

THE INFLUENCE OF FERTILIZERS ON CORN YIELD ON SLOPE SOIL AFFECTED BY SURFACE EROSION

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ABSTRACT

The trials carried out at Experimental Centre for Pastures Preajba – Gorj within 2006-2008 period on a slope luvisol that is affected by surface erosion have shown the importance of complex fertilization on corn grain yield.

By calculating the correlation between NPK type fertilizers rates and the corn grain yield by polynomial function there resulted a positive coefficient of correlation with the maximum value of 1. This way, there could be observed the fact that between two parameters (fertilizer rate and yield) there is an absolute positive correlation which means that when the fertilizer rate increases, so does the yield.

INTRODUCTION

Agriculture is an important occupation in Gorj District due to its economical value for local populace. This is the reason why the soil feature must be well known, especially the limitative factors and processes that can affect the yielding capacity.

Within Gorj District, from total surface of 243,768 ha, there are affected by erosion 139,027.95 ha which means 57.03% determining the diminishing of the soil yielding capacity by almost half.

Soil erosion is a physical and physico-chemical complex phenomenon that consists of disrupting soil structural aggregates even to elementary particles and their gravitational transport by water or wind.

Disrupting and transport of soil particles determine the removing of the fertile layer of soil so that the diminishing of soil content in organic matter and nutrients take place. Because of surface erosion, that removes the fertile layer from the surface, in a long term, the bedrock can reach the surface which lacks humus or nutrients and impede plants growth and development.

MATERIAL AND METHOD

The trials have been located at Experimental Centre for Pastures Preajba – Gorj which belongs to Tg. Jiu administrative territory, in Preajba locality. They consisted of a field experiment with corn in three treatments and three replications, using isolated block pattern method in order to determine the influence of fertilization on corn grain yield.

Each year, at the beginning of May the soil was prepared by tillage and then it was manually leveled. There was sown Monalisa corn hybrid which is an early hybrid, at 6-7 cm depth and 70 cm between rows, with a density of 40,000-45,000 plants per hectare.

Just after sowing there were applied complex fertilizers as follows:

- V_1 control, not fertilized;
- V_2 fertilized by $N_{60}P_{60}K_{60}$ using $N_{15}P_{15}K_{15}$ complex fertilizer type 2.5 kg/plot;
- V_3 fertilized by $N_{100}P_{90}K_{60}$ using $N_{15}P_{15}K_{15}$ complex fertilizer type 3.75 kg/plot + NH_4NO_3 - 0.206 kg/plot;

During vegetation period the weeds were manually removed by hoe on contour lines and the harvesting has been made at full ripe (wax phase).

RESULTS AND DISCUSSIONS

The yields obtained in 2006 (table 1, figure 1) demonstrates the outstanding contribution of fertilizers. This way, with the control treatment (not fertilized) there was obtained the lowest yield, of 2,560 kg/ha of corn grains. By fertilizing with $N_{60}P_{60}K_{60}$ the yield has increased to 4,300 kg/ha, the relative output reaching 67.9%.

When $N_{100}P_{90}K_{60}$ rate has been applied the yield reached 5,140 kg/ha, the relative expression being of 100.8%, double as compared with the control. The yield output on 1 kg active ingredient of fertilizer has been of 9.666 kg corn grains with treatment 2 and of 10.32 kg with treatment 3. This way, by supplementary applying of 70 kg/ha of nitrogen and phosphorus there was obtained an yield output of 840 kg/ha which means 12 kg corn per 1 kg a.i. of fertilizer.

Table 1

The influence of fertilization on corn grain yield in 2006

Treatment	Rate	Yield			Signification
		Kg/ha	%	$\pm d/ctrl.$	
V ₁	$N_0P_0K_0$ (Ctrl)	2,560	100.0	—	—
V ₂	$N_{60}P_{60}K_{60}$	4,300	167.9	1,740	***
V ₃	$N_{100}P_{90}K_{60}$	5,140	200.8	2,580	***

DL 5% = 262 kg/ha
 DL 1% = 433 kg/ha
 DL 0.1% = 811 kg/ha

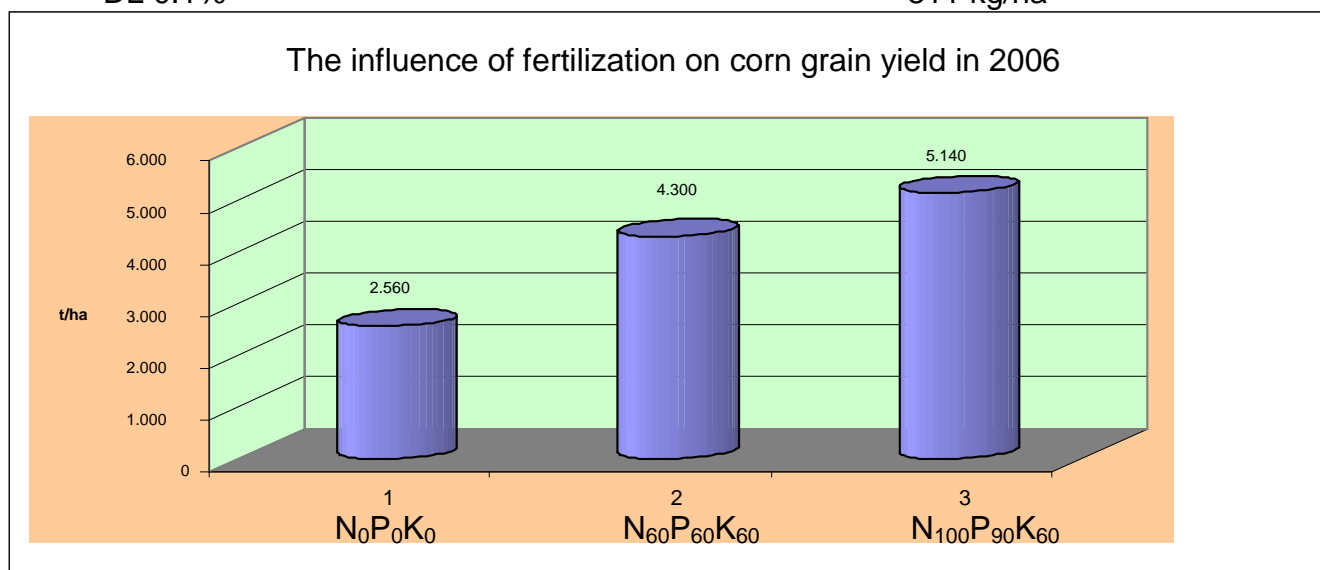


Fig. 1

In 2007, which was an unfavorable year for all crops, especially for maize, because of erratic rainfall during vegetation period, there were obtained lower yields in comparison with 2006. Nevertheless, the fertilized treatments have obtained significant output over the not fertilized control (table 2, figure 2).

This way, the control treatment (not fertilized) has given the lowest yield, of 1,560 kg/ha. The $N_{60}P_{60}K_{60}$ rate by which V₂ variant has been fertilized has determined the increasing of the yield to 2,864 kg/ha, 1.83 times higher than control, the relative output being of 83.6%.

With the V₃ treatment that was fertilized by $N_{100}P_{90}K_{60}$ the yield has increased to 3,119 kg/ha. The percentage output has been of 199.9%, so the yield has almost doubled as compared with the not fertilized control. The yield output has been of 1.559 kg/ha and it was significant.

Table 2

The influence of fertilization on corn grain yield in 2007

Treatment	Rate	Yield			Signification
		kg/ha	%	±d/ctrl.	
V ₁	N ₀ P ₀ K ₀ (Mt)	1,560	100.0	—	—
V ₂	N ₆₀ P ₆₀ K ₆₀	2,864	183.6	1,304	***
V ₃	N ₁₀₀ P ₉₀ K ₆₀	3,119	199.9	1,559	***

DL 5% = 131 kg/ha
 DL 1% = 216 kg/ha
 DL 0,1% = 405 kg/ha

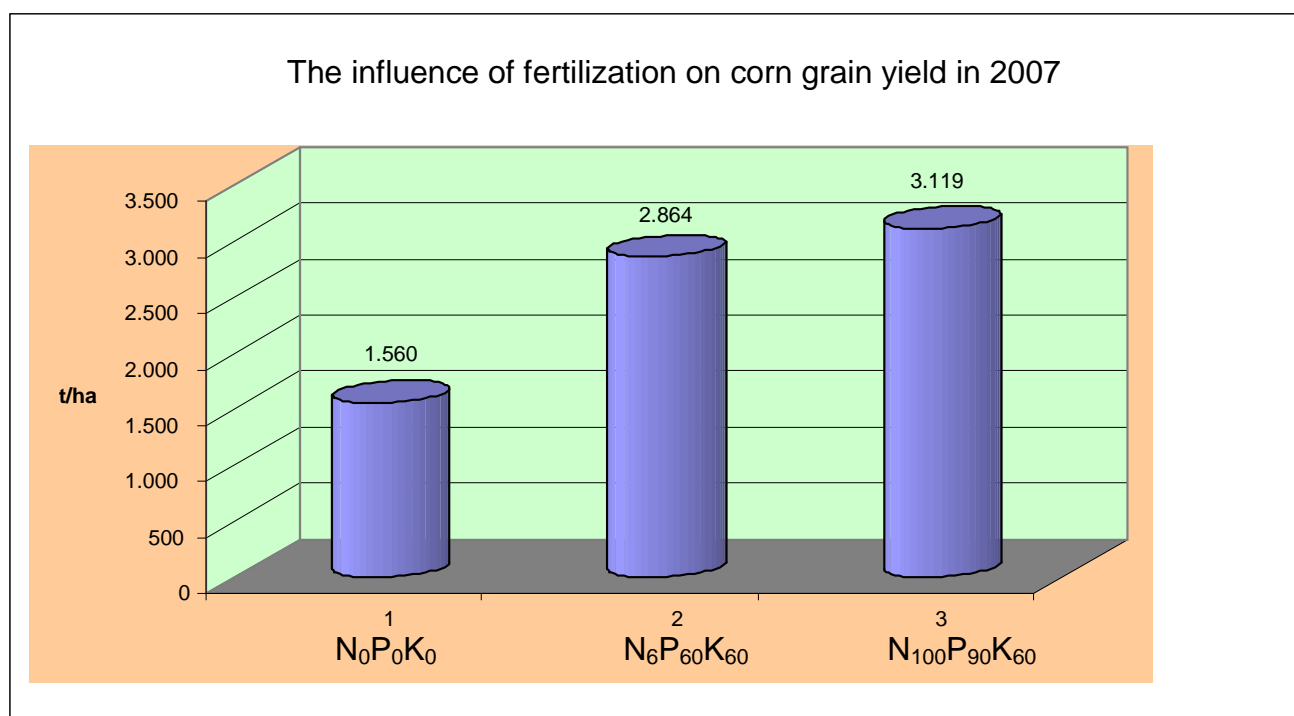


Fig. 2

Also, in 2008, by applying fertilizers there were obtained very significant increases of yield (table 3, figure 3). The lowest yield, of 2,190 kg/ha has been obtained with V₁ treatment – not fertilized control.

The applying of N₆₀P₆₀K₆₀ rate with V₂ treatment has determined the increasing of the yield to 3,970 kg/ha, the percentage value was of 181.3% and the yield output was of 1,780 kg/ha, so, very significant.

The same way, the applying of N₁₀₀P₉₀K₆₀ rate has determined an yield output of 2,440 kg/ha over the control and it was very significant. Thus, by obtained yield of 5,140 kg/ha there was achieved a percentage output of 111.4%, so, it was double over the not fertilized control.

The yield output on 1 kg of active ingredient of fertilizer has been of 9.88 kg corn grains with V₂ and of 9.76 kg with V₃.

Table 3

The influence of fertilization on corn grain yield in 2008

Treatment	Rate	Yield			Signification
		kg/ha	%	±d/ctrl.	
V ₁	N ₀ P ₀ K ₀ (Mt)	2,190	100.0	—	—
V ₂	N ₆₀ P ₆₀ K ₆₀	3,970	181.3	1,780	***
V ₃	N ₁₀₀ P ₉₀ K ₆₀	4,630	211.4	2,440	***

DL 5% = 254 kg/ha
 DL 1% = 421 kg/ha
 DL 0.1% = 788 kg/ha

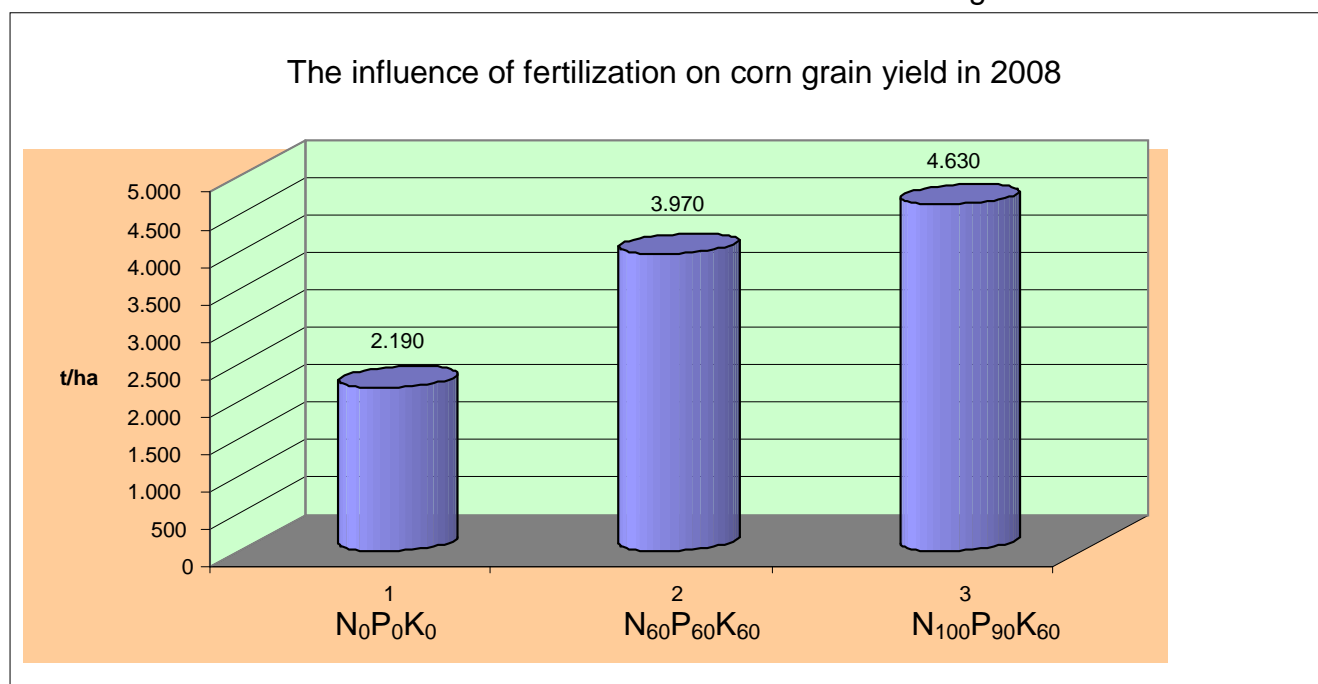


Fig. 3

The corn grain yields for 2006-2008 period are presented below (table 4, figure 4). After an analysis we can draw the following conclusions:

- the control treatment, not fertilized has given the lowest yield, of 2,103.3 kg/ha;
- by fertilizing with N₆₀P₆₀K₆₀, V₂, there was obtained a percentage output of 77.6% and an yield output of 1,608 kg/ha which is very significant;
- V₃ treatment which meant N₁₀₀P₉₀K₆₀, on three years average, the yield has been of 4,296 kg/ha, an yield output of 2,193 kg/ha which is very significant;
- there can be said that corn reaction to NPK complex fertilizer applying has been very favorable.

Table 4

Corn grain average yield in 2006 – 2008 period

Treatment	Rate	Yield			Signification
		t/ha	%	±d/ctrl.	
V ₁	N ₀ P ₀ K ₀ (Mt)	2,103.3	100.0	—	—
V ₂	N ₆₀ P ₆₀ K ₆₀	3,711.3	177.6	1,608	***
V ₃	N ₁₀₀ P ₉₀ K ₆₀	4,296.3	204.0	2,193	***

DL 5% = 215.6 kg/ha
 DL 1% = 356.6 kg/ha
 DL 0.1% = 668.0 kg/ha

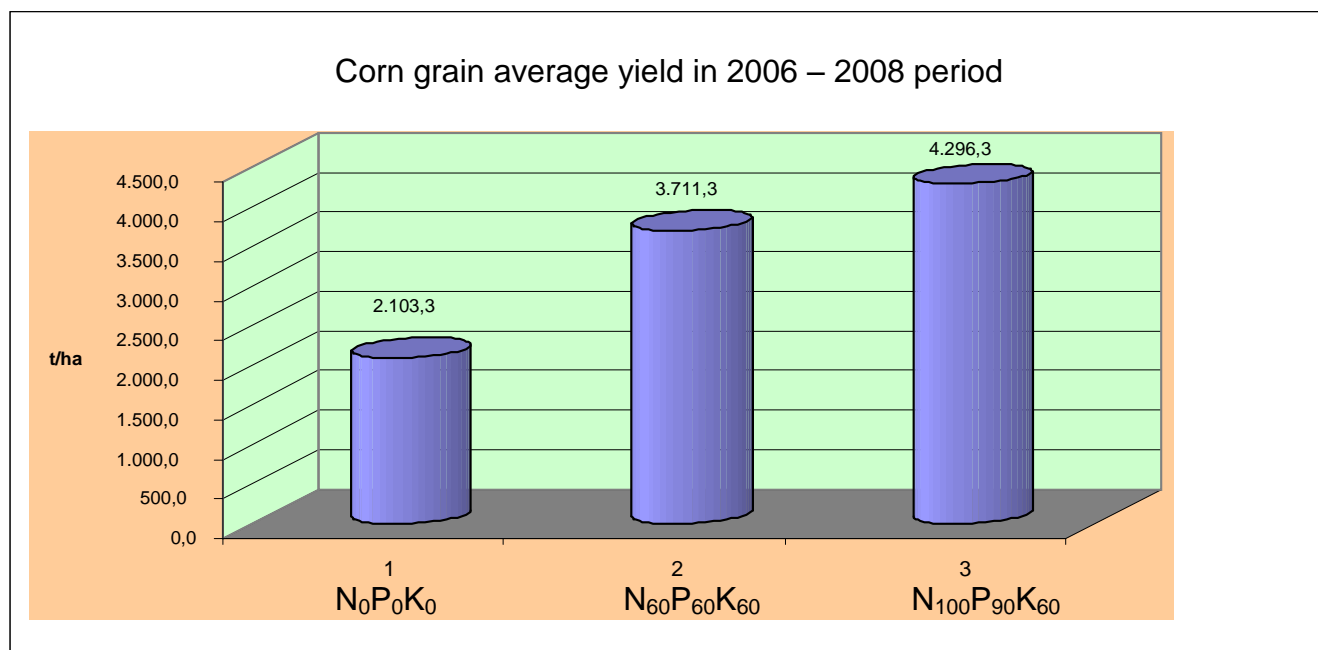


Fig. 4

By calculating the correlation between fertilization by NPK complex fertilizers and the corn grain yield, using polynomial function, there resulted maximum positive correlation coefficient 1 (figure 5) during 2006 – 2008 experimental period. Thus, there can be observed that between the two parameters (fertilizer rates and the average yields) there is an absolute positive correlation which means that as fertilizer rates increase, so does the yields. The polynomial function corresponding with the average yields during 2006-2008 period is the following:

- for 2006 – 2008 : $y = -511,5x^2 + 3142,5x - 527,7$ $R^2 = 1$

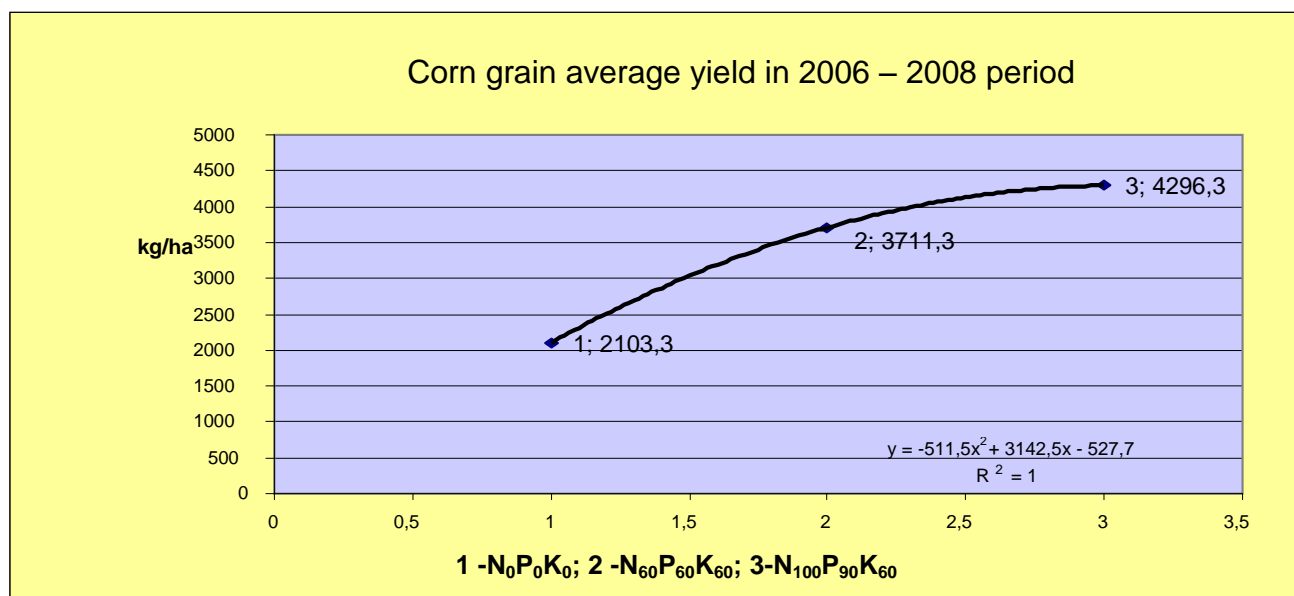


Fig. 5

CONCLUSIONS

The applying of NPK complex fertilizers has determined very significant yield outputs and there can be said that corn crop has positively responded to their application. On the other hand, fertilizers have had an indirect effect on erosion due their influence on crops vegetal mass growth. This way, the highest soil losses have been recorded with not fertilized control treatment because the vegetal mass of these plants has been less developed and, as a consequence, the soil has been less protected.

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