STUDY OF FERTILIZATION ON THE YIELD COMPONENTS, YIELD AND QUALITY OF WINTER WHEAT

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Abstract. *We examined the influence of different fertilizer doses on the yield components, yield and quality of winter wheat on meadow soil in 2016-2017 years in Hódmezővásárhely. The experiment was carried out on the area of SZTE Tangazdaság Ltd. in three replications. Six fertilizer steps were applied besides the control: N80PK30, N100PK30, N130PK30, N150PK30, N170PK0, N170PK50 kg/ha active ingredients. The year 2016-2017 was unfavourable for winter wheat production. The amount of precipitation in the vegetative period of winter wheat was lower by 80.2 mm than the average. The obtained data were processed by single factor variant analysis. The yield components, yield, and quality parameters reached the highest value in N130PK30 treatment. The fertilization significantly increased the yield and number of spike. The thousand seed weight, Zeleny number and crude protein content of grain did not changed statistically justified compared non fertilized treatment. We can conclude, that, the N130PK30 kg/ha fertilizer dose was the most favourable concerning the yield components, yield and quality parameters of the examined winter wheat variety.*

Key words: *winter wheat, fertilization, yield components, yield, quality*

INTRODUCTION

To determine the harmonical nutrient supply is crucial as it has a considerable effect not only on the volume and quality of yields and the environment but also on the effectivness of production (SÁRVÁRI, 1984). The cropyear basically determined the dry matter production, assimilation area and yield of winter wheat, these effects were modified by fertilization. The effects of genotypes were moderated (PEPÓ, 2005).

Nutrient supply is one is the most important agrotechnical element in winter wheat production. It had a direct and indirect effect on the other agrotechnical components. The proper fertilization is not only the yield and the yield stability can increased, but also can improve the quality of winter wheat (PEPÓ AND ZSOMBIK, 2002). Numerous macro-, meso- and microelements had importance in winter wheat fertilization. However, in the practice only three macronutrients (N, P, K) is of particular importance. Among of these three macroelements, the nitrogen had the highest effect on the yield and quality of winter wheat (ÁRENDÁS, 2005). The efficiency of nitrogen fertilization influences the time of application and sharing in great extent (ÁRENDÁS ET AL., 2006, KAJDI, 2005). In the case of same N dosage the shared N (winter + spring) much more effective compared to a single application (only fall or only spring) (PEPÓ, 2001). Based on the domestic and foreign results show that 300-350 kg/ha NPK is the optimum nutrient demand of winter wheat. This nutrient amount can modify the ecological, biological and agrotechnical factors. There are significant differences between fertilizer and N reaction of different winter wheat genotypes (PEPÓ, 2014; SÁRVÁRI, 2006).

The low yield averages in winter wheat production can be due to the fall-back of chemical fertilisation; this is why the use of fertilisers must be increased in order to reach

higher and more consistent amounts of crop (HORVÁTH AND KOMAREK, 2016; KOMAREK 2006, 2007a, 2007b, 2008).

In favourable year after good forecrop the winter wheat reached the maximum yield in N80PK30 treatment. The fertilization had different effect on the examined generative factors. The thousand seed weight did not change significantly, but the change of length of spike and number of spiklets under the influence of fertilization was significant (JAKAB ET. AL., 2017).
Beside the yield amount the nutrient supply had great effect on the different yield components of winter wheat. The higher N dosage increased the number of spikes and the number of grains in spike (RUZSÁNYI, 1985).

The PK and the NPK treatments significantly increased the number of shoots, the number of ears, the number of spikelets (KRISTÓ ET AL., 2008).
In addition to the nitrogen the phosphorus also play an important role in increasing the number of spike of winter wheat (RAGASITS, 1998).
There is significant correlation between N supply and thousand seed weight. Fertilization had a significant effect on the length of spike, weight of spike and grain number of spike (JAKAB ET AL., 2016; LÖNHARDNÉ ET AL., 1995).

MATERIAL AND METHODS

The field experiment was carried out on the area of SZTE Tangazdaság Ltd. in Hódmezővásárhely in 2016-2017 years. The soil was meadow, the reaction of which was nearly neutral (pH_{KCL} 7.16). Before setting the experiment the soil analysis data showed that it had good nitrogen, and very good phosphor and potassium contents (Table 1).

Table 1

Main properties of the experimental field area

pH (KCL)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (K_A)
7.16	335.6	619.6	3.38	48

Weather conditions
The year 2016-2017 was unfavourable for winter wheat production. The amount of precipitation in the vegetative period of winter wheat was lower by 80.2 mm than the average. The distribution of precipitation was unfavourable. The rainfall in October, November, April and May was more than the average, while in December, January, February, March, June, and July less rain fell compared the average (Table 2).

Table 2

The distribution of precipitation in the vegetative period of winter wheat in 2016-2017

Month	Rainfall (mm)	Average rainfall (mm)	Difference (mm)
October	88.0	34.7	53.3
November	50.0	41.1	8.9
December	2.0	43.0	-41.0
January	20.0	30.6	-10.6
February	24.0	30.1	-6.1
March	11.0	29.8	-18.8
April	43.0	39.9	3.1
May	71.0	58	13.0
June	48.0	75.3	-27.3
July	4.0	58.7	-54.7
Total amount of rainfall (mm)	**361.0**	**441.0**	**-80.2**

Main features of the agro-technology applied

The small-scaled plough experiment was set in three replications, organised as a random block in 2016. Beside the control we applied six fertilizer treatments: N80PK30, N100PK30, N130PK30, N150PK30, N170PK0, N170PK50 kg/ha active ingredients. The forecrop was sunflower. Fall tillage involved ploughing at 25 cm depth. Before the harvest we calculated the yield components (thousand seed weight, lenght of spike, number of spiklets). We processed the obtained data by single factor variant analysis (SVÁB, 1981).

RESULTS AND DISCUSSION

We studied the effect fertilization on the yield components of winter wheat (the number of spikes/m^2, grain number in spikes, and thousand seed weight). Fertilization had influence on the yield components of winter wheat. The number of spikes/ m^2 was 564.67 in control treatment. Under the influence of fertilization the values increased. The maximum values were 657.67 and 677.33 pieces in N100PK30 and N130PK30 kg/ha treatments. This results was significantly higher compared the control (Figure 1).

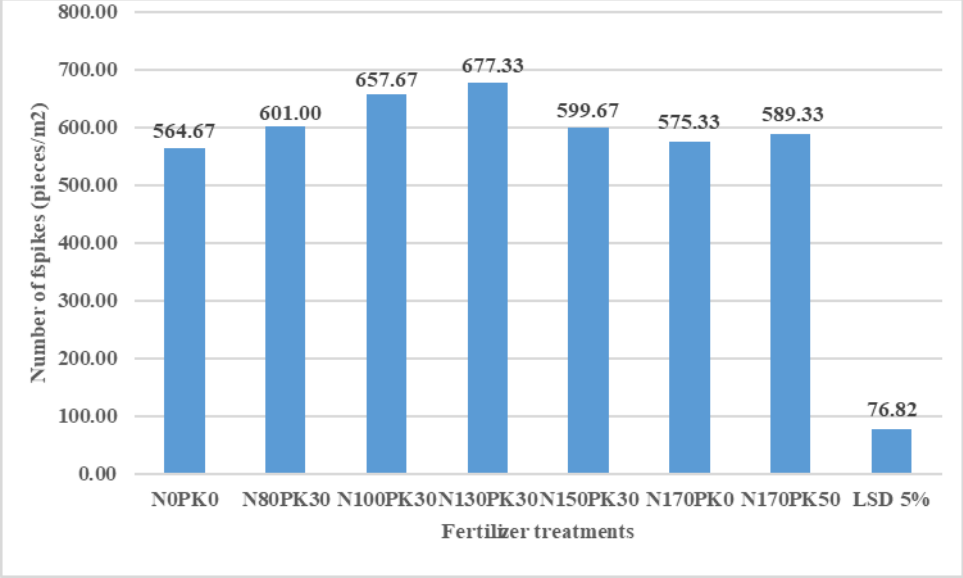

Figure 1. The number of spikes/m^2 of winter wheat in different fertilizer treatments

The thousand seed weight is highly dependent on the genetically background of variety. However, the ecological and agrotechnical factors are able to influence this value. Among the agrotechnical factors, the fertilization had the highest effect on this property. Our study proved, that the thousand seed weight is strongly dependent the genotype. The thousand seed weight was 31.8 g in control treatment. Fertilization slightly increased this parametes, its effect was not significant. The highest value was 32.71 g in N130PK30 treatment (Figure 2).

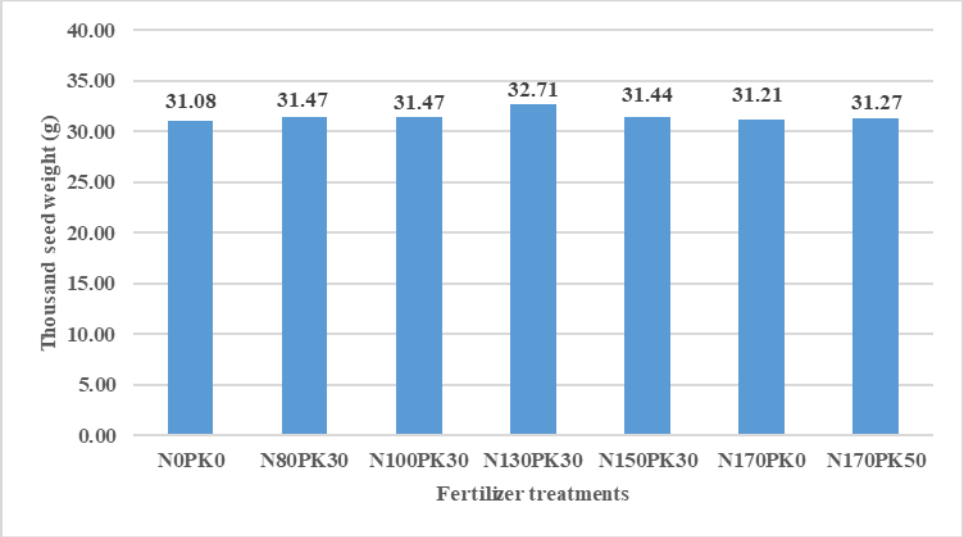

Figure 2. The effect of fertilization on the thousand seed weight of winter wheat

The grain number in spike is an important yield component. The fertilization can increased this yield component. In our examination the grain number in spike in control treatment was 36.50 pieces. Under the influence of fertilization, the values increased (40.8-43.77 pieces). The highest value, 43.77 pieces was in N130PK30 treatment, but the difference compared the control was not statistically justified (Figure 3).

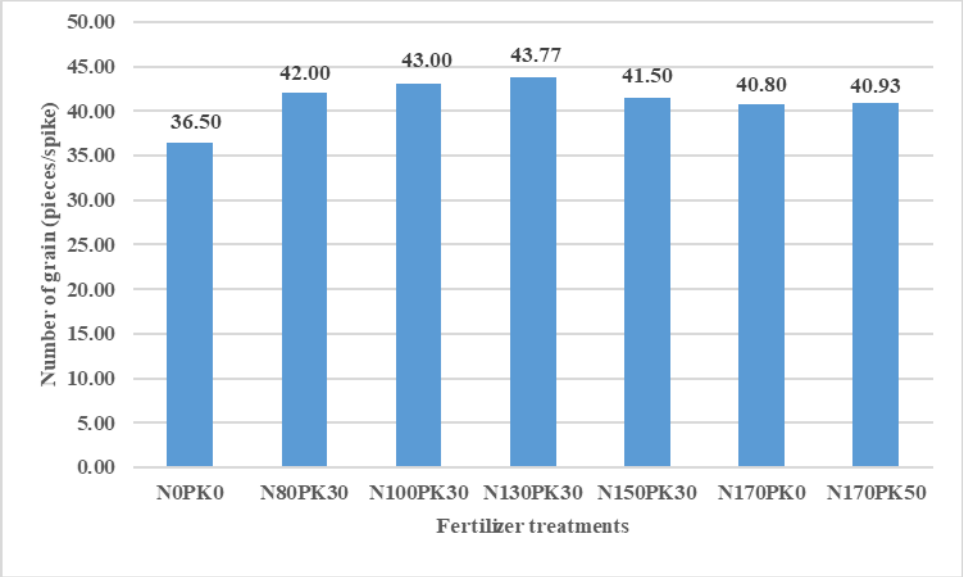

Figure 3. The effect of fertilization on the grain number in spike of winter wheat

Without any fertilizers the yield was 4.2 t/ha. It shows, that this variety has good nutrient exploration and utilization capacity. The newer winter wheat varieties are improved both in the natural nutrient exploration and utilisation capacity and in their reaction of fertilizers. In N130PK30 treatment we reached the maximum yield amount, 5.6 t/ha, which was significantly higher compared the control. The higher fertilizer doses did not increase the yield compared the N130PK30 treatment (Figure 4).

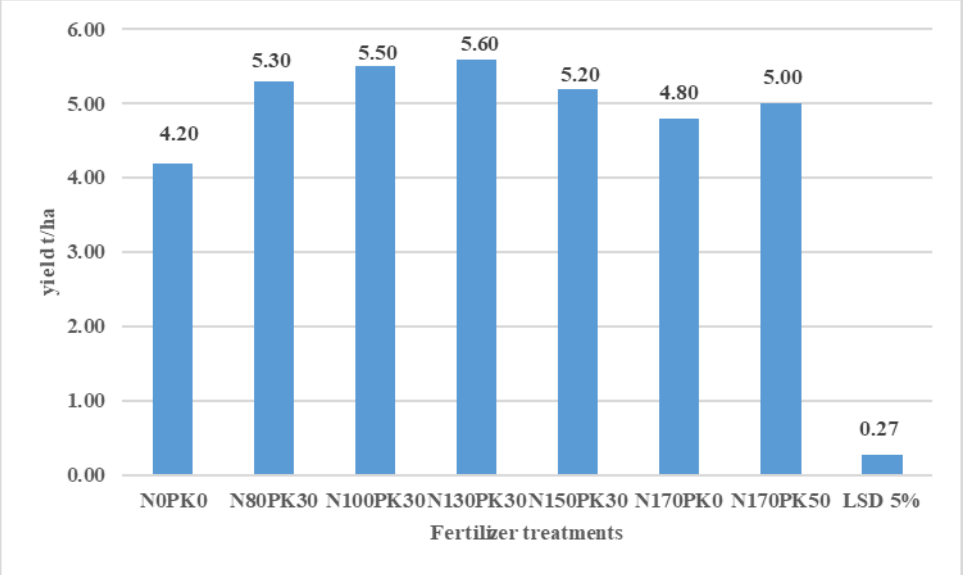

Figure 4. The effect of fertilization on the yield of winter wheat

The quality parameters of grain has great importance in winter wheat production. The winter wheat has numerous quality parametes. We studied the effect of fertilization on the crude protein content and Zeleny number of winter wheat. The crude protein content of grain was 17.6% in control treatment. In the most cases we got higher results compared the control. The highest value was 18.7% in N100PK30 and N130PK30 treatments. The increasing was not significant compared the control results (Figure 5).

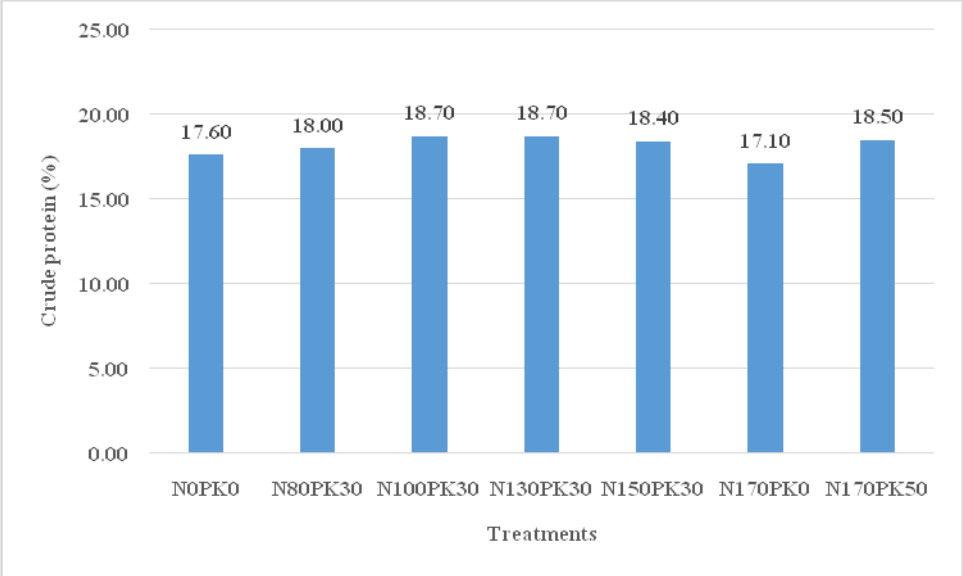

Figure 5. The effect of fertilization on the crude protein content of winter wheat

The other examined quality parameter was the Zeleny number. We studied how changed the Zeleny number in different fertilizer treatments. The minimum value was in control treatment (70.4 ml). Under the influence of fertilization we measured higher results. The Zeleny number was the highest in N130PK30 treatment (76.0 ml). The difference was not significant between control and this treatment. In the higher fertilizer treatments (N150PK30, N170PK0, N170PK50) we calculated less values (66.6-74.8 ml) compared the N130PK30 treatment (Figure 6).

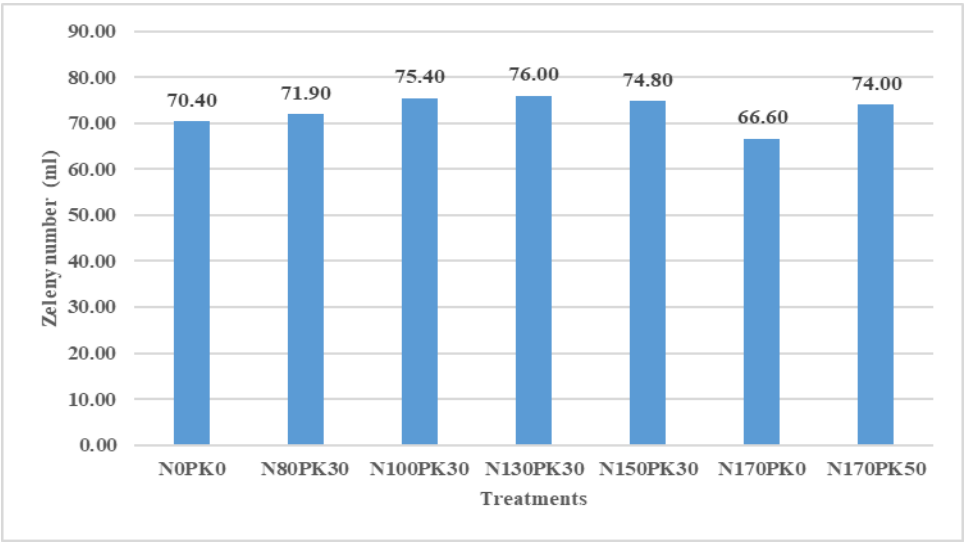

Figure 6. The effect of fertilization on the Zeleny number of winter wheat

CONCLUSIONS

The year 2016-2017 was unfavourable for winter wheat production. The amount of precipitation in the vegetative period of winter wheat was lower by 80.2 mm compared the average. Therefore, the yield of control plots was moderate 4.2 t/ha. Compared this result we measured higher result is fertilizer treatments. We got the highest yield 5.60 t/ha in the N130PK30 fertilizer treatment. The fertilization had different effect on the examined generative factors. The thousand seed weight and grain number of spike did not change significantly, but the change of the number of spikes/m^2 under the influence of fertilization was significant. The fertilization had effect on the quality parameters of winter wheat. The Zeleny number and crude protein content reached the maximum values in N130PK30 treatment, but the increasing was not statistically justified. We can conclude that concerning the yield amount, yield componets and the quality parameters of grain the moderate fertilizer dosage N130PK30 was the most favourable fertilizer dosage in our experiment.

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