OREGON STATE UNIVERSITY EXTENSION SERVICE

Growing Malting Barley

in and Around the Willamette Valley

Laura Helgerson, © Oregon State University

Figure 1. An experimental two-row winter barley ripening at Hyslop Farm in Corvallis.

Considerations for producers and craft brewers

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Malting barley production in the Willamette Valley could provide a local source of malt to brewers and a useful dryland rotation to growers.

Barley grows well in the Willamette Valley. Growers don't need to use a lot of resources to produce the kind of high-quality malting barley Oregon's thriving brewing and distilling industries require.

Before planting, prospective growers may want to learn more about malting barley, study supply chain issues, and address a few key production considerations.

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Malting and brewing

Malting is essentially a process of controlled germination, followed by high temperature treatments to halt the germination process and achieve target levels of malt color and flavor.

The process can be divided into steeping, germination, and kilning/roasting steps. Together these require approximately one week, and can involve temperatures ranging from 50°F to 450°F. Moisture percentages during the malting process can range from 3% to 50%.

At the low end of the color and flavor spectrum is "base malt," which makes up the highest percentage of malt usage for most beers. At the other end of the spectrum are dark malts. Some of these are treated at such high temperatures that they are nearly devoid of enzymatic activity due to protein denaturing. This spectrum of malts has been described as the "brewer's palette" because it represents the range of options available for a brewer to combine into a particular beer style.

Some beers are brewed with "adjunct" starch sources, or nonbarley sources of carbohydrate such as corn, rice, or cane sugar. Adjuncts are most commonly used in lighter styles of beer, and their use requires complementary barley malts with higher levels of enzymes to help break down and ferment the additional carbohydrates.

In contrast, most craft brewers produce all-malt beers, which do not include adjunct starch sources and do not require higher protein or enzyme levels. While craft breweries account for 7.8% of the current market share, they consume more than 25% of the malted barley used by U.S. brewers. Craft maltsters may have the opportunity to fine-tune the malting process, allowing them to use a broad range of varieties to achieve a range of specifications. But along with their potential to impart specific, desired flavors, the use of nontraditional malt varieties could reduce brewing efficiency.

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Figure 2. Examples of a malted grain (left) and a raw grain (right).

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Figure 3. Augers mixing grain during malting in order to provide aeration and prevent matting.

For more on the malting process, see:

- Understanding a Malt Analysis, *http://blog.brewingwithbriess.com/understanding-a-malt-analysis/*
- *Malt: a Practical Guide from Field to Brewhouse (Mallett, 2014)*
- *The Craft Maltsters' Handbook (Thomas, 2015)*
- The Craft Maltsters Guild website, *https://craftmalting.com/*

Malting barley production opportunities

More than 250 breweries produced more than 1 million barrels of craft beer in Oregon in 2017, according to the Brewers Association, an organization targeted to small and independent craft brewers.

Assuming an average of 60 pounds of malt is needed to brew one barrel of beer, and an average yield of 6,000 pounds per acre, growers would need to harvest an estimated 12,400 acres to satisfy current Oregon craft brewing requirements. Actual malt usage would depend on beer style and yields, and yields vary by region and year. For example, in dry regions of the state where malting barley is currently grown, yields are substantially lower.

Today, Willamette Valley growers produce an insignificant amount of malting barley, indicating an opportunity gap of as much as 10,000%. Before seizing that opportunity, let's consider some facts and perspectives.

Table 1. American Malting Barley Association grain quality parameters

	Six-row	Adjunct two-row	All malt two-row
Plump kernels (on 6/64)	> 80%	> 90%	> 90%
Thin kernels (thru 5/64)	< 3%	< 3%	< 3%
Germination (4ml 72 hr. GE)	> 98%	> 98%	> 98%
Grain protein	≤ 13%	≤ 13%	≤ 12%
Skinned and broken kernels	< 5%	< 5%	< 5%

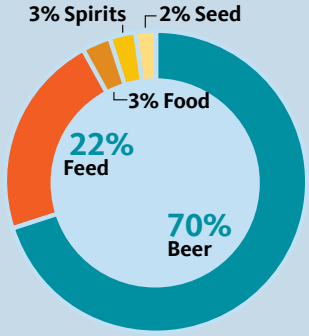

Figure 4. Barley uses

Most barley grown in the U.S. is used as malt in beer.

Barley and malting barley overview

Barley is a versatile grain with multiple end uses, including feed, food, and malt (Figure 4).

During the malting and brewing process (page 2), the barley kernel provides protein, starch, and enzymes to help break down the starch into fermentable sugars. Any barley can be malted, but the malting and subsequent brewing processes are most efficient and productive when the barley meets a set of specific quality parameters (Table 1).

In order to meet these parameters, barley varieties are rigorously tested for malting quality in a multi-year program across a range of geographic and environmental conditions. In addition to variety evaluation conducted at research institutions, most barley varieties grown for malting undergo testing and approval by the American Malting Barley Association. AMBA approval ensures a variety will likely meet industry-standard malting specifications and has advantages for obtaining crop insurance. However, varieties without AMBA approval can and have been grown and malted successfully.

When considering growing barley for malting, producers should contact the intended maltster and determine what varieties the maltster is interested in receiving. Most malting barley is grown under contract, so there is no vigorous open market. Those maltsters interested in working directly with a producer, after specifying the variety, will most likely specify maximum protein and skinned and broken kernels, as well as minimum kernel plumpness and germination values for the raw grain.

Growing a specified variety and meeting these quality specifications can be economically rewarding for the farmer. In general, malting barley fetches a premium compared to feed barley. Direct price comparisons of malting barley with food barley are not readily made, given the current limited market for the latter.

Key barley terminology

Successful production hinges on understanding a few concepts of barley physiology. Terms such as “winter, two-row, covered barley” refer to barley growth habit and botanical characteristics, and are essential to selecting a variety suited to your growing conditions, needs, and end use.

BARLEY GROWTH HABIT

Barley can be classified by growth habit as winter, spring, or facultative. When choosing a variety, growers will need to determine which varieties have a growth habit that fits into their cropping systems. Winter barley requires vernalization, meaning it must be planted in the fall in order to receive sufficient cold units to flower the following spring. Spring barley does not require vernalization, but lacks winter hardiness, so it is best planted in the spring. Facultative barley is winter hardy and does not require vernalization; it can be planted in the fall or spring.

Currently, winter and spring malting varieties are commercially available. The development of facultative varieties is one of the goals of the Barley Breeding Program at Oregon State University, and new potential varieties are in the pipeline.

Facultative varieties may be advantageous in the Willamette Valley, where they could give growers the option to plant the same variety anytime between October and April. Interested growers should contact Oregon State for variety release status and seed availability.

In western Oregon, winter barley is typically planted in mid-October and harvested in early July. Spring barley should be planted as early as possible, from February onward (as early as soil conditions and weather permit field operations) in order to capitalize on spring moisture and cool growing conditions. Spring varieties will usually overwinter in western Oregon; however, their accelerated developmental rate can lead to increased risk of scald (see Disease management, pages 8, 10) and sterility due to low nighttime temperatures during flowering.

BARLEY HULL ADHERENCE AND ROW-TYPE

Hull adherence and row-type are two botanical characteristics important to bear in mind.

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Figure 5. Naked barley (left) and covered barley (right).

Most barleys have adhering hulls and are described as "covered," or hulled (Figure 5). All current AMBA-approved varieties are covered, as the hull serves as a "natural" filtration system during brewing. In this process of filtration, called lautering, the wort — liquid containing barley-derived sugars and soluble starches — is separated from the spent grains by circulating it through a bed of grains.

"Naked," or hull-less, barleys do not have adhering hulls and thresh clean, like wheat. Currently, naked barleys are principally grown for food.

Naked barley for malting and brewing is still more of a research proposition, and not yet commercially viable. But the potential is there. Malts made from naked barley may yield more gallons of beer per pound of malt and, assuming good yields, produce more gallons of beer per acre.

As with wheat beers, brewers have options for filtration when using a hull-less grain. They can add hulls from another source (rice hulls are commonly used), or employ a mash filtration system using pressure to push the mash through filtration pads, separating the wort from the spent grain. They can also use it in smaller amounts as a portion of the grain bill and not have to add hulls or use a mash filter.

Barley is classified as two-row or six-row, based on the arrangement of kernels on the head (box at right). Most current AMBA-approved varieties are two-row. Hull adherence and head type are each controlled by different single genes. Growth habit is controlled by yet another set of genes. Therefore, every combination of growth habit, hull adherence, and head type is possible.

Barley production in Oregon

ACREAGE AND POTENTIAL MARKET

Oregon barley is grown on 30,000–35,000 acres, producing about 2.3 million bushels of barley valued at roughly $6 million. The principal barley-producing districts in Oregon are the southeast, primarily the

Two-row barley vs. six-row: kernel size, arrangement

Barley varieties are classified as two-row or six-row, depending on the number of fertile florets per rachis node — in other words, the number of rows per spike.

Two-row varieties have fewer but plumper kernels because the lateral florets in each inflorescence are sterile and remain unfilled. Traditionally, two-row barley has been used for brewing. Historically, all-malt craft brewers have preferred two-row, while large adjunct brewers have preferred six-row barley. The preference was based on the higher enzyme levels usually found in six-row varieties.

However, the number of fertile florets is controlled by one out of approximately 30,000 genes in barley. As a result, it is possible to have high- and low-enzyme varieties in either of the head types. There is no inherent difference in yield potential between two-row and six-row types.

Today, large and small brewers alike prefer two-row. Often, the same variety is malted for all-malt (a beer brewed with a 100 percent malted barley as the starch source) and adjunct customers, with lower protein lots going to all-malt brewers.

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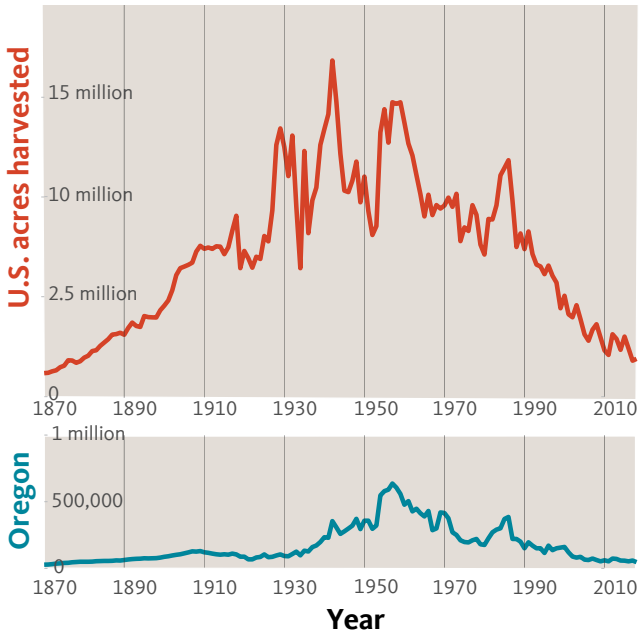
Figure 6. Brewers generally prefer two-row malting barley (top) over six-row (bottom).

Figure 7. National and Oregon barley acreage since 1870



Source: National Agricultural Statistics Service

Klamath Basin (about 35%–40%), the north-central (about 35%) and the northeast (about 20%). Only 3%–5% of barley is grown west of the Cascade Mountains.

Oregon barley production peaked in 1957, at over 600,000 acres (Figure 7). Principal causes of the decline in Oregon include the limited market for malting barley due to infrastructure and supply-chain considerations, low prices for feed barley, and the popularity of imidazolinone herbicide-resistant crops (Clearfield varieties).

Currently, about 10% of Oregon barley is used for malting, most of which comes from the Klamath Basin in the southeast district. This barley is malted in large quantities, often mixed with production from neighboring states, and sold nationally.

Aside from a small amount of seed and food production, the remaining barley acreage in Oregon is sold for feed. This is often a break-even or money-losing proposition, but it fills an essential rotation slot for growers. Some of the rotational advantages, however, cannot be exploited if herbicide residues, such as imidazolinone, remain in the soil.

Given the proximity to markets, growing and marketing malting barley west of the Cascades on a more local scale is an option worth exploring.

OREGON CRAFT BREWING AND MALTING

No information is available on how much of the malt in Oregon craft beverages is made from Oregon-grown barley, and this traceability doesn't often appear on product labels.

However, the largest regional supplier of malt — Great Western Malting Co. — has a "Pure Oregon Malt," suggesting that the "grown and made in Oregon" branding concept is of importance to some users.

Geographic provenance is more easily tracked by craft maltsters, but their current production is limited. Patterns of malting barley production are functions of climate, soil, competing crops, demand, and the infrastructure for grain storage and shipping. Cool winters with adequate precipitation make western Oregon an ideal climate for producing excellent malting barley.

An increasing number of breweries and distilleries in the Willamette Valley, coupled with increasing consumer interest in locally sourced food and beverages, makes malting barley production an attractive proposition.

Great Western, the largest buyer and processor of malting barley in the Pacific Northwest, is located across the Columbia River in Vancouver, Washington. While Great Western Malting presents a large-volume marketing opportunity, historically its needs have been for significant acreage in any production region, rail delivery to the Vancouver plant, and local storage until the grain is needed. Currently, the Klamath Basin is the only region in Oregon to consistently meet these requirements. However, the Grande Ronde Valley recently emerged as a malting barley production area for Great Western. The emergence of a craft malting industry has generated new opportunities for malting barley production in the state. Mecca Grade Estate Malt in Madras and Gold Rush Malt in Baker City represent budding malting operations. Mecca Grade produces its own barley, while Gold Rush contracts for barley in the local vicinity.

In Washington, Skagit Valley Malting in Burlington, LINC Malt in Spokane, and Mainstem Malt in Walla Walla may be able to accommodate custom malting. The capacity of these operations and whether they purchase the grain, distribute and sell it, or simply malt it, varies.

Interested growers should contact malting operations to determine contract specifics prior to planting malting barley.

Growers also need a backup plan for the sale of feed barley in case malting quality parameters are not met. Several conditions can compromise grain quality, including in-field sprouting caused by late-season precipitation, excessive protein levels caused by soil fertility variability, or thin grains caused by drought.

Local grain elevators may not take feed barley; in that case, partnering with local livestock or dairy operations, or shipping feed barley to eastern Oregon or California by rail or truck, may be the best options.

The presence of a large number of craft brewers and distillers in the Willamette Valley indicates

opportunities for developing a new malting enterprise in western Oregon. The investment required to start a malting facility is substantial, and the potential return on that investment would have to be carefully weighed. Key considerations will be the malt batch size, grain storage, and the malting system. The latter can be as complex as a "turnkey" automated system and as simple as a custom-built floor-malting system.

Anyone interested in investing in a malting system may want to participate in a malting short course, such as the Malt Academy offered by the Canadian Malting Barley Technical Center or the Advanced Craft Malting Course offered by Hartwick College.

Producers interested in growing malting barley should consider three take-home messages:

- There is potential for more Oregon barley to be used in producing Oregon beers.
- More than half of Oregon's current barley production could meet local brewing needs if the grain all met quality specifications.
- Western Oregon has the advantage of geographic proximity to a large concentration of breweries and distilleries and a suitable climate for production.

Malting barley quality specifications

The American Malting Barley Association defines malting quality criteria for adjunct and all-malt beers. These can be found online at the AMBA website; raw grain quality parameters are summarized in Table 1 (page 3). Specifications for adjunct malt refer to malt that will be used in brewing beers that use barley and additional sources of starch, such as corn or rice.

For an overview of the malting process and the relevance of a malt analysis to brewing, see page 2.

From a grower's perspective, key malting quality traits are:

- Grain protein.
- The percentage of plump kernels.
- The percentage of skinned and broken kernels.
- Germination percentage and rate.

If the barley does not meet specifications for these criteria, it will be sold at a lower price for feed.

Briefly, a protein content between 10% and 12% is ideal; at these protein levels there is an optimal ratio of enzymes to starch, which is needed to efficiently convert starch to sugars and produce a high-quality malt extract. Excessive protein can result in lower malt extract production and hazy beers.

Plump kernels of uniform size will germinate consistently during the malting process. Skinned kernels will take up water more quickly than kernels with complete hulls and are undesirable; broken kernels will lead to lower germination rates.

In addition to a grain analysis, the brewing potential and use of malting barley is evaluated by a malt quality analysis. In this analysis, the grain is actually malted under standard conditions. A standard malt analysis includes 16 chemical and physical traits measured in the raw barley, malt, and congress wort (the liquid extract formed during the mashing step of brewing).

Both barley grain and malt quality analysis packages are commercially available from Hartwick College Center for Craft Food and Beverage (*www.hartwick.edu/about-us/centers-institutes/center-for-craft-food-and-beverage/*) or Montana State University (*www.montana.edu/barleybreeding/malt-quality-lab/testing-services.html*).

Analysis packages cost between $75 and $150 per sample, depending on the package. Larger malting companies, such as Great Western Malting, have in-house laboratories capable of providing customers with a complete malt analysis profile. When purchasing malt, brewers receive the malt analysis and make decisions on how they will use it.

Beyond malt analysis parameters, flavor attributes also contribute to brewing. Craft brewers may be willing to work with malt that has a unique profile and can lend novel characteristics to craft beverages. Specifically, the industry would like to see the development of malt barleys with more distinctive flavors and aromas, lower free amino acids, lower total protein, lower diastatic power, and lower soluble protein-to-total protein ratios (a measure known as the Kolbach index).

Recent work from the Oregon State University Barley Breeding Program has shown that panelists can identify specific distinct flavors from different malting barley cultivars.

Industry interest in regionally distinct malting barley is also growing. *Craft Beer and Brewing* magazine explored the issue in a recent article titled "Brewing Impacts: The Terroir of Barley."

Malting barley varieties

WINTER VARIETIES

Prospective growers in western Oregon have limited options for AMBA-approved varieties (two-row and covered). There is a market for malting barley that is not AMBA-approved, but approval conveys marketing value similar to that of a Good Housekeeping seal of approval, and provides reasonable assurance that the variety will perform well under standard malting conditions.

For fall planting, the only AMBA-approved variety with commercially available seed that performs well in

Table 2. Performance of locally adapted varieties in research and commercial farm trials

Variety	Growth habit	Location	Number of years of data	Yield (lbs/a)	Plump (% on 6/64)	Protein (%)
'Wintmalt'	Winter	Hyslop Farm	6	5,573	94	9.7
'Wintmalt'	Winter	Goschie Farms	1	8,340	99	10
'Calypso'	Winter	Hyslop Farm	3	7,488	93	10.5
'Calypso'	Winter	Goschie Farms	1	8,220	97	10.6
'Buck'	Winter	Hyslop Farm	7	5,126	52	10.2
'Copeland'	Spring	Herb Farm	4	5,917	93	9
'Full Pint'	Spring	Herb Farm	4	5,531	92	10.3
'Full Pint'	Spring	Goschie Farms	1	2,800	80	10.7
'Genie'	Spring	Goschie Farms	1	3,800	75	12.9
'Lyon'	Spring	Goschie Farms	1	5,000	83	9.6

western Oregon is 'Wintmalt', developed in Germany and marketed exclusively in the U.S. by Tri-State Seed. 'Wintmalt' is reasonably tolerant of prevalent diseases, but a comprehensive program of fungicide protection is recommended. Research trials at Hyslop research farm produced six years of data on 'Wintmalt' production (Table 2). Data on commercial production at Goschie Farms in Silverton in 2018 is also available (Table 2).

'Puffin', a variety developed in England and marketed exclusively in the U.S. by Limagrain Cereal Seeds, was approved by AMBA in 2018, but production at this point is restricted to contracts in Ohio by Origin Malting.

The Oregon State program released 'Thunder' (a two-row, covered, winter cultivar) in 2019, with AMBA approval. Other AMBA-approved winter barleys are two-rows 'Charles' and 'Endeavor' and six-row 'Thoroughbred'. These varieties are not recommended due to disease susceptibility, but if a maltster specified them, they could be worth a try.

A number of winter two-row malting varieties developed for European markets and introduced to the U.S. could be of interest to the craft industry, but have not been approved by AMBA. These include 'Calypso', 'Flavia', 'Talisman', and 'Violetta'. Table 2 lists performance of 'Calypso' in research trials and commercial production.

'Buck' is a naked winter six-row, developed by Oregon State, that has performed well in research malting and brewing trials; AMBA approval for 'Buck' is not anticipated due to the currently limited market for naked malts. Oregon State has seven years of research data on this variety, although commercial-scale data are not yet available.

The Oregon State program also has a number of winter and facultative two-row potential varieties in various stages of the AMBA approval process. Check the Oregon State Barley Breeding Program website at *barleyworld.org* for updates on the release status of these selections.

SPRING VARIETIES

There are many more spring varieties on the AMBA-approved list than there are winter varieties. 'Copeland' is a common spring malting variety. Contact companies such as Great Western Malting before planting to gauge their interest in current and up-and-coming varieties.

The spring two-row covered variety 'Full Pint', from the Oregon State program, has developed a following among some craft maltsters and brewers, but is not AMBA-approved.

A number of public and private spring two-row varieties may be available, some with AMBA approval, many without.

In order to generate data for growers in western Oregon, non-irrigated field trials in Lebanon were conducted over four years. 'Copeland' and 'Full Pint' gave comparable yields and quality scores (Table 2). Commercial data for 'Full Pint', 'Genie', and 'Lyon' in 2018 is also available (Table 2). Variety lifespan can vary, and seed supply can fluctuate; contact the Oregon State Barley Breeding Program or your local Extension representative for current recommendations on varieties and seed sources.

Barley production considerations

Bearing in mind the marketing challenges, barley can be a valuable rotation crop in many cropping systems. In general, barley production recommendations for western Oregon are similar to those for wheat; see *Soft White Winter Wheat (Western Oregon), EM 8963.* One key exception to barley production practices relative to wheat is nitrogen management. Nitrogen management is critical for meeting malting barley production standards.

Barley is a hardy crop that does not require irrigation when fall-planted west of the Cascades, or if planted early enough in the spring to make best use of available moisture. Fall-planting of winter and facultative varieties makes best use of incident precipitation.

The optimum planting window is mid-October to mid-November. Earlier plantings risk infection with barley yellow dwarf virus. Later plantings risk cold, wet soils, leading to poor emergence of the crop and soil compaction.

Spring varieties should be seeded as early as possible, starting in February, in order to maximize crop growth and development while there is still a likelihood of rain. Seeding rates are comparable to those recommended for wheat.

Barley typically matures two weeks earlier than wheat planted at the same time and in the same location, which can distribute the harvest workload. Harvest and grain-cleaning practices are similar to those for wheat, except that prospective growers must pay careful attention to combine settings to ensure that skinned and broken grain specifications are met. A post-harvest de-bearding may be needed in some cases.

Weeds and weed management practices generally mirror those for wheat, except that growers are advised to ensure that the herbicides they wish to use are labeled for use on barley. For more information on weed management practices, see the *Pacific Northwest Weed Management Handbook* for detailed product, application and timing recommendations.

NITROGEN MANAGEMENT

Nitrogen is a key driver of grain protein, and nitrogen management is critical. There are some different considerations regarding nitrogen fertility management in fall-planted and spring-planted malting barley, but in both cases recommendations call for a maximum of 120 lbs crop available N per acre per season based on soil tests.

In the case of fall-planted barley, residual soil nitrogen and applied nitrogen will be lost over the winter. Total available fall nitrogen of 20 lbs/a is adequate, although substantially more may be present. For example, rotations with a legume (such as crimson clover) can result in several hundred pounds of nitrogen in the soil in the fall. By late winter/early spring, this nitrogen will likely be gone, although a soil test would be necessary to confirm levels. Assuming that the crop used 20 lbs N over the fall and winter, 100 lbs/a of N should be applied in the spring. For example, the overall fertility target of 120 lbs/a applied to research plots at Oregon State's Hyslop Farm over five years resulted in average grain protein levels of 10.8%. Consider applying slow-release fertilizers in fall if it is cost effective.

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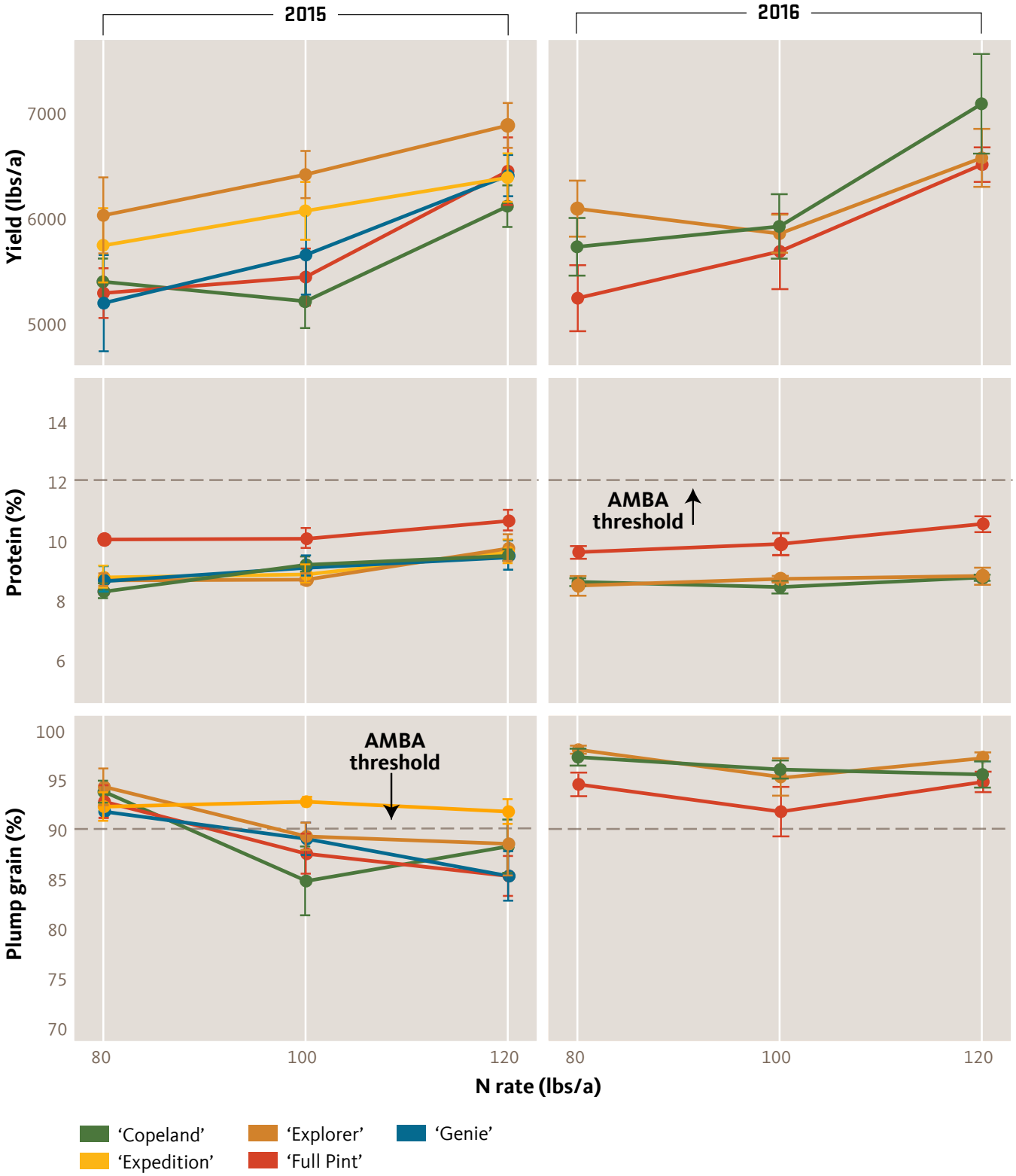
Figure 8. Gayle Goschie, center, of Goschie Farms discusses barley production during a field tour. Looking on are Betsy Verhoeven, left, OSU Extension agronomist; Kathryn Weeks, a prospective grower; and Christian DeBenedetti, a brewer at Wolves and People.

In the case of spring-planted barley, a shorter growing season makes it easier to achieve target protein levels. A nitrogen fertility trial on non-irrigated spring barley conducted near Lebanon, Oregon (Linn County, 2015 and 2016) that included three nitrogen rates (80, 100 and 120 lbs/a) indicated that protein levels were below 12% across all varieties and fertilizer application rates (Figure 9, page 9). Increasing nitrogen application did increase grain yield but decreased the percentage of plump seed, indicating that the medium level optimized performance for most varieties. Detailed data on yield, other agronomic traits, and malting quality are available at *barleyworld.org.*

Continued on page 10

Figure 9. Protein and plump grain percentage from Oregon State University trials

A nitrogen rate by variety trial was conducted over two years. All varieties were spring varieties. Three nitrogen rates were used each year — a low, medium and high rate targeted to 80, 100, and 120 lb N/a. Actual nitrogen applied was adjusted each year based on preseason soil nitrogen tests.



Photos: Pat Hayes, © Oregon State University

Figure 10. Examples of common barley diseases found in Western Oregon: stripe rust, scald and barley yellow dwarf virus.

DISEASE MANAGEMENT

The major diseases affecting barley in western Oregon are stripe rust (incited by *Puccinia striiformis* f.sp. *hordei*), scald (incited by *Rhynchosporium commune*), and barley yellow dwarf virus, or BYDV, an aphid-transmitted luteovirus. In general, all of these diseases are most prevalent on fall-sown crops.

Rusts: In recent years, leaf rust (incited by *Puccinia hordei*) has become more common. The best option to limit the impact of these pathogens is to plant certified seed of resistant varieties. Stripe rust symptoms are similar to those in wheat but are caused by a different strain of rust. Wheat and barley stripe rust tend to be crop-specific, although there are rare cases of specific races affecting both crops.

Scald: Scald is caused by a fungus that does not infect wheat. The fungus overwinters on crop residue and produces spores, which splash onto leaves following rain. Lesions first appear as dark, pale, or bluish spots and expand, forming dark brown margins. Scald has been observed in Oregon State trials on barley planted in fields with no recent history of barley cultivation, suggesting that the disease was introduced with the seed or contracted from an alternate host. Barley varieties differ in their susceptibility to scald, and no variety remains permanently immune in western Oregon. Fungicide applications can be effective in reducing scald symptoms. Late winter/early spring applications are recommended. Yield losses tend to be less severe with scald than stripe rust.

BYDV: Barley yellow dwarf virus is transmitted by aphids. The virus also infects wheat and grass seed crops. BYDV causes leaves to turn shades of yellow, red, and purple, with older leaves being more affected. Overall, plant vigor is reduced and young plants can die. Delaying fall planting until mid-October, where possible, will help to prevent intensive aphid activity. Insecticide seed treatments, as recommended for wheat, can help conventional growers control BYDV.

Smut: Loose and covered smuts (incited by *Ustilago nuda* and *Ustilago hordei*, respectively) are controlled by seed treatment in conventional production but can be serious problems in organic production. There is limited research on resistance to smuts in current malting barley varieties. If smuts are a concern, organic growers should attempt to plant resistant varieties, or purchase conventional (but untreated) certified seed that was produced under conventional conditions from treated seed.

Summary

Nationally, the Brewers Association has identified a need for more all-malt barley with distinct malt characteristics. The current malt industry standard is based on adjunct malt needs, for beers utilizing additional starches other than barley. The growing craft beer industry tends to rely less on adjunct starch sources.

For growers in western Oregon, high-quality malting barley offers several advantages:

- Malting barley often commands a higher price than either feed barley or wheat.
- The crop offers a needed low-input dryland rotation.
- Yields — especially for winter varieties — are quite good.

Expanded knowledge of and demand for locally produced malt will be essential for a stable market.

Given the vigor of the Oregon craft brewing industry and consumer desire for locally sourced products, more options for malting barley production are likely to emerge.

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Additional resources

Idaho Spring Barley Production Guide
https://barley.idaho.gov/pdf/spring_barley_production_guide.pdf

Brewers Association
https://www.brewersassociation.org

American Malting Barley Association
http://ambainc.org

***Malting Barley Production in Michigan*, Extension Bulletin GMI-035 (2014)**
http://www.canr.msu.edu/uploads/396/36753/Research_Files/Malting_Barley_Production_in_Michigan_-_GMI035.pdf

***Malting Barley: Keys to Successful Production in New York State*, Cornell Field Crops**
https://fieldcrops.cals.cornell.edu/small-grains/malting-barley/keys-malting-barley-production-new-york

Oregon State University Barley Project
www.barleyworld.org

Western Washington Variety Trials
http://thebreadlab.wsu.edu/western-washington-variety-trials

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