Agricultural Institute
Centre for Agricultural Research
Martonvásár, PO Box 19. H-2462

ELKH Eötvös Loránd Research Network

ÖMKi

✉:miko.peter@atk.hu

On-farm comparison of trials based on different plot sizes to help farmers' wheat cultivar choice

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Péter Mikó✉, Mihály Földi*, Mária Megyeri, Gyula Vida, Szilvia Bencze*, Judit Fehér*, Dóra Drexler*

(* ÖMKi , Hungary)

All farmers are searching for the best performing plant cultivars to improve their profitability, but there is still a lack of knowledge on how to choose these cultivars for organic production in Hungary. Organic cultivation is more affected by environmental factors compared to conventional due to the ban on artificial pesticides, herbicides and fertilizers. Additionally, without an official organic small plot variety testing system, there is a strong limitation regarding the annual number of cultivars that could be tested under on-farm growing conditions. Therefore, our aim is to develop an effective system for testing large number of wheat cultivars on the targeted organic farm.

Materials and Methods

- Testing on an organic farm near Nagydorog (Central Hungary) between 2019-2020 (Fig. 1)
- 11 winter wheat cultivars: 8 in 2019; 7 in 2020 (4 in both years)
- Farmer plot (1000 m^2 each) versus small plots (6m^2 each)
- 3 sampling (1 m^2/sample) per farmer plot versus 3 replications of small plots (randomized complete block design)
- Traits: grain yield, protein and gluten contents, Zeleny sedimentation value (quality measurement with NIR technology)
- Regression analyses between the 2 types of performance trials

Fig. 1: Winter wheat trial on an organic farm near Nagydorog (2019, Hungary)

Results

- Significant moderate correlation for all quality traits ($0.45<R^2<0.56$; $p<0.001$)
- Higher grain yield in small plots, but with good correlation ($R^2=0.6$; $p<0.001$) to farmer plots (Fig. 2)
- Based on the 4 common cultivars: stronger correlation ($R^2=0.7$) for protein and gluten contents
- Best (protein, gluten) and worst (yield) performing group of cultivars are the same
- Rapid NIR measurement of Zeleny sedimentation is not reliable, but good rank correlation with protein and gluten contents ($R^2>0.83$)

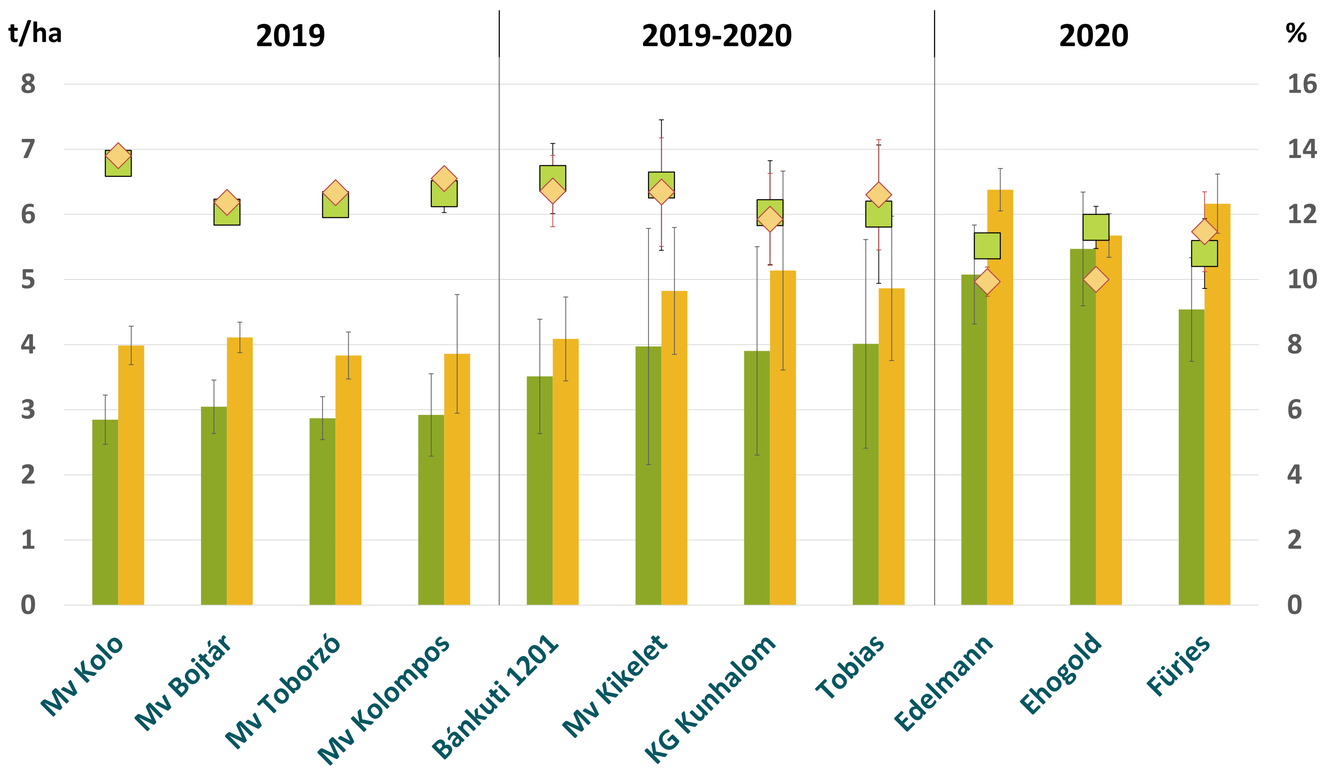

Fig. 2: Mean grain yield (bars), protein content (dots) and standard deviations of winter wheat cultivars examined for 2 years (2019-2020) on an organic farm near Nagydorog, Hungary using two types of trial setup (farmer plots: green; small plots: orange). Four cultivars were examined in both years (middle of the diagram)

Conclusion

Combination of trials is recommended on the target farm:

2 years of small plot trial (high number of cultivars, NIR quality)

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Positive selection of the best quality cultivars, while negative selection of the worst yielding cultivars

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Testing of preselected cultivars under farming conditions (1 year)

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Selection of best cultivars for the own organic farming system

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