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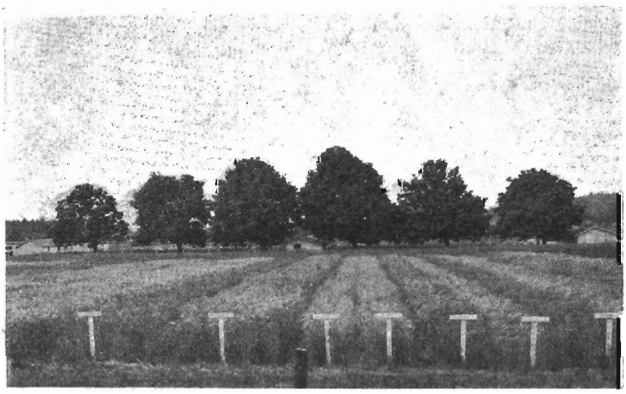
Barley Production in Oregon

By

D. D. HILL, D. E. STEPHENS, D. E. RICHARDS, ROY E. HUTCHISON, AND J. F. MARTIN



Oregon State System of Higher Education
Agricultural Experiment Station
Oregon State College
Corvallis
Cooperating with the
United States Department of Agriculture

SUMMARY

The total barley production of Oregon has remained rather constant for the past 35 years, although there have been important shifts in the major producing areas.

Barley is well adapted to production in most parts of Oregon. It will often produce more pounds of feed per acre than any other spring grain, except on the low-lying, wet lands. Winter barley can be grown successfully on all adapted soils in Western Oregon, and in certain protected localities in Eastern Oregon.

Barley has a wide variety of uses in Oregon. The widest use is as a feed grain. Feeding trials show it to have a feeding value only slightly lower than corn, and to be a satisfactory feed for all classes of livestock. Use for malting accounts for a substantial quantity of grain each year. In the drier sections it is important for hay. Where sufficient moisture is available barley may be grown with legumes for either hay or silage.

Barley provides the most satisfactory nurse crop for legume seedings of any of the small grains. As a green manure and cover crop barley is usually better than the other small grains on adapted soil types in Western Oregon.

Cultural methods for barley are similar to those for wheat. Trashy fallow is recommended in those parts of the Columbia Basin where erosion is a problem.

Good malting barley can be produced in Oregon where conditions are favorable for good yields. Hannchen is the variety most generally grown for this purpose. The quality of barley for malting can be improved by (1) providing favorable growing conditions, and (2) using care in harvesting and threshing. Analyses for malting trials over a four-year period show very good malting quality in local barley. Of the higher yielding varieties, Hannchen is the best adapted for use in malting. It produces a good quality of malt and yields a higher percentage of extract than most malting varieties. Oregon barleys tend to be slightly lower in diastatic activity than malting barleys produced in the principal producing areas of the United States. A breeding program to improve malting quality has been started.

TABLE OF CONTENTS

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By

D. D. Hill, D. E. Stephens, D. E. Richards, Roy E. Hutchison, and I. F. Martin

THE average annual production of barley in Oregon is more than two million bushels. In 1934, barley was reported on 4,802 farms, with an average acreage of approximately 15 acres per farm. The average acreage of oats per farm in 1934 was 20, of spring wheat 30, and of winter wheat 60 acres per farm. While the total production of barley in Oregon is less than that of either wheat or oats, the importance of barley in the agriculture of the state is indicated by the rather constant acreage and production during the last 35 years.

Shifts in the barley-producing areas. Although the total barley acreage of the state is not greatly different from what it was 35 years ago, there have been certain important shifts in the producing areas as indicated in Table 1. In the Willamette Valley and northern coast region there has been a marked increase in acreage, particularly during the period from 1919 to 1929. In the Columbia Basin there was a marked decline in barley acreage from 1909 to 1934. In the other regions the acreage has tended to be more or less constant.

In the Columbia Basin region the declining acreage has been due largely to relatively better prices for wheat and a decreasing use of barley. The demand for malting barley declined with prohibition, and the shift from horses to tractors has reduced the feed needs of the area. Although barley is productive in this area, the price of barley is dependent largely upon local supply and demand, whereas the price of wheat is dependent largely

Table 1. Production, Yield per Acre, and Acreage of Barley in the Various Producing Regions of Oregon, 1899-1934

Region		1899	1909	1919	1929	1934
Willamette Valley and northern coast counties	Bu.	149,650	207,943	258,617	864,058	661,437
	Bu. per acre	28.4	26.4	28.0	29.8	21.3
	Acres	5,275	7,879	9,232	28,975	31,013
Southern Oregon and southern coast counties	Bu.	138,507	77,168	136,527	127,653	187,536
	Bu. per acre	28.6	30.5	29.9	32.2	31.0
	Acres	4,844	2,526	4,570	3,968	6,052
Blue Mountain area and Grant County	Bu.	444,953	709,035	320,909	658,866	600,269
	Bu. per acre	27.4	37.0	24.2	34.7	36.3
	Acres	16,240	19,177	13,277	18,989	16,602
Crook, Deschutes, Klamath, Malheur counties	Bu.	52,200	239,847	153,590	303,583	263,333
	Bu. per acre	46.5	25.2	24.3	37.7	36.7
	Acres	1,122	9,501	6,319	8,116	7,380
Columbia Basin and eastern Oregon counties	Bu.	729,080	1,113,232	559,430	407,515	226,343
	Bu. per acre	22.8	16.0	16.9	30.3	20.8
	Acres	31,899	69,504	33,157	13,441	10,897
State	Bu.	1,514,390	2,347,225	1,429,073	2,361,675	1,938,918
	Bu. per acre	25.5	21.6	21.5	32.1	26.9
	Acres	59,380	108,587	66,555	73,509	71,944

upon the world supply and demand. In the Willamette Valley region the increased acreage is due to improved varieties and to an increasing need for a high energy feed grain for the increasing number of livestock. In Southern Oregon and in the Blue Mountain region the acreage has been maintained largely to meet the local feed demands.

THE ADAPTATIONS OF BARLEY

A well drained, fertile soil is best. The ideal soil for barley is a friable loam or sandy loam, well drained, and of high fertility. Most varieties of barley do very poorly when grown on heavy, poorly drained soils. Barley is fairly tolerant of high soil acidity, but it does not do well on the more acid soil types. On the other hand, barley can stand rather high alkalinity; it is often superior to both wheat and oats on soils which tend to be high in alkali. In Eastern Oregon barley can be grown on practically all of the soil types with the exception of the high alkali areas. In Western Oregon barley should not be grown on the low-lying, heavy, wet lands. Winter barley is particularly affected by poor drainage and a high water table during the winter months. Spring barley can sometimes be grown on land which is too wet for fall barley. In general, soils of the Dayton, Concord, Holcomb, and similar types are not adapted to barley production. Barley responds well to high fertility, although on rich soils it is more likely to lodge than either wheat or oats when planted in the spring, but it will stand better than winter oats seeded in the fall. Normally, wheat requires a more fertile soil than barley, but oats will produce better than barley on soils of low fertility.

Barley varieties differ more than do oat varieties in their adaptation to different soil conditions. For example, Hannchen is the only barley variety that gives good yields on such heavy soils as Amity in Western Oregon, whereas several varieties; namely, OAC 7, Trebi, and Union Beardless will yield as much as Hannchen on good soils of the Chehalis series. On good Willamette soil, Hannchen usually is superior to the other varieties. In contrast, Victory has outyielded all other varieties of oats on all three soil types at Corvallis.

The relative productivity of oats, wheat, and barley on three different soil types is shown in Table 2. Victory is the highest yielding oat variety on all three soil types; Hannchen is the highest yielding barley variety on the Amity and Willamette soils, but O.A.C. No. 7 is somewhat higher on the Chehalis and Newberg soils. On all three soils oats have yielded more pounds of grain per acre than barley, although when the yield in pounds is converted into total digestible nutrients, based on the analyses of these varieties when grown on the different soil types, barley shows the highest food value. Under the conditions of these trials, the Chehalis soil was a much higher yielding soil than either the Willamette or the Amity, while the Amity soil was considerably lower yielding than the other two. The difference in yield of total digestible nutrients between oats and barley on the Chehalis soil and on the Amity soil is evidence of the adaptation of barley to the better soil conditions. On the Chehalis soil barley has outyielded oats by 204 pounds of total digestible nutrients per acre, but on the Amity soil the margin of yield is only 94 pounds.

Barley grows well under varying moisture conditions. Barley is well adapted in many of the dry-land areas in Eastern Oregon. In the Columbia

Basin barley will ordinarily yield more pounds of grain per acre than wheat, the principal crop in the area. As shown in Table 3, yields of the best barley variety at the Branch Experiment Stations at Moro, Pendleton, Burns, and Union have been comparable to yields of the best wheat variety over a period of years. At Moro and Pendleton the yields have been obtained under dry-land conditions typical of the area, with average annual precipitation of about 11 and 14 inches respectively. At Union, the yields were influenced by a certain amount of subirrigation, and at Burns all yields were obtained under irrigation. The moisture available to the crop at these branch experiment stations varies widely. The yields of barley in comparison with wheat are an indication of the adaptation of barley to a wide range of moisture conditions. In the dry-land areas, barley is distinctly superior to oats as a producer of feed grain.

Table 2. COMPARISON OF THE HIGHEST YIELDING VARIETIES OF BARLEY, OATS, AND WHEAT ON DIFFERENT SOIL TYPES AT CORVALLIS, OREGON

Soil type	Chehalis		Willamette		Amity	
Ave. per acre	Grain pounds	T.D.N.*	Grain pounds	T.D.N.*	Grain pounds	T.D.N.*
Barley	2136	1870	1732	1540	1342	1189
Oats	2169	1666	1834	1425	1400	1095
Wheat	1788	1645	1362	1253	1092	1003
YEARS GROWN	4	.....	7	.....	10	.....

*Total digestible nutrients.

In Western Oregon, both winter and spring barley give good yields on the better drained soils. The winter barleys are not adversely affected by the long, wet winters in this area when they are grown on the proper soil types. The drought-resistance of spring barley enables it to make a good growth under the drier conditions found in Western Oregon during the summer months and in Eastern Oregon throughout most of the growing season. For spring planting in Western Oregon, barley is usually distinctly superior to spring wheat. The margin of difference between spring barley and spring wheat is greater in Western than in Eastern Oregon. Since, for many purposes, barley and wheat have about the same feeding value, if it is intended that the grain be fed to livestock, it will pay to produce the crop which yields the most pounds per acre. Oats, although valuable as a mixture in some feeds, is lower in feeding value than either barley or wheat.

Table 3. YIELDS OF BARLEY IN COMPARISON WITH WHEAT AND OATS AT BRANCH EXPERIMENT STATIONS IN EASTERN OREGON—POUNDS PER ACRE

	Moro	Union	Burns	Pendleton
Barley	1963	3115	3410	2971
Wheat (spring)	1524	2424	3319	2102
Wheat (winter)	1662	3372	3308	2436
Oats	1587	2470	2898	.....
YEARS GROWN	9	9	12	7

Growing seasons favorable. Barley grows well under the wide range of growing conditions found in this state. It is well adapted to the cool weather found in Coos County as well as to the higher temperatures found in Jackson County and in most of Eastern Oregon. Barley is not readily injured by high temperatures where the humidity is low. Winter barley is not so winter hardy as winter wheat, but is more hardy than winter oats. Winter varieties can be grown with safety in Western Oregon but are not generally suited to Eastern Oregon. Adapted varieties survive the Eastern Oregon winters only when well protected by snow. In practically all of the barley-producing areas of the state, there is a dry harvest season. This condition helps to produce a bright barley. The presence of heavy dew or fog during the ripening and harvesting season will cause barley to discolor readily. Stained barley is discounted in price on the market. With the exception of some winter barley, practically all barley produced in this state is bright.

Barley has a shorter growing season than either wheat or oats. The winter barleys grown in Western Oregon will usually mature from two to three weeks earlier than the adapted winter wheat varieties. Spring barleys mature from one to two weeks earlier than spring wheat in both Eastern and Western Oregon. They grow very rapidly and can be grown in areas where the season is often too short for oats or wheat. At the higher elevations where the other small grains are likely to be injured by frost during certain seasons, barley is often the safest grain crop to grow, because it may escape frost at either end of the season. During the growing season, however, barley is more susceptible to frost than wheat or oats.

THE USES OF BARLEY

Barley is a good substitute for corn. Barley is primarily a fattening feed and as such can be substituted for corn in areas where corn is not well adapted. The rather wide distribution of barley in Oregon, particularly in regions where there is considerable livestock to feed and where corn is not well adapted, is evidence of this. Feeding trials comparing barley and corn have been made at many experiment stations throughout the United States. Practically all of these show similar results; namely, that barley is similar to corn but slightly inferior to it in energy value. Trials conducted by the Oregon Experiment Station at Corvallis and the Eastern Oregon Livestock Branch Experiment Station at Union indicate the value of barley for feeding purposes. Table 4 summarizes some of these trials, and indicates the amounts of barley necessary to produce a given quantity of gain when fed to various animals. Feeding tests conducted by the animal husbandry department indicate that ground barley has approximately the same feeding value as shelled corn, but a slightly lower value than ground wheat. Barley appears to be slightly more palatable than wheat when fed to cattle, and is somewhat easier to feed.

In addition to its use as a fattening feed for hogs and cattle, barley constitutes a large part of the grain in the average dairy ration. Barley may be fed to horses, although more care is required than in feeding oats. Barley is an excellent feed for lambing ewes and fattening lambs. Certain types of barley are also well adapted to the poultry ration.

Table 4. FEEDING VALUE OF GRAINS

Kind of grain and preparation	Location of trial	Animal fed	Feed to produce 100 pounds gain
[1]Barley (whole)	Corvallis	Hogs	467
[1]Barley (coarse ground)	Corvallis	Hogs	422
[1]Barley (fine ground)	Corvallis	Hogs	402
[1]Barley (steam rolled)	Corvallis	Hogs	390
[2]Barley	Corvallis	Hogs	438
[2]Wheat	Corvallis	Hogs	463
[2]Barley and Tankage	Corvallis	Hogs	340
	Corvallis	Hogs	36
[2]Wheat and Tankage	Corvallis	Hogs	330
	Corvallis	Hogs	41
[3]Barley	Union	Calves	267
[3]Corn	Union	Calves	260
[3]Wheat	Union	Calves	251
[4]Barley (ground)	Corvallis	Hogs	442
[4]Corn (shelled)	Corvallis	Hogs	432

[1]Ore. Agr. Exp. Sta. Cir. 104.
[2]Ore. Agr. Exp. Sta. Bul. 269.
[3]Ore. Agr. Exp. Sta. Bul. 276.
[4]Unpublished data, Animal Husbandry Dept., Ore. Exp. Sta.

Analyses of Oregon barley show little variation. The analyses of 45 barley samples taken from the Experiment Station plots at Corvallis in the years 1929 and 1930 are given in Table 5. In comparison with barley grown in other parts of the United States, these Western Oregon barleys are lower in protein, although the total digestible nutrient supply is approximately the same.

Livestock feeders often express a preference for a certain variety of barley. In Western Oregon most feeders are partial to Hannchen because of its high test weight, low percentage of hull, and freedom from beards. These analyses show Hannchen to be only slightly superior to the other varieties grown. The total digestible nutrient value of Hannchen is only about one per cent higher than for most of the other barleys. Very little difference was found between any of the barley samples. The range in total digestible nutrient value was less than two per cent for all samples included in this trial. Assuming the barleys to be equal in condition, there does not appear to be much justification for the payment of substantial premiums in order to obtain a given variety of barley for feed purposes. Plump, well matured barley, however, is superior in feeding value to shriveled, immature grain of low test weight.

Barley as a hay crop. Barley makes an excellent hay crop, which, if handled properly, compares favorably with wheat and oat hays in nutritive value and in palatability. It is relished by all classes of livestock and will often produce gains in excess of those obtained from wheat or oat hay. Like all cereal hays, barley hay is not so nutritious as good legume hay, so reaches its greatest importance where legumes can not be grown. Because of its drought resistance, barley hay production is limited usually to the drier areas of the state. Throughout the wheat-producing counties of the Columbia Basin spring barley as well as wheat is grown for hay. During dry years spring barley usually produces higher yields than spring wheat. In the Southern Oregon counties of Jackson and Josephine, spring barley is widely used as an annual hay crop.

Table 5. ANALYSIS OF BARLEY GRAIN FROM VARIETIES GROWN ON DIFFERENT SOIL TYPES AND IN DIFFERENT YEARS AT CORVALLIS.* COMPUTED ON A MOISTURE-FREE BASIS.†

Sample No.	Variety	Protein	Ether extract	Ash	Crude fiber	Total digestible nutrients
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*
	Winter Barley Varieties Grown on Chehalis Soil—1929					
100	Tenn. Winter	8.54	1.80	2.56	6.60	87.57
103	Orel	9.61	2.06	2.95	5.18	87.80
104	Tenn. Winter	9.15	2.35	2.79	6.02	87.94
106	Tenn. Winter Sel.	9.61	2.12	2.56	5.92	87.92
108	O.A.C. Sel. 2	8.55	2.28	2.63	7.23	87.71
109	Alaska	9.51	2.43	2.90	6.54	87.64
110	Pidor	8.27	2.29	2.74	6.11	88.04
112	O.A.C. No. 7	8.39	2.32	2.78	7.20	87.60
114	O.A.C. Sel. 4	8.34	2.47	2.83	7.51	87.56
115	O.A.C. Sel 6	8.61	1.89	2.93	6.76	87.24
116	O.A.C. Sel. 1	9.34	1.85	2.96	6.31	87.19
117	Wisconsin Winter	9.33	2.14	2.91	6.65	87.44
	Winter Barley Varieties Grown on Willamette Soil—1930					
60	Pidor	10.19	2.26	2.90	6.46	87.47
61	Alaska	9.93	2.19	2.90	6.45	87.42
62	Wisconsin Winter	10.12	2.08	3.03	6.70	87.13
63	Kroph	9.84	1.71	2.94	6.98	86.40
64	Tenn. Winter	9.27	2.28	2.92	6.39	87.58
65	Tenn. Winter Sel.	8.98	1.96	2.85	6.10	87.55
66	Orel	9.91	1.86	2.95	5.38	87.69
67	O.A.C. Sel. 1	8.98	2.18	2.74	6.42	87.74
68	O.A.C. Sel. 6	8.78	1.97	2.84	6.42	86.92
70	O.A.C. No. 7	10.99	2.50	2.96	6.59	87.49
	Barley Grown at Averill Farm—1929-30					
71	O.A.C. No. 7 Fall planted	8.65	2.20	2.96	7.30	87.30
72	O.A.C. No. 7 Spring planted	7.59	1.89	2.50	5.94	88.09
	Spring Barley Varieties Grown on Amity Soil—1929					
101	Hannchen	9.77	2.23	2.14	4.83	88.58
102	Atlas	11.81	2.17	3.07	7.00	86.76
105	Union Beardless	9.10	2.10	3.10	7.24	87.06
107	Montana 1583	11.28	2.54	2.20	2.77	89.50
111	Peruvian	10.59	2.30	2.72	7.37	87.30
113	Trebi	9.86	2.17	2.69	5.60	87.95
	Spring Barley Varieties Grown on Willamette Soil—1930					
21	Hannchen	8.32	2.23	2.65	4.35	88.66
22	Peruvian	8.58	2.22	2.82	7.10	87.53
23	O.A.C. No. 7	8.59	2.82	2.96	7.07	88.03
24	Trebi	8.09	1.86	2.77	5.75	87.77
25	Union Beardless	8.09	1.93	3.05	7.10	86.78
26	Advance Pedigree	8.95	1.99	2.70	5.61	87.85
27	Blue Hull-less	10.33	1.99	2.25	2.54	89.12
28	Victory	7.74	2.07	2.76	4.33	88.55
29	Orel	9.20	2.18	3.09	5.44	87.75
30	Hannchen (clover sod)	8.30	2.15	2.61	4.20	88.47
	Spring Barley Varieties Grown on Chehalis Soil—1930					
1	Hannchen	9.20	1.78	2.96	4.33	87.92
2	O.A.C. No. 7	8.69	2.32	2.92	6.86	87.55
3	Union Beardless	8.11	1.72	3.16	7.19	86.78
4	Trebi	8.44	1.87	2.91	6.01	87.57
5	Peruvian	8.85	2.11	3.10	7.24	87.06
	Data on Barley from Henry & Morrison	12.68	2.31	2.97	5.02	87.59

*Analyses by Dept. of Agricultural Chemistry.
†Computed from Henry and Morrison feeding standards.

Where moisture is available, barley may be grown with field peas for hay purposes. This combination produces an excellent quality of hay which compares favorably in feeding value with clover and alfalfa. This combination is especially desirable as an emergency hay crop in the Blue Mountain area and in the irrigated regions of Eastern Oregon. The addition of peas not only tends to increase the yield, but also increases the average protein content of the hay. In Western Oregon, a combination of winter barley and vetch produces an excellent quality of silage at low cost. While barley and vetch or oats and vetch silage can be produced at a lower cost per ton than corn silage, the necessity of filling the silo in June rather than in the fall may limit the vetch combinations to summer feeding.

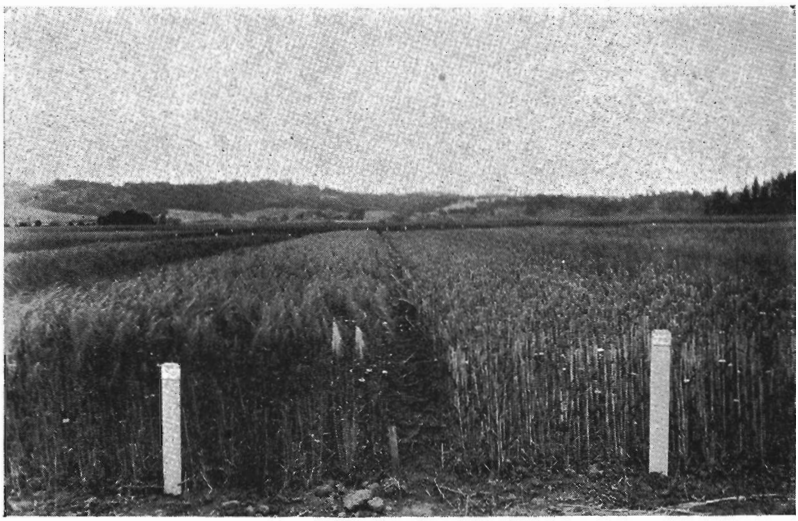
The variety of barley for hay production is even more important than for grain production. Where they can be grown, the hooded or beardless varieties are preferable to the bearded ones. Contrary to general belief, however, some bearded varieties make an excellent quality of hay, if cut at the right time and handled properly. Fortunately, there are hooded varieties available which are suitable for production in most parts of the state. For hay production in the unirrigated lands of the Columbia Basin, the Meloy variety is well adapted and will produce good yields of hay. In Southern Oregon Meloy also produces satisfactory hay yields. In the irrigated regions of Eastern Oregon, however, and in all other parts of this section where there is sufficient moisture to produce annual crops without a season of fallow, Union Beardless is better suited than Meloy. Union Beardless also is a desirable hay variety for the Willamette Valley, especially on fertile, well drained soils where planting can be done early. Of the bearded varieties grown in the state, Hannchen is the most suitable hay variety for all sections. It is leafy, fine-stemmed, and the beards or awns are less harsh than those of most varieties. Wisconsin 38, a smooth awned barley, is a desirable hay variety for Western Oregon. Flynn, a smooth awned variety, produces satisfactory yields of good quality hay in the Columbia Basin.

When barley is seeded for forage purposes, the rate of planting should be increased slightly over the recommended rate of planting for grain production. The heavier planting will tend to suppress weeds and will produce a finer-stemmed hay that will be more palatable. The other cultural practices are similar to those recommended for grain production. The best quality of hay is obtained by cutting at the dough stage. Feeding trials* have shown that barley hay cut at the dough stage is more palatable than when cut either in the milk stage or at the ripe stage, and will produce more gain per 100 pounds of hay. Awned varieties lose quality more rapidly than hooded ones as they approach maturity. There is very little increase in the dry weight of the barley plant after it reaches the dough stage. Any increase in the weight of the heads is offset by a decreased weight of leaves and stems. In addition, the increased fiber content of the stems decreases palatability and digestibility of this part of the plant.

As a nurse crop. Under many conditions barley is better suited than any other cereal as a nurse crop for red clover. In Western Oregon winter barley is distinctly superior to wheat or oats because it offers less competition to the young clover plants. It produces fewer stalks and leaves than

*Sotola, J., The Chemical Composition and Nutritive Value of Certain Cereal Hays as Affected by Plant Maturity, Journal of Agricultural Research 54: 399-415 (1937).

winter oats, thus allowing more light and less competition for the young clover, and matures from one to three weeks earlier than either wheat or oats. The clover should be seeded in the late winter or early spring. The early maturity of winter barley allows the young clover to take full advantage of any June rainfall and thus is more likely to become sufficiently well established to withstand the dry weather of July and August.



Experimental barley plot at Corvallis, Union Beardless (right), Wisconsin 38 (left).

If wheat volunteers in the next year's clover field, it is more serious than barley. The wheat will break up more in threshing, and as many of the wheat particles cannot be separated from the clover seed, the grade of the seed is lowered.

Spring barley normally is not used as a nurse crop in Western Oregon, although if a spring-seeded nurse crop is desired, barley is probably better than the other cereals. In Western Oregon, spring barley for this purpose should be planted early, preferably in February or March, and the clover should be planted at the same time. If planting is delayed until late March or April, the amount of barley planted should be reduced from one to two pecks an acre, and the clover should be drilled to insure prompt germination. In some irrigated regions spring wheat is more widely used than barley as a nurse crop for clover and alfalfa, partly because it stands up better and partly because it is a better cash crop. In those areas where rust seriously reduces wheat yields or where a feed crop is needed, barley is an acceptable substitute as a nurse crop.

As malting barley. Approximately one-fourth of the annual barley production of the United States is used for malting purposes. Most of the malting barley is normally produced in the North Central states where conditions are more favorable for the production of malting types. Drought in the Midwest in 1934 and in 1936 resulted in a shortage of malt-

ing barley in that area and caused maltsters to purchase large quantities of Oregon barley. As a result of these purchases there appears to be an opportunity for Oregon growers to dispose of some barley in this area even in years of normal eastern production. Oregon barley has certain desirable malting qualities, although the varieties now grown present some characters that are not entirely acceptable. The establishment of a malting plant in the Pacific Northwest has also opened a local market for considerable stocks of malting barley.

The suitability of barley for malting purposes depends in part on the variety and in part on the conditions under which it is grown. The proportion of the crop which is acceptable to the maltster will vary accordingly. Generally, the malting types represent the better portion of the crop and will bring the highest prices. Comparable price data for the Pacific Northwest are not available, but returns in certain years indicate a substantial premium. Analysis of price data from Milwaukee for the period 1914 to 1933 inclusive shows definite price advantages for malting grades over feed barley. Prices for Choice range from 10 to 52 per cent higher, Fair, 6 to 34 per cent higher, and Light, 3 to 17 per cent higher. At no time during this period did the price of any malting grade fall below that of the feed grades.

The malting barley production in Oregon has thus far been largely confined to the Klamath Falls area and to the Willamette Valley. Formerly considerable quantities of malting types were produced in the Columbia Basin counties, but shifts in the varieties produced and changes in demand have tended to eliminate this section, temporarily at least, as a malting-barley production area. The opportunities and difficulties of malting-barley production in the different sections of Oregon are discussed in the malting-barley section of this bulletin.

As a green manure and cover crop in Western Oregon. Winter barley provides a more desirable green manure and cover crop than either wheat or oats. Except for the very hardy winter varieties, barley makes a larger fall growth, grows more during cool weather, and will start to grow earlier in the spring. Except for the colder sections of the state, winter barley planted alone or with vetch and peas provides a large amount of growth. On poor soils or in cold sections it is less satisfactory than winter rye. Because of its satisfactory winter growth, barley will provide more winter pasture than any of the other small grains. A reasonable amount of pasturing on fields that are making a good growth will not affect grain yields materially.

CULTURE

The cultural operations for barley are similar to those required for the production of other small grains. Like them, barley responds to a seedbed in good physical condition and well supplied with moisture and plant nutrient material. The best quality and the best yields of barley are obtained by planting the proper varieties at the right time in a good seedbed and then exercising the proper care in harvest. Since there is such a wide variation in the different barley-producing areas of the state, the recommended cultural practices and varieties will differ, although the objective is the same in each area. In the following cultural recommendations, consideration is given to this difference in conditions.

Seedbed preparation. In the Columbia Basin counties of Wasco, Sherman, Gilliam, Wheeler, Morrow, and Umatilla, and in the dry-land areas of Union, Baker, Wallowa and other Eastern Oregon counties where the rainfall averages from 7 to 16 inches, production of barley, like that of other small grains should follow a season of fallow. The land should be plowed as early in the spring as conditions will permit and the following cultivation should keep the fallow free from weeds. On soils that are subject to blowing or which may wash badly during the winter months, it is desirable to leave a large amount of straw and stubble on the surface. A trashy fallow can be prepared by leaving the mold boards off the plow in the case of light stubble or in using one-way disks in the event of heavier stubble. Such a fallow is best cultivated with a rotary rod weeder. The rod weeder will kill weeds effectively unless they are too large, and it does not pulverize the soil to the same extent as other tillage implements. The straw and stubble will be left on the surface as protection against either wind or water erosion. Throughout most of the Columbia Basin, cultivation of fallow is much more likely to get the seedbed too fine than too cloddy. A very finely pulverized seedbed is subject to severe erosion by both wind and water.

In parts of the mountainous region of Eastern Oregon and in the irrigated districts where there is plenty of water, early spring plowing followed by thorough seedbed preparation, to kill as many of the weeds as possible before planting, is the desirable practice. In these areas the moldboard plow should be used so as to turn under all trash and debris. Planting usually follows within a short time after seedbed preparation, so there is little necessity for protection of the seedbed from erosion.

In Western Oregon where both winter and spring barley are grown, there are three general seasons of seedbed preparation. The seedbed for fall barley should be plowed as early in the fall as practicable. This may mean dry plowing before the fall rains or plowing soon after the fall rains. In any event it is desirable to have as long a period as possible after plowing and before planting to kill weeds and volunteer growth as well as to build up a supply of soil nitrates. On the heavier soils in Western Oregon the seedbed for fall planting should not be pulverized too finely, as the soil will tend to become too compact and to puddle too much during the winter months. The ideal seedbed for fall barley in Western Oregon should be one that is well worked but left in a slightly cloddy condition.

Probably the most satisfactory seedbed for fall planting in Western Oregon is that obtained when the barley follows a cultivated crop, such as corn, potatoes, beans, etc., when the cultivated crop can be harvested by September or early October. In this event the seedbed is easily prepared by one disking, or in the event the previous crop has been removed even this may not be necessary. A good seedbed can be prepared by disking corn ground, even though the stalks are not all covered. A large cover-crop disk will put the ground in such shape that barley can be drilled satisfactorily. The same practice may be used effectively when the winter barley follows either seed flax or fiber flax. In addition, the barley will generally grow better than when it follows another small grain crop.

Plowing is usually essential in the preparation of a seedbed for spring barley. This should be done just as soon as weather conditions permit in the spring. On many of the heavier soil types in the Willamette Valley it is necessary to disk and harrow after plowing. A finely pulverized seedbed is

highly important if good yields of spring barley are to be obtained. The average rainfall after spring barley is planted normally ranges from two to four inches, which is not sufficient to grow the barley crop. It is necessary to conserve the soil moisture and to provide favorable conditions for prompt germination and rapid growth of the barley. This is best done by giving special care to the seedbed preparation. If the seedbed is loose, as it may be following heavy working with the disk, rolling with some type of farm roller, such as the culti-packer, is recommended. Normally rolling is undesirable for the early plantings but may be worthwhile for late plantings occurring in the latter part of April or early May.

Time of planting. Barley may be planted later in the spring than most small grains and still make a fair crop because of its drought resistance and

Standard varieties of barley grown in Oregon.

its habit of rapid growth. For best results, however, it should be planted as early as the season permits. Table 6 has been prepared to show the range in planting dates in various parts of the state. The period from February to May for spring planting in Western Oregon covers several varieties. When conditions are favorable for planting barley in February or early March, generally a variety such as O.A.C. No. 7 should be grown. This variety is more winter hardy than most spring varieties and will often make a good yield when planted at this time. After the middle of March or the first of April, Hannchen is usually a better variety for spring planting in this area. In those irrigated regions where the supply of irrigation water is limited, the earliest possible seeding is recommended. If the supply of water is ample to mature the crop, seeding may be delayed without reducing the crop yields. In regions of high elevation, as in Harney County, where late spring and early summer frosts may injure the barley at heading time, seeding should be delayed until the recommended time.

The amount of seed to plant per acre will also vary with the conditions. Table 6 includes also the recommended rates of planting per acre for the various parts of the state. When barley is not thoroughly cleaned or when it has not been cleanly threshed, the amount actually planted often will not correspond with the amount indicated on the grain drill. Barley which retains part of the beard will not feed through the grain drill very rapidly and will often clog in the drill. Seed barley should be thoroughly cleaned to take out as many of the beards as possible. The actual amount planted should be checked against the acreage to insure the planting of sufficient seed.

Winter barley in Western Oregon should be planted about the middle of October. Except for the most winter-hardy types, too early planting will result in an excess of top growth that may be injured by subsequent cold weather. Barley planted after October 25 may not be well enough established to withstand low winter temperatures. Winter barley used as an orchard cover crop should be planted as early as possible in the fall.

Harvesting. Barley requires more care in harvesting than any of the other small grains. Ripe barley shatters readily when handled, so care is necessary in handling barley bundles after the binder. Heavy winds or

Table 6. RATE AND DATE OF PLANTING OF SPRING BARLEY FOR THE DIFFERENT SECTIONS OF OREGON

Section	Date of planting	Rate in lbs. per acre
Irrigated sections		
Klamath	May 1-20	90–100
Deschutes, Crook	May 1—June 1	70–90
Baker, Union	March 15—April 25	75
Wallowa	May	90–100
Jackson, Josephine	March 15—April 15	90–100
Malheur	April	100
Harney, Lake	May 1-15	90–110
Umatilla, Morrow	March 15—April 15	90–100
Nonirrigated sections		
Willamette Valley—Bottom land	March 1—April 15	110
Willamette Valley—Well drained upland	March 15—April 15	100
Willamette Valley—Poorly drained upland	April 1—May 15	80–100
Jackson, Josephine, Douglas	March 15—April 15	75–90
Coos, Curry	April 1—May 15	100
Columbia Basin	March 1—April 15	60–100
Blue Mountains	April 15-30	70–80

rains at harvest time are likely to cause more severe losses with barley than with either wheat or oats when grain is left standing for the combine-harvester. Excessive shattering losses can be avoided only if the various harvesting operations are done at the right time. With the binder, cutting should be done while the barley is in a good hard dough stage and only slightly tough; and with the combine, just as soon as the barley is thoroughly ripe. If the barley is allowed to stand in the field after full maturity, loss by shattering may be heavy.

Mature barley either standing in the field or in the shock is easily stained by foggy or rainy weather. This does not necessarily injure feeding value but detracts from its appearance and market value. For malting purposes, stained barley is not desirable, as heavy stain will sometimes influence the flavor of the malt. Barley that is cut too green will often stain in the shock, particularly when followed by a period of cool, cloudy weather. On this account, small bundles are desirable. Winter barley in Western Oregon is likely to be stained in many seasons because of the prevalence of dews and fogs at the time of harvest.

Threshing malting barley. Growers of malting barley should give particular attention to the adjustment of the threshing machine. Skinned and broken kernels are not acceptable to the maltster, and these are often the result of incorrect separator adjustment. Considerable beard on malting barley is not objectionable. Usually it is desirable to reduce the cylinder speed of the separator below that which is satisfactory for feed barley or for wheat or oats. This reduction may amount to as much as 150 revolutions per minute. Barley in Oregon is usually very dry at threshing time and most varieties have rather thin hulls, so high cylinder speed will cause considerable cracking and skinning. Too close setting or improper adjustment of the concaves, as well as any appreciable end play in the toothed cylinder of the machine, will also cause this result. Operation of the grain augers should also be adjusted to avoid the possibility of crushing or cracking the barley against the housing in this part of the machine.

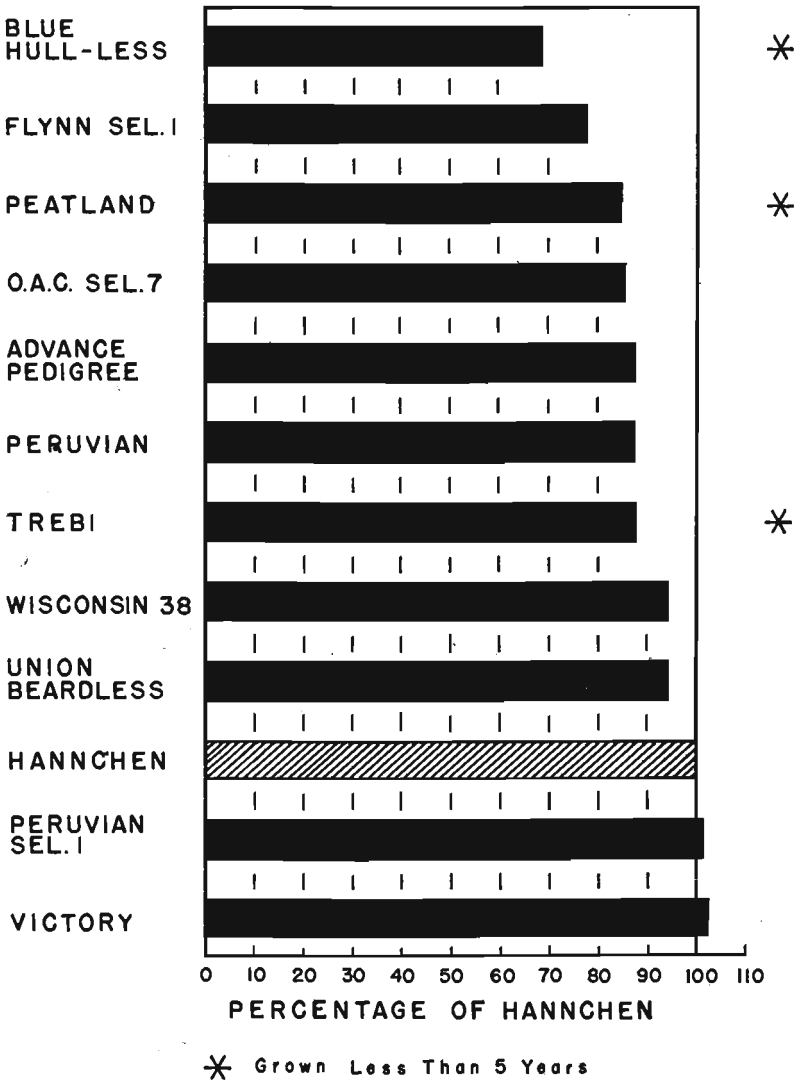
Threshing feed or seed barley. The presence of portions of the barley beard on the kernel is objectionable in feed or seed barley. Beards are disliked by most feeders. Beardy seed will not feed through the grain drill satisfactorily and will usually require a much heavier rate of seeding to be set on the drill than when seed barley is threshed more closely.

VARIETIES

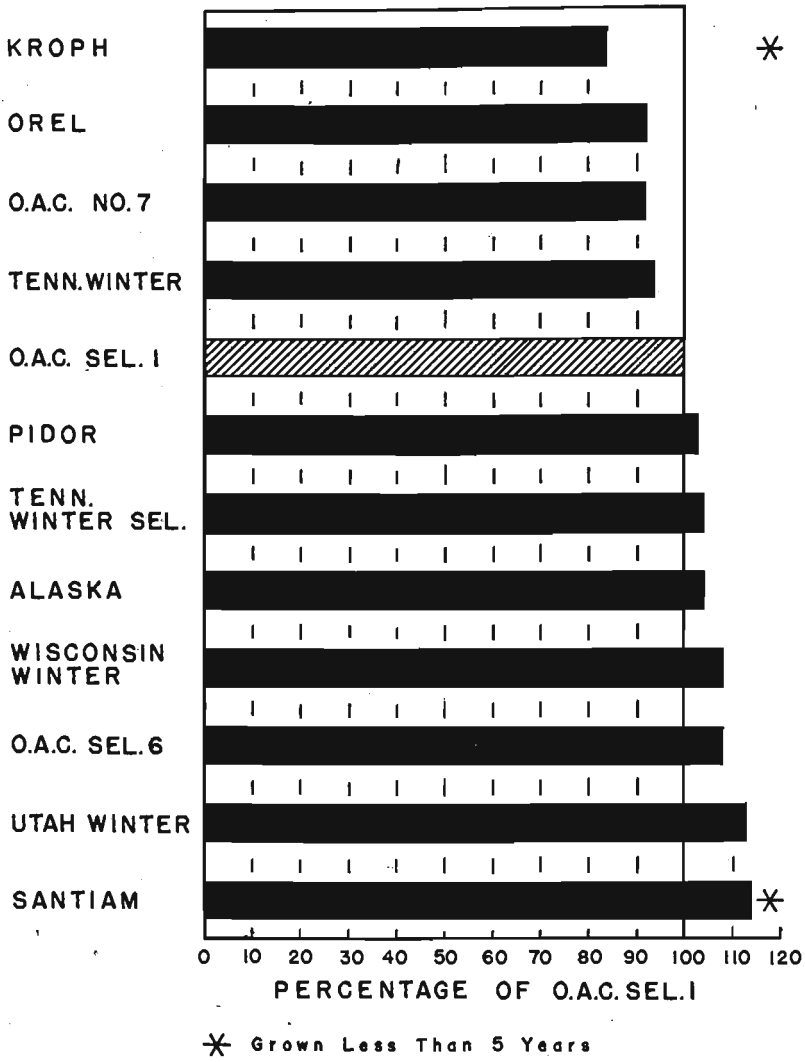
In making varietal recommendations for the state, it is necessary to consider the different areas. Yield data for the important barley varieties at a number of experiment stations in the state are given in chart form. Yield data are also given in Tables 8 to 14 in the appendix.

Willamette Valley. In the Willamette Valley counties, Hannchen has been the outstanding spring barley for many years. This is a two-rowed barley which produces an excellent type of feed grain as well as a desirable malting barley under certain conditions. Hannchen probably has a wider range of adaptation to soil and climatic conditions than any other variety grown in the state. Hannchen is recommended as a spring variety on all upland soils where planting is done after March 15. If the season

YIELDS OF SPRING BARLEY VARIETIES AT CORVALLIS EXPRESSED IN PERCENTAGE OF HANNCHEN



YIELDS OF WINTER BARLEY VARIETIES AT CORVALLIS EXPRESSED IN PERCENTAGE OF O.A.C. SEL. I



will permit planting in February or early March, O.A.C. No. 7 is often a better variety for planting at that time. On rich bottom lands Hannchen will sometimes lodge badly, and under these conditions O.A.C. No. 7 or Union Beardless will often slightly outyield the Hannchen. In trials on the Experiment Station at Corvallis, Victory, another two-rowed variety, has slightly outyielded Hannchen during a nine-year trial.

Columbia Basin and irrigated regions. Yield trials at Moro in Sherman County indicate that Peruvian and Club Mariout are the highest yielding varieties. For grain purposes in this area Club Mariout is the one most commonly grown. Relatively large quantities of Meloy are grown, especially for hay. Flynn is an especially good smooth-awned variety in the Columbia Basin. The smooth awn is of little advantage in this area unless the barley is cut for hay, since practically all grain is harvested with the combine-harvester. In those parts of the Columbia Basin where the average annual rainfall will range from 13 to 15 inches or higher, Trebi is the outstanding variety, unless the late spring season is very dry. In this case, Trebi matures too late. This is indicated by the yields at the Pendleton Field Station, which has an average rainfall of approximately 14 inches. Trebi is also the highest yielding variety in most of the irrigated regions of the state. In certain sections, such as in Klamath, Crook, and Deschutes counties, there has been a tendency in recent years to replace it with Hannchen. This is because of its fine quality for feed and also because of its value for malting purposes. Large yields of Hannchen can be obtained in these areas, although lodging sometimes offers a harvesting problem. Trebi is the variety generally grown in the Harney Valley, although O.A.C. No. 7 has slightly outyielded Trebi for an eight-year period at the Burns Experiment Station. Trebi is also the leading variety in Malheur County. Union Beardless is the leading hooded variety in this area and has given the best results of any variety grown for hay purposes.

Blue Mountain area. In the Blue Mountain area Trebi and Union Beardless are the two most important varieties. Union is usually grown for hay purposes, although it gives a satisfactory yield of grain where there is sufficient moisture. Yields of hooded varieties indicate the superiority of Union Beardless at the Union Station, as given in Table 7. Table 7 also includes yields of two commonly grown hull-less or bald barleys. These are often confused with the hooded, or "beardless," barleys.

Southern Oregon and Coast. In the Southern Oregon counties of Jackson, Josephine, and Douglas, Trebi is again the leading variety. Hannchen also does well, especially on the better lands. The hooded variety, Success, is grown to some extent for hay. While data on the growth of Union Beardless in this area are not available, the productive quality of this variety in other sections warrants a trial here. In Coos County O. A. C. No. 7 and Hannchen have given the most satisfactory returns.

Winter barley. The data on winter barley in the Willamette Valley are not so complete as for spring barley but they do indicate certain varieties to be superior. The O.A.C. No. 7 variety is a good variety to plant during mild winters, but records at Corvallis show it to winter kill severely at least one winter out of five. O.A.C. No. 1 and O.A.C. No. 6 are selections of O.A.C. No. 7, which are definitely more winter hardy than the parent variety. These varieties are sufficiently winter hardy for Willamette Valley

conditions but will not outyield O.A.C. No. 7 during mild winters. Yield data on Santiam barley over a three-year period show it to be higher yielding than any other fall sown variety now being grown in the Willamette Valley. This variety is sufficiently winter hardy for Willamette Valley conditions, and if preliminary field trials during the winter 1937-38 justify, it will be distributed to the growers in the fall of 1938.

DISEASES

No variety is so resistant to smut that seed treatment can be neglected. All seed barley should be cleaned thoroughly to remove the smut masses that may be in the seed, and then should be treated with a standard fungicide. The New Improved Ceresan, applied at the rate of ½ ounce per bushel in any standard gravity treater, will control smut satisfactorily in all of the barley-growing sections of Oregon. The barley should be covered for a few hours after treatment and should not be held longer than eight weeks after treatment. Although the New Improved Ceresan sometimes injures germination when barley is kept for a longer period, many records of barley treated with this fungicide show that seed has kept for a full year with no apparent loss in germination. The copper carbonate dust should not be used on barley because it will not penetrate sufficiently underneath the hull of the barley to come into contact with all of the smut spores.

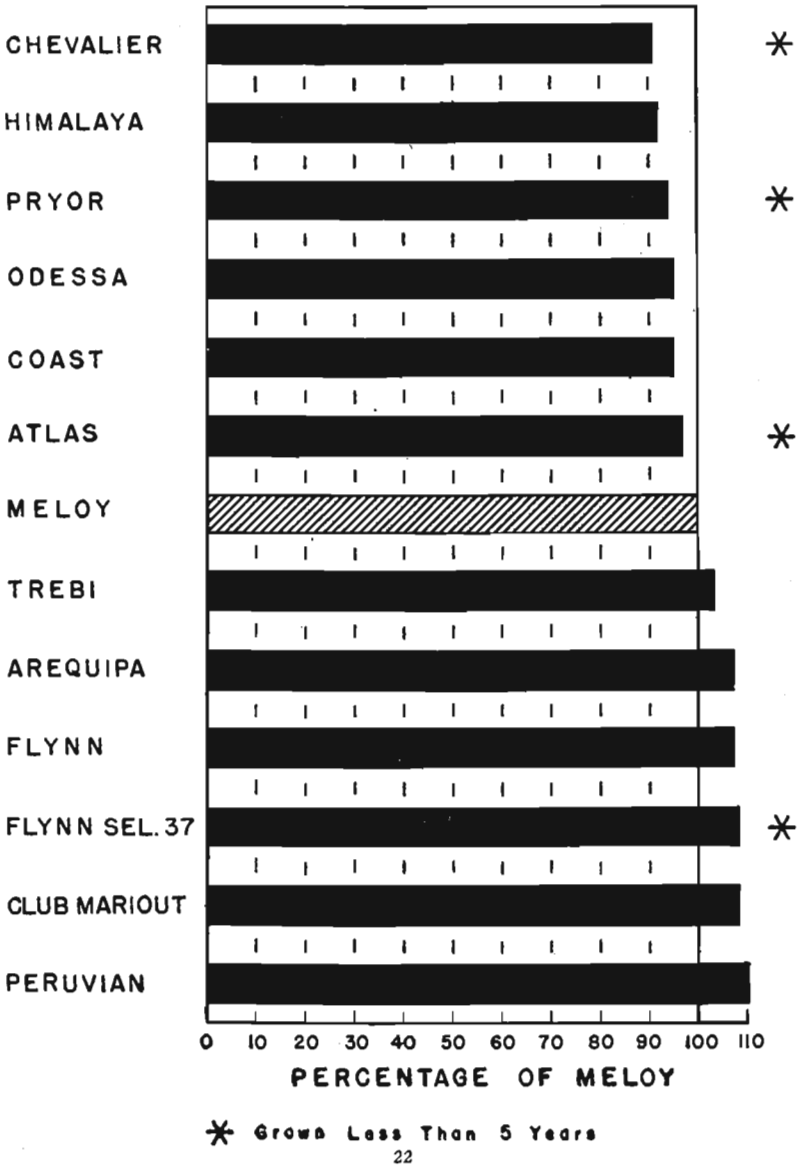
Table 7. YIELD COMPARISONS OF HOODED AND HULL-LESS BARLEY
Eastern Oregon Livestock Experiment Station, Union, Oregon

Variety	Number years grown	Average yield bushels per acre
Hooded barley:		
Union Beardless	15	56.1
Union Beardless No. 6	1	63.5
Meloy	9	51.3
Colsess	2	49.8
Success Beardless	4	42.0
Hull-less barley:		
Faust	4	32.0
Common Bald	1	30.8

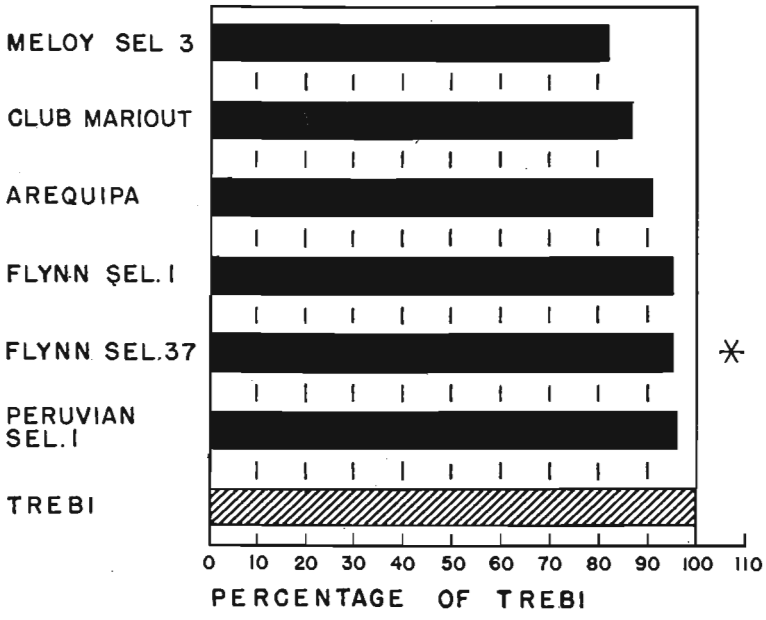
Powdery mildew (*Erysiphe graminis*) causes some damage to barley in some sections and in certain seasons. The prevalence of abundant moisture and cloudy weather during a certain period in the spring is conducive to heavy mildew. Mildew is often serious in the Coast area, but only occasionally in the Willamette Valley. There is no adequate control remedy except to grow resistant varieties. Fortunately, Hannchen appears to be extremely resistant to mildew and normally is injured very little by this disease. Unless the mildew condition is maintained for an extended period, little damage apparently results from such infection. The Atlas variety, which is grown to a certain extent in Klamath County, is extremely susceptible to mildew when grown in the Willamette Valley, probably a factor contributing to the low yield obtained from Atlas in trials at Corvallis.

Another disease that sometimes causes damage on winter barleys is one known as scald or blotch (*Rhyncosporium sp.*). The environmental conditions that cause the development of barley scald are not known definitely. Certain varieties such as O.A.C. No. 7, and to a lesser extent O.A.C. No. 6, are rather susceptible. The effect of this disease is more apparent than

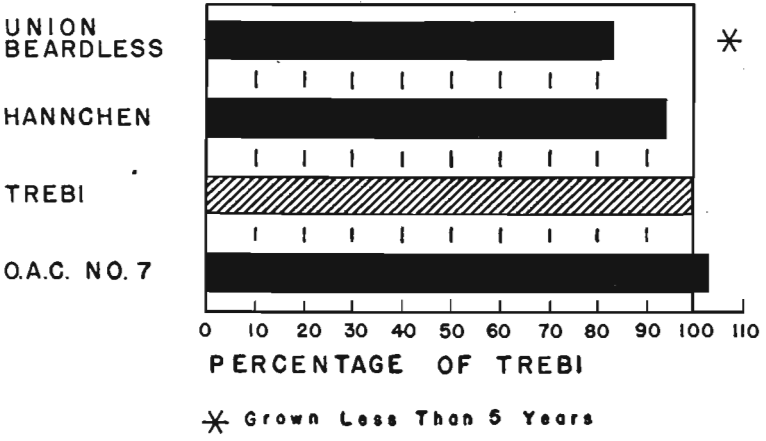
YIELDS OF SPRING BARLEY VARIETIES AT MORO EXPRESSED IN PERCENTAGE OF MELOY



YIELDS OF SPRING BARLEY VARIETIES AT PENDLETON EXPRESSED IN PERCENTAGE OF TREBI



AT BURNS



* Grown Less Than 5 Years

real and consists mainly in causing the barley to have a black spotted appearance. It does, however, sometimes reduce the vigor of the plants when they become fairly well covered with the disease. The varieties, Santiam and O.A.C. No. 1, appear to be rather resistant to this disease, as do other varieties and hybrid sorts which are being grown.

CROP ROTATION

An adequate crop-rotation system is recognized as an essential in any system of permanent agriculture. A good rotation system helps to control weeds, to maintain fertility and crop yields, to control plant pests, to distribute labor, and to reduce expenses. The rotation must be modified to meet cropping conditions in the different areas. In selecting the crops for any given rotation consideration should be given not only to the crops themselves but to the place in the rotation they should occupy. For many areas in the state, barley does fit into the rotation system satisfactorily. Rotation experiments from some of the branch experiment stations give some indication of the value and place of barley in the rotation.

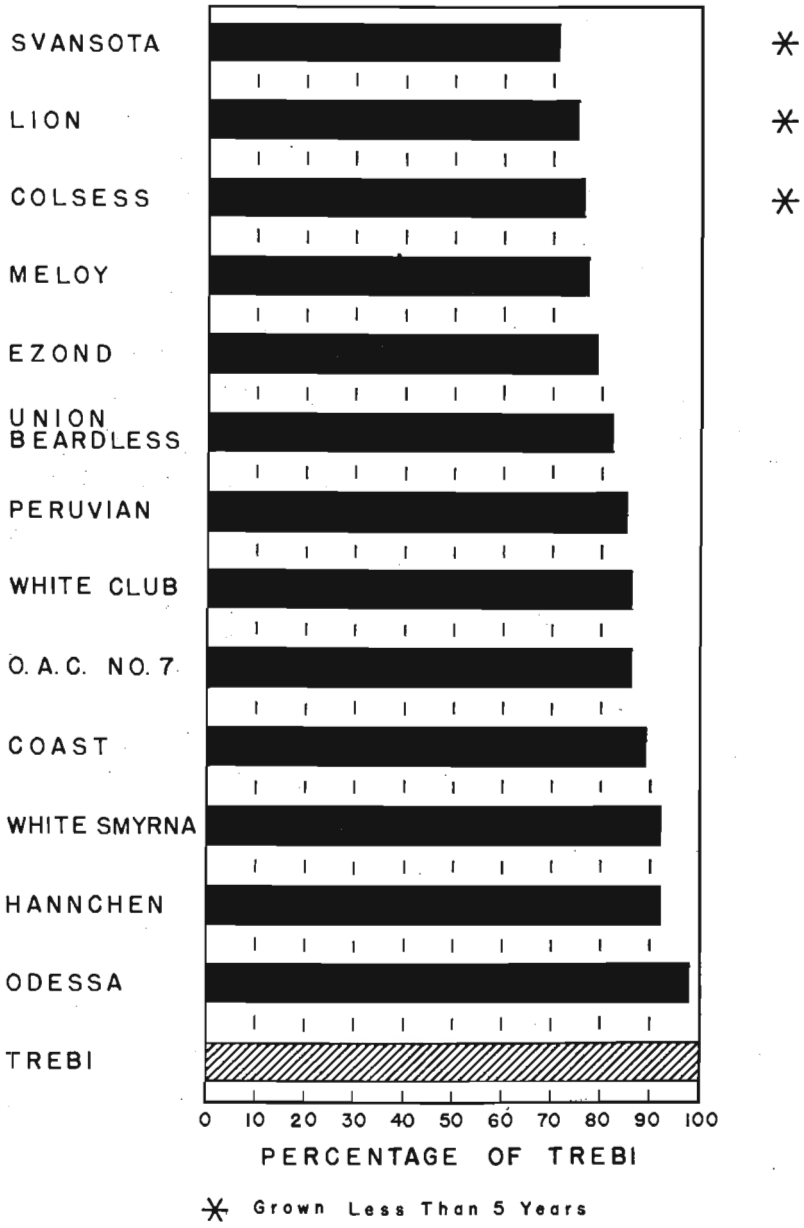
The yields of small grains given in Tables 15 and 16 were obtained from rotation experiments at Moro and Union. The Moro results cover the period from 1912 to 1936 and the Union results from 1924 to 1936, inclusive. The comparisons at Moro showed spring barley after fallow to have a higher average yield than winter wheat after fallow, and barley following corn at Moro had a higher average yield than either spring or winter wheats or spring oats following corn. The same is true when barley is compared with the other small grains as a preceding crop. The yields of barley following the other small grains are higher than are the yields of any of the other small grains following barley. The yields of barley in all of the rotation trials at Moro indicate the possibility of utilizing an appreciable acreage of barley in a rotation system to supplement some of the alternate wheat and fallow now universally followed in the Columbia Basin. Growing spring barley after wheat is an old custom in the Columbia Basin.

The results from the rotation trial at Union shown in Table 16 indicate much the same advantage for barley as was shown at Moro, although the rotations themselves are different. Barley grown after corn gives a higher yield than either winter wheat or spring oats following the same crop. Barley has given the highest yield of any grain in the trial, with the exception of winter wheat after fallow. Barley grown after corn yielded 2,347 pounds per acre as compared with 2,406 pounds per acre of winter wheat after fallow. Barley after the combination of peas and barley cut for hay averaged 2,174 pounds as compared with 2,316 pounds of winter wheat after fallow in the same rotation. Barley after winter wheat produced 1,690 pounds of grain as compared with 1,230 pounds of winter wheat after peas and barley in the same rotation. These figures indicate definitely that barley is also well adapted to the conditions found at the Union Experiment Station and throughout most of the Blue Mountain area.

The results at Moro and at Union indicate also that barley does relatively better following certain crops. At Moro, for example, the highest yields of barley other than those obtained after fallow were obtained following the pea fallow.* The next highest yield of barley was obtained after

*Pea fallow consists of peas grown in cultivated rows.

YIELDS OF SPRING BARLEY VARIETIES AT UNION EXPRESSED IN PERCENTAGE OF TREBI



corn in contrast to the lower yields obtained following other small grain crops. At Union the highest yield of barley was obtained after corn, and the next highest yield after peas and barley. Further evidence regarding the effect of previous crops on the yield of barley is supplied from the rotation experiments at the Harney Branch Experiment Station at Burns. The results from this experiment over the nine-year period from 1928 to 1936, inclusive, are shown in Table 17. The average yield of barley in the peas, potatoes, barley rotation was 82 bushels per acre as compared with an average yield of only 35.7 bushels for barley grown continuously. The effect of the cultivated crop on barley yields in this series of rotations is rather pronounced. The average yield of barley in the peas and oats—potato-barley rotation is 77.3 bushels; whereas, the yield of barley in the peas and oats-barley rotation is only 44.8 bushels.

In Western Oregon winter barley does well following almost any cultivated crop. Wherever possible, winter barley should follow such crops as corn, beans, potatoes, or similar crops rather than other small-grain crops. Unless conditions are favorable for early seedbed preparation with rather long periods of cultivation before seeding the barley, the available nitrate supply of the soil following a small-grain crop is likely to be so low that the barley does not make a satisfactory growth. When barley follows a cultivated crop the seedbed is more likely to be free of weeds and the supply of available nitrate is somewhat higher. If winter barley cannot be sown following a cultivated crop, better opportunities for a good seedbed are offered by such previous crops as seed flax or fiber flax rather than the small grains.

Spring barley preferably should follow a legume crop such as clover. Spring barley also fits in nicely following an annual legume crop such as vetch or peas harvested for seed. Fall grain following vetch or peas sometimes is heavily infested with volunteer growth of these crops, whereas spring grain ordinarily is little affected. The volunteer vetch and peas resulting from the previous seed crop will provide a good cover and green-manure crop during the winter months. The land should be plowed early in the spring, and a period of cultivation to induce germination of volunteer vetch and peas is advisable prior to sowing the barley.

Regardless of whether winter or spring barley is grown in the Willamette Valley, a legume crop should be included in the rotation. If an annual legume is grown, it is desirable to have as much of the straw returned to the soil as possible in order to help maintain the nitrogen supply of the soil.

MALTING BARLEY IN OREGON

Malting and brewing. Before barley can be used in manufacturing beer, it must go through a malting process. In most cases this is done in a separate establishment and not in the brewery. In the malting process barley is germinated for a given length of time and is then dried and cleaned. During the germination process a substance in the barley known as the enzyme diastase is liberated by the barley germ and is distributed throughout the starch of the barley kernel. The function of the diastase is to convert the starch of the barley into sugar, which can be used by the germinating seedlings. The germination is stopped by drying when the barley

sprout is from three-fourths the length to the length of the kernel. At this time only a small portion of the starch has been converted into sugar, but the diastase has been so thoroughly distributed throughout the kernel that is will begin to function again when the proper conditions are available.

This is the finished malt of commerce and is the material used by the brewer. The brewer will take this finished malt, grind it, add other material such as corn or rice to provide additional starch, and then mix with the yeast. The entire malting operation is carried out under carefully controlled conditions of temperature and humidity in order to get the most efficient conversion of starch to sugar and to develop certain desired flavors in the malt. To do this, the maltster must have barley of certain definite quality.

What the maltster wants. The maltster must have pure varieties, because individual varieties will vary in their malting behavior. He wants varieties that are soft in texture rather than hard because soft-textured barley absorbs water more rapidly and germinates more rapidly and uniformly, although the present tendency of the maltster is to pay less attention to texture. He wants barley of uniform size, because a small kernel will germinate at a different rate than a large kernel. If germination is not uniform, then the individual kernels will vary in the degree of conversion that is obtained during the process. The barley must be free from impurities of weeds, dirt, or other grain, and be relatively sound. Skinned and broken kernels are discriminated against, because they either do not germinate at all or provide a means for the ready development of certain molds and fungi. The barley must be bright and free from stain because stained barley may not germinate readily and may impart an undesirable flavor to the malt. The maltster wants a barley with a rather high diastatic power, that is, a barley in which there is sufficient of the enzyme diastase to convert the starch to sugar quickly, and also to convert the starch contained in the supplements of corn or rice which are added to the malt in the brewing process. It is obvious that the maltster is rather particular in his demands and can use only the better quality of certain types of barley that are suitable for his purpose.

Production in Oregon. The main producing area of malting barley in Oregon at present is in the Willamette Valley. There is a possibility that certain of the irrigated regions of the state can produce good malting barley with the present varieties and that the Columbia Basin could also produce malting barley in certain seasons, if there is sufficient demand for it. Of the varieties now being grown Hannchen is the most acceptable. A small quantity of Atlas is also being grown in Klamath County but this variety is not adapted to the Willamette Valley. Good Hannchen barley produces malt of fine flavor and with a high percentage of extract. The diastatic power of Hannchen and other varieties now grown in Oregon is rather low for certain purposes, and some of these varieties are also too thin hulled. Thin-hulled barleys may be injured easily in threshing because of the dry harvest conditions that prevail in the state.

How to produce. Good malting barley is produced only under favorable conditions. It is seldom that any variety is suitable for malting when it is produced on poor soil, or on a poorly prepared seedbed. Lack of moisture and fertility, as well as competition from weeds will make the crop

anything but suitable for this purpose. The seedbed for malting barley should be prepared thoroughly, and there should be an adequate supply of fertilizer, particularly nitrogen, to insure that the crop is given every opportunity to make a satisfactory growth. Injury to the barley kernels during threshing must be kept at a minimum. It is sometimes helpful to thresh barley early in the morning when it is slightly tough. Hannchen will injure less readily at that time than in the afternoon when thoroughly dry.

The growing of other barleys which are successful malting varieties in other areas is not recommended. The comparison of yields of Trebi and Oderbrucker at Pendleton, shown in Table 14, affords a good illustration of this point. A farmer cannot afford to grow any variety that will not give him high yields, because even under the best conditions only a small portion of the barley crop is acceptable for malting. Normally, there is not sufficient premium for malting barley to justify the farmer in taking any reduced yields in order to grow a specific variety. Consult your County Agent and Oregon State College for the varieties best suited to your particular conditions.

Opportunity for improvement. As there was little or no demand for malting barley in Oregon for many years, little or no attempt was made for a long time to improve varieties for this purpose. Beginning in 1933 the Experiment Station has undertaken a series of investigations with the view of improving the production methods for malting barley and of breeding new varieties. These investigations are under way, and a large number of new hybrid varieties have been produced and are being tested for yield and malting quality. The results of malting trials for the period 1934 to 1937 are given in Table 18. The data presented are selected from complete malting analyses, and include characters of primary importance to the maltster. Sufficient variation in these characters is shown to indicate that malting quality of a given variety will vary with the environment under which the barley was grown. These data also indicate that good quality malting barley can be grown in Oregon. Attention is directed particularly to the high percentage of extract, the uniform growth of acrospire and high diastase of certain samples of Hannchen.

Table 8. YIELDS OF WINTER BARLEY VARIETIES GROWN IN REPLICATED FIELD PLOTS AT CORVALLIS, 1928-1936

Ore. No.	Variety	Bushels per acre										Per cent of O.A.C. Sel. 1
		1928	1929	1930	1931	1932	1933	1934	1935	1936	Ave.	
1	O.A.C. Sel. 1 Ck.	55.8	52.8	26.3	23.0	31.6	47.6	34.8	59.7	32.2	40.4	100.0
7	O.A.C. No. 7	60.8	63.4	0.0	35.4	37.1	0.0	39.5	67.1	34.4	37.4	92.5
6	O.A.C. Sel. 6	71.7	78.3	20.0	26.8	30.3	36.2	36.9	60.2	32.8	43.8	108.4
10	Alaska	58.1	66.0	30.0	23.6	40.0	40.4	34.4	61.6	24.8	42.1	104.2
11	Orel	54.2	55.0	21.7	24.3	30.8	28.1	36.1	53.4	32.0	37.3	92.3
13	Tenn. Winter	46.5	61.5	19.2	26.6	38.3	38.4	36.1	56.6	30.1	38.1	94.3
14	Tenn. Winter Sel.	57.5	61.8	25.0	25.8	33.4	40.0	40.6	62.9	30.1	41.9	103.7
15	Utah Winter	46.2	76.9	31.7	16.4	39.4	62.2	24.7	74.4	39.3	45.7	113.1
36	Santiam	.....	.....	.....	.....	.....	.....	38.2	72.0	34.7	48.3	114.4
8	Pidor	54.2	66.8	21.7	26.3	37.8	37.9	37.7	.....	.....	40.3	103.6
12	Wis. Winter	60.0	59.6	18.6	28.3	38.6	.....	.....	.....	.....	41.0	108.2
25	Kroph	.....	.....	22.5	28.0	43.1	20.1	.....	.....	.....	28.4	84.2

Table 9. YIELDS OF SPRING BARLEY VARIETIES GROWN IN REPLICATED FIELD PLOTS AT CORVALLIS, 1920-1937

Ore. No.	Variety	Bushels per acre									Per cent of Hannchen	Years grown
		1930	1931	1932	1933	1934	1935	1936	1937	Ave.		
17	Hannchen Check	44.7	42.0	24.6	57.4	28.7	24.3	31.4	43.1	33.9	100.0	18
19	Trebi	38.2	33.0	21.5	68.6	28.6	19.6	31.7	38.6	30.2	87.2	17
7	O.A.C. No. 7	46.7	44.5	16.8	67.5	23.4	15.3	24.7	35.3	30.1	84.8	13
18	Peruvian	41.1	36.1	18.9	60.8	33.0	23.1	31.1	.....	30.5	87.4	13
20	Union Beardless	46.7	40.5	22.3	64.0	28.7	19.0	18.1	43.4	32.8	93.7	10
27	Victory	46.7	45.7	20.1	67.3	26.7	20.3	33.7	42.1	37.8	102.2	8
34	Peruvian Sel. 1	.....	34.6	32.5	62.6	33.2	23.1	31.6	38.5	36.6	101.3	7
37	Wisconsin No. 38	.....	.....	.....	50.2	23.3	17.4	30.1	42.7	34.7	93.8	5
44	32,602	.....	.....	.....	.....	.....	.....	.....	41.7	41.7	96.7	1
45	32,673	.....	.....	.....	.....	.....	.....	.....	48.7	48.7	113.0	1
30	Flynn Sel. 1	.....	22.9	14.0	51.1	27.9	16.1	28.8	.....	26.8	77.2	6
33	H-88	.....	32.5	14.2	64.3	25.4	22.3	34.8	.....	32.2	92.8	6
35	Peatland	.....	.....	24.2	53.3	20.5	14.7	.....	.....	28.2	83.7	4
	Bulk Hybrid	.....	.....	9.7	41.4	.....	.....	.....	.....	25.5	61.0	2
53	Advance Pedigree	36.0	.....	.....	.....	.....	.....	.....	.....	28.5	87.0	3
28	Blue Hull-less	.....	35.0	24.4	.....	.....	.....	.....	.....	29.7	68.6	2

Table 10. YIELDS OF SPRING BARLEY VARIETIES GROWN IN REPLICATED FIELD PLOTS AT EASTERN OREGON LIVESTOCK EXPERIMENT STATION, UNION, OREGON, 1923-1936

Variety	Bushels per acre									Per cent of Trebi	Years grown
	1929	1930	1931	1932	1933	1934	1935	1936	Ave.		
Trebi	55.3	67.2	34.4	76.7	58.7	72.6	75.0	68.8	67.6	100.0	14
Hannchen	48.2	54.5	38.8	70.1	68.1	61.4	65.3	60.7	62.1	91.9	14
Union Beardless	44.9	73.5	49.0	43.4	63.9	57.3	60.4	56.2	55.6	82.2	14
O.A.C. No. 7	63.5	50.0	37.0	50.0	44.1	69.4	56.6	68.1	51.6	86.4	9
Ezond	.....	51.9	34.9	63.9	42.0	63.2	48.6	55.6	51.4	79.3	7
Blue barley	59.9	60.7	38.0	58.0	.....	.....	.....	.....	59.9	89.3	10
Coast	50.7	58.3	39.1	.....	46.5	.....	.....	.....	58.3	89.3	10
White Smyrna	53.9	50.3	35.4	.....	.....	.....	.....	.....	60.7	92.0	9
Odessa	48.6	56.5	37.5	.....	.....	.....	.....	.....	64.5	97.7	9
White Club	45.3	56.3	37.0	.....	.....	.....	.....	.....	56.7	85.9	9
Beardless No. 3	57.7	58.6	38.8	44.8	.....	.....	.....	.....	53.1	79.6	9
Meloy	42.6	51.3	37.0	50.3	.....	.....	.....	.....	51.3	76.9	9
Peruvian	52.2	50.0	33.3	.....	.....	.....	.....	.....	55.8	85.3	8
Beardless x Blue	49.7	54.7	34.9	.....	.....	.....	.....	.....	52.4	80.1	8
Blue x B-A	41.9	53.1	39.6	.....	.....	.....	.....	.....	46.9	71.7	8
Blue x White Club-C	32.0	53.2	29.4	.....	.....	.....	.....	.....	45.0	68.8	8
Steigum	44.5	44.5	34.1	.....	.....	.....	.....	.....	36.6	79.0	4
Lion, C. I. 923	42.6	39.1	30.2	.....	.....	.....	.....	.....	34.9	75.4	4
Success	.....	43.0	31.5	.....	43.0	50.4	.....	.....	42.0	72.1	4
Colsess	.....	.....	.....	.....	54.1	45.5	.....	.....	49.8	75.8	2
Svansota	32.9	46.1	31.3	.....	.....	.....	.....	.....	36.8	71.3	3

Table 11. YIELDS OF SPRING BARLEY VARIETIES GROWN IN REPLICATED FIELD PLOTS AT MORO, 1912 TO 1936

C. I. No.	Variety	Bushels per acre									Per cent of Meloy	Years grown
		1928	1929	1930	1931	1932	1934	1935	1936	Ave.		
261	Club Mariout	43.9	30.0	38.4	27.6	31.0	34.8	27.6	43.4	38.9	108	20
1167-3	Meloy	43.3	26.4	37.3	26.2	28.1	26.9	27.8	42.4	36.1	100	20
935	Peruvian	47.8	32.5	40.2	29.2	34.3	34.8	28.8	47.5	39.6	110	13
936	Trebi	38.1	34.9	41.5	25.8	28.9	27.5	23.6	39.1	37.1	103	13
1311-1	Flynn	43.0	31.5	37.5	27.5	31.8	31.1	28.4	45.3	34.5	107	8
1311-37	Flynn Sel. 37	....	.....	.....	.....	.....	34.2	26.0	45.0	35.1	108	3
	Himalaya	.....	.....	.....	.....	.....	.....	.....	.....	35.4	92	14
	Coast	.....	.....	.....	.....	.....	.....	.....	.....	39.6	95	14
	Odessa	.....	.....	.....	.....	.....	.....	.....	.....	39.6	95	10
	Arequipa	.....	.....	.....	.....	.....	.....	.....	.....	40.9	107	9
	Chevalier	.....	.....	.....	.....	.....	.....	.....	.....	30.4	91	4
	Pryor	.....	.....	.....	.....	.....	.....	.....	.....	31.2	94	4
	Atlas	.....	.....	.....	.....	.....	.....	.....	.....	32.4	97	4

Table 12. Yields of Spring Barley at the Harney Branch Experiment Station, Burns, Oregon, 1919-1936

Variety	Bushels per acre								
	1919	1920	1921	1923	1924	1925	1927	1928	1929
Trebi	52.0	67.3	73.3	70.4	36.6	70.6	79.7	82.7	88.9
Hannchen	49.1	63.0	55.0	60.0	37.4	74.4	73.5	88.7	88.0
O.A.C. No. 7	.....	.....	.....	.....	.....	.....	.....	19.8	100.5
Union	.....	.....	.....	.....	.....	.....	.....	.....	.....

Variety	Bushels per acre							Ave.	% of Trebi
	1930	1931	1932	1933	1934	1935	1936		
Trebi	60.7	41.7	54.6	77.9	123.1	89.8	58.6	70.5	100.0
Hannchen	53.7	.....	.....	.....	.....	.....	.....	64.3	94.2
O.A.C. No. 7	68.9	30.4	58.1	72.5	119.6	87.7	66.7	76.2	102.7
Union	.....	.....	.....	70.4	88.5	85.6	46.5	72.8	83.3

Table 13. Annual and Average Yields of Spring Barley Varieties Grown in Replicated Field Plots at the Pendleton Field Station in the Years 1929 to 1937, Inclusive

C. I. No.	Variety	Bushels per acre									Ave.	Yield in per cent of Trebi
		1929	1930	1931	1932	1933	1934	1935	1936	1937		
936	Trebi	76.3	69.5	65.5	54.3	74.5	49.2	44.3	63.0	67.8	62.7	100.0
(a) 5911	Flynn sel. 1	.....	67.2	56.8	54.6	71.0	47.4	49.2	57.5	59.7	57.9	94.9
(a) 5918	Flynn sel. 37	.....	.....	.....	.....	.....	46.8	48.6	56.8	61.9	53.5	95.4
261	Club Mariout	.....	.....	52.6	50.0	64.9	42.8	43.6	55.2	55.2	52.0	87.0
(b) 4656	Meloy sel. 3	61.5	.....	59.7	48.6	56.3	36.4	39.6	45.4	58.3	50.7	81.9
(b) 5449	Composite Cross sel.	.....	.....	.....	.....	.....	.....	.....	47.4	57.4	52.4	80.1
1256	Arequipa	75.3	.....	62.1	54.0	63.5	49.5	43.1	42.6	.....	55.7	91.3
5912	Peruvian sel. 1	67.4	.....	61.8	55.5	71.2	49.1	47.5	55.5	.....	58.3	95.6

(a) Smooth-awn
(b) Hooded

Table 14. Annual and Average Yields of Spring Barley Varieties Grown in Replicated Nursery Rows at the Pendleton Field Station in the Years 1931 to 1937, Inclusive

C.I. No.	Variety	Bushels per acre								Yield in per cent of Club Mariout
		1931	1932	1933	1934	1935	1936	1937	Ave.	
261	Club Mariout	45.3	52.3	68.9	48.1	44.8	47.6	51.8	51.3	100.0
936	Trebi	.....	50.6	68.7	41.4	39.9	61.7	56.9	53.2	101.7
531	Hannchen	40.3	46.3	62.1	42.6	42.9	52.8	39.5	46.6	90.8
4656	Meloy Sel. 3	35.0	40.1	53.3	26.9	42.5	59.3	45.2	43.2	84.2
5676	Union Beardless	.....	.....	50.5	19.1	33.7	51.5	45.9	40.1	76.8
5449	Composite Cross Sel.	.....	.....	59.2	53.5	36.8	48.6	43.1	48.2	92.3
5918	Flynn Sel. 37	63.0	61.0	67.8	60.7	49.4	63.9	60.7	60.9	118.7
5912	Peruvian Sel. 1	54.8	50.4	76.2	54.4	49.6	70.9	60.4	59.5	116.0
1256	Arequipa	41.8	52.7	74.9	46.9	43.7	59.6	57.2	53.8	104.9
1556	Minsturdi	.....	.....	.....	.....	29.2	43.0	32.4	34.9	72.6
4577	Glabron	.....	.....	.....	.....	32.8	31.9	33.9	32.9	68.4
1907	Svansota	.....	.....	.....	.....	36.6	36.8	35.6	36.3	75.5
5105	Wis .Ped. 38	.....	.....	.....	.....	30.0	39.2	25.8	31.7	65.9
4666	Oderbrucker	.....	.....	.....	.....	18.1	14.3	.....	16.2	35.1

Table 15. Yields of Small Grains in Various Rotations, Moro, 1912-1936

No.	Rotation	Crop*	Lbs. per A.
1A	Winter wheat—fallow	Winter wheat	1,470
1B	Spring wheat—fallow	Spring wheat	1,344
1C	Spring barley—fallow	Barley	1,852
1D	Spring oats—fallow	Oats	1,443
4	Spring wheat—barley—fallow	Spring wheat	1,320
	Spring wheat—barley—fallow	Barley	979
7	Spring wheat—barley—pea fallow	Spring wheat	1,494
	Spring wheat—barley—pea fallow	Barley	1,286
8	Spring wheat—barley—corn	Spring wheat	1,014
	Spring wheat—barley—corn	Barley	979
9	Spring wheat—corn—barley	Spring wheat	930
	Spring wheat—corn—barley	Barley	1,324
13	Spring wheat—spring wheat—pea fallow—barley	Spring wheat	822
	Spring wheat—spring wheat—pea fallow—barley	Spring wheat	780
	Spring wheat—spring wheat—pea fallow—barley	Barley	1,483
14	†Pea fallow—winter wheat	Winter wheat	1,158
15	Spring wheat—corn—oats—fallow	Spring wheat	1,278
	Spring wheat—corn—oats—fallow	Oats	963
16	Oats—barley—pea fallow—corn	Oats	1,273
	Oats—barley—pea fallow—corn	Barley	1,315
17	Spring wheat—barley—fallow—corn	Spring wheat	1,350
	Spring wheat—barley—fallow—corn	Barley	1,214
26	Winter wheat—corn	Wheat	990

*Previous crop indicated by position in the rotation.
†Complete rotation.

Table 16. Yields of Small Grains in Various Rotations, Union, 1924-1936

No.	Rotation	Crop	Lbs. per A.
1	Spring wheat continuous	Spring wheat	840
4	Winter wheat—fallow	Winter wheat	2,406
5	Spring wheat—peas and barley	Spring wheat	1,392
6	Spring wheat—peas	Winter wheat after peas	1,752
7	Winter wheat—peas and barley	Winter wheat after peas and barley	1,668
8	Barley—corn	Barley	2,218
9	Winter wheat—corn	Winter wheat	2,004
10	Spring wheat—sweet clover	Spring wheat	1,578
11	Spring wheat—red clover	Spring wheat	1,674
12	Winter wheat—barley—fallow	Winter wheat	2,484
	Winter wheat—barley—fallow	Barley	2,062
13	Winter wheat—barley—peas and barley	Winter wheat	1,230
	Winter wheat—barley—peas and barley	Barley	1,690
14	Spring wheat—corn—oats	Spring wheat	1,464
	Spring wheat—corn—oats	Oats	1,946
15	Spring wheat—corn—barley	Spring wheat	1,236
	Spring wheat—corn—barley	Barley	2,347
18	Winter wheat—peas and barley—barley—fallow	Winter wheat	2,316
	Winter wheat—peas and barley—barley—fallow	Barley	2,174

Table 17. Rotation and Annual and Average Yields of Barley Grown in the New Rotations Experiment, with Irrigation, in Duplicated Twentieth Acre Plots, at the Harney Branch Experiment Station, Burns, Oregon, 1928 to 1936 Inclusive

Rotation	Yield in bushels per acre									
	1928	1929	1930	1931	1932	1933	1934	1935	1936	Ave.
Peas—Potatoes—Barley	64.6	71.3	71.5	72.7	92.3	86.7	101.7	83.6	93.3	82.0
Peas and Oats—Potatoes—Barley	61.4	88.2	61.7	70.4	91.9	78.1	93.8	72.9	77.5	77.3
Sunflowers—Peas—Barley	78.4	90.2	62.7	64.2	99.0	77.5	77.0	70.0	73.2	76.9
Peas and Oats—Barley	59.7	62.1	28.4	42.7	63.7	46.0	55.2	37.3	43.8	48.8
Barley continuous	47.2	40.6	31.1	32.1	41.5	32.5	41.3	22.9	32.3	35.7

Note: The experiment was started in 1928 and the crops varied on the various plots in 1927.

Table 18. Selected Data from Malting Trials of Barley Grown at Corvallis, 1934-1937

Sample No.	Soil type	Previous crop	Date planted	Variety	Skinned and broken	1000 kernel weight	Texture	Acro-spire 3/4-1	Nitrogen	Extract	Diastase
1934											
1A	Will.	Clover	4/11	Hannchen	6.0	37.0	36	90	1.77	79.6	55
8A	Will.	Clover	4/11	Wis. No. 38	14.4	36.6	45	85	1.67	74.6	45
137				Wis. No. 38	7.7	38.6	83	67	1.43	75.7	54
138				Hannchen	1.3	41.4	100	91	1.07	82.5	49
150			May	Hannchen	9.8	38.0	31	87	1.53	80.4	70
1935											
1	Will.	Clover	4/12	Hannchen	5.8	39.0	37	95	1.65	80.5	80
2	Will.	Clover	4/12	Wis. No. 38	5.4	33.0	41	95	1.88	74.0	100
3	Wil.	Clover	4/27	Hannchen	2.6	34.0	17	89	2.18	81.9	105
4	Will.	Clover	4/27	Wis. No. 38	2.6	31.6	45	92	2.36	70.5	125
a5	Will.	Barley	4/16	Hannchen	7.4	37.0	17	94	1.59	81.5	60
b6	Will.	Barley	4/16	Hannchen	7.9	38.5	24	86	1.52	81.6	70
c7	Will.	Barley	4/16	Hannchen	5.4	34.5	25	89	1.65	80.9	85
8	Will.	Barley	4/16	Hannchen	5.6	38.6	19	86	1.64	81.6	77
9	Will.	Barley	4/16	Wis. No. 38	10.0	33.7	60	96	1.72	75.1	82
10	Will.	Barley	4/27	Hannchen	5.2	34.4	22	91	2.10	78.2	134
11	Will.	Barley	4/27	Wis. No. 38	6.3	31.5	52	99	2.06	71.9	102
13	Will.	Corn	4/13	Hannchen	3.7	37.5	32	94	2.09	79.2	122
17	Che.	Clover	3/20	Hannchen	7.3	41.2	37	87	1.60	81.7	93
19	Che.	Clover	4/26	Hannchen	3.0	37.0	16	93	1.90	77.5	100
23	Amity	Clover	4/16	Hannchen	4.1	41.0	45	91	2.08	79.4	153
24	Amity	Clover	4/16	Wis. No. 38	1.6	44.5	47	98	2.17	75.7	128
1936											
88	Will.	Peas	4/15	Hannchen	4.7	36.8	....	93	1.48	81.9	78
a89	Will.	Peas	4/15	Hannchen	3.6	35.9	....	92	1.45	81.9	79
b90	Will.	Peas	4/15	Hannchen	5.1	35.9	....	91	1.45	81.1	74
c91	Will.	Peas	4/15	Hannchen	5.2	36.1	....	91	1.41	81.1	79
92	Will.	Peas	4/15	Hannchen	6.5	36.3	....	89	1.47	81.3	83
93	Will.	Peas	4/25	Hannchen	2.7	37.3	....	89	1.51	81.8	78
94	Will.	Peas	4/15	Wis. No. 38	1.0	32.2	....	84	1.56	78.1	68
95	Will.	Peas	4/25	Wis. No. 38	2.0	33.5	....	86	1.50	78.6	67
96	Will.	Peas	4/15	Wis. No. 38	3.8	32.7	....	84	1.48	78.6	66
97	Will.	Peas	4/15	Victory	1.2	37.7	....	90	1.46	81.7	68
98	Will.	Peas	10/25	Utah Winter	2.0	39.6	....	79	1.30	78.4	69
99	Will.	Peas	10/25	Santiam	2.5	45.0	....	79	1.50	79.3	60
1937											
102	Will.	Peas	4/22	Hannchen	.9	37.7	100	80	1.38	81.9	90
103	Will.	Peas	4/22	Victory	.4	39.3	100	86	1.38	81.9	80
140	Will.	Peas	4/22	Hannchen	....	37.4	100	90	1.44	81.9	81
137	Will.	Peas	4/22	32,855	....	39.6	....	96	1.43	76.9	66
138	Will.	Peas	4/22	32,2712	....	41.2	....	98	1.55	76.8	85
139	Will.	Peas	4/22	32,4641	....	43.7	....	82	1.49	77.5	80
141	Will.	Peas	4/22	33,5087	....	34.4	....	88	1.24	76.2	44
142	Will.	Peas	4/22	33,4923	....	45.2	....	96	1.32	78.0	70
143	Will.	Peas	4/22	33,4984	....	38.7	....	96	1.48	78.7	71
144	Will.	Peas	4/22	Hannchen	....	36.7	....	96	1.48	82.1	82

a Ammonium sulphate, 200 lbs. per acre. b Superphosphate, 200 lbs. per acre. c Complete, 10-10-10, 200 lbs. per acre.

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Roland Scott, D.V.M. ..... Research Assistant (Veterinary Medicine)
Marion Robbins, B.S. ..... Technician in Poultry Pathology

Division of Plant Industries

G. R. Hyslop, B.S. ..... Agronomist; In Charge, Division of Plant Industries

Farm Crops

H. A. Schoth, M.S. ..... Agronomist; Division of Forage Crops and Diseases*
D. D. Hill, Ph.D. ..... Associate Agronomist
R. E. Fore, Ph.D. ..... Assistant Agronomist*
Elton Nelson, B.S. ..... Agent (Division of Fiber Plant Investigations)*
Grace Cole Fleischman, A.B. ..... Assistant Botanist, Division of Seed Investigations*
H. H. Rampton, M.S. ..... Assist. Agronomist (Division of Forage Crops and Diseases)*
L. E. Harris, M.S. ..... Assistant Agronomist
H. E. Finnell, M.S. ..... Assistant Agronomist
A. E. Gross, M.S. ..... Research Assistant (Farm Crops)

Horticulture

W. S. Brown, M.S., D.Sc. ..... Horticulturist
H. Hartman, M.S. ..... Horticulturist (Pomology)
E. H. Weigand, B.S.A. ..... Horticulturist
A. G. B. Bouquet, M.S. ..... Horticulturist (Vegetable Crops)
C. E. Schuster, M.S. ..... Horticulturist (Div. Fruit and Veg. Crops and Diseases)*

STATION STAFF—*(Continued)*

W. P. Duruz, Ph.D.....Horticulturist (Plant Propagation)
G. F. Waldo, M.S.....Asst. Pomologist (Div. Fruit and Veg. Crops and Diseases)*
T. Onsdorff, M.S.....Assistant Horticulturist
E. Hansen, M.S.....Assistant Horticulturist (Pomology)

Soil Science

W. L. Powers, Ph.D.....Soil Scientist
C. V. Ruzek, M.S.....Soil Scientist (Fertility)
M. R. Lewis, C.E.....Irrigation and Drainage Engineer, Bur. of Agric. Engineering*
R. E. Stephenson, Ph.D.....Associate Soil Scientist
E. F. Torgerson, B.S.....Associate Soil Scientist (Soil Survey)
James Clement Lewis, B.S.....Research Fellow in Soils

Other Departments

J. S. Jones, M.S.A.....Chemist in Charge
R. H. Robinson, M.S.....Chemist (Insecticides and Fungicides)
J. R. Haag, Ph.D.....Chemist (Animal Nutrition)
D. E. Bullis, M.S.....Associate Chemist (Food Products Industries)
M. B. Hatch, M.S.....Assistant Chemist
L. D. Wright, B.S.....Assistant Chemist

Agricultural Engineering

F. E. Price, B.S.....Agricultural Engineer in Charge
H. R. Sinnard, M.S.....Associate Agricultural Engineer (Farm Structures)
C. I. Branton, B.S.....Assistant Agricultural Engineer

Bacteriology

G. V. Copson, M.S.....Bacteriologist in Charge
J. E. Simmons, M.S.....Associate Bacteriologist
W. B. Bollen, Ph.D.....Associate Bacteriologist
Noel Gross, M.S.....Research Assistant

Entomology

D. C. Mote, Ph.D.....Entomologist in Charge
J. C. Chamberlin, Ph.D.....Asso. Entom. (Div. Truck Crops and Garden Insects)*
A. E. Bonn, B.S.....Junior Entomologist (Div. Truck Crops and Garden Insects)*
B. G. Thompson, M.S.....Assistant Entomologist
S. C. Jones, M.S.....Assistant Entomologist*
K. W. Gray, M.S.....Assistant Entomologist
W. D. Edwards, M.S.....Assistant Entomologist
H. E. Morrison, M.S.....Research Assistant (Entomology)
Joe Schuh, M.S.....Research Assistant (Entomology)
G. R. Ferguson, B.S.....Research Assistant (Entomology)

Home Economics

Maud M. Wilson, A.M.....Home Economist

Plant Pathology

C. E. Owens, Ph.D.....Plant Pathologist in Charge
S. M. Zeller, Ph.D.....Plant Pathologist
F. P. McWhorter, Ph.D.....Plant Pathologist*
B. F. Dana, M.S.....Plant Pathologist (Div. Fruit and Veg. Crops and Diseases)*
F. B. Bailey, M.S.....Associate Plant Pathologist (Insecticide Control Division)*
P. W. Miller, Ph.D.....Assoc. Pathologist (Div. Fruit and Veg. Crops and Dis.)*
G. R. Hoerner, M.S.....Agent (Division of Drug and Related Plants)*
R. F. Grah, B.S.....Agent (Division of Drug and Related Plants)*
R. Sprague, Ph.D.....Associate Pathologist (Div. of Cereal Crops and Diseases)
John Milbrath, M.S.....Research Assistant (Plant Pathology)
J. H. Pryor, B.S.....Research Assistant (Plant Pathology)

Publications and News Service

C. D. Byrne, M.S.....Director of Information
E. T. Reed, B.S., A.B.....Editor of Publications
D. M. Goode, M.A.....Editor of Publications
J. C. Burrier, B.S.....Associate in News Service

Branch Stations

L. Childs, A.B.....Superintendent, Hood River Br. Expt. Station, Hood River
F. C. Reimer, M.S.....Superintendent, Southern Oregon Br. Expt. Station, Talent
D. E. Richards, B.S.....Supt. Eastern Oregon Livestock Br. Expt. Sta., Union
H. K. Dean, B.S.....Supt., Umatilla Br. Expt. Sta. (Div. West. Ir. Agric.), Hermiston
Obil Shattuck, M.S.....Superintendent, Harney Valley Br. Expt. Station, Burns
H. B. Howell, B.S.....Superintendent, John Jacob Astor Br. Expt. Sta., Astoria
R. G. Johnson, B.S.....Acting Supt., Squaw Butte Range Experiment Station
G. A. Mitchell, B.S.....Asst. Supt. Pendleton Br. Ex. Sta., (Dry Land Ag.), Pendleton*
G. G. Brown, A.B., B.S.....Horticulturist, Hood River Br. Expt. Station, Hood River
Arch Work, B.S.....Supt. Medford Br. Sta. (Asso. Irrig. Engr., Div. Irrig.), Medford*
E. S. Degman, Ph.D.....Asso. Pomologist (Div. Fruit Veg. Crops and Dis.), Medford
Bruce Allyn, B.S.....Junior Irrigation Engineer (Division of Irrigation) Medford*
L. G. Gentner, M.S.....Associate Entomologist, So. Or. Br. Expt. Sta., Talent
J. F. Martin, M.S.....Junior Agronomist, Div. Cereal Crops and Diseases, Pendleton*
M. M. Oveson, M.S.....Superintendent Sherman Br. Experiment Station, Moro*
Robert W. Henderson, B.S.....Research Assistant, Sherman Br. Expt. Station, Moro*
R. E. Hutchison, M.S.....Asst. to Supt., Harney Branch Expt. Station, Burns