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Formation of triticale crop ideotype for organic farming

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SUMMARY – In 2004 in State Priekuli Plant Breeding Institute testing of winter triticale breeding lines for organic farming was initiated. The first tasks of this testing were to determine the most important traits and their optimum expressions to be utilised as selection criteria in plant breeding for organic farming. Nineteen lines were tested simultaneously in organic and conventional field, to compare yield and grain quality for the same lines. Different traits were tested for lines in organic field and importance of different trait influence on yield and quality traits was evaluated. The results prove, that breeding lines react to growing conditions differently. Important traits for organic crop ideotype of triticale for Latvian conditions are: good winterhardiness, resistance to snow mould, good weed competitiviness, early maturity, prostate growth habit and greater leaf size. Plant height did not influenced significantly competitiviness against weeds and yield.

Introduction

For the last 50 years, varieties of cereals have been specifically developed to produce high yields under potentially unlimited use of pesticides and synthetic fertilisers. Currently, organic farmers largely depend on varieties supplied by conventional plant breeders. New varieties adapted to organic farming systems are required for further optimisation of organic product quality and yield stability (Lammerts van Bueren *et al.*, 2002). For creating varieties adapted for organic farming special breeding programs are started in different places. Such qualities like yield stability, efficient uptake and use of nutrients, weed competitiviness, broad durable tolerance to diseases and pests, grain quality (Goyer *et al.*, 2005; Kopke, 2005), should be brought to the forefront in those breeding programs.

In 2004 in State Priekuli Plant Breeding Institute, the testing of winter triticale breeding lines for organic farming was initiated (Skrabule, 2005). The first tasks of this testing were: to determine the most important traits and their optimum expressions to be utilised as selection criteria in plant breeding for organic farming.

Materials and methods

In our trials there were 25 different winter triticale breeding lines, selected from conventional breeding. Their program testing in organic field were started in 2005 with the aim of finding the most desirable traits for triticale organic crop ideotype for Latvian growing conditions. Nineteen lines were tested simultaneously in conventional field too, to compare yield and grain quality for the same lines in organic and conventional growing conditions.

Yield, heading, maturity, winter hardiness, lodging, infection with leaf diseases (*Septoria* spp., *Puccinia* spp., *Rhynchosporium* spp. a.s.o), infection with snow mould (*Microdochium nivale*), plant height, leaf size, plant growth habit, grain quality parameters (1000 kernel weight, protein content, volume weight, falling number) were estimated for all lines in organic field. Importance of different traits influence on yield and quality traits (protein content) was tested. The correlation analysis was used to find out the most acceptable traits for organic crop ideotype of triticale.

Results and discussion

The first obtained results certify, that different lines respond differently on organic and conventional growing conditions (Table 1). The average yield, 1000 kernel weight and volume weight were higher

in conventional field. The average protein content in grain was higher in organic growing conditions. However, it was possible to select lines with higher yield and grain quality in organic growing conditions (lines '9507-31', '9540-1') and lines which were performing better in conventional conditions (lines '9405-23', '9403-142').

Table 1. Results of lines testing in biological and conventional fields (Priekuli, 2005)

Line	Yield (t/ha)		Protein (%)		1000 kernel weight (g)	
	Biol. field	Conv. field	Biol. field	Conv. field	Biol. field	Conv. field
9507-31	6.36	4.33	11.3	10.6	50.1	49.1
Disco	6.05	7.54	11.7	11.0	45.4	49.0
9540-1	5.49	4.74	11.1	9.7	42.1	39.3
9506-22	5.36	4.29	11.6	10.9	44.7	46.0
9405-23	5.31	7.43	10.2	10.9	43.9	45.0
285-3	5.28	5.38	10.2	8.5	40.0	36.9
9403-142	4.82	6.35	10.5	11.5	52.9	57.7
Average	4.76	5.01	11.3	10.9	45.7	46.0
Min-max	3.11-6.36	3.49-7.54	9.9-12.9	8.5-12.7	40.0-52.9	36.9-57.7

The results prove, that breeding lines react to growing conditions differently. At least testing of breeding lines must be done in organic growing conditions, to be able to select varieties with better suitability for organic system. It would be necessary also to carry out research and clarify, if crossing and selection of elite plants from hybrid populations must be done in organic conditions or it is possible to do it in conventional breeding field.

The first gained results show the significant influence of winterhardiness ($r = 0.504 > r_{0.05} = 0.396$; $n = 25$), the amount of weeds in the plot ($r = 0.639 > r_{0.05} = 0.396$; $n = 25$) and awns length ($r = -0.483 > r_{0.05} = 0.396$; $n = 25$) on the yield in organic field. The shortest genotypes got infected more with leaf diseases ($r = -0.409 > r_{0.05} = 0.396$; $n = 25$). Infection with snow mould decreased winterhardiness ($r = -0.581 > r_{0.05} = 0.396$; $n = 25$) and number of plants per plot ($r = -0.410 > r_{0.05} = 0.396$; $n = 25$). Infection with leaf diseases did not influenced significantly yield and grain quality. Early maturity has not influenced the yield significantly, but have increased protein content in grain ($r = -0.415 > r_{0.05} = 0.396$; $n = 25$). Thousand-kernel weight was positively influenced by leaf size ($r = 0.688 > r_{0.05} = 0.396$; $n = 25$) and spike length ($r = 0.553 > r_{0.05} = 0.396$; $n = 25$).

The first obtained results indicated, that important traits for organic crop ideotype of triticale for Latvian conditions are: good winterhardiness, resistance to snow mould, good weed competitiviness, early maturity, prostrate growth habit and greater leaf size. Plant height is one of important characteristics for organic farming (Ostergaard and Jensen, 2004) because higher plants mostly have larger leaves and they are infected less with leaf diseases. But plant height not influenced significantly competitiviness against weeds and yield. It is not yet clear if it influenced yield and quality parameters resistance to leaf diseases (rusts, Septoria leaf spot, mildew).

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