Antioxidants in spring barley (*Hordeum vulgare* L.) grains

(Centre, bold, Times New Roman 12, spacing 0;0)

**(Centre, bold, Times New Roman 16, Spacing 0;18)**

Name Surname1, Jan Novak2, Nicol Graf3

1Department of Soil Science

2Department of Animal Husbandry

Mendel University in Brno

Zemedelska 1, 613 00 Brno

CZECH REPUBLIC

3Department of Life Science

University of Natural Resources and Life Sciences, Vienna

Konrad Lorenz str. 20, 3430 Tulln

AUSTRIA
(Centre, standard letters, Times New Roman 12, spacing 0;0)

name.surname@mendelu.cz
(Centre, standard letters, Times New Roman 12, spacing 6;6)

*Abstract:* Barley is an important source of fiber, vitamins, mineral substances and enzymes; on the other side however grain can be a source of mycotoxins. Vitamin E activity was determined in the interval of 10–20 mg/kg and the highest values were measured in the varieties XY and XX. Averagely strong relationship (r = 0.61\*) was determined between vitamin E activity and deoxynivalenol content in the set of varieties. The average content of DON 13.1 μg/kg was determined …
(Times New Roman 11, block alignment, spacing 18;0)

*Key Words:* barley, tocopherol, DON, NIV (Times New Roman 11, block alignment, spacing 6;6)

# Introduction (bold, Times New Roman 11, Spacing 18;0)

Antioxidants are substances that reduce oxidative damage such as that caused by free radicals. Free radicals are highly reactive chemicals that attack molecules by capturing electrons and thus modifying chemical structures.

Vitamin E is the major chain-breaking antioxidant in body tissues, and it is considered the first line of defense against lipid peroxidation, protecting cell membranes at an early stage of free radical attack (Landvik et al. 2002, Pláteník 2009).

*Fusarium* fungi are the most common pathogens of cereals worldwide. Although 70 species have been already described in the latest laboratory manual (Leslie and Summerell 2006), only a relatively small number is important with regard to food spoilage in its broad concept. In Europe, *Fusarium graminearum*, *F. culmorum*, *F. poae,* and *F. avenaceum* are the most common fungal species that cause a disease called *Fusarium* head blight (FHB) which can result in considerable economic losses due
to lower yields and decline of grain quality (Bottalico and Perrone 2002) … (Times New Roman 11, block alignment, spacing 0;3)

# MATERIAL AND METHODS (Bold, Times New Roman 11, Spacing 18;0)

## Characterization of growing locality, experimental design and barley grain samples (Bold, Times New Roman 11, block alignment, spacing 6;0)

The total of 160 barley samples (2011 harvest) were analysed (10 variety x 4 variants of fungicide treatment x 2 inoculation variants x 2 replications).

An overview of the fungicides and their active ingredients used are displayed in Table 1; the inoculation by *F. culmorum* took place at the beginning of … (Times New Roman 11, block alignment, spacing 3;0)

Table 1 Overview of fungicide treatments (Italic, Times New Roman 11, block alignment, spacing 6;3)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Fungicide | Application rate | BBCH | Active ingredient(s) |
| Control | - | - | - | - |
| H2+Z3 | HuttonZantara | 0.8 l/ha1.5 l/ha | 3965 | prothioconazole, spiroxamine, tebuconazolebixafen, tebuconazole |
| H2+P3 | HuttonProsaro 250 EC | 0.8 l/ha0.75 l/ha | 3965 | prothioconazole, spiroxamine, tebuconazoleprothioconazole, tebuconazole |
| H1+P3 | HuttonProsaro 250 EC | 0.8 l/ha0.75 l/ha | 25–3065 | prothioconazole, spiroxamine, tebuconazoleprothioconazole, tebuconazole |

# Results and Discussion (Bold, Times New Roman 11, Spacing 18;0)

## Pathogen spectrum on barley grains samples (Bold, Times New Roman 11, block alignment, spacing 6;0)

In the total of 160 barley grain samples, 4182 microorganisms from 12 genera (*Alternaria*, *Aspergillus*, *Bipolaris*, *Cladosporium*, *Drechslera*, *Epicocum*, *Fusarium*, *Nigrospora*, *Penicillium*, *Rhizopus*, *Stemphylium*) were isolated; … (Times New Roman 11, block alignment, spacing 3;0)

## Infection of barley grains by fungi of Fusarium spp. – the method of roll-tubes and PCR

A distinct fungicide effect did not occur after application of fungicides Hutton and Prosaro 250 EC that contained active ingredients prothioconazole, tebuconazole, and spiroxamine;
the occurrence of *Fusarium* spp. was lower only by 4–18% in comparison to the non-treated control variant (see Figure 1).

Figure 1 Spring barley grain infection by Fusarium spp. (in %), Žabčice, CR, 2011 (Italic, Times New Roman 11, block alignment, spacing 6;3)

Legend: H – fungicide Hutton, Z – Zantara, P – Prosaro 250 EC; 1 – growth stage BBCH 25–30, 2 – BBCH 39, 3 – BBCH
(Italic, Times New Roman 9, Spacing 0;6)

A positive influence of a fungicide treatment containing active ingredients prothioconazole, spiroxamine, tebuconazole (Hutton), bixafen, tebuconazole (Zantara) and prothioconazole, tebuconazole (Prosaro 250 EC) resulted in a lower occurrence of grains infected by *F. graminearum*
and the absence of *F. verticillioides* (Figure 2A–D).

At the beginning of this millennium …

Figure 2 Representation of the Fusarium spp. (in %) in spring barley grains (non-inoculated variants), Žabčice, CR, 2011

|  |  |
| --- | --- |
| A) Untreated control | B) Hutton (BBCH 39) + Zantara (BBCH 65) |
|  |  |
| C) Hutton (39) + Prosaro 250 EC (BBCH 65) | D) Hutton (25–30) + Prosaro 250 EC (BBCH 65) |
|  |  |

# Conclusion (Bold, Times New Roman 11, Spacing 18;0)

Agricultural practices use several effective approaches to reduce the *Fusarium* infection as well as the following mycotoxin production. A selection of the suitable variety for respective locality
and environmental conditions and the use of a fungicide treatment can be … (Times New Roman 11, block alignment, spacing 3;0)

# Acknowledgements (BOLD, Times New Roman 11, Spacing 18;0)

The research was financially supported by the … (Times New Roman 11, block alignment, spacing 0;3)

# References (BOLD, Times New Roman 11, Spacing 18;0)

Bottalico, A., Perrone, G. 2002. Toxigenic Fusarium Species and Mycotoxins Associated with Head Blight in Small-Grain Cereals in Europe. European Journal of Plant Pathology [Online], 108(7): 611–624. Available at: http://link.springer.com/article/10.1023%2FA%3A1020635214 971. [2015-05-21].

Landvik, S.V. et al. 2002. Handbook of Antioxidants. 2nd ed., New York: Marcel Dekker, Inc.

Leslie, J.F., Summerell, B.A. 2006. The Fusarium Laboratory Manual. 1st ed., Ames, Iowa: Blackwell Pub.

Pláteník, J. 2009. Volné radikály, antioxidanty a stárnutí. Interní Medicína pro praxi, 11(1): 30–33.

(Times New Roman 11, block alignment, spacing 3;0)

Other Examples – see **[INSTRUCTIONS FOR CONTRIBUTING AUTHORS](https://mendelnet.cz/attachments/000041.pdf)**