

EVALUATION OF QUALITY AND QUANTITY PARAMETERS IN WINTER WHEAT PRODUCTION ON CHERNOZEM SOIL

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Introduction

The winter wheat is one of mankind's ancient grains and in Hungary's plant cultivation is one of the most important crops (Barnard – Bona, 2004).

Winter wheat is produced almost on every farm or estate. It is vital to focus on the quality of the crop not only on its quantity. The quality of winter wheat is determined by the biological basis, the agro-ecological circumstances and the agro-technology altogether (Bocz et al., 1983, Pepó, 2000). In the last decade the level of agronomical expenditures decreased. Plant improvement tried to adjust itself to the reduced input application and resulted in the appearance of more and more, stronger varieties with better adaptability (Pepó, 2002). Hungary's agro-ecological characteristics provide adequate ground for the qualitative wheat production (Szabó et al., 1987). From the agro-technical factors, the nutrient supply has a significant effect on the quality and quantity of wheat (Ragasits, 1998). A fertilizer in the adequate dose, rate and division can ensure the quality parameters and moderate the negative effects of the unfavorable ecological and agro-technical factors (Győri et al., 1998, Jolánkai et al., 1998).

Methods

The research was conducted in the growing seasons of 2003/2004 and 2004/2005, after forecrops of maize and peas on five different fertilizer levels (control, $N_{50}+PK$, $N_{100}+PK$, $N_{150}+PK$, $N_{200}+PK$) and by using three plant protection technologies (extensive, average, intensive) at Látókép, the Experiment Site of the University of Debrecen, Centre of Agriculture, Faculty of Agricultural Sciences, Department of Crop Production and Applied Ecology under the polifactor continuance experiment adjusted by professor László Ruzsányi in 1983. The examined variety was the Mv Pálma.

The soil of the experiment was calciferous chernozem soil. The soil's status before the experiment was characterized by medium humus content (2,8%) and phosphorous supply (Al soluble P_2O_5 133 $mgkg^{-1}$) and favorable potassium supply (Al soluble K_2O 240 $mgkg^{-1}$). The pH (KCl) value was 6,2, the Arany-fixity was 43. The soil can be described with medium water-reception and good water-bearing features. The ground water was between 6-8 meters. The agro-technical operations (cultivation, sowing, harvesting) fulfilled the requirements of modern crop production.

From the viewpoint of the development of winter wheat the weather of the growing seasons of 2003/2004 and 2004/2005, during autumn, spring and the early summer period were characterized by favorable weather and water supply.

Results and discussion

The effects of the forecrops, the fertilizer doses and the plant protection technologies on the yields and quality parameters (valorigraphic value, wet gluten content %) were examined in our research.

In this study, the yields are analyzed first. In the crop after maize forecrop, small differences (40-250 $kg ha^{-1}$) were realized between the yields of control parcels treated with different

plant protection technologies in both years (Table 1). The yields of the control parcels of the crop sowed after peas showed more significant differences ($500 - 900 \text{ kg ha}^{-1}$), because the peas enriched the soil in nitrogen, so the soil of the control parcels had adequate nutrient supply for the development of wheat. After the more unfavorable maize forecrop the yields reached their maximum on higher ($N_{100}+PK$) level in all the three plant protection technologies in both years then after the favorable peas green crops, because these crops showed the highest yields on $N_{50}+PK$ level.

It was observed in the case of the plant protection technologies that the parcels treated with extensive technology (with the exception of the control parcels) provided the lowest and the parcels treated with intensive plant protection technology the highest yields.

Using correlation analyses, the connections between the crop quantity, the doses of fertilizers, plant protection technologies and forecrops were defined (Table 2.). The doses of fertilizer and the quantity of crops showed a loose, but significant connection. From the viewpoint of the wheat the correlation between the forecrops and the quantity of crops was strong in 2004, and in 2005 with the somewhat less favorable weather it was medium. Loose correlation could be determined between the plant protection technologies and the yields.

The quality indicators were examined in the growing season of 2003/2004. We stated that after maize forecrop, the valorigraphic value was the highest on $N_{150}+PK$ fertilization dose, and after peas on $N_{200}+PK$ (Figures 1 and 2). The gluten content was the higher on $N_{150}+PK$ both after maize and peas forecrops.

Table 2. Values of correlation indices among fertilization, crop protection and forecrops (Debrecen 2004-2005.)

	Fertilizer doses	Plant protection technologies	Forecrops
2003/2004. year			
Yield	0,357**	0,186*	0,543**
2004/2005. year			
Yield	0,386**	0,200*	0,338**

** Correlation is significant at the 0.01 level

* Correlation is significant at the 0.05 level

Table 1. The effects of plant protection and fertilization on the yields of winter wheat (Debrecen, 2004-2005.)

Forecrops	Plant protection technologies	Fertilizer doses (kg ha^{-1})	Yield : (kg ha^{-1})	
			2004. year	2005. year
Maize	extensive	control	2513	3654
		$N_{50}+PK$	5017	6201
		$N_{100}+PK$	7231	7678
		$N_{150}+PK$	6983	7551
		$N_{200}+PK$	6853	7451
	average	control	2714	3392
		$N_{50}+PK$	4873	6602
		$N_{100}+PK$	8186	8559
		$N_{150}+PK$	7215	7977
		$N_{200}+PK$	6243	7464
	intensive	control	2477	3500
		$N_{50}+PK$	5567	7029
		$N_{100}+PK$	8214	8907
		$N_{150}+PK$	7287	8472

Peas	extensive	N ₂₀₀ +PK	6231	7815
		control	7257	7249
		N ₅₀ +PK	7510	8125
		N ₁₀₀ +PK	6730	7625
		N ₁₅₀ +PK	6429	7179
	average	N ₂₀₀ +PK	6578	7054
		control	7758	7446
		N ₅₀ +PK	8855	8668
		N ₁₀₀ +PK	8243	7752
		N ₁₅₀ +PK	7991	7521
	intensive	N ₂₀₀ +PK	7920	7070
		control	7221	8159
		N ₅₀ +PK	9429	9080
		N ₁₀₀ +PK	8295	8084
		N ₁₅₀ +PK	8396	7916
		N ₂₀₀ +PK	8129	7779

Figure 1. The effects of maize forecrop and fertilization on quality parameters of winter wheat. (Debrecen 2004.)

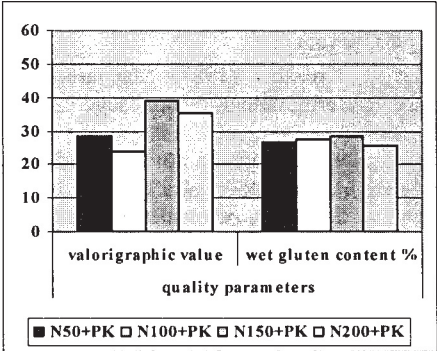
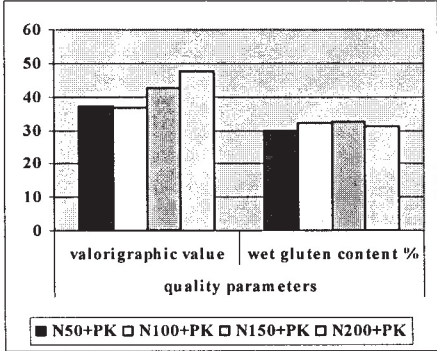


figure 2 The effects of peas forecrop and fertilization on quality parameters of winter wheat. (Debrecen 2004.)



Conclusions

Good yields could be achieved with adequate nutrient supply after both forecrops. As a result of the favorable effect of peas, more yields were achieved with lower input than after maize. By choosing favorable forecrops the costs can be reduced considerably and the environment can be protected. The quality indicators were the best on higher fertilizer level in both cases. Thus, to achieve better quality, more nutrients are needed than to achieve maximum yields.

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