6th INTERNATIONAL MULTIDISCIPLINARY CONFERENCE

THE EFFECT OF NUTRIENT SUPPLY ON THE YIELD AND QUALITY OF MAIZE HYBRIDS

Zoltán Futó – Péter Jakab

Tessedik Sámuel Collage, Agricultural College Faculty, Department of Crop Production, 5400 Mezőtúr, Petőfi square 1.

Abstract:

The experiment is a random block settling artificial fertilisation test carried out on small plots. During the experiment we applied seven different fertilizer bacteria treatments (Micro soil), which we supplemented with a control plot.

We have stated shat the grain moisture content was the highest during the control treatment. The reason probably is that under control conditions the nutrient supply of maize is not optimal.

The control plots had the lowest average yield, but these were between 6,25 and 7,6 t/ha, too. We can claim that improving the nutrient supply the crop results were higher. Without the bacteria treatment the crop results were between 7,8 and 9,5 t/ha *(Figure 3.)*. The most favourable results occurred in case of 40-80 kg/ha N treatment. Under the influence of soil bacteria treatments in many cases the average yields were better, which obviously proves the nutriment transformation ability of the bacteria. With bacteria treatments the result was 9,7 – 11,3 t/ha, so owing to this we registered 0,5 – 1 t/ha extra yield.

Keywords: maize, bacteria fertilizer, mineral fertilizer, yield, protein content

1. INTRODUCTION

Maize takes 22-25% of agricultural area and 28-29,5% of arable area on average. After World War II the average yield increased from 2,2 t/ha to 6 t/ha, and crop fluctuation was below 10-20%. At the moment the average yield varies between 3,5 and 6,7 t/ha, which is due to the neglected agrotechnical standard and the decrease of chemicals.

Berzsenyi and Lap (2003) think, that averaged over the years 1970-2002 the maize grain yields in the different N treatments were as follows t/ha: N-0: 3.69, N-80: 6.97, N-160: 8.33, N-240: 8.34. The maize grain yield and yield stability were greatest at the 160 kg/ha N rate. When the dry (12) and wet (21) years were compared, the yield surplus t/ha in wet years in each N treatment were: N-0: 1.29, N-80: 1.96, N-160: 1.87, N-240: 1.65. The agronomic efficiency kg/kg was the greatest in the N-80 treatment (45.8 in wet years, 34.8 in dry years). The correlation between grain number and grain yield was close at low N supply levels (stress

environment) and looser with favourable N supplies. The opposite trend was observed for the relationship between grain yield and thousand grain mass.

The first fertiliser level (40 kg/ha N + PK) had the most pronounced effect on leaf area, which increased to 2.90-3.84 m(2)/m(2). The leaf area did not increase so sharply with further increases in the fertiliser rate, but the maximum LAI values of 3.08-3.92 m(2)/m(2) were reached at higher fertiliser levels. On the basis of regression analysis, it could be concluded that the effect of the leaf area index (LAI) on yield was very strong *Futó (2003).*

Dobos and Nagy (1998) studied the effect of year and fertilisation on the dry matter production of the maize hybrid Volga SC was examined on a 5-year series of data in four replications, including two favourable and three unfavourable years, without fertilisation and with a fertiliser treatment involving 120 kg N/ha + 90 kg/ha P2O5 + 106 kg/ha K2O. In the unfertilised treatment there was a significant difference in the dry matter content of the maximum vegetative mass in the years examined. In the fertilised treatment higher values were recorded each year than in the control plots, the fertiliser effect being 17-19 % in 1991, 1993 and 1994 and 22-28 % in 1992 and 1995. The effect of the year and the fertiliser on grain yield were both significant in the years examined. In the years 1991-1994 the application of fertiliser led to a yield increase, while in 1995 drought during flowering resulted in yield depression.

Sárvári and Szabó (1998) studied that, the productivity and nutrient response of maize hybrids are significantly different. Hybrids which are able to produce high yields and greater revenue per hectare at smaller fertiliser doses are more valuable. Considering the aspects of efficiency and environment protection, maize needs only N60-120, P45-90, K53-106 kg/ha active agents. At N doses greater than N60-120 kg/ha quantity of NO3-N the 100-120 cm soil profile reaches 150-200 mg/kg, which could result in significant environment pollution.

2. MATERIAL AND METHOD

2.1. Soil properties of the experimental field

We set the experiment on the plot of the Department of Plant Cultivation at the Agricultural College Faculty of the Tessedik Sámuel College. The soil was calcareous meadow chernozem, the reaction of which was nearly neutral (pH_{KCL} 6,72). Before setting the experiment the soil analysis data showed that it had proper nitrogen, poor phosphor and good potassium content. The soil was hard to cultivate, with slow transformation of phosphor and potassium.

Main properties of the experimental field are shown in *table 1*.

Table 1.

pH (H_2O)	$CaCO_3$	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (Ka)
6,72	0,7	64	433	3,07	57

2.2. Weather in the experimental years

The weather was favourable on the whole for corn in the region of Mezőtúr in 2004. The weather in 2004 was more hostile than in 2003, there were significant rainfalls at the beginning of summer and just before harvesting. In general, yields were higher than average. Rainfall data are shown in *table 2.*

Table 2.

Mezőtúr rainfall in 2004											
Months	Jan.	Febr.	Marc.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Okt.	Sum.
Rainfall	40,8	45,6	62,5	55,8	50,5	78	147	54,4	29,7	44	608,3
Average rainfall	29	32	33	46	56	59	50	50	40	47	442
Difference	**11,8**	**13,6**	**29,5**	**9,8**	**-5,5**	**19**	**97**	**4,4**	**-10,3**	**-3**	**166,3**

2.3. Main features of the agrotechnique applied

The experiment is a random block settling artificial fertilisation test carried out on small plots. In the experimental years (2004), three fertilisation levels were applied in three replications besides the control, where the lowest fertiliser dosage was 40 kg N; 30 kg P_2O_5; 35 kg K_2O and the highest was three times more, 120 kg N; 90 kg P_2O_5; 105 kg K_2O.

Nitrogen was applied in autumn and spring in 50-50 %; the total amount of phosphorus and potassium was applied in autumn in one dosage. Fall tillage involved deep ploughing at 28-32 cm depth in the experimental years. During the experiment we applied seven different fertilizer bacteria treatments (Micro soil), which we supplemented with a control plot.

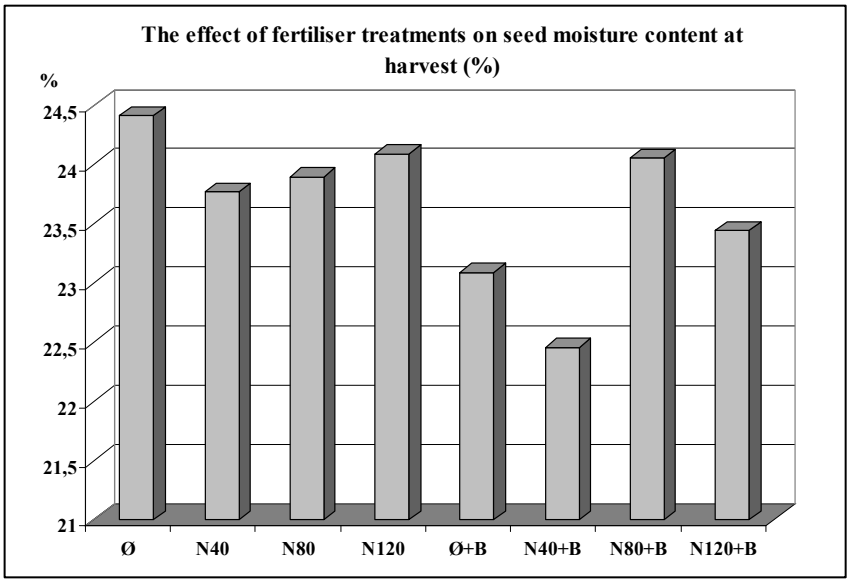
Table 3.

Treatments	Fertiliser dose
∅	0
N40	N 40 kg+P_2O_5 30 kg+K_2O 35 kg/ha
N80	N 80 kg+P_2O_5 60 kg+K_2O 70 kg/ha
N120	N 120 kg+P_2O_5 90kg+K_2O 105 kg/ha
∅+B	∅+1 l/ha Micro Soil
N40+b	N 40 kg+P_2O_5 30 kg+K_2O 35 kg+ Micro Soil 1 l/ha
N80+B	N 80 kg+P_2O_5 60 kg+K_2O 70 kg+Micro Soil 1 l/ha
N120+B	N 120 kg+P_2O_5 90 kg+K_2O 105 kg + Micro Soil 1 l/ha

3. RESULTS AND DISCUSSION

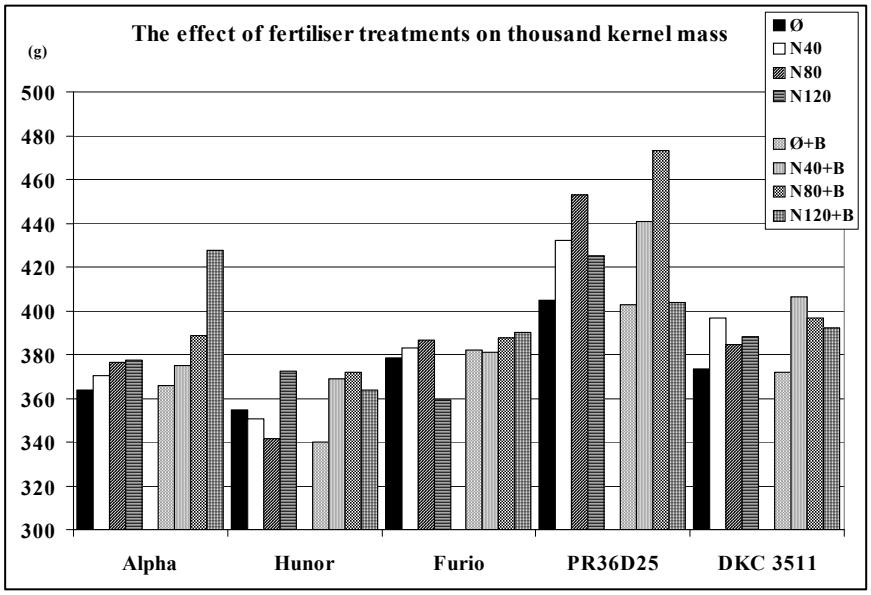
We have stated shat the grain moisture content was the highest during the control treatment *(Figure 1.)*. The reason probably is that under control conditions the nutrient supply of maize is not optimal. Improving the nutrient supply the decrease of moisture content can be observed. We have found significant differences only among hybrids.

Figure 1.



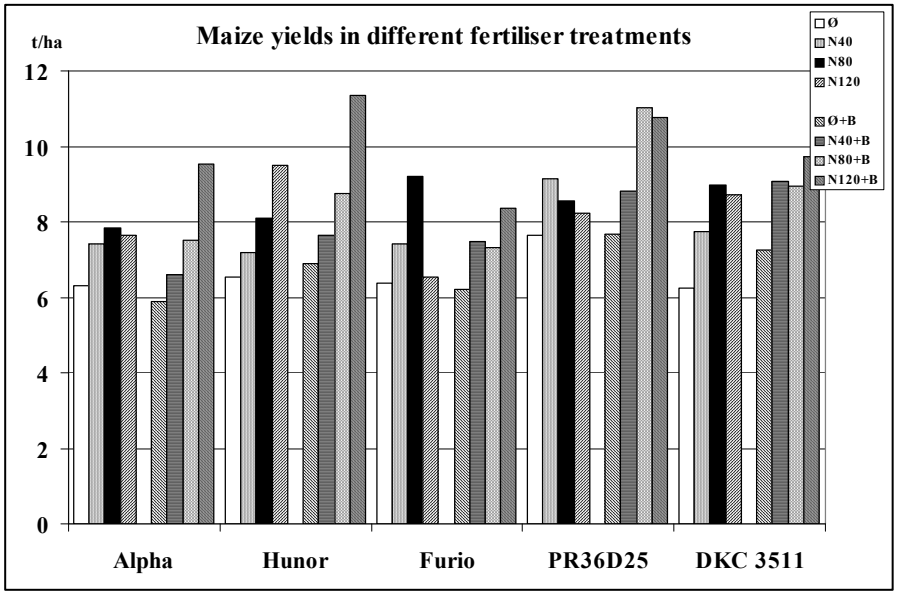
On the basis of the measured data in the experiment we have stated that improving the nutrient supply the thousand kernel mass will increase and the results on the plots of soil bacteria treatment are also better *(Figure 2.)*.

Figure 2.



The control plots had the lowest average yield, but these were between 6,25 and 7,6 t/ha, too. We can claim that improving the nutrient supply the crop results were higher. Without the bacteria treatment the crop results were between 7,8 and 9,5 t/ha *(Figure 3.)*. The most favourable results occurred in case of 40-80 kg/ha N treatment. Under the influence of soil bacteria treatments in many cases the average yields were better, which obviously proves the nutriment transformation ability of the bacteria. With bacteria treatments the result was 9,7 – 11,3 t/ha, so owing to this we registered 0,5 – 1 t/ha extra yield.

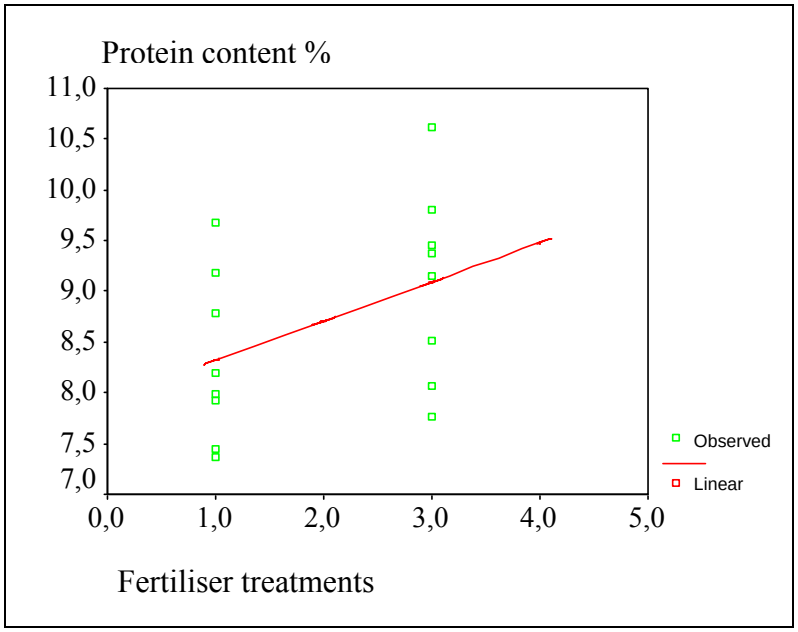
Figure 3.



The crude protein content of maize hybrids considerably grew under the influence of fertilizing compared to the control conditions *(Figure 4.)*. The change of crude fat content depended on the hybrids. We saw little change, but the scale of decrease or increase is genetically determined in all cases.

Increasing the quantity of fertilizer the starch content decreased. The scale of decrease strongly changed depending on the hybrid and soil bacteria treatment.

Figure 4.



4. CONCLUSIONS

We concluded that between the yield of maize and fertilization as well as between protein content and fertilisation were positive correlation in 2004.

5. REFERENCES

Berzsenyi Z, Lap DQ: Effect of N fertilisation on the grain yield and N fertiliser response of maize (Zea mays L.) hybrids in a long-term experiment. Növénytermelés Tom. 52. No. 3-4. p. 389-408. 2003.

Dobos A, Nagy J: Effect of year and fertilisation on the dry matter production of maize (Zea mays L.). Növénytermelés. Tom. 47. No. 5. p. 513-524. 1998.

Futó Z: Effect of leaf area on the yield of maize in a fertilization experiment. Növénytermelés. Tom. 52. No. 3-4. p. 317-328. 2003.

Sárvári M, Szabó P: Effect of crop production factors on maize yields. Növénytermelés. Tom. 47. No. 2. p. 213-221. 1998.