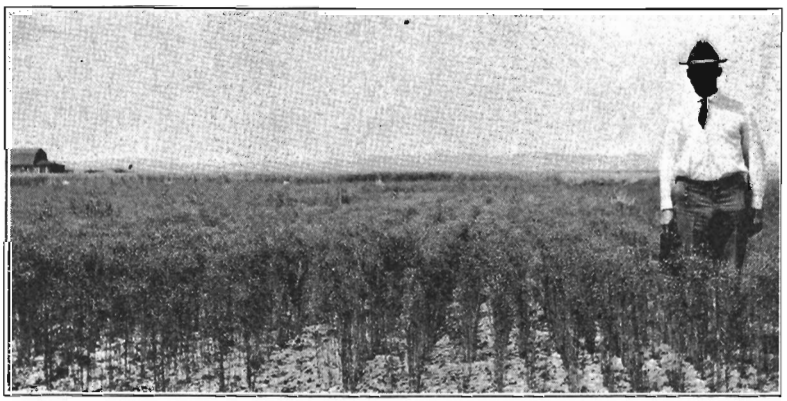

Fig. 14. Flax grown on dry land at the Harney Valley Branch Station, Burns.

FLAX

Recent reports from the United States Department of Agriculture state that the 1923 flaxseed crop for the United States was about 17,400,000 bushels, which, according to official estimates, is less than 50 percent of our actual requirements for the year. With an import duty of 40 cents per bushel and a shortage in production of at least 20,000,000 bushels and a present market price at Portland around $2.40 per bushel flax grown for seed might be a profitable spring crop for Eastern Oregon farmers to consider.

During the past five-year period from 1918 to 1922, inclusive, the average market price for flaxseed in Portland has been $3.15 per bushel of 56 pounds. Our local Portland Mills have a present capacity sufficient to handle in the neighborhood of a half million bushels of flax per year.

The branch experiment station at Union began growing flax as early as 1910. It has demonstrated that both fiber and seed varieties can be grown successfully in certain sections of Eastern Oregon where conditions are favorable for this crop.

The average acre yield of seed flax in the United States is 8.5 bushels. When grown under field conditions at the Union Branch Experiment Station yields ranging from eleven to seventeen bushels per acre were obtained.

Limited trials with flax have been made at the Moro Branch Station, but the crop thus far has not proved successful.

At the Burns Branch Station flax has done well on irrigated land but has not shown much promise as a dry-land crop.

POTATOES

Limited experiments have been conducted on the branch stations in Eastern Oregon to determine the potato varieties best adapted for this area. Under the dry conditions prevailing at Moro, potatoes have been tried both after grain and after fallow. When grown after fallow, fair yields have been obtained from a number of varieties. The leading ones are listed in Table XIII.

There are a number of districts in Eastern Oregon where the growing of potatoes by farmers for the commercial market and for seed is being successfully carried on both with and without irrigation. It has been found under dry farming conditions such as prevail at Moro that the one most important item influencing yields is the planting of disease-free seed. In the experiments at Moro, nearly all potato varieties have proved almost valueless for seed after being grown there for two years. In fact, the yields are greatly reduced when seed is used that has been grown more than one year. The introduction of disease-free seed at frequent intervals appears necessary for successful potato growing on the drier lands of Eastern Oregon.

The production of potatoes on a commercial scale in Eastern Oregon should be limited to sections especially suited to this crop. Yields obtained at Moro as shown in Table XIII indicate that satisfactory yields might be obtained from potatoes for home use by the average farmer. The crop should always be grown on land which was summer-fallowed the previous year. Much better yields of potatoes have been obtained after fallow than when planted after grain.

TABLE XIII. ANNUAL AND AVERAGE YIELDS OF THE LEADING POTATO VARIETIES GROWN AFTER FALLOW AT MORO, OREGON, FOR THE YEARS 1916 TO 1923, INCLUSIVE

Variety	1916	1917	1918	1919	1920	1921	1922	1923	Avge.
Idaho Rural	296.0	80.0	145.0	125.0	170.0	150.5	207.0	211.0	173.0
Early Rose	251.0	116.0	148.0	140.0	168.0	151.0	146.0	230.0	168.7
Irish Cobbler	219.0	135.0	126.5	105.0	119.0	161.0	142.0	150.0	144.7
Early Ohio	171.0	126.0	155.8	67.5	154.0	143.0	157.0	138.0	139.0
Netted Gem	214.0	47.0	85.0	135.0	127.4	137.0	100.0	192.0	129.7

Of the varieties listed in Table XIII, Idaho Rural has given highest yields. This is a medium-early maturing variety which is quite widely grown under irrigation in southern Idaho. It appears to be a little less injured by disease at Moro than many of the other varieties. The quality of the Idaho Rural variety is fair and good yields have been obtained from this variety when new seed is used at least every third year.

The second highest yielding variety was Early Rose. The quality of this well-known variety when grown on dry lands was only fair, and during some seasons it made considerable second growth.

For quality, the Irish Cobbler and Early Ohio on the average have been the best varieties grown at Moro. These two varieties mature early and rarely make second growth. The yield of the Early Ohio variety in 1919 was considerably lower than that of the other varieties because of the fact that the seed planted had been grown at Moro for two years previous and the high percentage of disease in the crop cut down the yields.

The yields of most of the other varieties listed in Table XIII are from seed obtained each year from other localities, or from seed grown at Moro only one year. In a few instances it was necessary to use seed grown at Moro for two years, and reduced yields invariably resulted when such seed was used.

At the Burns Branch Station, under irrigation, Early Ohio averaged 217.4 bushels per acre for the three-year period 1921 to 1923, inclusive, and Netted Gem averaged 185.9 for the same period.

At the Union Branch Station all potato varieties tested have given very satisfactory yields.

For further information regarding potato growing and the control of potato disease, consult Oregon Station Circulars 24 and 25.

SUMMARY

The cereals—wheat, barley, rye, oats, and corn—constitute the chief source of farm income in Eastern Oregon. Of these, wheat and rye are usually grown from fall sowing.

Fall-sown cereals are generally more productive than when spring-sown, especially if preceded by summer fallow.

Large areas in Eastern Oregon are devoted to spring-sown grains, especially wheat and barley. The average acreage sown to spring wheat for the past five years exceeded that of winter wheat in twelve counties in Oregon east of the Cascades. Jefferson county's acreage was highest, averaging 31,130 acres, and Union county was second with an average acreage of 28,025.

Experiments to determine the best varieties of spring-sown crops to grow have been in progress on the three branch stations in Eastern Oregon since their establishment. One of these stations is located at Moro where the average annual precipitation is 11.52 inches, one at Union in Union county, where the average annual precipitation is 14.03 inches, and another at Burns in Harney county, where the average annual precipitation is 8.18 inches.

At the Moro Branch Station, the Federation, Hard Federation, and White Federation spring wheats have proved superior to all other spring-sown varieties. At Burns, the Federation variety exceeded all other varieties when grown under irrigation, and Baart has slightly exceeded the average yield of Federation wheat, when grown on dry land.

Preliminary trials at the Union Branch Station indicate that the Federation variety will prove a valuable spring wheat for that section of Eastern Oregon. Trials by farmers under dry-farming conditions on lighter soil have shown that Hard Federation has exceeded the average yield of other spring wheats grown in Union county.

Trials by farmers in Umatilla, Union, Wallowa, Baker, Malheur, Deschutes, and Crook counties, indicate that Federation and Hard Federation spring wheats will likely soon supplant all other spring wheat varieties in Eastern Oregon. The Federation has proved to be an especially high yielding wheat under irrigation. When fall-sown, it exceeded the yield of all varieties in Umatilla county ten bushels per acre in 1923. It is not recommended for general sowing in the fall.

Milling and baking trials conducted by the Section of Milling Investigations, Grain Division, United States Department of Agriculture, show that Hard Federation is a very satisfactory wheat for breadmaking, being better than Baart or Pacific Bluestem and about equal to Marquis. The quality of the Federation variety grown on dry land appears to be about equal to Baart for breadmaking. When grown under irrigation, the Federation variety appears to be somewhat superior to Dicklow as a milling wheat.

Barley is the most productive crop for spring sowing in Eastern Oregon. At the Moro Branch Station, the best varieties were Mariout and Peruvian. At Union, Trebi and Hannchen proved to be the highest yielding varieties. At Burns, under irrigation, highest yields were obtained from Trebi. Hannchen proved best on dry land.

Oats have not proved as productive on dry land in Eastern Oregon as barley. The highest yielding varieties at Moro have been Markton, an early, smut-immune variety, and Three Grain, a midseason, plump-kerneled variety. At Union best results have been obtained from Silvermine, and at Burns, under irrigation, Early Mountain has yielded highest for the two years it has been tried.

Aside from the cereals, field peas have been one of the most promising crops grown on the branch stations in Eastern Oregon. Average yields of from 12 to 14 bushels per acre have been obtained at Moro from this crop when grown after grain in cultivated rows. The highest yielding varieties have been O'Rourke, Lima, and White Canada.

At the Union Branch Station field peas have been successfully grown for the past fifteen years for seed and for hay and silage in grain mixtures. The white Canada variety has averaged about 25 bushels per acre when grown for seed. Peas and barley have produced from eight to ten tons of green feed per acre.

At Burns, in Central Oregon, the most satisfactory field pea variety to grow on irrigated land has been Kaiser. On dry land, field peas have not been successful at Burns because of injury to the crop by red spiders.

In feeding experiments at the Union Branch Station, field peas have proved superior to the small grains for feeding hogs. Field peas have been successfully used for pasture for hogs and sheep at each of the three branch stations in Eastern Oregon.

On the branch station at Moro, Minnesota 13, Northwestern dent, and Walla Walla White dent have been the highest yielding corn varieties. These varieties when grown after grain averaged nearly twenty bushels per acre in yield. For silage, Minnesota 13 has been one of the most satisfactory varieties at Union. The use of corn for silage, for pasture, for hogging down, and for sale as grain, should be increased in Eastern Oregon.

Results with flax at Union indicate that this crop might prove profitable in certain sections of Eastern Oregon. At Moro, flax has not shown much promise. It has done well at Burns on irrigated land but it has not proved profitable on dry land.

Potatoes have given fair yields under dry-farming conditions at Moro when grown after fallow. The highest yielding varieties have been Idaho Rural, Early Rose, and Irish Cobbler. At Burns, under irrigation, Early Ohio outyielded the Netted Gem variety.

It is important to secure disease-free potato seed to get satisfactory results.