

- Guidelines For Growing Barley For Malting -



Northern Periphery and Arctic Programme

Northern Cereals – New Markets for a Changing Environment

GROWING BARLEY FOR MALTING IN THE NORTH ATLANTIC REGION

Guidelines

(Deliverable T4.2.4 i)

1 Introduction

With a growing tourist market for high provenance beers and spirits in the North Atlantic region and potential for exports, regional breweries and distilleries are sometimes prepared to pay attractive premiums for locally grown malting barley. Nevertheless, for local barley to be acceptable for malting it will be important that it meets commonly accepted quality criteria (http://cereal.interreg-npa.eu/subsites/CEREAL/Malting-Quality_criteria-Report-NPA-Cereal-DT411.pdf) because these have an important effect on the economics of alcohol production and the acceptability of the end-products. The below guidelines are intended to help growers produce barley which will meet these quality criteria.

2 Grain contract and quality

As the financial investment in growing a crop of malting barley is significant it is usual for there to be a contract between the grower and end-user specifying the terms under which the crop will be purchased from the grower. Since grain quality is so important for malting, end-users may offer a contract which specifies price premiums and deductions which are designed to reward growers for producing high grain quality. The contract usually also specifies conditions which will lead to rejection of the grain. It is very important for both growers and end-users to have a contract which clearly states these criteria. Typically the contract will include:

- Purchase price based on a specific grain moisture content
- Grain moisture content at delivery
- Grain nitrogen content and any premiums for low nitrogen or deductions for high nitrogen. Generally, distillers require barley with a lower grain nitrogen ($\leq 1.65\%$ on a dry weight basis) than brewers (usually about 1.55-1.75%)
- Maximum levels of screenings (small grains) acceptable

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- Germination % required
- Acceptable agrochemicals which can be applied to the crop. In the UK, these can only come from an approved list (<http://www.ukmalt.com/pesticides>)
- Barley variety to be grown
- Payment terms
- Conditions of crop rejection

In Northern areas where malting barley is not an established crop, it is likely that contracts will be less demanding in some of the above criteria. Nevertheless, one criterion which is especially important for malt production is a high germination capacity (>98%) and a threshold of about 95% is normally adopted by commercial maltings.

3 Field selection

- It is important that fields used for growing malting barley are suitable for the crop. Most of the criteria for determining this are the same as for feed barley. It is particularly important that the soil is not too acidic (minimum pH, 6.0) and to prevent the risk of excessively high grain nitrogen, fields should be avoided which have high levels of residual available nitrogen. This is particularly likely in fields which have come straight out of grass, especially if this has been heavily fertilised, or after crops which leave high nitrogen residues (SRUC, 2013).
- In parts of the region, some coastal soils derived from shell sand have a high pH which can result in deficiencies of trace elements like manganese, copper and zinc. Most modern varieties require the application of these trace elements as foliar sprays to grow successfully.
- If the nutrient status of fields selected for growing malting barley is not known, this should be determined by a soil analysis of pH, macronutrients and micronutrients. Normally, the soil analysis report will indicate any corrections which are necessary and should also provide fertiliser recommendations.

4 Barley variety

- In regions where malting barley is a well-established crop, end-users are mostly likely to require grain from specific malting varieties and in this case the variety should be specified in the grower contract.
- Where malting barley is not an established crop, knowledge of which varieties are best for malting will not be available and growers and end-users will either have to run their own trials to determine this or adopt varieties which have been used successfully elsewhere under similar climatic conditions. Although 2-row varieties are usually favoured for malting because their larger grains give a higher alcohol yield, in North America 6-row varieties are often used and may be preferable in locations where they out-perform 2-row barley in the field.

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- In northern areas, where the cropping season is short, varieties which come to maturity in a short time are especially important for malting. This is because they are more likely to produce ripe grain with a reasonably low grain moisture content by harvest which will reduce drying costs. Early varieties are also more likely to be harvested successfully before the weather becomes too adverse.

5 Field cultivations and sowing

- Cultivations are the same as for feed barley and should be carried out as soon as field conditions are suitable.
- Sow as early as soil conditions allow and after the threat of damaging late frosts has passed. Early sowing for malting barley is especially important as it will help to achieve an earlier, more secure harvest and often results in higher yields, lower grain nitrogen and lower screenings.
- It is likely that the optimum seed rate varies across the region and with variety. Tillering tends to be less at high latitudes and to compensate for this seed rates need to be higher. The cost benefits of high seed rates also have to be considered, however. Thus, the higher yields expected from higher seed rates must cover the extra cost of the seed. In Scotland, a viable seed rate of about 350-400 seeds m⁻² (roughly 200 kg ha⁻¹ or 20 kg per 1000 m²) seems optimal while rates up to about 500 seeds m⁻² are sometimes used in more northern areas.

6 Fertiliser

- The amount of N, P and K required will depend upon many factors. Ideally, the amount applied should be based on the results of a soil analysis and consultations with an advisory service. Nitrogen is especially important because it has a large effect on both grain yield and grain nitrogen – insufficient nitrogen may result in low yields while high nitrogen may give excessively high grain nitrogen for malting. In deciding how much fertiliser nitrogen to apply, the amount available in the soil must be considered and the amount applied should take into account factors like the cropping history of the field, soil texture and local rainfall (SRUC, 2013). Fertiliser will be most effective if it is applied at the time of sowing using a combination drill.
- The application of nitrogen after plants have started to tiller is not recommended as this tends to increase grain nitrogen.

7 Weed control

- An application of herbicide will usually be necessary to control weeds in the developing crop and reduce contamination of grain with weed seeds at harvest. This should be applied between Growth Stage (GS) GS14 and GS32¹ and at an appropriate stage of weed growth – ideally,

¹ GS14 is when plants have about 4 leaves unfolded on the main stem, while GS 32 is when the second node on the main stem is detectable.

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when weeds are young but have sufficient leaves to be a good target (about 2-4 leaves per plant).

8 Fungicide

- An application of a fungicide may be necessary if barley is affected by a fungal disease before heading. Common diseases of concern within the region are powdery mildew (*Blumeria graminis*), net blotch (*Pyrenophora teres*) and scald (*Rhynchosporium secalis*). Expert advice should, however, be sought about the identity of diseases, the need for control and appropriate chemicals for use and the stage at which they should be applied. Application of chemicals should only be made by fully certified operators.
- Where necessary, the application of fungicide can result in significant yield increases and a larger grain size with fewer screenings, Some fungicides may, however, result in the crop maturing slightly later.

9 Harvesting

- In northern areas, a crop desiccant (e.g. glyphosate or glufosinate ammonium) is sometimes applied to malting barley to hasten drying out of the crop and senescence of secondary tillers. This should only be applied, however, when the grain has completely filled and is physiologically mature (after grain moisture is below 30%) to avoid the risk of translocation of the chemical to the grain. Use of desiccants should be approved by the end-user and should rigorously follow best practice national guidelines. It should also be noted that the use of crop desiccants before harvest is an increasingly controversial practice.
- In more favoured northern areas, grain moisture should ideally be below 22% before harvesting (to reduce drying costs). In some areas and in some years, however, this may not be possible. There is also a risk that grain which is left too long in the field at a high moisture content will start to germinate in the head, which would result in it being rejected for malting.
- Grain should be harvested and handled with care to avoid physical damage (skinning) which can reduce germination. Grains harvested at a high moisture content are particularly susceptible to such damage.
- To prevent contamination with grain of other varieties and extraneous materials, combines, trailers and grain dryers must be cleaned out before harvesting malting barley.
- At harvest and during grain drying, varieties being grown for malting should not be mixed with any other varieties. This is because varieties differ in the conditions they require during malting and if mixtures of varieties are malted the resulting malt is likely to be of variable quality.
- At all stages in grain handling, take care not to expose it to any chemicals (e.g. diesel and oil) which could give it a taint and impair its quality.

10 Grain drying

- Ideally, grain should be delivered straight from the field to the grain drying facilities and dried as soon as possible. In wet weather, grain trailers need to be covered with a tarpaulin when transporting grain.
- Drying immediately after harvest is particularly important if grain moisture content is above about 20%. Between 18% and 20% moisture, drying can be delayed for a couple of days but it may still be advisable to use grain air spears to prevent the grain from heating up.
- For secure storage, grain needs to be dried to below 13% moisture content
- Guidelines for grain drying have been produced in a different project work package (http://cereal.interreg-npa.eu/subsites/CEREAL/Grain_Drying-Guidelines-NPA-Cereal-DT223.pdf).
- Recently-harvested barley is often dormant for a period of time during which it has a reduced germination ability. Dormancy has to be lost before the grain can be used for malting. This means that growers may be required to store their malting barley for several months before it can be sent for malting. Growers should have access to appropriate grain storage facilities for this.

References

- SRUC (2013) Nitrogen recommendations for cereals, oilseed rape and potatoes. Technical Note TN651.
https://www.sruc.ac.uk/downloads/file/1271/tn651_nitrogen_recommendations_for_cereals_oilseed_rape_and_potatoes

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Summary of Main Points

- Growers should be familiar with the grain quality criteria which are normally expected for malting barley.
- Before growing malting barley, draw up a contract with the end-user. The contract should specify all the quality criteria the grain should meet as well as any which will result in rejection and whether there are any restrictions on how the grower treats the crop.
- Avoid growing malting barley in fields likely to have high levels of residual available nitrogen.
- Suitable fields for growing malting barley should be identified with the help of a soil analysis which should also indicate appropriate levels of fertiliser to be applied to the crop and whether correction of soil pH is necessary.
- A suitable, early maturing variety of barley should be selected for growing and approved by the end-user.
- After appropriate soil cultivations, sow malting barley as early as is safe and possible.
- Usually, it will be best to apply a selective herbicide during the early stage of crop growth and a fungicide may also be necessary. Advice should be sought from suitably qualified advisors about the need for any crop protection chemicals, the chemicals to be used and the time of their application.
- If crop protection chemicals are necessary, they should be applied by certified operators.
- Where local conditions allow, delay harvesting until grain moisture content is below about 22% but do not risk leaving grain in the field so long under wet conditions that it starts to germinate in the head.
- Once grain has been harvested, dry it within 24 h, especially if it is above 20% moisture content.
- Avoid contaminating the harvested grain with any substances which could add a taint to it.
- Growers of malting barley should have access to appropriate grain storage facilities in case their malting barley requires to be stored to lose dormancy.