

Identification of barley genotypes with high antioxidant activity

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Abstract

Antioxidant activity is a very important characteristic of the cereal grains like wheat and barley. Barley genotypes with higher antioxidant activity can be beneficial both as food and also in brewing. A barley crossing block with 265 lines was screened for the antioxidant activity using two antiradical methods. Using both the methods, the line Kasota showed significantly high antioxidant activity. Multi-location trials in the subsequent year also showed that this line has high antioxidant activity as compared to the check and one more line used. Identification of the barley lines with higher antioxidant activity can help the breeding programme in developing food and malt barley varieties with higher antioxidants and better health and industrial benefits.

Keywords: Barley, antioxidant activity, malt, crossing block

Barley is the fourth-largest cereal crop in the world, with a share of 7 per cent of the global cereals production. Most of the barley produced (80-90%) is used for animal feeds and malt. Barley is still used as staple food in many parts of the world. In India, 75 per cent of total barley produced is used as animal feed, 20-25 per cent for malt production and a very small percentage is used directly for food purpose (Verma *et al.*, 2008). Malt is being utilized for brewing, distillation, baby foods, confectionaries, cocoa-malt drinks and medicinal syrups with the major share going to brewing. Malting barley and the malting process can have impact on beer instability owing to the presence of pro-oxidant and anti-oxidant activities. Oxidation is involved in off-flavour formation, occurrence of haze, modification of bitterness and astringency, and sometimes colour changes. Whole grains, including wheat and barley, contain several compounds that are capable of minimizing the damaging effects of oxidation reactions. Their antioxidant activity is due to the presence of different types of phytochemicals like carotenoids, phenolics, lignans, vitamins, minerals and phytates. Polyphenols and phenolic acids present in malt are natural antioxidants, capable of delaying, retarding or preventing oxidation processes, and therefore thought to have a significant effect in malting and brewing as inhibitors of oxidative damage. The antioxidant activity of barley has been evaluated by a number of workers using different methods & genotypes under different environments and have reported the results in different units. Kim *et al.* (2007) analysed 127 coloured barley lines and reported 46.4 to 86.3% DPPH radical

scavenging activity. Dvorakova *et al.* (2008), however reported low values of 22-32% in ten barley varieties. Zhao *et al.* (2008) evaluated 14 malting barley varieties with ABTS radical scavenging activity ranging from 11.39-13.58 μM Trolox Eq/g. Environment also plays important role in determining the antioxidant levels in cereals. Differences in the antioxidant activity of barley between the years has been reported by Maillard *et al.* 1996.

Variation in antioxidant activity: In the year 2011-12, 265 barley lines grown at DWR, Karnal farm in malt barley crossing block were screened for their antioxidant potential using two radical scavenging methods viz. ABTS assay (Re *et al.*, 1999) and DPPH assay (Beta *et al.*, 2005). Using ABTS method, the antioxidant activity range was between 4.6-12.0 with an average of 7.5 μM Trolox Eq/g samples, wherein 82 per cent of the lines had activity between 6.0 – 9.0 (Fig.1). By DPPH method, the antioxidant activity ranged between 10-70 per cent discoloration with an average of 45 per cent and 90 per cent of the lines showed activity between 30 – 60 per cent discoloration (Anonymous, 2013). Using both the assay methods, the line Kasota (EC532635) showed the highest antioxidant activity (11.95 μM Trolox Eq/g by ABTS assay and 70.25 per cent by DPPH assay).

Stability over the locations: In the year 2012-13, Kasota along with one more line (2nd IFN BON-131, dark coloured grain with good malting quality parameters) were tested for this trait along with a check K551 in the multilocation trials under AICW& BIP. It was observed that there

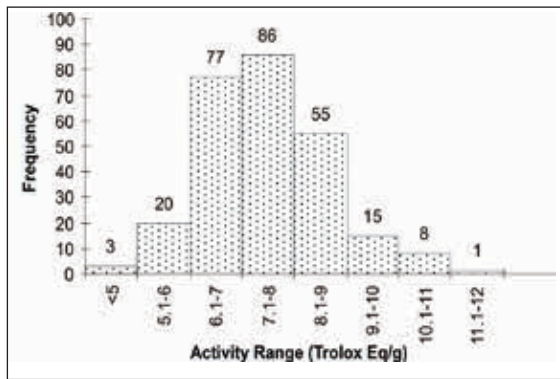


Fig 1. Frequency distribution of the antioxidant activity in barley by ABTS assay.

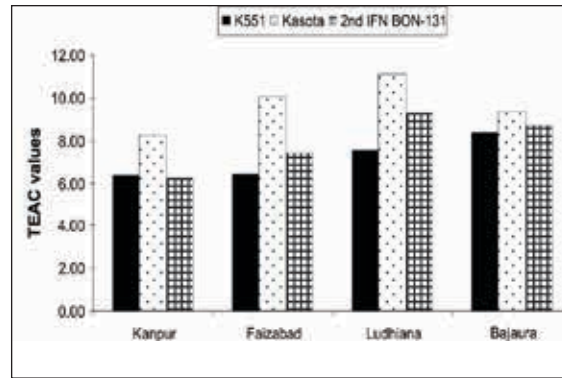


Fig 2. Antioxidant activity of the barley genotypes at different locations using ABTS assays.

were significant differences in the antioxidant activity of both the lines between the locations. But, Kasota showed significantly high mean antioxidant activity than the 2nd IFN BON-131 line and considerably higher than K551 using the ABTS method (Fig.2). Using DPPH method, significant differences were observed only at Ludhiana centre. Overall, lower antioxidant activity was observed in the year 2012-13 as compared to the year 2011-12.

This could be possible because of year to year variation in the environment and literature also states that antioxidant activity is highly influenced by the environment. However, the overall trend of the antioxidant activity was the same. Some physico-chemical traits of these lines and the check which are important from the malting purpose are listed elsewhere (Kumar *et al.*, 2012).

Since barley is the rich source of antioxidants, the varieties with high activity will be preferred for malt preparation which in turn will help in improving the stability of beer during long term storage. For food purpose also varieties with high antioxidant activity will provide more health benefits. The sources identified for high antioxidant activity can be used in the malt and food barley improvement programme of the country to develop varieties with higher anti-oxidant activity.

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