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GRDC GROWNOTES™

GRDC
GRAINS RESEARCH & DEVELOPMENT CORPORATION

BARLEY

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Introduction

A.1 Crop overview

Barley (*Hordeum vulgare*) is a widely grown and highly adaptable winter cereal crop that is used mainly for stock feed and the production of malt for the brewing industry.

Barley (Figure 1) is an annual plant that has been selected from wild grasses. It is thought to have been an important food crop from as early as 8000 BCE in the Mediterranean/Middle East region.

Figure 1: Barley has long been an important food crop. (Photo: Rachel Bowman)

Because of barley's tolerance of salinity, by 1800 BCE it had become the dominant crop in irrigated regions of southern Mesopotamia, and it was not until the early CE period that wheat became more widely grown.

Over the past 5 years, Australian barley farmers produced an average of 7.5 million tonnes (t) of grain per year, of which around two-thirds was exported.

Australia is the world's second-largest exporter of barley and supplies almost 30% of the world's barley trade. Saudi Arabia, Japan and China are large importers of Australian barley, and these markets are growing rapidly. [1]

Australia produces high-quality 2-row spring-type barley, with annual production averaging ~7.0 million t/year. It is a widely grown crop (second in size only to wheat)

[1] Industry & Investment NSW Agronomists (2010) Barley growth & development. PROCROP Series, Industry & Investment NSW. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf

and occupies a large geographic area—almost 4 million ha, dispersed from Western Australia to southern Queensland.

Australia has an enviable reputation for producing a reliable supply of high-quality, contaminant-free barley that is sought after by the malting, brewing, distilling, shochu (Japanese distilled spirit) and feed industries.

Australia produces around 2.5 million t of malting barley and 4.5 million t of feed barley; the average Australian malting selection rate is the highest of the world's exporting nations with ~30–40% of the national crop selected as malting.

Domestically, malting barley demand is around 1 million t/year and Australian domestic feed use ~2 million t/year. Domestic brewers are tightly linked to Australia's barley production and strong relationships exist between all facets of the industry, from breeder to brewer and all stages in between.

In addition, Australia exports around 1.5 million t of malting barley and ~2.5 million t of feed barley. Major exporting states are Western Australia and South Australia, where domestic demand for malting and feed barley is considerably smaller than in the eastern states.

Australia makes up more than 30% of the world's malting barley trade and ~20% of the global feed barley trade. On a production basis (as opposed to actual inter-country trade), Australia makes up around 5% of the world's annual barley global production. [2]

Barley is very versatile in its planting time, as it is slightly more frost-tolerant (1°C) than wheat and can be planted earlier in the season. It is also often a better option than wheat for late planting, especially if feed grain prices are good. Preferred planting times are from late April to June but this will vary for each region depending on frosts and seasonal effects. In the cooler areas of southern Queensland, planting can occur into July. Feed barley commonly competes with Sorghum in the North as it is widely used in feedlot rations.

Early planting will generally produce higher yields, larger grain size and lower protein levels, making it more likely to achieve malt quality. However, early crops are more likely to have exposure to frost and growers should assess the frost risk for their area prior to sowing. Late plantings will often mature in hot dry weather, which can reduce grain size, yield and malting quality. The major determinant of barley profitability is yield. [3]

To maximise yield, it is important to ensure that the crop has every chance to succeed.[4] Paddock selection and nitrogen management are often the keys to producing malting quality. [5]

Use adequate nitrogen fertiliser but do not over-fertilise as this will encourage excessive vegetative growth and could result in lodging. Phosphorus, zinc and sulfur levels are also important. A starter fertiliser is recommended.

Growers should record paddock rotations or soil-test to have adequate nutrition. To grow a 4 t/ha barley crop at 11.5% protein requires 144 units of nitrogen, and adequate phosphorus. In 2011, low-protein grain was common so soil fertiliser levels need to be checked.

2 Barley Australia (2014) Industry information. Barley Australia, http://www.barleyaustralia.com.au/industry-information

3 DAFF (2012) Barley planting, nutrition and harvesting. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-nutrition-harvesting

4 DAFF (2013) Barley planting and disease guide. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-disease-guide

5 P Matthews, D McCaffery, L Jenkins (2014) Winter crop variety sowing guide 2014. NSW Department of Primary Industries, http://www.dpi.nsw.gov.au/agriculture/broadacre/guides/winter-crop-variety-sowing-guide

A deep soil test combined with a nitrogen budget which is adjusted during the season with changing yield outcomes is a more accurate way to managed nitrogen.

Agronomist's view

Inspect barley crops regularly for insect infestations and foliar diseases and consult your agronomist about potential control methods. [6]

Barley is a crop that fits well into northern region farming systems.

Growing conditions in northern New South Wales and Queensland are quite different from other barley growing regions of Australia. The crop is grown on moisture stored during the summer season with sporadic in-crop rainfall. In the southern part of the region, rainfall during the season is generally more regular.

The northern cropping zone also has a much shorter winter and harvest may start as early as October in some areas. Selecting a variety with proven performance in the region is important. If trying a new variety, it is important to compare it with a variety you have grown before. Factors to take into consideration for variety selection include:

- suitability of the variety for the region
- time of planting
- available moisture at planting
- disease risks
- yield potential
- standability and straw strength
- soil nitrogen status (i.e. not high starting N levels for malting barley)
- marketing options—malt *v.* feed
- rotation (past crops and future planting intentions)
- availability of seed [7]

A.2 Malting barley and malt

Malt is produced from a cereal grain (usually barley) that has been allowed to germinate for a limited period of time prior to undergoing a mild kilning.

Malt is produced from the malting process, where raw barley is steeped, germinated and kilned to change the raw barley seed into a friable, biscuit-like texture, which from the outside looks just like a barley kernel.

It is then easily crushed in the brewery mill in preparation for the sugar conversion that takes place in the brewery mash tun. The malting process converts around 10% of the carbohydrate in the raw grain into fermentable sugars via the process of germination. The malting process prepares the grain for more modification, which will be undertaken in the brewhouse.

A point of difference for the Australian barley industry is that there are two distinct markets to service—a domestic market and an export market—each of which has different requirements and needs for malt and raw barley respectively. This is due to a fundamentally different style and method of brewing whereby in Australia brewers use sugar as an adjunct, whilst in Asia, solid adjuncts such as rice are predominantly used in the brewing process.

6 DAFF (2013) Barley planting and disease guide. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-disease-guide

7 DAFF (2013) Barley planting and disease guide. Department of Agriculture, Fisheries and Forestry Queensland, http://www.daff.qld.gov.au/plants/field-crops-and-pastures/broadacre-field-crops/barley/planting-disease-guide

The malting process causes numerous chemical reactions to occur between amino acids and reducing sugars to develop colour and flavour compounds. Malt extract is a natural flavouring and colouring that is high in protein and natural sugars and is a major natural energy source. In addition to its use in brewing, it is also widely used in baking, confectionery, breakfast cereals, malt beverages, dairy products, condiments and as a caramel substitute.

Australia produces >900,000 t of malt per year, with ~200,000 t consumed domestically (predominantly in the brewing industry) and >700,000 t exported predominantly into the Asian regional marketplace. [8]

A.2.1 Feed barley

Barley is used as stock feed, especially in the intensive pig, poultry, dairy and beef industries. This demand is met by varieties specifically grown as high-yielding feed types as well as grain that does not meet the quality requirements for malting or human food.

Barley can be sown as a dual-purpose crop (i.e. for grazing by livestock and for grain). Barley seedling growth is vigorous and therefore quick to produce enough dry matter for grazing. Its recovery after grazing is good provided the developing head is not grazed. When barley crops are grazed, care must be taken in the use of pesticides on the seed or in the crop to observe the withholding periods for grazing or cutting for hay/silage. [9]

Barley grain is commonly kept on farm for cattle and sheep feedlot rations as it is a good source of protein and energy, though care must be taken with introduction to stock as well as insect damage in storage.

[8] Barley Australia (2014) Industry information: Malt. Barley Australia, http://www.barleyaustralia.com.au/industry-information/malt

[9] Industry & Investment NSW Agronomists (2010) Barley growth & development. PROCROP Series, Industry & Investment NSW. http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0003/516180/Procrop-barley-growth-and-development.pdf