# THE INFLUENCE OF FERTILIZERS ON HAY PRODUCTION ON SLOPPY SOILS AFFECTED BY SURFACE EROSION

***BĂLAN MIHAELA, PĂTRU FLORIAN***
*University of Craiova*

**key words: surface erosion, sown pasture, slope, complex fertilizers**

## ABSTRACT

*The researches that have been carried out at Experimental Centre for Pastures Preajba Gorj have emphasized the role of balanced fertilization by nitrogen, phosphorus and potassium on sown pasture; the soil in this area is stagnic luvosoil, it is affected by surface erosion and it is low supplied by nitrogen and phosphorus and very low supplied by potassium.*

*The trials unfolded during three years have shown that the best results were given by $N_{100}P_{90}K_{60}$ fertilizer rate which conducted to very significant outputs.*

## INTRODUCTION

Within Gorj District erosion is the most limiting factor because 57.2% of agricultural land of the county is located on slopes higher than 5% affecting the soil features and its production capacity.

Erosion affects soil properties by its action of disrupting, transport and deposition of soil particles at different distances in function of their size and weight.

Erosion is influenced by land declination, its intensity increasing with the slope. In the same time, erosion is influenced by the soil covering degree by vegetation, bare soil being more affected than covered soil. The applying of fertilizers on slope soils has a good effect both by positive influence on plants growth and development and by providing a good coverage of soil surface thereby decreasing the quantity of soil than can be carried away by water during heavy rainfall due to better infiltration of water into the soil instead of runoff.

## 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 sown pasture in three treatments and three replications, using isolated block pattern method in order to determine the influence of fertilization on hay production. In 2006 the experiment was initiated in April when the soil was prepared by mechanical tillage and then it was manually leveled; there was sown a mixture of 60% grasses + 40% pulses as follows:

- Dactylis glomerata 20% (210 gr.);
- Lolium perenne 20% (228 gr.);
- Phleum pratense 20% (228 gr.);
- Trifolium pratense 15% (120 gr.);
- Lotus corniculatus 25% (282 gr.).

Just after sowing there were applied fertilizers in the following rates:

- $V_1$ - not fertilized control;
- $V_2$ - 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 mowing was done at flowering stage.

## RESULTS AND DISCUSSIONS

In 2006 the applying of fertilizers has determined very significant hay yield outputs (table 1, figure 1). With the control treatment (not fertilized) there was obtained the lowest

hay yield, of 3.12 t/ha. By applying $N_{60}P_{60}K_{60}$ rate the yield has increased to 7.11 t/ha. The percentage output has been of 127.9% which means 2.27 times higher.

Also, by applying $N_{100}P_{90}K_{60}$ rate the hay yield has been of 8.03 t/ha. The percentage production was of 257.4%, so the percentage output has been of 157.4%. The hay yield output was of 4.91 t/ha which meant very significant. So, the yield output on 1 kg of active ingredient of chemical fertilizer has been of 22.16 kg hay with $V_2$ treatment and of 19.64 kg hay with $V_3$ treatment. Therefore, by supplementary application of 70 kg/ha nitrogen and phosphorus the hay yield output has been 0.92 t/ha which meant 13.14 kg hay/1 kg of active ingredient of fertilizer.

***Table 1***

**The influence of fertilizer rates on hay production with sown pasture in 2006**

| Treatment | Rate | Production | | | Significance |
|---|---|---|---|---|---|
| | | t/ha | % | ±d/ctrl | |
| $V_1$ | $N_0P_0K_0$ (Mt) | 3.12 | 100.0 | – | – |
| $V_2$ | $N_{60}P_{60}K_{60}$ | 7.11 | 227.9 | 3.99 | *** |
| $V_3$ | $N_{100}P_{90}K_{60}$ | 8.03 | 257.4 | 4.91 | *** |

DL 5% = 0.528 t/ha
DL 1% = 0.870 t/ha
DL 0.1% = 1.632 t/ha

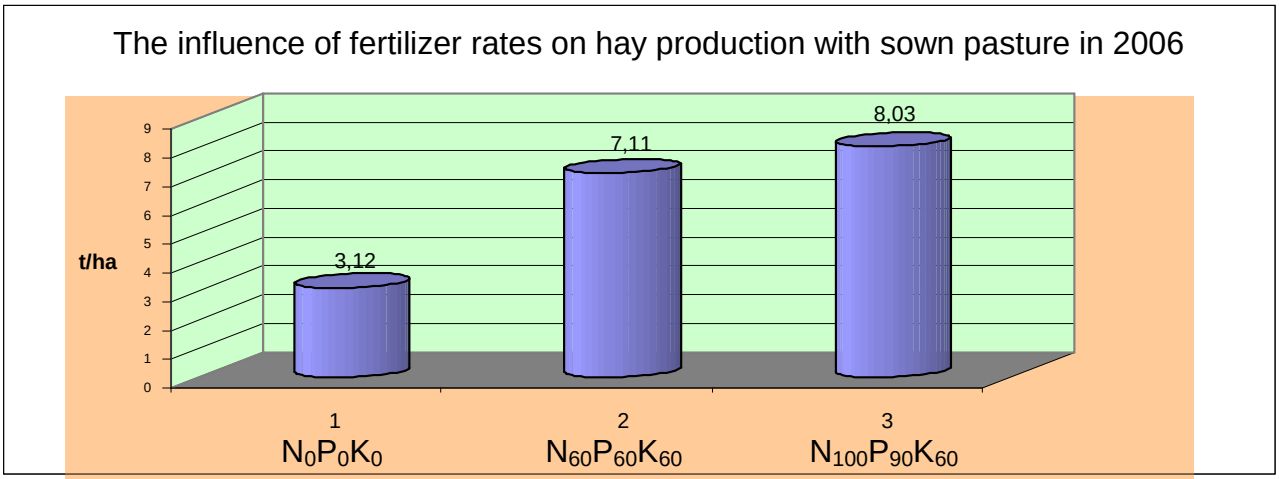


**Fig.1**

In 2007 there lowest hay production has been recorded with the control treatment (not fertilized), of 2.54 t/ha (table 2, figure 2). The applying of $N_{60}P_{60}K_{60}$ rate has determined the increase of the hay production to 4.91 t/ha, the percentage output being of 93.3% over control.

With the applying of $N_{100}P_{90}K_{60}$ rate the hay production reached 5.37 t/ha. The relative production has been of 211.4%, so the percentage output has been of 111.4%. The production output was of 2.83 t/ha, very significant.

The production output on 1 kg of active ingredient of fertilizer was of 13.17 kg hay with $V_2$ treatment and of 11.32 kg of hay with $V_3$.

Thus, the supplementary application of 70 kg active ingredient of nitrogen and phosphorus has brought an output of production of 0.46 t/ha hay which means 6.57 kg hay per 1 kg of active ingredient.

***Table 2***

**The influence of fertilizer rates on hay production with sown pasture in 2007**

| Treatment | Rate | Production | | | Significance |
|---|---|---|---|---|---|
| | | t/ha | % | ±d/ctrl | |
| $V_1$ | $N_0P_0K_0$ (Mt) | 2.54 | 100.0 | – | – |
| $V_2$ | $N_{60}P_{60}K_{60}$ | 4.91 | 193.3 | 2.37 | *** |
| $V_3$ | $N_{100}P_{90}K_{60}$ | 5.37 | 211.4 | 2.83 | *** |

DL 5% = 0.180 t/ha
DL 1% = 0.297 t/ha
DL 0.1% = 0.558 t/ha

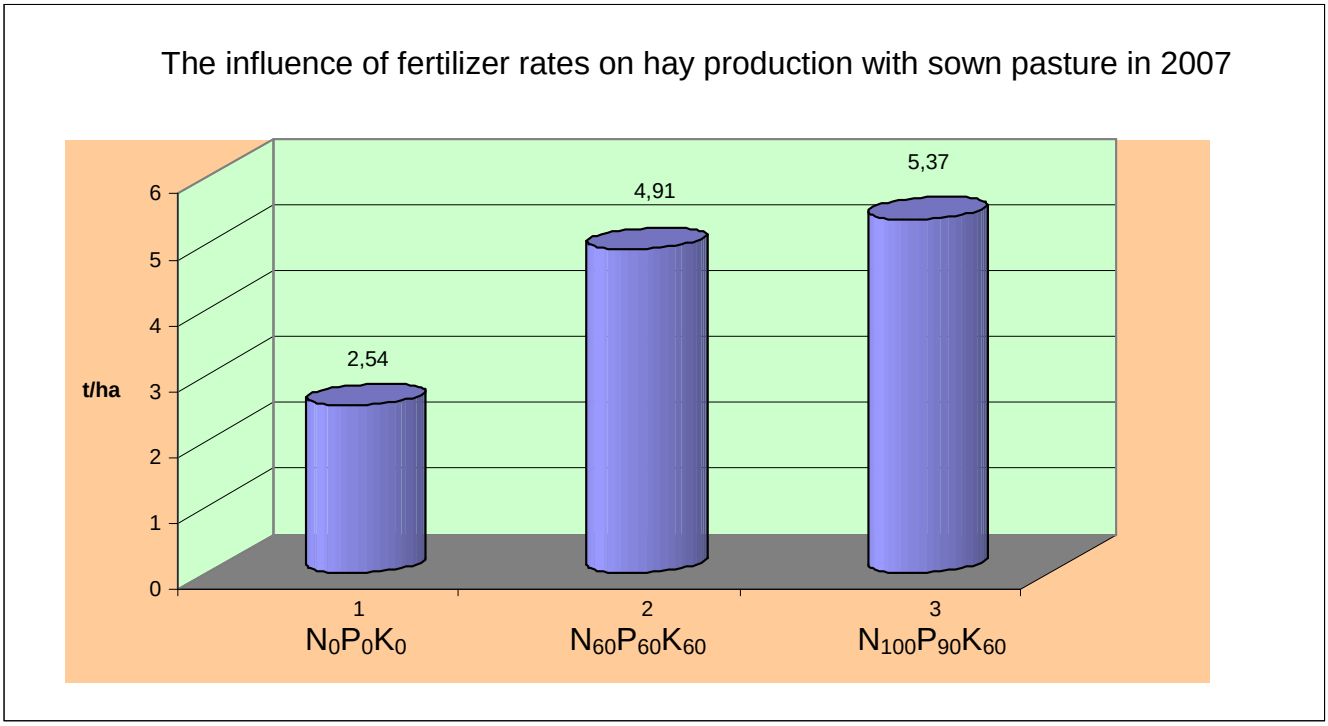


**Fig. 2**

In 2008 the applied fertilizers rates have, also, contributed to the obtaining of higher hay productions (table 3, figure 3).

With the control treatment (not fertilized) there was obtained the lowest yield, of only 2.82 t/ha hay. By applying $N_{60}P_{60}K_{60}$ rate there was obtained a production output of 3.07 t/ha hay, the yield reaching 5.89 t/ha. The percentage output has been of 108.9%, so the production has doubled over control. By applying $N_{100}P_{90}K_{60}$ rate the yield has increased to 6.55 t/ha hay. The relative production has been of 232.3%, so, the percentage output has been of 132.3%. The yield output has been of 3.73 t/ha, very significant. The yield output on 1 kg fertilizer active ingredient has been of 17.06 kg with $V_2$ treatment and of 14.92 kg/ha with $V_3$. Supplementary application of 70 kg fertilizer active ingredient of nitrogen and phosphorus has brought an output of hay production of 0.66 t/ha, therefore, an output of 9.43 kg hay per 1 kg active ingredient.

***Table 3***

**The influence of fertilizer rates on hay production with sown pasture in 2008**

| Treatment | Rate | Production | | | Significance |
|---|---|---|---|---|---|
| | | t/ha | % | ±d/ctrl | |
| $V_1$ | $N_0P_0K_0$ (Mt) | 2.82 | 100.0 | – | – |
| $V_2$ | $N_{60}P_{60}K_{60}$ | 5.89 | 208.9 | 3.07 | *** |
| $V_3$ | $N_{100}P_{90}K_{60}$ | 6.55 | 232.3 | 3.73 | *** |

DL 5% = 0.069 t/ha
DL 1% = 0.111 t/ha
DL 0.1% = 0.210 t/ha

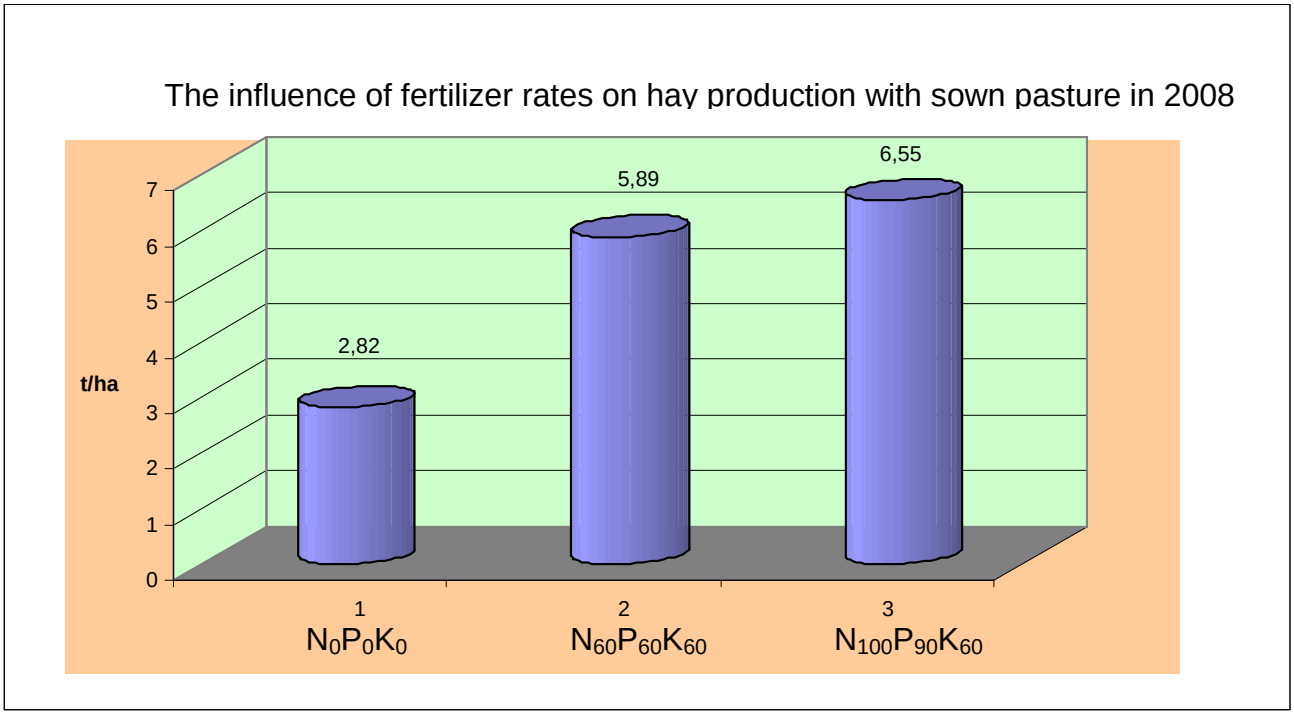


**Fig. 3**

The average hay productions with sown pasture during research period 2006-2008 are presented in the following table and figure (table 4, figure 4). After analyzing this table there can be issued the following conclusions:

- On three years average, the hay production with sown pasture control not fertilized treatment was the lowest, of 2.82 t/ha;
- With the $N_{60}P_{60}K_{60}$ treatment the average hay production has been of 5.97 t/ha, recording a percentage output of 110 and a production output of 3.4 t/ha which is very significant;
- With the $N_{100}P_{90}K_{60}$ rate, on average for the researching period, over the control treatment, there was recorded a production of 6.65 t/ha which meant a percentage output of 3.8 t/ha which is, also, very significant;
- Taking account of upward affirmations there can be said that the hay productions with the sown pasture have been favorably influenced by fertilizers.

***Table 4***

**Average hay productions with sown pasture within 2008-2008 period**

| Treatment | Rate | Production | | | Significance |
|---|---|---|---|---|---|
| | | t/ha | % | ±d/ctrl | |
| $V_1$ | $N_0P_0K_0$ (Mt) | 2.82 | 100.0 | – | – |
| $V_2$ | $N_{60}P_{60}K_{60}$ | 5.97 | 210.0 | 3.4 | *** |
| $V_3$ | $N_{100}P_{90}K_{60}$ | 6.65 | 233.7 | 3.8 | *** |

DL 5% = 0.259 t/ha
DL 1% = 0.426 t/ha
DL 0.1% = 0.800 t/ha

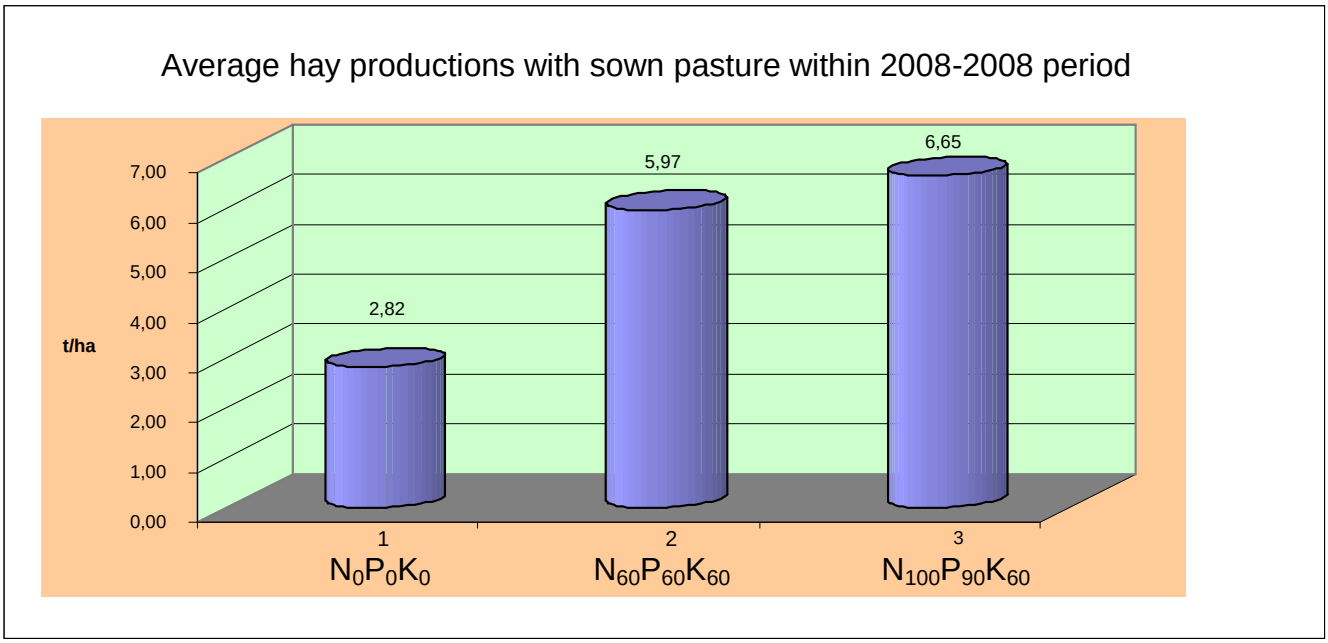


**Fig. 4**

For the resulting average hay productions within 2006-2008 period we have calculated the correlation between the NPK complex fertilizer rates and the hay production by using polynomial function and we have obtained a maximum positive correlation coefficient 1. This way there can be observed that between the two experimented parameters (fertilizer rates and hay productions) there is an absolute positive correlation which means that when the fertilizer rates increase, so do the hay productions. The polynomial function corresponding with the average yields during 2006-2008 period is the following:

- for 2006 – 2008 : $y = -1235x^2+6855x-2800$ $R^2=1$

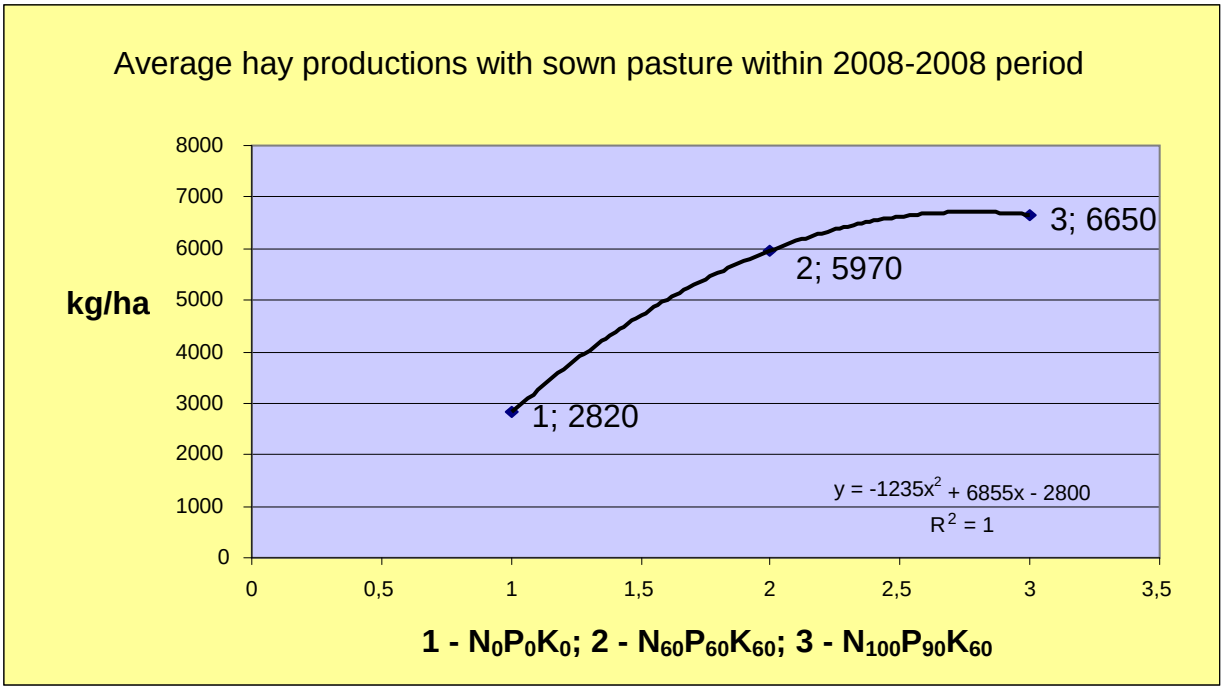


**Fig. 5**

## CONCLUSIONS

The application of fertilizers has determined the obtaining of very significant production outputs, so, there can be said that sown pasture has positively responded to their application.

The fertilizers that are applied at the beginning of the vegetation period have a direct effect on hay productions and an indirect effect on soil erosion meaning that fertilizers influence the growth of the vegetal mass of the crop and, as a consequence, the soil is better protected. This thing is explained by the fact that more abundant vegetal mass on the surface unit alleviates the impact of falling water drops, allowing infiltration into the soil till field capacity rather than runoff downward.

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