THE IMPACT OF CHEMICAL FERTILIZATION ON MAIZE YIELD

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Abstract. *The main purpose of the research undertaken to develop this work was the impact of chemical fertilization on maize yield in the experimental field of SDE Timisoara. Fertilizers make their best contribution to the enhancement only if it falls within a hierarchical system of good technological measures and the doses used are related to crop plants, soil, climate, and culture technology. The fertilization system influenced the maize harvest, leading to the production of 9034 kg of maize / ha. In recent years, the amount of fertilizer used has remained relatively constant while average yields have steadily increased. Because of the complex nature of soil and weather variability, farmers face significant challenges in optimizing the amount of nitrogen to apply to each field, year and area within a field. This results in under-application of nitrogen in some years and fields, with resulting yield losses, and over application of nitrogen in other years and field areas resulting in inefficient use of nitrogen resources.*

Keyword: *fertilization, maize, production, variants.*

INTRODUCTION

Adding chemical fertilizers to the crop plays a major part in the production per hectare, and on the intensification of the agricultural yield, respectively.

Due to its large production of dry mass per surface unit, maize is a big consumer of nutriments. Maize is one of the most productive agricultural plants cultivated in our country, but it needs large quantities of nutriments in order to yield large quantities of grains.

In order to grow and develop, maize must find in its environment all the conditions as any other plant: light, warmth, water, nutriments, etc. Of all of these, nutriments are especially important for maize, for the following reason: the rhythm in which the various substances that make up organic matter accumulate in plants is very different.

This depends primarily on the biology of the maize plant, which is very different from other plants. Secondly, it depends on external factors. Knowing the biology of the plant and its requirements concerning food elements and their role in different stages of development, people can intervene and apply fertilizers to increase the yield.

MATERIAL AND METHOD

In the area with chernozem in Banat, where rains are more abundant in the period of vegetation of maize, plants make better use of fertilizers, although these soils also have good natural fertility. On these soils it is not enough to use nitrogen fertilization: one must add phosphorus fertilization, too.

The fertilizers used for the purpose of our research are: Crop Starter 18.40.0 micro-granular fertilizers, 20.20.0 complex mineral fertilizers, N 28 liquid foliar fertilizers.

Table 1 presents the values of the maize yield determined after application of fertilizers.

Table1

Maize yield parameters after mineral fertilization

Fertilization variants	N	U%	Yield Kg/ha
V1	0	11.425	5677
V2	18	10.75	6879.25
V3	38	10.6	7977.75
V4	66	10.55	9034

The samples were obtained from field plots treated with foliar fertilizers:
V1- non fertilized - control
V2- Crop Starter 18.40.0 (NPK 18% N, 40%) - 20kg/ha.
V3- Crop Starter 18.40.0 (NPK 18% N, 40%) - 20kg/ha + Granular 20.20.0. (20% N, 20% P 2O5) - 150kg/ha.
V4- - Crop Starter 18.40.0 (NPK 18% N, 40%) - 20kg/ha + Granular 20.20.0. (20% N, 20% P 2O5) - 150kg/ha + N28 liquid (28% N) - 20L/ha

As for the best period for applying fertilizers, our experiments show that the results obtained were different depending on the type of fertilizer and the dose applied, whether they were applied in spring through spreading, or were applied locally at sowing or incorporated into the soil by pre-sowing works. Application of nitrogen in various stages of maize development determined yield increase.

Consider a growth model in relation to one factor (the dose of nitrogen in fertilizers) of the type of the Mitscherlich function:

$$y = a\left(1 - e^{-b(x+x_0)}\right), \quad (1)$$

where y represents the dependent variable;
x independent variable;
a maximum expected;
b growth rate;
x_0 fertilizer doses existent in the soil.

By linearizing relation (1) we get:

$$-\ln\left(1 - \frac{y}{a}\right) = bx + bx_0. \quad (2)$$

In the regression line (2) b is the coefficient of x, a is determined as the maximum expected, and x_0 is determined in relation bx_0 as the free term in (2).

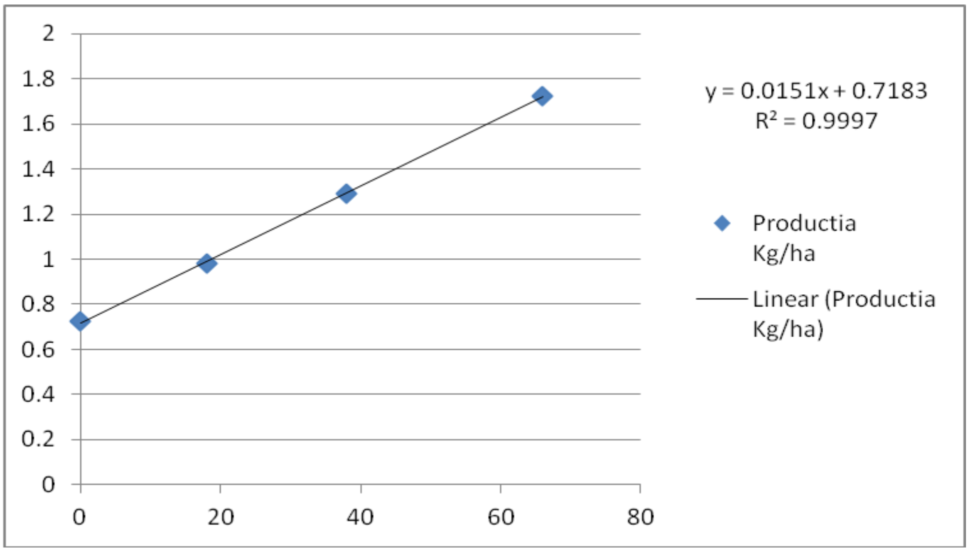

Figure 1 . The regression points and line given by relation (2) for the yield

After determining the coefficients in the model given by the Mitscherlich function, the following constant values are obtained:

$$a = 11000,\ b = 0.015 \text{ and } x_0 = 47.87.$$

By graphic representation in the same system of coordinates, both the experimental data (averages) and the theoretical curves given by the Mitscherlich function, we obtain the following figure:

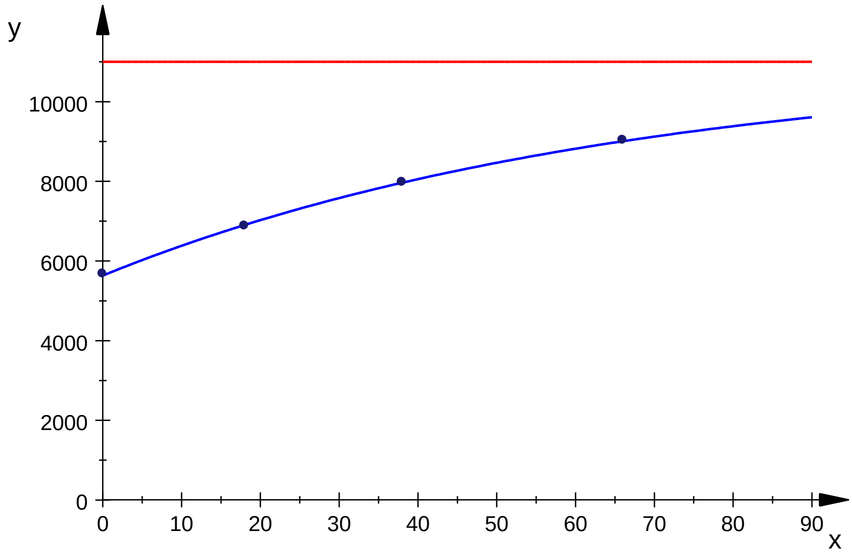

Figure 2. Experimental data and theoretical curve given by (1) for the yield

The figure shows good concordance between the experimental data and the theoretical curve.

The yield increase determined by nitrogen fertilizers was parallel with the increase of the fertilizer dose. There are great differences that appear between the yields in the control variant (V1) and the fourth variant, which used all three types of chemical fertilizers. The maximum increase, 3357 kg/ha, was determined when applying 66 kg N/ha.

As the fertilizer dose increases, so does the yield, to a certain limit; beyond that limit, any dosage increase is ineffective or can even have negative effects.

For prediction of humidity, the theoretical model is of the following type:

$$y = y_0 + ae^{-bx}, \quad (3)$$

where y is the dependent variable;

x independent variable;

a proportionality constant;

b the decrease rate;

y_0 inferior asymptote.

By linearizing relation (3) we obtain:

$$-\ln(y - y_0) = bx - \ln a. \quad (4)$$

On the regression line (4) b is the coefficient of x, a is determined from the free term and y_0 is determined from the tendency to decrease.

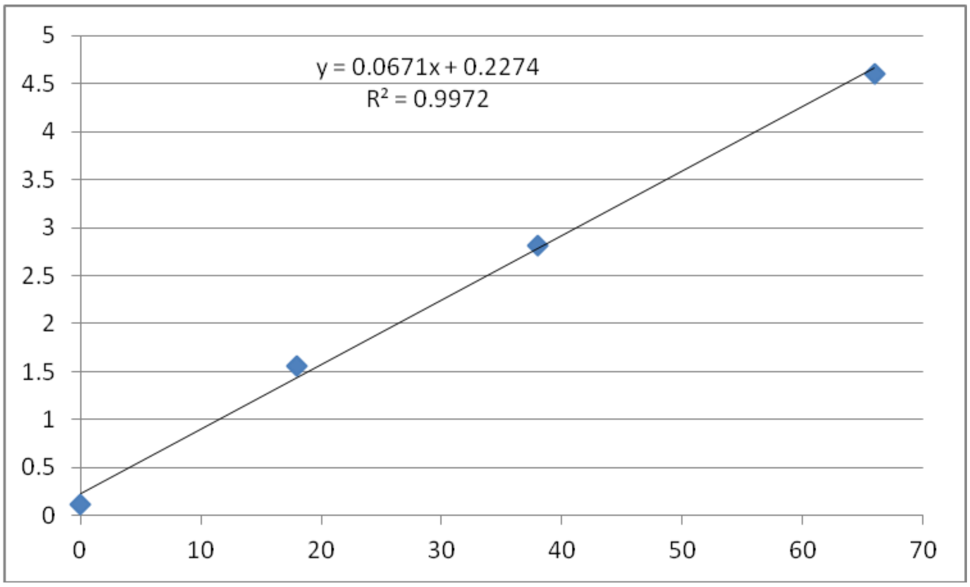

Figure 3. The regression points and line given by relation (4) for humidity

Harvest humidity of maize grains varied, decreasing from 11.42% in variant V1 to 10.55% in variant V4, and so the maize grains could be kept in optimum conditions.

After determining the coefficients of the model given by function (3), we get the following constant values:

$a = 0.797$, $b = 0.067$ and $y_0 = 10.54$.

When drawing the graphic representation, in the same system of coordinates, the experimental data (averages) and the theoretical curves given by function (3) as well, we will obtain the following figure:

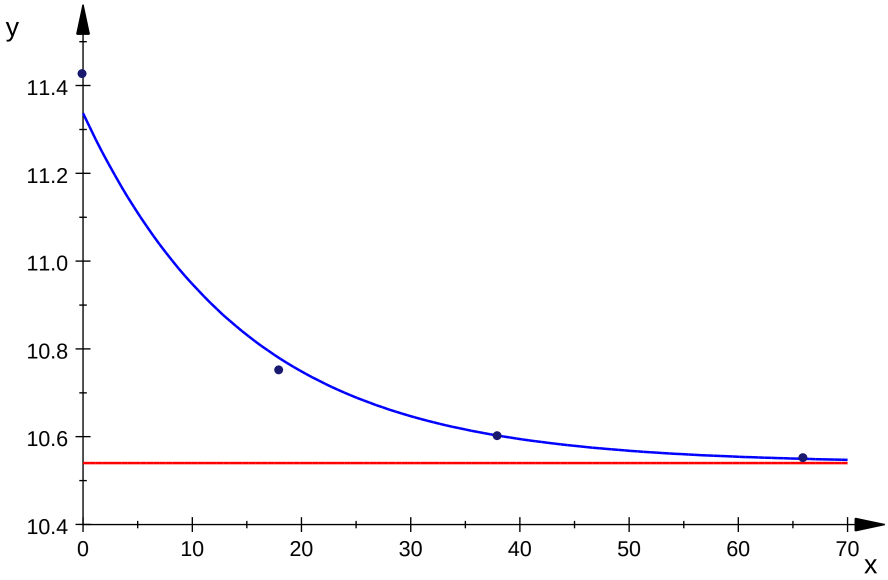

Figure 4. The regression points and line given by relation (3) for humidity

The figure reveals good concordance between the experimental data and the theoretical curve.

CONCLUSIONS

The highest yield value, 9034 kg/ha, was determined in variant (V4). It means an increase by 59.13% when compared to the yield obtained in the control variant (V1).

Application liquid nitrogen in the various stages of maize development determined yield increase.

In both predictions, of the yield and of humidity respectively, it is clear that for any cumulated dose of nitrogen in the fertilizer applied, we will have the theoretical evolution of the dependent variables under study (figure 2, figure 4 respectively).

Harvest humidity of maize grains varied, decreasing from 11.42% in variant V1 to 10.55% in variant V4, and so the maize grains could be kept in optimum conditions.

The crop quality depends not only of the choice of an optimal ratio between the elements in soil and of the fertilizers doses quantity .Up to a certain point, the yield increase of the doses , behind this point any raise of the dose has no effect or a negative one.

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