Influence of agronomic practices on antioxidant compounds of pigmented wheat and tritordeum cultivars

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Cereals are staple foods worldwide and have long shelf life, so they could contribute substantially to the daily intake of antioxidant compounds and the prevention of aging processes associated with oxidative stress. Among cereals, bread wheat is one of the major cereal crops all over the world and constitutes a key source of micro- and macronutrients for human nutrition. Furthermore, researchers and breeders have focused their attention on wheat as a reservoir of protective phytochemicals that have shown several biological activities. Novel pigmented genotypes have been recently developed for their content in antioxidant pigments and represent a valuable raw material for the production of baked goods with added health benefits.
It is already known that agronomic practices, such as nitrogen (N) fertilization, can affect both physical and nutritional parameters of cereal grains (grain yield, protein content). Such practices may also influence the phytochemical content of kernels and flours. The aim of the present study was to investigate the effect of N on the content of bioactive compounds and the antioxidant capacity of innovative purple, blue, black, yellow genotypes, having one common-coloured wheat cultivar as control. One variety of the new cereal species tritordeum, characterized by yellow-coloured grains, was included in the scope of the study. The N effect was investigated in terms of N fertilization and soil N content, growing the genotypes at different fertilization rates (0, 80 and 160 kg of N/ha) in three experiments characterized by low, medium, and high soil N content, carried out in northern Italy. As the successful application of these novel genotypes will depend on their agronomic performances compared to commercially used varieties, also grain yield and physical kernel parameters were taken into consideration.
Grain yield of the novel genotypes was significantly lower than that of the control, with the black type differing slightly and the yellow-grained varieties differing the most. The genotype factor showed a significant effect on all the analysed agronomic and chemical parameters, and soil N content had a greater impact than N fertilization. Black-grained cultivars stood out for having the highest content of anthocyanins and phenolic acids, both soluble and cell-wall bound, and the highest value of antioxidant capacity (AC) measured by FRAP assay (AC_{FRAP}). AC_{FRAP} was found to be positively correlated with the mentioned bioactive compounds, while the highest AC measured by ABTS assay was observed in tritordeum grains and was positively correlated with total carotenoid content. Samples from the site with low soil N content were characterized by a high content of anthocyanins and cell-wall bound phenolic acids (CWBPAs), whereas samples from medium and high soil N content differed for a higher content of soluble phenolic acids and greater AC_{ABTS}. N fertilization significantly affected the grain yield, but had limited effects, although still significant, on the anthocyanins and CWBPAs.
Among the analysed genotypes, some of them seems to be promising for the development of an innovative supply chain and the production of health-valued foods, having the highest performance when considering their antioxidant properties, quality and yield capacity.

Key words: wheat, tritordeum, anthocyanins, carotenoids, phenolic acids, pigmented grains, nitrogen fertilization, soil nitrogen, antioxidant capacity.

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