Barley *Hordeum vulgare*
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Introduction

Barley (*Hordeum vulgare)* is cereal crop grown widely through out the world. Barley was first domesticated in the Fertile Crescent around 10,000 years ago from its wild relative *Hordeum spontaneum* (Badr et. al. 1999). Barley is well known for its use as fermented malt in the making of beer and other beverages. It can also be used as animal feed, or an ingredient for health foods such as bread, soups and stews. Barley is grown across Canada as well as throughout the United States in both conventional as well as organic agriculture. One of barley's uses is its use as fermented malt in the making of beer. Any cereal with the right protein and sugar content can be fermented to make a malt which in turn can be processed to create a beverage. Joshua Moats states in his article concerning ancient beers that the Chinese used fermented barley in the making of Kui around the year 7000 BCE (2011).

Identification

Barley is an annual grass with an erect stem and alternate leaf arrangement (Duke 1983). The leaves are lanceolate shaped and grow to be up to 25cm long while only 1.5 cm wide (Duke 1983). Barley can be found in two row or six row varieties. Two row varieties are well suited for malting purposes due to a low protein level while six row varieties are mainly used for animal feed or other specialty types of beer or lagers (Johnston et. al. 2008). *Hordeum jubatum* or Foxtail Barley is grassy weed relative of barley that infests pasture and rangeland (Government of Saskatchewan 2013).

Adaptations

Two-Row and Six-Row Barley

Barley has 2 rows of spikelets arranged in triplets that are alternately attached to the rachis but in two-row barley only the central spikelet in the triplets is fertile while the other two are barren (Komatsuda et. al 2006). Komatsuda et. al. also state that the mutation of barley where the adjacent spikelets are barren allows the seed to get past rocks and pebbles to get to the ground and ensure germination (2006). Komatsuda et. al. also state in their paper that the mutation from six-row to two-row barley is controlled by one gene mutation that is recessive to the two row spike gene (2006). This six-row variety is very advantageous to the farmer oriented towards high yield crops while two row barley is usually beneficial for quality and protein requirements for malting (Johnston et. al. 2008).

Hull-less Barley

In his review of hull-less barley Bhatty states how when studies found that the hull content of cereals including barley had a large impact on animal feed

cultivars with either no hull or an easily removable hull were quickly found (Bhatty 1999). Along with the animal health benefits commercial food production benefits were found. Malt extracts and syrups are prepared to destroy or remove the hull before they are added into foods while hull-less barley malt can skip this entire step in food processing saving time and money for the producer (Bhatty 1999). Bhatty summarizes the advantages of hull-less barley in making malts into four characteristics: "a short steep time; high extract yield due to fine grind of malt and more fermentable materials per unit weight of malt; low polyphenols due to absence of hull and consequently less chill haze problem in the beer; and low shipping costs of hull-less malt." (1999).

Cropping Considerations

Johnston et. al. in their article call to attention the fact that when organic farmers choose to grow barley they intend to go malt that they should pay careful attention to the amount of nitrogen fertilizer they put on their crop (2008). Barley responds well to nitrogen fertilizer with increasing yield as well as protein content but adding too much nitrogen to the crop may cause the protein content to rise above malt buyer standards (Johnston et. al. 2008). High protein levels can cause undesirable qualities in the malt, long steeping times as well as erratic germination (Johnston et. al. 2008).

Sahota and Malhi demonstrated in their study of intercropping barley with a legume (pea) increased the yield of barley with less levels of nitrogen fertilizer in the field (2012). The experiment was done with barley and pea being in both separate and alternate rows as well as in the same rows with differing amounts of nitrogen (Sahota and Malhi 2012). Yield was lower in the intercropping system for each single crop when compared to their sole crop counterparts but the land productivity was greater overall in the intercrop systems (Sahota and Malhi 2012). This study demonstrates that intercropping of barley with a nitrogen-fixing legume in alternate rows increases net land productivity as well as economic sustainability (Sahota and Malhi 2012). Another option for increasing nitrogen levels for barley crops in organic systems is manure. Olesen et. al.'s study illustrated that adding manure as a fertilizer increased productivity as well as reduced perennial weeds compared to crops without manure (2006).

Fusarium Head Blight (FHB) is a concern for both conventional and organic growers alike. FHB is hard to control as it affects all cereals alike and is both seed and soil borne (Government of Saskatchewan 2008). Although barley is more resistant to FHB than other cereals such as wheat growers should take care to still not follow wheat or other cereals with barley as a means of control because the disease will still be maintained in the field (Government of Saskatchewan 2008). Instead non-cereals should be chosen for a two to three year break between susceptible crops to successfully control the disease (Government of Saskatchewan 2008). To combat root rot diseases as well crops that are not hosts for root rot such as canola and legumes should be chosen for management of cereal diseases (Government of Saskatchewan 2008). This will also control ergot disease in barley

and other cereals in your cropping system (Government of Saskatchewan 2008).

Summary

Barley was one of the earliest domesticated crops and was used in bread making, beer and animal feed. Today it is still used as animal feed and beer making as well as a growing health food market because of its high protein and fiber content. Two-row and six-row barley varieties are both widely grown as well as hull-less varieties each with specialized uses. Nitrogen availability is also important to growing barley as it has a large impact on the yield and protein levels of the end crop and growers should look carefully at their fertilizer options. In organic agriculture disease can sometimes be tough to deal with but through well planned cropping rotations hard hitting diseases such as Fusarium Head Blight and different root rots can be controlled.

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