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## CROP YEAR EFFECTS ON THE QUALITY AND QUANTITY OF WINTER WHEAT VARIETIES

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Crop year impacts have been studied in a long-term trial of the Nagygyombos experiments of the Szent István University, Gödöllő, Hungary. The present paper is intended to give an overview of 18 winter wheat *Triticum aestivum* L. varieties tested during the time range between 1996 and 2018. All of the varieties were studied under similar agronomic conditions, each of them for min 3 years in a series of a polyfactorial replicated field trials. The 120 kg.ha<sup>-1</sup> N plant nutrition applications of the respective crop years were processed in the evaluation. Amount of grain yield, protein (%), wet gluten and farinographic values of the varieties examined were compared. The results obtained suggest that most of the varieties had a rather high variation concerning yield figures, however protein, and farinographic indicators proved to be more stable characteristics. Wet gluten values were influenced mainly by the crop year. The study supports an evidence that *Fusarium graminearum* infection of the trials was in accordance with the pre-harvest moisture conditions of a crop year. The study may support a conclusion that certain varieties have shown a higher stability in quality manifestation regardless to the amount of their grain yield. Alföld 90, Jubilejnaja 50, Mv Magdaléna and Mv Toldi varieties proved to be the best quality varieties in this research series.

**Keywords:** Long term trial, winter wheat, quality, quantity

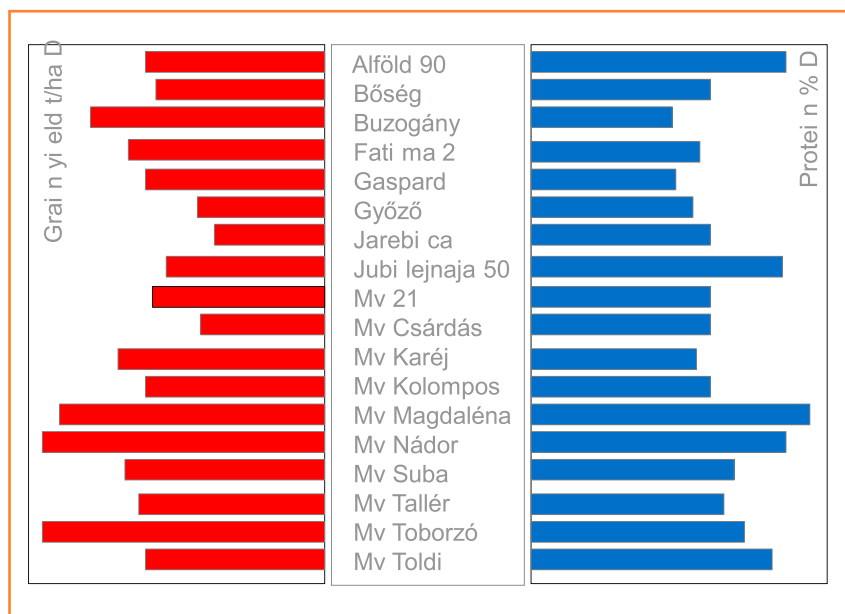
Crop quality and quantity performance is affected by environmental conditions in general. Grain yield and yield quality of winter wheat *Triticum aestivum* L. is highly influenced by the meteorological conditions of the given crop year, especially the amount and distribution of precipitation and the actual temperature (Grimwade et al., 1996; Győri 2008; Pepó, 2010). Crop yield and grain quality can also be influenced by agronomic applications. Plant nutrition in general and N topdressing in particular should be considered as the most effective treatments within the technologies of winter wheat production. The amount of nitrogen and the timing and distribution of the application have an impact on wheat quality, especially on the protein production of the crop (Pepó, 2010). Wheat varieties may have different responses to agro-ecological impacts (Mesterházy, 2019). Varietal differences are to be evaluated in long term trials to reduce the impact of variable crop year effects (Kismányoky and Ragasits, 2003). The aim of the series of trials was to evaluate quality and quantity of the grain yield of certain wheat varieties.

### Material and method

Winter wheat *Triticum aestivum* L. varieties were examined under identical agronomic conditions in a long-term field trial. The small plot trials were run at the Nagygyombos

experimental field of the Szent István University, Crop Production Institute, Hungary. Soil type of the experimental field is chernozem (calciustoll). Annual precipitation of the experimental site belongs to the 550–600 mm belt of the Northern edges of the Hungarian Great Plain. Experiments were conducted in a split-plot design with four replications. The size of each plot was 10 m<sup>2</sup>. Plots were sown and harvested by plot machines (standard Wintersteiger cereal specific experimental plot machinery series). Various identical agronomic treatments were applied to plots. Plant nutrition applications were done in single and combined treatments. N topdressing variants were applied by single and repeated topdressings representing 6 levels: 0, 80, 80 + 40, 120, 120 + 40 and 160 kg.ha<sup>-1</sup> N in single and split applications. All plots were sown with identical series of wheat varieties for studying their performance in relation with agronomic impacts. The present paper is intended to give an overview of 18 winter wheat *Triticum aestivum* L. varieties tested during the time range between 1996 and 2018. All of the varieties were studied under similar agronomic conditions, each of them for at least 3 years in a series of a polyfactorial replicated field trial. The 120 kg.ha<sup>-1</sup> N plant nutrition applications of the respective crop years were processed in the evaluation for both yield and quality parameters. Wheat grain quality parameters: protein and wet gluten contents were determined from grain samples, as well as quality characteristics

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**Figure 1** Grain yield and protein content of wheat varieties Nagygyombos, 1996–2018

varieties examined were compared. The results obtained suggest that most of the varieties had a rather high variation concerning yield figures, however, protein and farinographic indicators proved to be more stable characteristics. Wet gluten values were influenced mainly by the crop year.

Fig. 1 provides information on grain yield and protein content of the varieties. Buzogány, Mv Magdaléna, Mv Nádor, Mv Toborzó were the highest yielding varieties during the examined years.

The study may support a conclusion that certain varieties have shown a higher stability in quality manifestation regardless to the amount of their grain yield. Fig. 2 presents information on the quality ranges of the varieties summarising the wet gluten content and the baking quality groups. Alföld 90, Jubilejnaja 50, Mv Magdaléna and Mv Toldi varieties proved to be the best quality varieties in this research series.

During the examined period fusarium infection was monitored in all years.

According to the data presented in Fig. 3 it can be stated, that except for few extreme years, the Nagygyombos experimental site was not exposed to severe fusarium infections. There were two peaks with high infection: 1997 to 1999 was a strong infection period followed by an almost 10 years' free period of *Fusarium graminearum*. The next peak occurred in 2010. Both high infections were escorted by extreme weather conditions – such as water flood during the pre-harvest vegetation period.

| Variety        | Wet gluten content (%) | Baking quality |
|----------------|------------------------|----------------|
| Alföld 90      | 28-38 %                | A1 – B1        |
| Bőség          | 21-27 %                | B2 – C1        |
| Buzogány       | 22-27 %                | B1 – C1        |
| Fati ma 2      | 25-29 %                | A2 – B2        |
| Gaspard        | 21-26 %                | B1 – C1        |
| Győző          | 22-25 %                | B2 – C2        |
| Jarebi ca      | 23-28 %                | B1 – C1        |
| Jubilejnaja 50 | 26-35 %                | A1 – B2        |
| Mv 21          | 26-32 %                | A2 – B2        |
| Mv Csárdás     | 25-32 %                | A2 – B2        |
| Mv Karéj       | 23-33 %                | A2 – C1        |
| Mv Kolompos    | 25-31 %                | B1 – C1        |
| Mv Magdaléna   | 26-38 %                | A1 – B2        |
| Mv Nádor       | 26-35 %                | A2 – B1        |
| Mv Suba        | 23-30 %                | B1 – B2        |
| Mv Tallér      | 24-30 %                | B1 – B2        |
| Mv Toborzó     | 25-37 %                | A2 – C1        |
| Mv Toldi       | 25-38 %                | A1 – B2        |

**Figure 2** Wet gluten content and baking quality ranking of wheat varieties Nagygyombos, 1996–2018

at the Research Laboratory of the SIU Crop Production Institute, and RET Regional Knowledge Centre laboratories according to Hungarian and EU standards (MSZ, 1998; EK 2000; Horváth, 2014). During the examined period, levels of fusarium (*Fusarium graminearum*) infection was detected in the wheat trials.

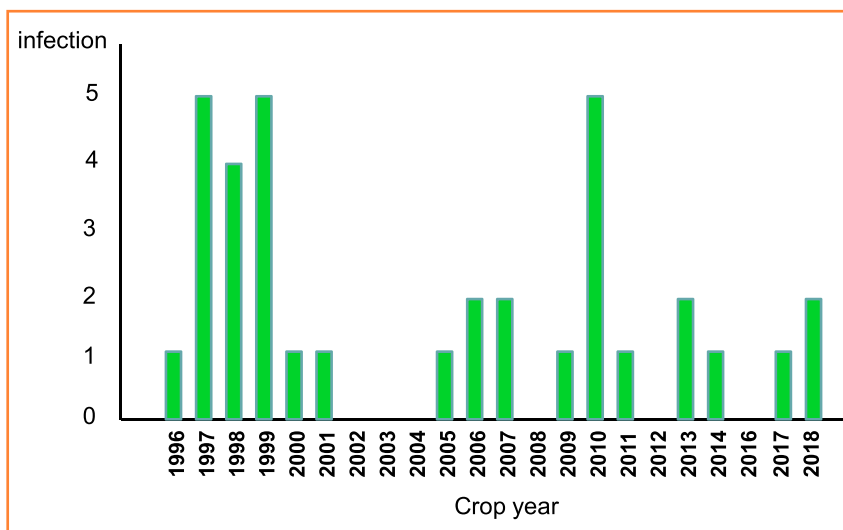
## Results

Many varieties were studied in the trials during the 22 years of the experimental series (Jolánkai et al., 2018). In this paper only those 18 cultivars are introduced which were tested for at least 3 years at the Nagygyombos site. Amount of grain yield, protein (%), wet gluten and farinographic values of the

## Discussion and conclusion

According to the results obtained it should be emphasized that the quantity and quality parameters of any crop varieties are to be examined in polyfactorial long term trials that may provide the researcher with identical conditions to exclude unfavourable factors and buffer the crop year effects.

The authors are sorry to inform the reader that in 2018 year the Nagygyombos experimental site of the SIU Crop Production Institute had to



**Figure 3** Occurrence of fusarium (*Fusarium graminearum*) infection in wheat trials, Nagygombos, 1996–2018

be terminated. We do hope to preserve the main blocks of the experimental design, once the trial can be restarted again.

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