AGRI-FACTS
Practical Information for Alberta's Agriculture Industry

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Malting Barley

Quality requirements

The Brewing and Malting Barley Research Institute says a good malting barley has the following characteristics:

- a pure lot of an acceptable variety
- high per cent germination and vigorous growth (95 per cent or over using the three-day test)
- fully mature
- free from disease
- free from frost damage
- not weathered or deeply stained
- less than 5 per cent peeled and broken kernels
- free from heat damage
- 13.5 per cent moisture maximum
- not artificially dried
- no desiccants
- free of primary insects, large oil-bearing seeds, ergot, treated seeds, smut and odour
- plump kernels of uniform size
- low to moderate protein content 10.5 per cent to 13 per cent dry basis

Choosing a variety

Selecting a variety is the first step in the successful production and marketing of malting barley. Some markets prefer only one or two varieties of a particular type. Demand is mostly for two-row malting varieties although there is a small but significant market in the USA for six-row malting types. Historically, malting barleys grown in Canada were blue aleurone (a protein found in granules in the seeds) six-row types, but that market no longer exists. All currently grown malting barleys have white aleurones.

Each year, the Canadian Malting Barley Technical Centre, with the input of its members, produces a list of recommended malting barley varieties (see the website http://www.cmbtc.com/CMBTC_Site/Variety_Quality_Overviews_%26_Recommended_Lists.html). Consult with buyers and contractors of malting barley to decide which varieties are in demand by the various markets. Growers are reminded that the industry is cautious about purchasing new varieties. New varieties are usually phased in over several years.

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Seed

A good way to start malting barley production is by planting Certified Seed. The seed selected for planting should be true to variety, plump, free of weed seeds and diseases and also have high germination.

Smutted barley is undesirable for malting purposes, so chemical seed treatments are available to control smuts that attack barley. Most malting barley producers treat their seed before planting both for smut control and for the general health of the plant when seeding early into cool soil.

However, if it is not known whether smut is present, the following recommendations for seed apply:

- varieties rated susceptible to smuts should be treated every year
- varieties rated intermediate to smuts should be treated every second year
- varieties rated resistant to smuts should be treated every third year

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For control of true loose smut, various systemic fungicides are now available. See Alberta Agriculture and Rural Development's *Crop Protection* publication, Agdex 606-1 (the Blue Book, published annually), or check with your seed treatment dealer.

Selecting a field

Plant malting barley on relatively uniform fields to obtain even maturity and to avoid green patches at harvest. Green seed is not suitable for malting and will downgrade the quality of your sample. Harvest green areas separately as feed. Avoid fields where volunteering of other cereals, especially other varieties and types of barley and large oilseeds such as sunflowers may be a problem. Check your cropping history to avoid fields where barley diseases may have built up.

Consult the Grain Grading Guide for tolerances for other cereals and varieties. An up-to-date copy of the Grain Grading Guide is available at any grain elevator, on the Internet or from the Canadian Grain Commission.

Seeding

Date

Long-term studies have shown that the best quality and the highest yields are obtained from barley that is sown early. Barley sown early matures while soil moisture reserves are still adequate to allow good grain filling. An additional benefit of early seeding is earlier maturity. Thus, harvesting can be carried out when the weather is favorable and the risks of fall frost and cool, wet harvest conditions are minimal.

Rate

The optimum plant density for barley on dryland is approximately 20 to 25 plants per square foot. Today's malting barley varieties have a high percentage of plump kernels and high test weights (bushel weight). Farmers should calibrate their seeders so that about 20 to 25 plants per square foot will emerge. The number of emerged plants accounts for the germination of the seed and field mortality.

For example, if the barley has 90 per cent germination, the seeding rate must be 28 seeds per square foot to obtain 25 plants per square foot. Under poor seed bed conditions, for example wet, cold or dry conditions that may impair germination, a farmer may have to increase the seeding rate even more to account for field mortality.

Under average conditions, an extra 3 to 5 per cent more seed must be planted to compensate for seedling mortality. This means a farmer has to plant about 30 seeds per square foot to get a stand of about 25 plants per square foot. To convert this figure to pounds per acre, use the following:

> Determine the 1,000 kernel weight for your seed lot in grams, say 40 grams for this example. Then, the seeding rate in pounds per acre = 30 kernels per square foot x 40 grams divided by 1,000 kernels x 1 pound divided by 454 grams x 43,560 square feet per acre = 115 pounds per acre.
>
> 30 x 40/1000 x 1/454 x 43,560 = 115 lbs/acre

Visit the Alberta Agriculture and Rural Development website www.agriculture.alberta.ca where there is a seeding rate calculator that will do the calculation for you.

Depth

Planting depth should be 1 1/2 to 2 inches into moist soil. Deeper seeding results in weaker plants, reduced emergence, greater susceptibility to root rot and decreased yield. However, seeding too shallow will isolate seed in soil that is too dry to support germination and plant establishment. One-half inch of moist, packed soil over the seed is ideal on medium to heavy textured soils.

Fertilizer

Proper fertilizing is vital for producing good yields of an acceptable quality malting barley. Yield and/or quality will be lowered when nutrients are lacking.

Prairie soils are usually deficient in nitrogen and phosphorus. Some soils are also deficient in potassium, sulphur or micronutrients. Soil testing is a good way to assess the nutrient status of the soil. Crop inspection and tissue testing will allow for problem diagnosis and refinement of the fertility program. Applying additional nutrients in test strips is a good way to evaluate fertilizer requirements for the following year.

Nutrient removal is an indication of nutrient requirements, but not a recommendation for fertilizer application (Table 1). Recommended application rates of fertilizer account for fertilizer use efficiency and the availability of nutrients in the soil

Table 1. Approximate macronutrient removal in pounds per acre by an 80 bushel per acre barley crop with 11.5% protein.

	Nitrogen (N)	Phosphate (P_2O_5)	Potassium (K_2O)	Sulphur (S)
Seed	78	34	25	7
Straw	28	9	68	5
Total	106	43	9	12

Many producers are reluctant to apply nitrogen fertilizer to malting barley crops because of concerns that nitrogen will produce a higher protein crop. As a result, malting barley yields are often lower than optimal. Desirable protein levels are 10.5 to 13 per cent for six-row and 10.5 to 12.5 per cent for two-row malting barley.

Protein content and yield are, in large part, determined by precipitation and nitrogen supply, provided other factors are not limiting. Higher levels of precipitation will lower protein content, whereas drier conditions means higher protein content for the same nitrogen supply. The timing of precipitation is also important because moisture stress during grain filling results in higher protein levels and reduced plumpness.

Protein content and yield will increase with increased rates of nitrogen application; however, protein content increases at a slower rate. For example, where nitrogen application doubles yield, protein content may only increase by 1 to 2 per cent. However, newer malting varieties are very powerful enzyme producers, which is great in the brewhouse but means they tend to have the potential for protein levels that are too high (>12.5%). Protein levels that are too high means less energy source in the seed and less brewhouse potential (less beer from the malt). So watch those fertilizer levels to keep the protein levels down and the beer levels up.

To obtain good yields, while reducing the risk of increasing protein levels too greatly, producers may want to base their fertilizer application rates on a soil test and the measurement of available soil water just before seeding. There is approximately 1 inch of available soil water per:

- 12 inches of moist sandy loams
- 9 inches of moist loams and clay loams
- 6 inches of moist clay

Four inches of available soil water at seeding time is considered an excellent start. Soil testing labs can update soil test recommendations with the amount of available soil water just before seeding.

If a post-emergent application of nitrogen will be applied, do it before the five-leaf stage to reduce the risk of higher protein content. At least a half inch of rain is necessary to leach top-dressed nitrogen into the soil. For more information on nutrients and fertilizer application methods, refer to Alberta Agriculture's *Alberta Fertilizer Guide*, Agdex 541-1.

Weed control

Good weed control is essential for profitable crop production. Identify the weeds in your field; then select the registered herbicide that will do the best job. When a choice of herbicides is available, use the product that is most gentle on the malting barley, to reduce injury and secondary tillering. For information on weed control, consult *Crop Protection*, Agdex 606-1, available from Alberta Agriculture. Always read and follow label directions.

Disease control

Regularly monitor malting barley fields for leaf diseases during the growing season. Identify any diseases, and apply a registered fungicide to minimize yield loss, if control proves economical. Timing of the fungicide application is critical, so read and follow label directions carefully.

Net blotch and scald are the most common foliar diseases attacking most varieties of malting barley. Do not grow malt barley on land that has a risk of infecting the crop with Fusarium head blight (scab) as the tolerance for infected malt grain is zero. Fields where these or other troublesome barley diseases are found should not be planted back to barley the next year because of an increased risk of a serious yield loss and reduced kernel plumpness.

All forms of smuts can be controlled with the appropriate seed dressing.

Harvesting

Swathing

Maltsters want plump, mature kernels. The crop must not be swathed on the green side. Delay swathing until the heads have lost their green colour and have a moisture content of 30 per cent or lower. At 30 per cent moisture, the barley kernel is difficult to dent with your thumbnail. Swath around green patches to avoid having the sample from the field turned down because of green or immature kernels.

A well-formed swath will cure quickly if the weather co-operates. However, wetting and drying cycles caused by dew and showers may loosen the hull, reducing the quality of the malting barley.

Once the kernel moisture is down to 13.5 per cent, combining can begin. Straight combining is becoming popular. Standing malt barley suffers less damage from moisture and dries faster. This benefit must be balanced against the increased risk of shattering losses. Six-row barley is more prone to shattering and neck-break than two-row barley.

Moisture levels for safe storage

The Grain Grading Guide states that 13.5 per cent or less moisture content is considered dry for malting barley. However, feed barley is considered dry and safe for storage at 14.8 per cent moisture or less. The malt industry will select grain on the basis of 13.5 per cent or less moisture content.

Combining

Combining can begin at 13.5 per cent kernel moisture. Higher kernel moisture content may lead to storage problems. If the barley dries below 13.5 per cent, peeling during combining and handling may become a serious problem.

Some farmers use natural air drying systems to allow harvesting to begin earlier, when the kernel moisture is at 16 per cent. In this way, farmers may be able to improve the quality of the sample by less exposure to the weather and reduced peeling. Natural air drying must begin as soon as the first few loads are in the bin.

Threshing at a moisture content greater than 16 per cent and then aerating has lead to disappointing results due to germination loss during storage. Reduced germination makes the barley undesirable for malting. Do not apply heat when aerating malt barley. Artificially dried grain will not knowingly be purchased for malt.

To reduce peeling and breakage when combining, slow the cylinder speed, increase the concave clearance and maintain low volume in the return. Today's combines have on-the-go adjustments that allow the operator to maintain a good sample, even through the heat of the day when over threshing usually happens. The combine operator must keep an eye on the sample, checking that a bit of awn is left on the kernels to indicate that the machine is doing a proper job of threshing. Kernels with awns of 1/8 to 1/4 inch left on are about right. If the barley crop is causing problems because it is too dry, try threshing in the evening, at night or in the early morning.

Grain augers should be run full. Run augers that are not full at a slower speed. Some peeling occurs each time malting barley is handled.

Preparing a representative sample

Preparing a representative sample is a very important step for malt barley producers. This sample must accurately reflect the quality of the barley. If the sample is poorer than the rest of the crop, it may not be selected for malt. On the other hand, if the sample submitted is better than the crop, the entire car lot will be turned down at unloading. This rejection is costly for the producer.

Up to five samples can be drawn from a lot of malt barley from the time the bin is filled at harvest until the barley is unloaded at the malting plant or terminal. **The first sample is the most important one because selection for malt is based on it.**

The best time to prepare a sample is during bin filling. Prepare a separate 20 litre pail for each bin and label the pail on both the inside and outside. While unloading the truck, take a small amount of barley for every 50 bushels unloaded and put it in the pail. If a sample is taken every 25 bushels, then take a smaller amount.

When the bin is full, label the pail with the variety name, field and bin number. Then, mix the contents thoroughly, cover the pail and put in a cold, dry place for safe storage.

When preparing a sample for selection, the farmer knows which bins have the same variety and quality to make up a car lot(s). For example, if three bins of Harrington were combined under the same weather conditions and look the same, the farmer will take an equal amount of barley from each of the three pails that represent these bins. Mix this sample before submitting for selection.

The next sample is taken at the elevator when the barley is delivered. This stage is referred to as a re-check sample. Each truckload is sampled several times. Once the delivery is complete, the sample is mixed and a portion is put into a lockable container and sealed. This sample is the only proof of the quality for the grain that was delivered. Another portion is sent to the malt plant prior to shipping to re-confirm selection.

Some farmers are now pre-cleaning or scalping their malting barley before delivery. They do this for several reasons:

- upgrade the barley to malt standards
- keep the dockage at home for on-farm feed
- help reduce the cost of freight

The value of the feed and the savings on the freight often more than offset the cleaning costs. Pre-cleaning has to be done in a way that does not cause peeling or damage to the malt barley.

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