INVESTIGATION OF NUTRIENT SUPPLY IN DIFFERENT MAIZE HIBRIDS

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Abstract

The research was set up on chernozem soil at the Látókép research area of the University of Debrecen in Hungary. We examined the yield and the yield production per 1 kg NPK fertilizer utilization of hybrid PR37N01, PR37M81and SY Afinity in 2013. We found that SY Afinity produced the most yield at the level of N_{120}+P (18,619 kg ha^{-1}) while PR37M81 reached the highest yield at level N_{150}+PK (16,754 kg ha^{-1}). Studies related to yield production per 1 kg NPK indicated that the best results were achieved at level N_{30}+PK compared to the control treatment. Yield production per 1 kg NPK was17.6 kg kg^{-1} by PR37N01, 44.2 kg kg^{-1} by PR37M81and 25.6 kg kg^{-1} by SY Afinity.

Key words: hybrids, maize, nutrient levels, fertilization

INTRODUCTION

Maize occupies the largest area of cultivation in Hungary which varies between 1.1 and 1.2 million hectares (Nagy and Megyes, 2009). The relationship between the effect of vintage, fertilization and maize hybrids is very strong (Sárvári and Boros, 2009). According to Pepo (2001) in excessively dry, droughty years fertilization did not have any yield raising results, while under favourable circumstances it could bring a yield raise of up to 50%. The type-specific fertilization is a fundamental factor of nutrient management. The different genotypes have different agronomic and vegetal-physiological features. Finding the optimal fertilization dosage is one of the most difficult tasks in crop production technology. The cropyear and different agrotechnikal factors (fertilization, crop rotation, irrigation etc.) could modify the yields of different maize genotypes (Pepó et al. 2006). Nutrient exploitation facility, reaction on fertilizer and vintage effect have to be taken into consideration at each grew hybrid (Nagy, 2007). Radics (2003) proved that nitrogen utilization of various maize genotypes (hybrids, inbred strains) is different. The amount of nutrients needed has to be determined based on the estimated yield and nutrient supply of the soil. Zembery et al. (2011) describe a significant relationship between the fertilization and the yield of maize. Several researches (Moser et al., 2006) stated that water and nitrogen supply were key elements in maize production.

According to the experimental results of Rácz and Nagy (2011), on chernozem soils of medium-good NPK supply, the nutrient doses above 120 kg ha-1 N didn't increase the yield in economical extent. In fact, in dry weather year, N dose above 120 kg ha-1 decreased maize yields directly.

MATERIAL AND METHOD

The research was set up on chernozem soil with lime patches at the Látókép research area of the University of Debrecen. The research area is located in Eastern-Hungary on the area of the aeolain loess of the Hajdúság. Tilth of the research area is around 80 to 90 cm, is of good agricultural condition, medium hard and loamy with medium humus content. Features of water supply of the soil are favorable. The long-time experiment was set up in 1983.

In 2013 we used the PR37N01, PR37M81, SY Afinity hybrids as a small parcel research in four repetitions. Our pre-crop was winter wheat. The fertilization covered six levels of treatments shown in Table 1. 50% of the nitrogen and 100% of phosphorus and potassium were applied in the autumn in the special complex form 10:15:18. The residual 50% of nitrogen was applied during the spring in the form of a 34% ammonium nitrate on each parcel.

Table 1

Applied fertilizer doses (Debrecen, 2013)

Treatment	N	P_2O_5	K_2O
	kg ha^{-1}		
Control	0	0	0
1	30	22,5	26,5
2	60	45	53
3	90	67,5	79,5
4	120	90	106
5	150	112,5	132,5

By comparing rainfall data, we established that the amount of rainfall in the first half of 2012 (332.7 mm) exceeded the 30-year average of that of the same period (220.2 mm). Rainfall levels in April 2012 (48.0 mm) and May (68.7 mm) were also lower than the long term average (42.4 mm and 58.8 mm). Precipitation values in June (30.8 mm), July (15.6 mm) and August (32.2 mm) was lower than that of the 30-year average (June: 79.5 mm, July: 65.7 mm, August: 60.7 mm). After comparing temperature data, we found that average temperature in the first half of 2012 (21.3^{o}C) exceeded the 30-year average (17.2^{o}C). Temperature measured in April

(12.0°C), May (16.6°C), and July 2013 (21.2°C) was also higher compared to the long term average (Table 2).

Table 2

Some important meteorological data (Debrecen, 2013)

	Precipitation (mm)		Temperature (°C)	
	2012-2013	30 year average	2012-2013	30 year average
October - March	332,7	220,2	3,6	2,9
April	48,0	42,4	12,0	10,7
May	68,7	58,8	16,6	15,8
June	30,8	79,5	19,6	18,7
July	15,6	65,7	21,2	20,3
August	32,2	60,7	21,5	19,6
September	47,6	38,0	14,0	15,8
Total	575,6	565,3	15,5	14,8

RESULTS AND DISSCUSIONS

Yield results indicated that the non-fertilized stocks produced the lowest yields in the case of hybrids (PR37N01: 14,250 kg ha^{-1}, PR37M81: 10,630 kg ha^{-1}, SY Afinity: 14,550 kg ha^{-1}. By increasing the fertilizer doses, we experienced yield growth up to level N_{120}+PK for hybrid PR37N01 and SY Afinity and up to level N_{150}+PK for PR37M81. Hybrid SY Afinity produced the highest yield at level N_{120}+PK (18,619 kg ha^{-1}) while PR37M81 reached its maximum at level N_{150}+PK (16,754 kg ha^{-1}). The application of maximum fertilizer doses resulted in yield decrease in the case of hybrid PR37N01 (17,127 kg ha^{-1}) and SY Afinity (17,718 kg ha^{-1}) compared to the results measured at level N_{120}+PK (PR37N01: 17,476 kg ha^{-1}, SY Afinity: 18,619 kg ha^{-1}).

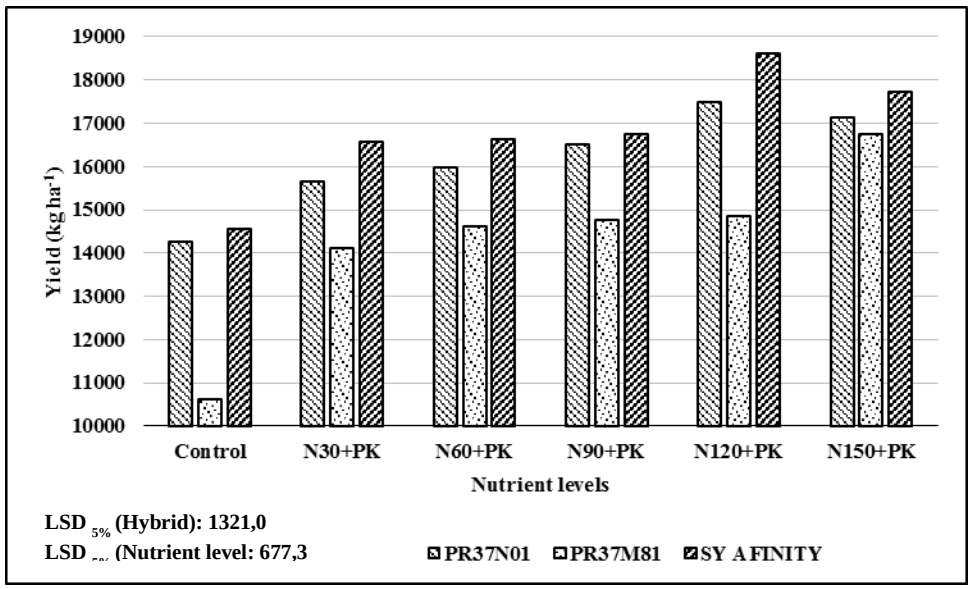

Fig. 1 The average yield of the hybrids on the different nutrient levels (Debrecen, 2013)

We also determined the yield production per 1 kg NPK. We found that the highest yield increase was measured at level N_{30}+PK compared to the control treatment. This increase was 17.6 kg kg^{-1} in the case of PR37N01 and 44.2 kg kg^{-1} in the case of PR37M81 and in case of SY Afinity (25.6 kg kg^{-1}). We experienced yield decrease at level N_{150}+PK for hybrid PR37N01 (4.4 kg kg^{-1}) and SY Afinity (11.4 kg kg^{-1}) while hybrid PR37M81 produced an increased yield at the same level compared to the results measured at level N_{120}+PK (24.3 kg kg^{-1}) (Fig. 2).

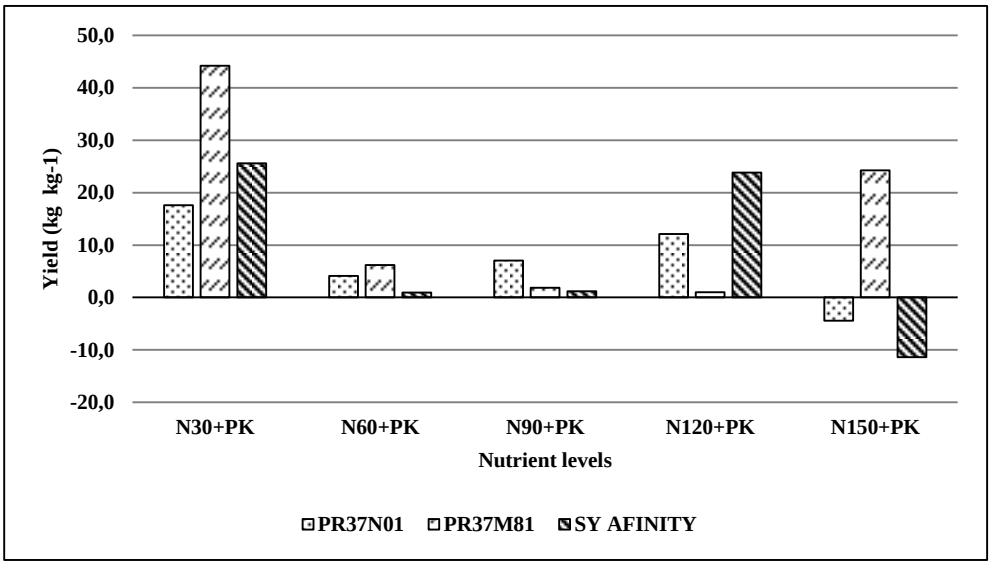

Fig.2 Development of the yield growth per each kg applied NPK fertilizer active substance (Debrecen, 2013)

CONCLUSIONS

The research was set up on chernozem soil at the Látókép research area of the University of Debrecen in Hungary. We examined the yield production, the yield production per 1 kg NPK fertilizer utilization of hybrid PR37N01, PR37M81 and SY Afinity in 2013. After examining the yield we found that yield production of hybrid P37N01 varied between 14,250 kg ha^{-1} – 17,476 kg ha^{-1} hybrid PR37M81 was between 10,630 kg ha^{-1} and 16,754 kg ha^{-1} while that of hybrid SY Afinity was between 14,550 kg ha^{-1} and 18,619 kg ha^{-1} at different nutrient levels. The highest yield results were achieved by PR37N01 (17,476 kg ha^{-1}) and SY Afinity at level N_{120}+PK (18,619 kg ha^{-1}) and at level N_{150}+PK in the case of hybrid PR37M81 (16,754 kg ha^{-1}). Pepó et al. (2006) proved the significance of hybrid-specific fertilization and the different nutrient utilization of maize hybrids based on their experimental results. We examined the amount of yield per 1 kg NPK and concluded that the highest yield increase was achieved at level N_{30}+PK compared to the control treatment in the case of both maize hybrids. Yield achieved per 1 kg NPK was 17.6 kg kg^{-1} in the case of PR37N01, 44.2 kg kg^{-1} in the case of PR37M81 and 25.6 kg kg^{-1} in case of SY Afinity.

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