BREEDING BARLEY FOR DISEASE RESISTANCE AND NITROGEN USE EFFICIENCY IN NORDIC COUNTRIES

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During the past forty years, the total barley area in Finland has increased by 50 % leading to short crop rotations or monocultures in many farms. Simultaneous traditional ploughing has been replaced by reduced and no-tillage systems, which again has enhanced the risks for seed- and stubble-borne diseases. Plant disease resistance is an economical and environmentally feasible approach to control plant diseases. Genetic diversity is a necessity aiming to breed for higher yields, efficient N use and disease resistance. It has, however, been postulated that genetic diversity of European barley has been decreased due to bottlenecks and strict selection during a century of breeding. Our study aimed to evaluate breeding effect on disease resistance and on nitrogen use efficiency (NUE) in barley by using extensive germplasm covering 72 landraces and 123 cultivars released since 1916. Trials were established at the experimental farm of Natural Resources Institute Finland in Jokioinen, situated in southern Finland. The germplasm collection was genotyped with 1536 SNP markers and phenotyped in a two-year field experiment during 2011–2012. SNP data was used to evaluate the effect of barley breeding on genetic diversity. A significant improvement in the net blotch resistance level was found in the European barley cultivars released during the last 40 years. The frequency of resistant genotypes against net type net blotch was highest among the European barley cultivars and Syrian landraces. No reduction in genetic diversity of the European barley material was recorded. The results revealed clear positive breeding effect on N use efficiency in barley cultivars. Breeding had also improved grain yield and traits related to yield, like grain number, grain weight and harvest index. Efficient N use and utilization correlated positively with grain yield and negatively with stem length.