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University of Wyoming Agricultural Experiment Station

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UNIVERSITY OF WYOMING
AGRICULTURAL EXPERIMENT STATION

PLATS ON THE UNIVERSITY AGRONOMY FARM

BARLEY PRODUCTION AND VARIETIES FOR WYOMING

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Barley Production and Varieties for Wyoming

GLEN HARTMAN
A. F. VASS

Barley is a feed crop and holds the same place on the farms which are located in the cooler areas of the United States that corn occupies on the farms of the Middle West where the summer days are hot and the nights warm.

Barley requires less heat for growth and maturity than does corn. The small eared, low yielding, early maturing varieties of corn have entered into competition with barley on the cool irrigated lands of this state, but a few years of experience has shown the fallacy of trying to grow corn in those areas where the nights are cool and the growing season short. As less than one per cent of the area of the state is below 4000 feet, and 95 per cent of the area of the state is above 5000 feet, the area to which corn is adapted is rather limited. There are, however, no irrigated farming areas in the state where barley cannot be grown.

As Wyoming is primarily a livestock state we must rely very largely upon barley as the grain to use in our livestock finishing operations and also in our supplementary feeding of range livestock. The development of agriculture in the state means more livestock, which in turn means more supplementary feeds, as our ranges are already well stocked.

Barley ranks high as a feed crop for a maintenance and fattening ration for our livestock, when properly prepared. The hardness of the seed coat makes it desirable to crack or grind or roll the seed before feeding.

Barley grown under high-altitude conditions on our soils that are rich in the mineral plant food elements is of superior quality and color and the tests of feeding value on our experimental station have proved its superiority over barley grown in the corn belt. It has been found to have a feeding value almost equivalent to our corn. The winnings in the show ring of our livestock that have been fattened on barley speak well for its feeding value.
Figure 1 shows the acreage and yield of barley in the United States during the last 72 years. There was a gradual increase in the acreage of barley from 1866 to 1900. From 1900 to 1909 there was a marked increase in the acreage. From 1909 to 1926 there was no increase with the exception of the 1917 and 1918 year periods when all crop production was stimulated.

The years of 1927 and 1928 saw a very marked increase in the acreage of barley. Some of the wide fluctuations in the acreage may have been due to the fact that prior to 1918 considerable barley had been used for malting purposes. The marked increase in acreage during the last two years seems to be due to the fact that farmers appreciate more fully the value of barley in the feeding rations.

The average farm price of barley in the United States from 1866 to 1918 was 59.6 cents per bushel. The average wholesale price of all commodities during that same 53 years was 101. The present price of 67.8 gives barley a purchasing power of 76 cents on the dollar when compared to wholesale prices of all commodities. The increase in acreage cannot be attributed to a high market value.
Figure 2 shows the acreage and production of barley in Wyoming from 1901 to 1928. There was a gradual increase in barley from 1901 to 1918, at which time there was a slight decrease in acreage and a marked decrease in yield due to the dry year of 1919. The acreage started upward again in 1921 and with the exception of 1924 there has been a marked increase in acreage each year.

The acreage in Wyoming increased 500 per cent from 1920 to 1928, which is greater than the increase of any of our other general farm crops for the same period. This indicates that farmers are recognizing more and more that barley is one of our best crops for the production of feed.

Barley as a rule is produced on the farm or ranch for feeding on that farm or ranch, and the producer is not therefore influenced directly by what the price quotation at a distant market happens to be. The price of barley in Wyoming on December 1, 1928, was given as 60 cents per bushel by the United States Department of Agriculture, which is about what a farmer might expect to receive should he sell it. It does, however, have a greater value than that on the farm for feeding purposes, for many of our livestock pr
ducers, either raise barley or else ship in corn for feed. The freight on the barley to the market as well as the freight on the corn from the market to the farm or ranch might well be added to the quoted price, as the farmer saves freight charges when he grows his own barley instead of shipping in corn.

It may be advisable to continue to ship in corn to feed our winter bands of range sheep on the desert, where the feed is scattered on the ground, but this condition is the exception, rather than the rule. We should, however, work out better means of handling barley for open range feeding.

Figure 3. Barley plats on the Agronomy Farm that yielded one hundred bushels per acre.

Figure 3 shows barley which yielded at the rate of 100 bushels per acre at an altitude of 7200 feet and indicates the possibilities of this crop at our high elevations, where the farmer or rancher needs a grain crop to finish his livestock or to use as supplementary feed to carry his livestock through the winter in a little better condition. It is often desirable that the rancher feed his breeding cows, bulls, calves, and breeding ewes a little grain during the winter months. Barley seems to be the best crop that we can raise for this purpose.

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

CULTURAL METHODS

ROTATION

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

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

Barley does best following a cultivated crop such as potatoes or sugar beets, and serves as a nurse crop in which the alfalfa or clover may be seeded.

In general, barley does best after a cultivated crop. In the dry-farming sections of the state spring-seeded barley upon disked corn or potato ground has yielded very profitable returns. Corn is a common crop on many of our dry lands. Tests have shown that on the Great Plains the largest returns of barley per acre were obtained after summer fallow, but on account of the cost of summer tillage the crops on disked corn ground were more profitable. Potatoes, where grown, occupy the same place as the corn in the scheme of rotation.

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

Any well-planned rotation should include deep rooted and shallow rooted crops, and a legume. A shallow rooted crop should follow a deep rooted one. Where alfalfa is used as the legume, barley may be used as a nurse crop in those sections where a nurse crop is used. Barley is probably the most desirable of the small grains for this purpose.

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

A good rotation for our irrigated lands, where sugar beets and potatoes can be grown, is barley as a nurse crop for clover or alfalfa the first year, clover or alfalfa two to four years, followed by potatoes, and then by sugar beets. Barley or one of the other small grains should follow the beets. Some such rotation as the above will improve our soils and increase our yields.

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

SEED BED PREPARATION

 Practically all of the barley grown in this state is spring sown. Some years ago there was a common impression that spring seeding should always be done on fall plowing. Results of recent investigations do not always support this idea. In experiments of the United States Department of Agriculture at fourteen stations spring plowing for spring barley gave average results exactly the same as those for fall plowing. In those sections of the state where soil blowing is not troublesome during the winter season, fall plowing may be very economical from the standpoint of labor. Early spring seeding of barley is desirable. Fall plowing, while it may not be a distinct advantage in itself, permits much of the land prep-
Barley Production and Varieties

aration to be done at a time when farm work is rather lax. This method also is a time saver in the spring.

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

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

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

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

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

**SUMMER FALLOW**

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

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

As stated elsewhere in this bulletin, summer fallow has given the largest average yield of any cultural method. However, it must be borne in mind that it is more costly than other methods. The results secured from the field station at Sheridan gave the following results: Barley seeded on fall plowing gave a yield of 21.1 bushels per acre compared to 18.6 on spring plowing. Summer fallow gave a yield of 30.0 bushels per acre. Barley following corn gave a yield of 30.3 bushels, compared to 28.8 on the plots where barley followed small grains in the rotation.

**SEED TREATMENT OF BARLEY**

The smut diseases of wheat, barley, and oats are among the most destructive that attack cereal crops. Several million bushels are destroyed each year by smuts. Besides the actual grain destroyed there is an additional loss due to dockage on smutty grades. Most of these losses could be prevented by seed treatment.
Smuts are caused by parasitic fungi which infect the plant through the seed. The smut grows up through the plant and destroys the seeds or whole head. Seed treatment kills the smut spores and therefore prevents smuts from infecting the young seedlings.

Barley should be treated regularly for smut. If a little smut is present in the crop it is likely to increase until it becomes very destructive, unless the seed is treated. Sometimes smut gets on the seed from smutty thresher or infected drills or bags.

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

Barley is subject to attack by two smuts: (a) Covered smut, and (b) loose smut. When barley is infected with covered smut the heads turn into a black mass of smut spores. This mass is held together by a thin grey membrane. The long-time formaldehyde treatment is best.

Loose smut causes the barley to turn into a loose, black mass of smut spores which are soon blown away, leaving the naked rachis. This form of barley smut is difficult to control. The long-time formaldehyde treatment is as effective as any form of treatment. When loose smut becomes troublesome an effort should be made to secure clean seed.

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

**Long-Time Formaldehyde Treatment.**

This method is recommended only for barley smut control. It is not extensively used, but is very satisfactory for the control of covered smut of barley and loose smut of barley. The long-time formaldehyde treatment consists of soaking barley seed which has been placed in sacks in a solution of 1 pint of full strength formaldehyde in 40 gallons of water. Allow the seed to soak for 2 hours, after which the sacks are removed and the seed spread out to dry.
When the seed is dry enough to run through the drill it may be planted.

*Precautions in Using Formaldehyde.*

1. Always see that it is guaranteed full strength i.e., 37 to 40 per cent.
2. Do not use more or less formaldehyde than the directions call for.
3. Plant all grain which has been treated as soon as possible after treatment. Do not store it after treatment as seed injury results.

*Seed Injury Due to Formaldehyde.*

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

Again seed injury will be brought about if the seed coats are broken. The broken seed coat permits the disinfectant to soak through to the embryo and kill it.

The copper carbonate dust treatment is effective against wheat bunt (smut), but will not control smut in grains with a hull, such as ordinary oats and barley.

**SEEDING METHODS UNDER IRRIGATION**

All seeding should be done with the drill. On nearly level land, the drilling should be done in the same direction as the slope, to aid in directing the water. On hillsides the drill rows should be at right angles to the slope, so as to check the water. Barley should
be sown at the rate of 1 1/2 to 2 bushels per acre. The lighter rate of seeding is best where it is to be used as a nurse crop.

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

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

SEEDING METHODS ON DRY LAND

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

Early seeding in April is desirable. The farmers upon our dry lands often plant large acreages of grains. They sometimes find it difficult, or impossible to seed the entire acreage early. While barley responds to early seeding, it will better stand late seeding than either wheat or oats. Barley grows quicker than either of these grains; hence, it will mature earlier than wheat and may avoid some of the late drought.

The results of summer fallow on the Archer dry land station gave 18.6 bushels per acre on summer fallow, compared to 12.3 on spring plowing. The yield on disked corn land was 15.1 bushels per acre. The lowest yields were on the plots cropped continuously to barley.
IRRIGATION OF BARLEY

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

Barley is more affected by over-watering than most other small cereals. The quality of the kernel is injured by too much irrigation, and watering later than the soft dough stage may cause a strong second growth, often resulting in mouldy bundles after harvesting. Over-irrigation is more detrimental to barley than to wheat or oats.

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

Barley is slightly more tolerant to alkali than either wheat or oats, and for that reason may be used in preference to the above crops on lands which are being reclaimed. Lands which contain an accumulation of alkali at the surface should be plowed to a depth of from 8 to 10 inches and seeded immediately, before the alkali has had time to again accumulate at the surface. This will enable the seeds to germinate and start growth before the excessive accumulation occurs at the surface.
VARIETIES

CHARLOTTETOWN BARLEY

Charlottetown traces to a selection from Old Island Two-Rowed barley made by J. A. Clark, superintendent of the Experimental Farm, Charlottetown, Prince Edward Island, Canada. It is a two-rowed, hulled, bearded barley. (See Fig. 4.)

In recent years Charlottetown has given very good results, not only at Charlottetown, but at many of the experiment stations in western Canada and in the United States. This barley is of Chevalier type and is one of the best selections which has been made so far as its culture in America is concerned.

Botanical description of Charlottetown barley: Foliage medium green; culm slender, sometimes lodging; erect in early growth; spikes usually well out of sheath of last leaf; medium to late in maturity; spikes lax, nodding; grain rather short, very plump; lemma and palea cross-wrinkled, reddish in color, often darker at base; awns long, more or less spreading, shows tendency toward deciduousness at maturity; base of lemma with slight horse-shoe-like depression; rhachilla is long and beset with short, fine hairs, which are more or less recurved at the tip.

HANNCHEN BARLEY

Hannchen is a two-rowed, hulled barley. (See Fig. 4.) It was introduced into the United States by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture in 1904. It was originated by the Svalof Plant Breeding Association of Svalof, Sweden. Hannchen barley was grown at the University of Wyoming Experiment Station for the first time in 1911 from seed secured from South Dakota.

Hannchen has given by far the best yields and has exhibited a much wider range of adaptations than any of the other barleys imported from Svalof. Although coming from the very different climate of northern Europe, it has proved to be of special value in regions of low rainfall in the United States. In recent years it has been among the best five varieties at thirteen stations located between Eureka, South Dakota, and Burns, Oregon.

Botanical description of Hannchen barley: Foliage medium green, culms rather long, slender and often lodging under adverse weather conditions; erect in early growth; spike usually well out of
sheath of last leaf; medium to early in maturity; spikes nodding and medium lax; grain rather short, very plump, symmetrical; lemma and palea cross-wrinkled, yellow in color, often dark at base; awns long, more or less spreading, five nerves of lemma more or less conspicuous, lateral nerves smooth; base of lemma with a slight horseshoe-like depression; rhachilla beset with long, straight hairs.

**Smyrna (White) Barley**

Smyrna is a two-rowed, hulled barley introduced into the United States by the Office of Foreign Seed and Plant Introduction of the United States Department of Agriculture from Smyrna, Asia Minor, in 1901. Smyrna was brought to the Wyoming Station from South Dakota in 1911. It has been widely tested at the experiment stations in the western half of the United States and is the most drought-resistant of any of the varieties so far tested. The straw is very short, sometimes making it very difficult to harvest. In point of yield it has done particularly well in sections of Montana, Wyoming, western South Dakota, northern Colorado, Idaho, and eastern Oregon.

White Smyrna (C. I. No. 658), a selection from White Smyrna has a longer straw and has been reported as yielding well at Bozeman, Montana; Burns, Oregon; Dickinson, North Dakota, and Archer, Wyoming.

*Botanical description of Smyrna barley*: Foliage medium green, number of nodes in the culm small; culm short; erect in early growth; spikes scarcely emerge from sheath of last leaf; early in maturity; spikes medium in length, lax, nodding; internodes of rhachis long; grain large, white; lemma closely adhering to caryopsis, usually discolored, awned; awns barbed at the tip and about one-half to two-thirds of the distance to the base, the base of the awn being perfectly smooth; nerves of lemma smooth; base of lemma with horseshoe-like depression; outer glumes awn-pointed, extending just beyond the lemma; the rhachilla beset with long straight hairs, the hairs occasionally rather sparse.

**Horn Barley**

Horn is a pedigreed selection from C. I. No. 31 of the same name which originally came from Gassen, Austria. This selection, a two-rowed, hulled, and bearded variety of the Chevalier group, was made by the United States Department of Agriculture in breed-
ing experiments in cooperation with the Minnesota Experiment Station. (See Fig. 4.) It was sent from there to Archer, Wyoming, where it was grown in nursery rows. Here it showed such promise that it was increased and included in field plot tests. The yields continued to be large, and seed was sent to a number of other stations for testing. At Havre, Montana, it produced the highest average yield of all varieties grown for the five-year period from 1917 to 1921, inclusive. At Sheridan, Wyoming, it proved to be the second highest yielder of all varieties tested during the three-year period 1921-1923, inclusive.

**MANCHURIA BARLEY**

Manchuria is a six-rowed, bearded, hulled variety, with lax head and long straw. It is a mixture of strains and the aleurone layer may be either blue or white. This barley probably came from Russia to Canada about 1881. It has been widely tested for many years in the United States. It has produced exceptionally high yields at St. Paul, Minnesota, and Fargo, North Dakota, and is the common barley grown commercially in the states mentioned. In the United States its area of best adaptations is undoubtedly the humid states of the upper Mississippi Valley.

*Botanical description of Manchuria barley:* Foliage medium green, culm strong, average in size and length; erect in early growth; spikes well out of sheath of last leaf at maturity; medium to early in maturity; spikes nodding; lateral rows of spikelets overlapping more at the tip than at the base of the spike; grain short and usually plump, white or yellow in color, hulled, awned; awns showing only slight tendency toward deciduousness; lemma barbed, base with a horseshoe-like depression; rhachilla beset with long, straight hairs.
Figure 4. Varieties of Barley: 7, Hannchen; 8, Charlottetown; 9, Horn.
Figure 5. Varieties of Barley: 4, White Hulless; 5, Beldi Giant; 6, Odessa.
O. A. C. 21 BARLEY

A selection of Manchuria made by Professor C. A. Zavitz at the Ontario Agricultural College at Guelph, Ontario, proved to be of unusual merit and was given the number O. A. C. 21. (See Fig. 6.) It is probably the best Manchuria selection tested in Canada. It has been grown at a number of points in the United States in recent years. It produced the best yields at Indian Head, Saskatchewan and yielded well at Lacombe and Rosthern. The yields have not been relatively as high in the United States as in Canada.

Botanical description of O. A. C. 21 barley: The variety O. A. C. 21 differs from Manchuria only in that it has a rhachilla beset with short, fine hairs more or less recurved at the tip, thus presenting a wooly appearance. O. A. C. 21 also possesses pigment in the aleurone layer, which gives the grain a light blue color.

ODESSA BARLEY

Odessa is a six-rowed, hulled, and bearded barley belonging to the same general group as Manchuria. (See Fig. 5.) It has produced very high yields in South Dakota and seems well adapted to culture in that state. For many years Odessa was the best barley at Ottawa, Canada. Odessa contains several types and many selections have been made in recent years.

Botanical description of Odessa barley: This barley is very similar in appearance to Manchuria. Foliage medium green; culm medium long, and medium coarse; spike lax, drooping; awns long, barbed, tinged with brown, deciduous; outer glumes narrow, pubescent, carry medium long awns; rhachilla hairy; grain medium sized and white.

COAST BARLEY

For many years Coast has been the most important of all varieties grown commercially in the western half of the United States. It has been called Bay Brewing, Common, Blue, and California Feed. It is of North African origin. It is a six-rowed, hulled, and bearded variety. (See Fig. 6.) Short pieces of the awns are left on many of the kernels in threshing. Such kernels do not pack closely, and the bushel weight may be low even when the individual kernels are plump and heavy. Coast barley requires a semi-arid climate and for this reason is particularly well adapted.
to the barley-growing sections of the western states. It is the common feed grain of the West. This variety has been widely tested at the experiment stations of the West and has yielded exceptionally well at Burns, Oregon, and at Davis and Chico, California.

*Botanical description of Coast barley:* Foliage varying from light to dark green; culm rather coarse and of medium length; erect in early growth; heads fully emerged at maturity from sheath of the last leaf; medium to late in maturity; spikes lax, but nodding very little; lateral rows of spikelets overlapping the same from base to tip of spike; grain long and coarse; pigment in aleurone layer; grain hulled, awned; awns stiff, harsh, barbed, usually having no tendency toward deciduousness; nerves of lemma barbed; base of lemma with horseshoe-like depression; rhachilla beset with short, fine hairs, usually more or less recurved at tip.

**TREBI BARLEY**

Trebi is a pure-line selection made in 1907 in the cooperative breeding experiments conducted by the United States Department of Agriculture and the Minnesota Agricultural Experiment Station at St. Paul. The original importation was brought into the United States by the Office of Foreign Seed and Plant Introduction from Samsun, Asiatic Turkey, in 1905. Trebi is a six-rowed hulled, and bearded barley with heads very similar to that of Coast. (See Fig. 6.) In threshing, the awns break off from the kernel more easily than those of the Coast variety.

At Aberdeen, Idaho, (irrigated) Trebi has produced the highest average yield of any of the barleys grown. It has also produced unusually high yields at other irrigated experiment stations. It appears to be well adapted to culture under irrigation. On the dry lands Trebi has yielded well in years when there was a fair amount of rainfall.

*Botanical description of Trebi barley:* In general appearance Trebi resembles Coast. Foliage medium green; culm medium short; spike medium, lax, erect; spike not greatly extended out of sheath of the last leaf; awns long, fairly coarse, barbed, not persistent as in Coast; outer glumes slightly pubescent, and carry long fine awns; rhachilla covered with fine hair; grain large, having a slight tinge of blue.
Figure 6. Varieties of Barley: 1, Trebl; 2, Coast; 3, O. A. C. 21.
Barley Production and Varieties

BELDI GIANT BARLEY

This barley undoubtedly belongs to the Coast group and is a variety of the Peruvian type. It was apparently substituted for the original Beldi at Davis, California, and distributed to several sections. At Pullman, Davis, and Aberdeen (irrigated) it was the second highest yielding spring barley for the years in which it was grown.

Botanical description of Beldi Giant barley: Foliage varying from light to dark green; culms rather coarse; erect in early growth; heads fully emerged from sheath of last leaf; medium to late in maturity; spikes lax, but not nodding; lateral rows of spikelets overlapping the same from base to tip of spike; grain long and coarse, hulled, awned; awns stiff, harsh, barbed, having very little tendency toward deciduousness; base of lemma with horseshoe-like depression; rhachilla beset with short, fine hairs.

COLSESS BARLEY

Colsess is a hooded six-rowed barley of hybrid origin. It was produced at the Colorado Experiment Station from a cross between Coast and Success. It has a bluish green tinge, due to the grain which has a bluish aleurone layer. The base of the hood has a rather distinct saw edge similar to that of Success. The head is less brittle than Success and the straw is stiff.

WHITE HULLESS BARLEY

White Hulless originally came from C. I. No. 347. It is a six-rowed, hooded barley. (See Fig. 5.) When threshed the kernels are left entirely naked. In tests at western stations this barley has not yielded as well as the hulled six-rowed varieties.

Botanical description of White Hulless barley: Foliage dark green, broad; culms large, coarse, medium to tall; somewhat spreading in early growth, but inclined to lodge easily; spikes scarcely emerging from sheath of last leaf; occasionally emerging from side of sheath; medium in maturity; spikes nodding, grain white to yellow, about half as broad as long; lemma free from caryopsis, hooded, hoods set close to end of kernel; five nerves of lemma rather conspicuous, lateral nerves barbed; base of lemma possessing horseshoe-like depression; outer glumes narrow, awn-pointed, total length about the same as the lemma; rhachilla beset with long, straight hairs.
EXPERIMENTAL METHODS

CLIMATE

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

The Agronomy Farm is situated about two and one-half miles west of the city of Laramie. Laramie, the seat of the University and Experiment Station, is situated at the eastern edge of a large, nearly level plateau known as the Laramie Plains. These plains constitute the drainage basin of the Laramie River and its tributaries which have their sources in the mountains to the south and west. Laramie has an elevation of 7200 feet above sea level.

To the eastward the land rises rapidly to the crest of the Laramie mountains, about eight miles distant, where it reaches an elevation of from 8700 to nearly 9000 feet, or from 1500 to 1800 feet above the valley. This range has a general north and south direction and connects with a spur of the Medicine Bow range near the Wyoming-Colorado state line, about twenty miles to the south.

To the westward some thirty miles lies the Medicine Bow range. This range has an elevation well above 9000 feet and culminates in Medicine Bow Peak, with an altitude of 12,005 feet above sea level. The Laramie Plains slope toward the north and northwest.

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

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

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

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

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

SOIL

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

The soil contains considerable clay and becomes rather difficult to handle unless quite well supplied with humus. The alkali content is comparatively high, but causes no material damage to the crops grown. The nitrogen content of the soil is low and all crops respond to the application of organic matter. The legume crops in the rotation also give very noticeable results on the succeeding crops.
TREATMENT OF PLATS

The Agronomy Farm is divided into fields and a crop-rotation system is maintained. An attempt is made to secure as nearly uniform soil in each field as possible. The plats are arranged within a field to obtain the greatest degree of uniformity in soil conditions. A three foot alley is left between plats. Figure 7 shows some of these plats.

![Grain Plats on the University Agronomy Farm.](image)

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

In variety plats some means of comparing the performance of one variety with another is necessary when the two are some distance apart, because there may be a difference in yield due to soil conditions. To supply a means for thus comparing the plats, check
plats are used. Every third plat, plats 1, 5, 9, etc., is planted as a check. The variety used in seeding the checks is a variety which has been grown in the locality and has been sufficiently well graded to insure uniformity in its producing power so that the yields of the checks vary directly with the soil conditions. In the tests here reported, O. A. C. 21 and Trebi have been used as check varieties. The varieties being tested are seeded in duplicate.

The land is prepared for all plats in as uniform a manner as possible and as perfect a seed bed is prepared as the soil conditions will permit. The land is fall-plowed as this fits in with the labor distribution, and enables earlier spring seeding than does spring-plowed land. The land is harrowed and leveled in the spring with a float as early as the ground may be worked. The plats are seeded with a drill usually during the first ten days in April. Great care is used to thoroughly clean the drill between the drilling of plats. Beginning on one side of the field, plat number 1, a check plat, is sown, a three-foot alley is left and plat number 2, a variety plat, is sown, then another three-foot alley. Thus all varieties are planted in their turn. As the plats are sown a marking sign is placed in the center of one end of the plat, thus identifying it. Heavy rates of seeding are always used. A rate equal to 80 to 100 pounds of seed per acre is used. The drill is set so as to give approximately the same number of seed per acre regardless of size of the kernels. The seed is sown with a single disk, chain drag drill, and drilled to a depth of from one and one-half to two inches.

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

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

**CARE OF THE BARLEY PLATS**

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

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

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

A limited supply of clean unmixed seed of each variety grown is available each spring for distribution in small lots.
EXPERIMENTAL RESULTS

Eight varieties of barley have been grown in variety-test plats since 1920. The yields of these varieties for each year are shown in Table I. The average yield of each variety for the eight-year period 1920-1927 inclusive, is also shown. It will be noticed that there is only 0.05 of a bushel, or 2.4 pounds, per acre difference in the yielding ability of the two highest varieties, Trebi and Coast. These are the two leading six-rowed barleys for this period. Charlottetown and Hannchen hold third and fourth place, respectively. Here again there is only a small difference in yielding ability of 1.54 bushels per acre. Charlottetown and Hannchen are both of the two-rowed type.

The two best six-rowed varieties out-yielded the two best two-rowed varieties by 4.27 bushels per acre. This table shows that Trebi and Coast are well adapted to the irrigated sections in the state.
TABLE I—Average Yields of Barley Variety Test Plots on Agronomy Farm for Eight-Year Period, 1920-1927, inclusive. Yields are given in bushels per acre. One bushel equals 48 pounds, except White Hulless which equals 60 pounds.

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>1920</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>8-year average</th>
<th>No. plats average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trebi</td>
<td>34.25</td>
<td>71.20</td>
<td>56.06</td>
<td>80.08</td>
<td>76.51</td>
<td>34.04</td>
<td>100.48</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Coast</td>
<td>31.55</td>
<td>104.00</td>
<td>39.50</td>
<td>82.39</td>
<td>69.93</td>
<td>59.23</td>
<td>103.77</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Charlottetown</td>
<td>35.37</td>
<td>66.88</td>
<td>48.82</td>
<td>63.24</td>
<td>69.66</td>
<td>51.82</td>
<td>96.46</td>
<td></td>
<td>100.19</td>
</tr>
<tr>
<td>Hannchen</td>
<td>31.72</td>
<td>65.60</td>
<td>52.17</td>
<td>67.83</td>
<td>63.60</td>
<td>49.50</td>
<td>86.29</td>
<td></td>
<td>103.61</td>
</tr>
<tr>
<td>Smyrna</td>
<td>29.85</td>
<td>62.15</td>
<td>43.05</td>
<td>65.87</td>
<td>60.00</td>
<td>46.42</td>
<td>81.00</td>
<td></td>
<td>103.17</td>
</tr>
<tr>
<td>O. A. C. 21</td>
<td>25.30</td>
<td>32.20</td>
<td>48.82</td>
<td>67.21</td>
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<td>33.95</td>
<td>98.96</td>
<td></td>
<td>100.23</td>
</tr>
<tr>
<td>White Hulless</td>
<td>18.73</td>
<td>50.70</td>
<td>39.46</td>
<td>49.62</td>
<td>49.86</td>
<td>39.21</td>
<td>73.57</td>
<td></td>
<td>92.67</td>
</tr>
<tr>
<td>Manchuria</td>
<td>20.53</td>
<td>44.60</td>
<td>46.72</td>
<td>59.77</td>
<td>43.68</td>
<td>33.30</td>
<td>60.54</td>
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<td>80.40</td>
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<td></td>
<td>51.73</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>51.73</td>
<td>11</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In 1921 the six-rowed variety Odessa was added to the test. Table II shows the yield for each year and the average for the seven-year period 1921-1927 inclusive. Odessa holds the lead in point of yield for this period. There is but little difference in the relationships of the other varieties shown in Table I.

In 1924 the variety Beldi Giant was added to the test. Table III gives the yearly and average yields of each variety for the four-year period 1924-1927 inclusive. It is interesting to note that Trebi again assumes leadership in yielding ability. However, the differences in yields between the first five, Trebi, Charlottetown, Odessa, Hannchen, and Coast are very small. There is only a difference of 4.11 bushels between the first and fifth of this group.

Two new varieties, Horn and Colsess, were added to the list of varieties in 1925. Table IV gives the yearly yield and the average yield of each variety for the three-year period 1925-27 inclusive. Here we have Trebi yielding first place to Charlottetown and the new variety Horn assuming third place. Again we find a small difference in yields between the first five best barleys.
<table>
<thead>
<tr>
<th>VARIETY</th>
<th>1921</th>
<th>1922</th>
<th>1923</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>7-year average</th>
<th>No. plats average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Odessa</td>
<td>103.20</td>
<td>54.56</td>
<td>87.56</td>
<td>67.06</td>
<td>41.77</td>
<td>100.53</td>
<td>96.58</td>
<td>78.89</td>
<td>..</td>
</tr>
<tr>
<td>Coast</td>
<td>104.00</td>
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<td>69.93</td>
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<td>103.77</td>
<td>69.90</td>
<td>75.56</td>
<td>10</td>
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<td>Trebi</td>
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<td>56.06</td>
<td>80.08</td>
<td>76.51</td>
<td>34.04</td>
<td>100.48</td>
<td>108.24</td>
<td>75.23</td>
<td>..</td>
</tr>
<tr>
<td>Charlottetown</td>
<td>66.88</td>
<td>48.82</td>
<td>63.24</td>
<td>69.69</td>
<td>51.82</td>
<td>96.46</td>
<td>100.19</td>
<td>71.07</td>
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</tr>
<tr>
<td>Hannchen</td>
<td>65.00</td>
<td>52.17</td>
<td>67.83</td>
<td>63.60</td>
<td>49.50</td>
<td>86.29</td>
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<td>69.80</td>
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<tr>
<td>Smyrna</td>
<td>62.15</td>
<td>43.05</td>
<td>65.87</td>
<td>60.00</td>
<td>46.42</td>
<td>81.00</td>
<td>103.17</td>
<td>65.95</td>
<td>9</td>
</tr>
<tr>
<td>O. A. C. 21</td>
<td>52.20</td>
<td>48.82</td>
<td>67.21</td>
<td>47.50</td>
<td>33.95</td>
<td>98.96</td>
<td>90.28</td>
<td>62.70</td>
<td>28</td>
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<tr>
<td>Manchuria</td>
<td>44.60</td>
<td>46.72</td>
<td>59.77</td>
<td>43.68</td>
<td>33.30</td>
<td>60.54</td>
<td>89.40</td>
<td>52.72</td>
<td>9</td>
</tr>
<tr>
<td>White Hulless</td>
<td>50.70</td>
<td>39.46</td>
<td>49.62</td>
<td>49.86</td>
<td>39.21</td>
<td>73.57</td>
<td>92.67</td>
<td>56.44</td>
<td>10</td>
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</table>
TABLE III—Average Yields of Barley Variety Tests Plats on Agronomy Farm for Four-Year Period, 1924-1927, inclusive. Yields are given in bushels per acre. One bushel equals 48 pounds, except White Hulless which equals 60 pounds.

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>1924</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>Four-year average</th>
</tr>
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<tr>
<td>Trebi</td>
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<td>34.04</td>
<td>100.48</td>
<td>108.24</td>
<td>79.82</td>
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<tr>
<td>Charlottetown</td>
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<td>51.82</td>
<td>96.46</td>
<td>100.19</td>
<td>79.54</td>
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<td>41.77</td>
<td>100.53</td>
<td>96.58</td>
<td>76.48</td>
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<td>Hannchen</td>
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<td>49.50</td>
<td>88.29</td>
<td>103.61</td>
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<td>Coast</td>
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<td>59.23</td>
<td>103.77</td>
<td>69.60</td>
<td>75.71</td>
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<td>Beldi Giant</td>
<td>73.59</td>
<td>49.63</td>
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<td>74.35</td>
</tr>
<tr>
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<td>46.42</td>
<td>81.00</td>
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</tr>
<tr>
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<td>95.96</td>
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<td>67.67</td>
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<tr>
<td>White Hulless</td>
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<td>73.57</td>
<td>92.67</td>
<td>63.83</td>
</tr>
<tr>
<td>Manchuria</td>
<td>43.66</td>
<td>33.90</td>
<td>60.54</td>
<td>89.40</td>
<td>54.48</td>
</tr>
</tbody>
</table>

Tables I, II, III, and IV are given so that each barley may be directly compared with any other barley grown during the same seasons and under the same conditions. Trebi held first place in yields twice in the four periods, second once and third once. Since it is the only barley holding this high a record, and since it leads slightly in the longer period of test, it seems to be somewhat better adapted to local conditions than any of the others. Odessa and Coast, two more six-rowed varieties, if inferior to Trebi, are only slightly so. Horn, a two-rowed variety adapted to dry lands, also gave a very satisfactory yield during the short period of test. Charlottetown, however, seems to be the best adapted two-rowed variety, with Hannchen a close second.

Manchuria failed to place high in these tests because of its shattering tendencies. Table I shows a marked increase in yields secured from 1920 to 1928. This increased yield is due, in part, at least, to better cultural methods used, crop rotation, and care.

The average yield of all barleys for the eight-year period was 69.53 bushels per acre. The highest single yield was 113.77 bushels per acre, produced by Horn barley in 1927.

The results of the year 1928 are not included in the results reported above. The year was omitted because of a hail storm occurring that year just as the plats were ripening. The hail stones were very small and fell without wind. The barley straw was not broken down, but those varieties which were sufficiently ripened shattered
badly. Hence a very high yielding variety may have a low yield for 1928, simply due to the fact that it ripened early. This was the first time that a hail storm of any importance has hit the Agronomy Farm since the authors have been in charge of the work.

**TABLE IV—Average Yields of Barley Variety Tests Plats on Agronomy Farm for Three-Year Period, 1925-1927, inclusive. Yields are given in bushels per acre. One bushel equals 48 pounds, except White Hulless which equals 60 pounds.**

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>1925</th>
<th>1926</th>
<th>1927</th>
<th>3-year average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlottetown</td>
<td>51.82</td>
<td>96.46</td>
<td>100.19</td>
<td>82.82</td>
</tr>
<tr>
<td>Trebi</td>
<td>34.94</td>
<td>100.48</td>
<td>108.24</td>
<td>80.92</td>
</tr>
<tr>
<td>Horn</td>
<td>23.74</td>
<td>103.39</td>
<td>113.77</td>
<td>80.30</td>
</tr>
<tr>
<td>Hannchen</td>
<td>49.50</td>
<td>86.29</td>
<td>106.61</td>
<td>79.80</td>
</tr>
<tr>
<td>Odessa</td>
<td>41.77</td>
<td>100.53</td>
<td>96.38</td>
<td>79.63</td>
</tr>
<tr>
<td>Coast</td>
<td>39.23</td>
<td>103.77</td>
<td>69.90</td>
<td>77.63</td>
</tr>
<tr>
<td>Smyrna</td>
<td>46.42</td>
<td>81.00</td>
<td>103.17</td>
<td>76.86</td>
</tr>
<tr>
<td>Beldi Giant</td>
<td>49.63</td>
<td>90.88</td>
<td>83.31</td>
<td>74.61</td>
</tr>
<tr>
<td>O A. C. 21</td>
<td>33.95</td>
<td>98.96</td>
<td>90.28</td>
<td>74.39</td>
</tr>
<tr>
<td>White Hulless</td>
<td>39.21</td>
<td>73.57</td>
<td>92.67</td>
<td>68.48</td>
</tr>
<tr>
<td>Colsess</td>
<td>35.53</td>
<td>67.84</td>
<td>72.56</td>
<td>58.74</td>
</tr>
<tr>
<td>Manchuria</td>
<td>33.30</td>
<td>60.54</td>
<td>80.40</td>
<td>58.08</td>
</tr>
</tbody>
</table>

Blackbirds may occasionally, at harvest time, cause considerable damage to the ripened grain. Figure 8 shows a flock of birds in the grain plats. However, the birds damaged the barley plats less than the oat plats. Attempts have been made to poison the black birds, but this is a very difficult thing to do when there is an unlimited supply of untreated grain near at hand.

![Figure 8. Blackbirds in Grain Plats.](image-url)
DISCUSSION

Barley is the outstanding grain feed crop for the Wyoming farms and ranches, in that it will yield more food value in the form of grain than any of our other crops. The average yield of all the varieties during the three-year period 1925-27 was 77 bushels per acre, with a high yield of 113 bushels per acre.

The barley yields in 1925 were rather low, due to the fact that there had to be a readjustment of our plats for rotation purposes, and it was necessary for our grain to follow alfalfa that year. It was planned to crown the old alfalfa in the fall preceding the barley seeding, but due to an early freeze we were not able to finish the fall crowning. The plants for the wheat and oats were fall crowned and their yields in 1925 were high.

The alfalfa on the barley plats was plowed early in the spring before the alfalfa started, but many of the alfalfa plants were not killed and they crowded the young barley plants and took moisture from them during the early spring months. As a result the barley never recovered throughout the season and was short-strawed at harvest time. In other seasons, where barley has followed alfalfa, the alfalfa was crowned in the fall preceding the barley seeding, and the yields were very satisfactory. The best results, however, are secured when potatoes follow the fall-crowned alfalfa and are in turn followed by barley. This is the system that is now being used.

The better yields the last few years have been due to a rotation of legumes, potatoes, and grains. No commercial fertilizers were used. A dressing of barnyard manure is given to the legume crop the year previous to plowing for potatoes. This permits the organic matter to be broken down into available form by the time that the potatoes need it. A 60 to 70-bushel yield of barley per acre is well within the reach of good practical farm management on irrigated lands.

The rapid increase in the production of barley in the state indicates the high favor which it is rapidly gaining with our farmers and ranchers. The average length of growing season between frosts in our farming sections is about 120 days, which gives barley an advantage over corn on our irrigated lands.
The development of agriculture in the state depends very largely on the development of our livestock industry, which in turn is dependant upon the development of more feed resources. Barley enters very well into this plan. An increase in the production of barley means an increase in the number of livestock which may be produced on our ranches and farms.

A better production per animal unit is one of the needs of our ranches. The use of barley in our supplementary feeds will improve the calf and lamb crop and thereby increase returns per animal.

Barley is being used to good advantage in our feed yards for fattening livestock, and it promises to be one of our best and most economical feeds for this purpose.

The cost of producing a 50-bushel crop of barley under irrigation should not exceed $30 per acre for all charges, including interest on investment and labor. The cost per hundred pounds, under the above conditions, would be $1.25. With good organization and management barley can be produced to an advantage on most of the farms and ranches in Wyoming.

Barley contains more carbohydrates than either wheat or oats, has less fat than wheat or oats, and contains about one-third as much crude fiber as oats. Barley is nearly equal to corn in feeding value, having six per cent less total nutrients, but slightly more protein.

Barley often gives better results than corn in the Wyoming feed lots, due to the fact that our corn is not always mature, and that our barley carries very high feeding values. The high plant food content and correct balance of the same in our soils results in a grain of superior quality. Fifty-six pounds per bushel tests on our barleys are not uncommon.

The time of seeding is influenced to some extent by the climatical condition. The best results have been secured from the early seedings of barley at the rate of 1½ to 2 bushels per acre. The lighter seedings should be used on dry lands, and on the irrigated lands when used as a nurse crop. The larger coarse varieties should be seeded at a heavier rate than the small seeded varieties.
Barley should be irrigated when the condition of the soil and plant show that they need water. Most of our soils have sufficient spring moisture to give the barley a good start. Avoid irrigating the crop before it comes up if possible. Two irrigations of 6 inches each is sufficient in most cases where the rainfall is 10 inches or above. Late irrigations should be avoided whenever possible.

The six-rowed types of barley, such as Trebi and Coast, are recommended for our irrigated lands, and the two-rowed varieties, such as Hannchen, Charlottetown, and Horn, are recommended for our dry land farms.

One of the objectional features of barley, which prevents it from becoming more popular with many farmers is the long beards with their short barbs. Some work has been done with the beardless and barbless varieties, but so far they have not proven so satisfactory in yields. The White Hulless and the Colsess are the beardless or hooded sort. They have not, however, proven to be as good yielders as the bearded varieties in our tests. The White Hulless has been in all our tests for many years and the Colsess has been in our tests since 1925. The station has been working on the above problem and hopes to find or develop a beardless variety that will meet the approval of the farmers.
SUMMARY

The production of barley for a feed crop, is rapidly increasing in the state. Due to high yields and the exceptional feed value of our barleys their production should be increased.

Barley makes a good nurse crop for the legumes and works well into the rotations.

Fall plowing for barley should be practiced on our irrigated lands in order to permit early seeding. If barley follows a cultivated crop disking and floating are sufficient. Barley should be seeded early so as to take advantage of the early spring moisture. The first week or two in April is preferable.

Barley should be seeded at the rate of $1 \frac{1}{2}$ to 2 bushels per acre. The lighter seedings are advisable when seeded on dry lands or when used as a nurse crop.

Trebi, with an average yield of 70.11 bushels per acre, gave the highest yield over the eight-year period. Coast was second, with 70.06 bushels per acre. Charlottetown was third, with 66.58, and Hannchen fourth, with 65.04 bushels per acre.

In the seven-year tests Odessa gave the highest yield, with 78.89 bushels per acre. Coast, Trebi, Charlottetown, and Hannchen ranked in the order above.

In the four-year tests Trebi was again high, with Charlottetown, Odessa, and Hannchen in the order named.

Trebi and Coast (California Feed) are the varieties recommended for our irrigated lands. If the grower wishes two-rowed varieties, Charlottetown, Hannchen, and Horn are recommended.

The two-rowed varieties listed above have given very good results on our dry lands.

The beardless or hooded varieties have not proved to be as high yielders as the bearded varieties.

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