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Organic field trials to promote Hungarian organic cereal production – Testing wheat varieties

Mihály Földi*, Dóra Drexler

Hungarian Research Institute of Organic Agriculture (ÖMKi), Budapest, Hungary

Among various factors affecting the cultivation of organic cereals, the biological basis is one of the most important ones. Within organic arable cropping the cash crop grown on the largest surface in Hungary is common wheat (*Triticum aestivum*). 2012-2015 we conducted a series of participatory on-farm experiments involving a number of organic farmers from all over Hungary in order to identify best suited wheat varieties for Hungarian organic farming. We studied the most important standard quality measures (protein, gluten, falling number) and yields, which strongly affect the economy of organic cereal production. Results show that there is a gap between conventional breeding aims and demands in organic farming. Moreover, even farmers' proven varieties cannot guaranty premium quality yield in climatically difficult years. There is strong need to continue variety testing and identification of well adapted cultivars.

Keywords: organic wheat variety test, on-farm research, Hungary

1 Introduction

According to latest annual reports of local certification bodies in 2013 the total area in organic production was about 130.000 hectares in Hungary out of which slightly more than 50 % was devoted to grassland. Arable cropping consisted of just over 50.000 hectares with most farm production sold as exported raw material. Among arable crops wheat at 7.500 hectares and spelt (*Triticum spelta*) at 6.800 ha were among the most important ones (Göblyös 2014, Roszik 2014).

The exact composition of varieties used in organic wheat and spelt production is unknown, as monitoring and controlling agencies do not record yields or area by variety. Organic seed is hard to obtain and many farmers rely on reuse of seeds produced on their own farms from favored varieties. However, also organic farmers aim to harvest high yields, and customers buying organic produce are looking for high quality. Under current conditions, these two demands are sometimes difficult to reconcile. High yielding conventional varieties under organic production or farm-raised seed may be less disease resistant or produce lower quality grain, leaving the farmer with a crop that is difficult to sell.

2 Material and Methods

2.1 Material

Tested varieties were recommended by local breeding and seed companied. Farmers joined the test on a voluntary basis. Each participant received 50 kg of seed per variety. Production methods were not aligned among farms; participants pursued their usual practice, which was recorded. Over the last three years of the following varieties were tested on following locations (Table 1).

* **Correspondence:** Mihály Földi, Hungarian Research Institute for Organic Agriculture (ÖMKi), Miklós tér 1. H-1174 Budapest, Hungary. E-mail: mihaly.foldi@biokutatas.hu

Table 1 Tested varieties in the last three years

Year/ Variety	2012/2013	2013/2014	2014/2015
GK. Fény (GKI. Szeged / Hungary)	A (4)	A (4)	A (4)
GK. Petúr (GKI. Szeged / Hungary)	A (4)		
GK. Göncöl (GKI. Szeged / Hungary)		A (4)	
GK. Hunyad (GKI. Szeged / Hungary)	F (1)		A (7)
Exotic (Tradisco Ltd. / France)	A (4)		A (5)
Rustic (Tradisco Ltd. / France)	A (4)		
Forblanc ((Tradisco Ltd. / France)		A (4)	A(5)
MV. Karizma (Martonvasar / Hungary)		A (4)	A (5)
MV. Béres (Martonvasar / Hungary)			A (5)
MV. Kolompos (Martonvasar / Hungary)			A (5)
Antonius (Saatbau Linz / Austria)		A (4)	A (5)
Stefanus (Saatbau Linz / Austria)		A (4)	A (4)
KG. Kunhalom (Karcag / Hungary)	F (3)	A (4)	A (7)
Fürjes (Bartolak – breeder's candidate / Hungary)	F (1)		A (7)
Bánkuti (Old Hungarian variety)	F(1)		A (4)
Laurenzio			F (1)

Farms location in 2012/13: Mezőberény, Kömlő, Füzesgyarmat, Zagyvarékas, Hajdúböszörmény. 2013/14: Mezőberény, Tornyiszentmiklós, Békésszentandrás, Hajdúböszörmény. 2014/15: Mezőberény, Tornyiszentmiklós, Nagydorog, Hajdúböszörmény, Somogyvámos, Zalaháshágy. "A" means varieties recommended for every farmer, "F" means farmer's choices. In brackets: number of trial sites

2.2 Methods

Varieties were sown in large subsequent parcels by participating farmers. Previous crop and soil management was homogenous within the trial plot. Sampling was conducted using 1x1 m quadrates in three repetitions per variety. In some cases separate harvesting of varieties allowed an exact measurement of yields. Quality measurements were pursued using rapid tests (NIR). Falling number was measured with traditional wet-chemistry methods. Results were compared with the national quality standard MSZ 6383 (2012) of common wheat.

Table 1 Growing system parameters at the research sites (2014)

Research site	Földes	Tornyiszentmiklós	Hajdúböszörmény
Humus content of soil (%)	2.2	1.9	3.5
Previous crop	maize	maize	maize
Row spacing (cm)	76.2	50	35
Number of plants	500	600	500

3 Results

The goal of the study was to find varieties that produce high quality organic wheat that meet customer needs, and provide competitive yields for economical viability. In the first year (2012/13) varieties recommended by breeders typically achieved good yields, but modest quality, mostly under the threshold of first class quality (Table 2). Most of the farmers included their favored (proven) variety into the trial as local control. Farmers' choices typically produced better quality than breeders' recommendations, but lower yields (Table 3).

2013 provided favorable conditions for wheat production in Hungary. Contrarily, 2014 was a climatically difficult year (heavy rains during summer and autumn). Despite the fact that

breeders – in light of first results – changed almost all tested varieties for the second year, in 2014 none of the newly suggested varieties could reach premium quality. Farmers' preferred choices performed similarly.

Table 2 Average values of wheat varieties recommended by breeders (2012/13)

Variety	Yield (t ha)	Protein (%)	Wet gluten (%)	Sedimentation value (Zeleny index) / (ml)	Alveograph (W) value (10^{-4} J)
Exotic	4,3	12,2	25,5	44	219
Rustic	4,4	11,1	23,3	37	236
GK Fény	4,1	11,5	23,7	43	289
GK Petur	4,2	12,1	24,9	44	235

Table 3 Results of farmers' variety choices (2012/13) – Average values of test locations

Variety (farm location)	Yield (t ha)	Protein (%)	Wet gluten (%)	Sedimentation value (Zeleny index) (ml)	Alveograph (W) value (10^{-4} J)
Bitop (Kömlő)	3,10	13,3	29,1	48	369
Fürjes (Kömlő)	2,81	13,5	29,6	48	308
GK Hunyad (Füzesgyarmat)	5,22	13,1	28,0	48	279
GK 0909 (Füzesgyarmat)	3,85	13,4	29,4	50	317
Bánkuti keverék (Füzesgyarmat)	3,60	14,8	34,0	61	360
Lupus (Mezőberény)	3,63	12,1	26,0	48	250
KG Kunhalom (Kömlő, Füzesgyarmat)	4,1	14,0	31,4	57	322

In the 2014/15 season only one variety was withdrawn from the test, while the overall number of varieties available for testing increased to above ten. More varieties preferred and produced successfully in 2013 by farmers were included in the assortment. Results of the 2014/15 season will be presented at ICOAS 2015.

4 Conclusions

Results of the first two years of participatory on-farm wheat variety tests on Hungarian organic farms reaffirm the fact that the biological basis of production is crucial for good agricultural performance, also in organic farming (Lammerts et al., 1999). First year results suggest that farmers' experience and variety preference may be of special importance when defining breeding priorities for organic wheat cultivars.

Hungarian breeders and seed companies involved in the 2012/13 trial recommended conventionally bred varieties that could not perform well under organic production circumstances. Second year results show that even proven varieties of farmers cannot guaranty premium quality in climatically difficult years. Therefore, further testing of available cultivars is essential for defining locally adapted wheat varieties, suitable for Hungarian organic production.

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