



## OWC 2020 Paper Submission - Science Forum

*Topic 1 - Ecological approaches to systems' health*

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### FARMER INVOLVEMENT IN AGRO-ECOLOGICAL RESEARCH – THE ORGANIC ON-FARM WHEAT VARIETY TRIALS IN HUNGARY

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**Abstract:** The acreage of organic farming is constantly increasing in Hungary. The cultivation of cereals – and within it – the production of winter wheat is of main importance in organic field crop production. However, it encounters various difficulties. As official post-registration variety trials only exist under conventional farming conditions, ÖMKi started participatory organic on-farm variety tests in 2012, with the involvement of volunteer farmers all over Hungary. In the past seven years, nearly 50 varieties and more than 20 farms have been included in the tests which were conducted with the aim to find the most suitable varieties for high quality organic wheat production and to exclude the inappropriate ones for respective production regions. Our results demonstrate that there is great potential in choosing the varieties best suited, and that it is possible to achieve both high yield and excellent quality also in organic farming, when applying the suitable cultivars.

**Introduction:** Among small-grain cereals, wheat cultivation has the highest acreage in Hungary also in organic agriculture with its 73,046 ha, 35.4% of the total area in 2018 (from: Annual agricultural report 2019). Its production, however, is rather vulnerable in the light of climate change. Although choosing the right variety is essential (*Lammerts et al.* 1999), official post-registration variety trials are still missing in organic farming in Hungary. The above reasons led to the initiation of the participatory on-farm variety trials that were begun by ÖMKi in 2012. These types of tests provide unique opportunities to allow scientific experimentation with practice and obtain reliable information on the performance of a great number of varieties under various climatic and environmental conditions on organic farms all over Hungary. Based on the data acquired on cultivation, performance, weed suppression and disease resistance, variety recommendations can be made, taking into account local environmental and climatic issues, resulting in a more diverse and optimized variety usage.

**Material and methods:** At start in 2012, four varieties of two local breeding companies were sown on five volunteer organic farms together with the varieties the farmers usually grew on each site. These initial test varieties have been replaced with

more suitable accessions in the following years during which both the number of the varieties and that of the participating farms increased gradually. The varieties currently investigated originate from local breeding centres in Hungary and from the organic breeding companies of Austria and Germany. A characteristic of the on-farm trial is that not all of the varieties are sown in all locations but most varieties are grown in at least three places, partly based on the farmers' choice. To allow comparisons between sites, a standard variety (KG Kunhalom) is used in all testing sites. Varieties producing yield above average without restricting characteristics (such as e.g. poor disease resistance, weed suppression or quality) have been repeatedly included in the tests so that the most suitable ones could be selected for cultivation by farmers. Although the farms participating might vary with time there is a core of 5-7 farmers who take part already in several subsequent years. Sowing seeds (typically 30-50 kg from each variety) are provided for the farmers who are requested to sow them in strips (usually in the width of their sowing machine) side by side, possibly in the most homogenous part of their field. The standard variety is sown twice in each experiment, in order to estimate field heterogeneity effects. During field surveys, data on the incidence and coverage of most relevant diseases and pests are recorded for each variety on each site. Yield is determined via estimation (collecting the spikes with a sickle from 3×1 m<sup>2</sup> randomly selected plots) and, when possible, also with machine-harvesting of the plots. Grain quality is measured on the threshed grain samples with NIR equipment (Mininfra Scan-T Plus, Infracont) and results are related to generally used quality standards (MSZ 6383 2017).

**Results:** Up till now, more than 20 farms and nearly 50 varieties have been involved in the experiments. In this paper, the main findings of the last two years, and in more detail those of 2019 are presented. In this last year 7 on-farm sites participated and 34 varieties were tested in total (with an average of 2.5 sites for each variety and 12.9 varieties per site, which was unusually high this year compared to the average of 8.8 varieties per farm in 2018). The relatively low number of repetitions by site was due to the fact that 14 varieties were only sown in one location this year.

Despite the fact that sowing and emergence was greatly delayed by the extraordinary drought in the autumn of 2018, the prolonged wet period later in the vegetative period favoured fungal diseases and resulted in more severe infections of various fungi (such as e.g. *Septoria tritici*, *Drechslera tritici-repentis* and *Fusarium* spp.) on certain locations than those of 2018. The average grain yield (over sites) was rather high, 4.9 t/ha (compared to 2.7 t/ha of the nine sites of 2018), varying between 2.8-6.8 t/ha. The top three ranking sites were Tiszaigar, Želiezovce (Slovakia) and Tiszasziget, which not only had the highest grain yields but also the highest protein and wet gluten values; performing 6.8, 6.1, 5.0 t/ha yield, 14.8, 14.7, 15.0% protein content and 31.8, 31.6, 31.5% wet gluten content, respectively. These impressively high values are partly due to the favourable environmental conditions of the trial sites, but are also the result of the farmers' commitment to the constant improvement and high level of organic farming. There are, of course also sites in our test network, where the soil conditions are limiting, and also some with medium or fairly good conditions, such as e.g. Füzeggyarmat, the results of which are presented here in more detail (Fig. 1). This site illustrates the changes in the variety assortment as well as in the ranking of repeatedly grown varieties due to crop year. It can be seen that 2019 was more favourable with respect to both quantity and quality of the grain yield compared to 2018.

**Discussion:** In organic farming, where the use of artificial fertilizers and pesticides is prohibited, biological bases – i.e. choosing the most suitable variety – have outstanding importance (Lammerts et al. 1999). Experiences of conventional farming can poorly be adapted to organic conditions (Murphy et al. 2007), due to their contrasting circumstances; the same variety is very unlikely to thrive equally well under both cultivation systems (Carr et al. 1971). This is in accordance with our findings, which suggested that organic breeding has a great potential. Some of the tested Austrian varieties, which are

recommended for or were bred under organic conditions, performed well in several locations of Hungary. It is also demonstrated by the network that there are good examples of organic farming practices where not only the grain yield but also the grain quality can be very high. The results of the on-farm system are thus encouraging. As a next step, the research tries to take into account the specific quality needs of artisan bakeries in order to support the development of local value chains.

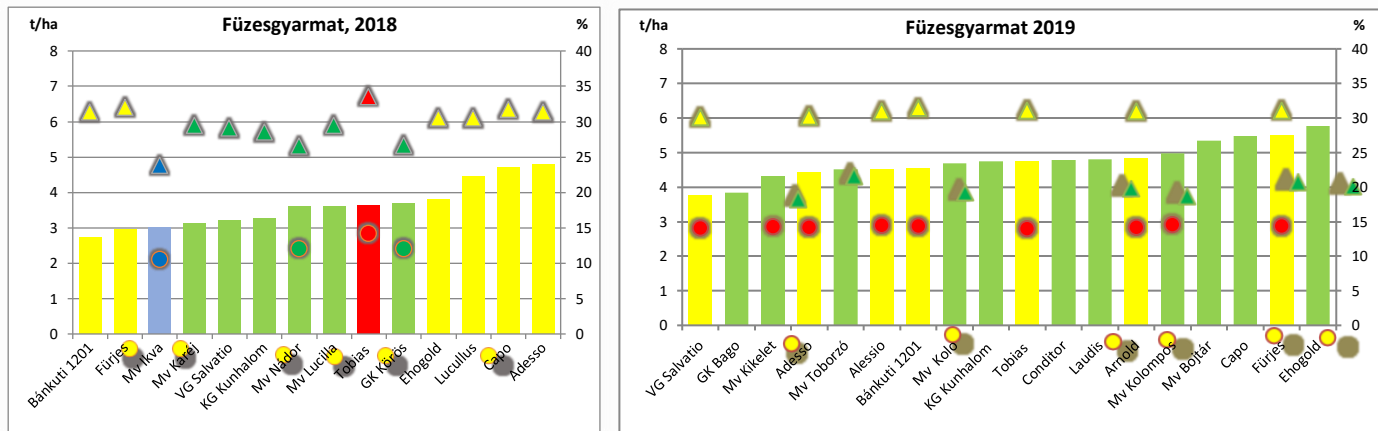
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## Image:



**Fig. 1. Grain yield in Füzessgyarmat (2018 and 2019).** Columns, dots and triangles refer to the average grain yield (left axis), protein and gluten content (right axis), while blue, green, yellow and red colours represent feed, milling II, milling I, and premium quality, respectively, indicating grain quality levels according to the Hungarian MSZ 6383 2017 standard.

**Keywords:** organic farming, on-farm research, variety test, winter wheat

**Disclosure of Interest:** None Declared