2023 MULTIDISCIPLINARY CONFERENCE ON SUSTAINABLE DEVELOPMENT

Timisoara, 25-26 May

Alternative genotypes of barley as a source of health – promoting substances.

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Abstract: *Barley is one of the most important agricultural crops in the world. Among other cereals, it is distinguished by the high dietary qualities of the grain, mainly due to its relatively high content of antioxidant bioactive compounds as well as vitamins and fibre. As consumer awareness increases, interest in functional foods and nutraceuticals is growing. Plant genotypes distinguished by such properties are therefore being sought. Primary barley varieties with black pigmentation of the grains could be potentially useful for functional food production. Two field experiments were conducted in organic and conventional farming systems. Three diverse barley genotypes, including two primary barley varieties with black kernels, were treated with an amino acid biostimulant in these experiments. The effects of these factors on the content of phenolic compounds, carotenoids and fatty acids in the different barley genotypes were observed.*

• Introduction

Barley (*Hordeum vulgare*) – is a popular cereal around the World with sowing acreage - 49 mln ha and production - 146 mln tonnes. Only 2% of grains are iused for human consumption. Barley is source of carbohydrate, fiber, proteins, nutrients and important biochemicals (eg. polyphenols, FFA, carotenoids, *b*-glucan).
Among barley we have altternative genotypes with colourful grains or spikes that not evolve the awns.
In our work we are focused on:
H. v. nigricans – black grains with awns,
H. v. rimpaui – black grains without awns – hooded,

Our research also focused on usage of biostimulants – natural origin products, that enhance functioning of plants. They help plants while biotic or abiotic stresses or provide to higher concentrations of nutrients and biochemicals.

Currently, great emphasis is placed on organic farming, and consumers demand food with high quality and nutritional value. Considering that tendency, we also have conducted our researches in organic farms and have evaluated the effect of that system on concentration of health – promoting substances.

• Material and method

The test material consisted of grain from three different barley genotypes. Two of these were two-row primary forms of spring barley, with black pigmentation of the grains, while the third, which was the control, was also a two-row modern variety of 'Soldo' barley, one of the most popular in Europe.

The grain analysed came from two rigorous field experiments, conducted in a split-plot system in triplicate. The experimental factors were the barley genotypes described earlier and the foliar application of the amino acid biostimulant Naturamin WSP, which was carried out twice during the growing season (in stem elongation stage and the beginning of ear emergence stage). The control objects was not subjected to the application. After harvest, the grain was chemically analysed for phenolic compounds, fatty acids and carotenoids.

Determinations were carried out by high-performance liquid chromatography using an Acquity UPLC (Waters, USA) with a Waters Acquity PDA detector (Waters, USA). Chromatographic separation was performed on an Acquity UPLC® BEH C18 column (250 mm x 2.5 mm, particle size 1.5 µm) (Waters, Ireland).

• Results and discussions

Under our experimental conditions, we observed that alternative barley were characterized by better assortment of health – promoting substances. Application of biostimulant on *H. v. nigricans* and *H. v. rimpaui* contributed to higher concentration of anthocyanidins, flavonoids, phenolic acids, lutein and *b*-carotene.

Implementation of amino acid on *H. v. vulgare* increased volume of saturated fatty acids. In the contrary, black barley forms, without biostimulant, had better share of polyunsaturated fatty acids, that are important for human health.

Within black barley *H. v. rimpaui* reacted more vigorously for biostimulant, having better composition of anthocyanidins, flavonoids and phenolic acids.

Common barley in both farming systems and treated or non-treated fields achieved the highest amount of zeaxanthin, what is explained by the fact that zeaxanthin is plant pigment, providing yellow colour.

• Conclusions

1. A foliar application of an amino acid biostimulant significantly increases the phenolic compounds and carotenoids in barley grain, but decreases the PUFA content.
2. The response to foliar-applied amino acids varies from genotype to genotype.
3. The original genotypes with black grain contain significantly more phenolic compounds than the modern variety, which may indicate its higher antioxidant potential.
4. Organically grown barley contained more bioactive compounds compared to conventionally grown barley.

Acknowledgement: *none*