with 20,000 rad of gamma-rays, resistance to leaf rust, yellow rust, stem rust, and to some extent to Erysiphe graminis was determined. The mutants responded to infection by producing necrotic flecks in the presence of high level of disease inoculum. Similar flecks develop under stress condition. It is likely that the mother variety "San Pastore" carries genes for resistance which are masked by suppressor genes. Irradiation inactivates suppressors so that resistance genes which were previously masked are expressed. The first results of monosomic analysis indicate that chromosomes of groups 4 and 5 or possibly 7 may be critical for expression of resistance in the mutant lines.

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Objectives and results of barley breeding in Australia

An important current development in Australian barley improvement is the release of semi-dwarf cultivars. These are derived from Abed Deba, Triumph or Aapo which are believed to have an allelic series of mutant genes. A common problem with these genes is their association with relatively late maturity and small grain, limiting current cultivars to rainfall areas above 450mm per annum. The first release "Skiff" (S.A., N.S.W. 1988) is to be followed by selections from "Forrest" x "Aapo" in Western Australia and "Grimmett" x "Triumph" in Queensland, whilst "Triumph" is already being grown in Tasmania.

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Breeding of proanthocyanidin free malting barley

Haze formation in stored beer is due to colloidal precipitation of proteins with polyphenols of which proanthocyanidins are the most important group. 70-80% of proanthocyanidin in beer are from barley malt. Today breweries attain haze stability by using enzymes, additives or adsorbents. A better solution would be to remove proanthocyanidins. Carlsberg Plant Breeding uses induced mutations to breed proanthocyanidin-free malting barley.

After mutagen treatment with sodium azide M1 seeds are planted in the field and M2 seeds are harvested in bulk. A single seed, non-destructive method has been developed to identify mutant kernels lacking proanthocyanidins in the testa. The method involves the inclusion of M2 seeds - 50 at a time - in semisolid clay blocks, whereafter a small part of the endosperm, testa and pericarp are exposed by sanding the seeds. The clay block is then placed in a vanillin-HCl solution so that the uncovered tissues can react with the solution. A red colour will develop in the testa of "normal" seeds, whereas the testa layers of proanthocyanidin-free seeds remain colourless. So far, more than 600 mutants have been induced in over 100 barley varieties, spring as well as winter-types, from barley producing areas around the world. The mutants can be assigned to at least 7 loci, all of which can block the biosynthetic pathway for the proanthocyanidins. Mutants in the ant-18 and ant-19 loci show poor kernal development. Only a few mutants are known in the ant-12, ant-22 and ant-25 loci. Breeding work is focussed on mutants belonging to the ant-13 and ant-17 loci . Whereas the malting quality of ant-17 lines suffer from apparent abnormal enzyme development in the aleurone layer, this defect does not exist in ant-13 lines. Brewing trials with proanthocyanidin-free malt have shown excellent haze stability