

Studies on the molecular forms of alpha-amylase and their implications for improving malting quality in barley

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Malting barley involves the controlled germination of the grain in order to degrade the endosperm cell walls with minimal loss in starch. The process is designed to produce adequate levels of hydrolytic enzymes and release the maximum amount of carbohydrate reserves for use during the brewing process. Most of the processes which occur in the stages following malting are dependent on the activities of enzymes produced during malting. The correct balance of these hydrolytic enzymes is therefore very important. Studies (1,2) over the past few years on one of the major hydrolytic enzymes in barley malt, α -amylase have shown that the enzyme consists of multiple molecular forms which are most commonly separated by electrofocusing into low pI (α -amylase I) and high pI (α -amylase II) isoenzyme groups. Genetic studies have shown the two groups are produced by two sets of α -amylase genes located on separate chromosomes (3). The significance of these multiple molecular forms of α -amylase to malting quality in barley is examined in this study using recently developed immunochemical assays (4) and standard biochemical techniques.

Methods

Immunochemical techniques have been developed at the Waite Institute to screen barley lines for several major malts. Specific immunochemical analyses for α -amylase coupled with isoelectric focusing, enzyme activity staining and western blotting techniques were used to examine α -amylase variation in a wide range of genetic material for potential use in the breeding programme. Similar techniques were used to study the effects of environmental conditions on the molecular forms of α -amylase in malting quality barley.

Results and discussion

Results indicate that in addition to the importance of the total amount of α -amylase available in barley malt, the qualitative and quantitative balance of the molecule forms of this enzyme may be of significance to malting quality. In particular, the presence or absence of a very low pI α -amylase form may affect malting quality.

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