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STUDY REGARDING THE OPTIMIZATION OF CORN PRODUCTION ACCORDING TO HECTOLITRIC MASS AND SEEDING TIME

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Abstract

This article approaches the nonlinear regression model, the method of the smalles squares with examples, and calculations for the power function model. For this, we used data obtained from a study using corn hybrids such as Kornelius, Karmas, KWS 1394, KXB2482 / KWS2482, Konfites. The variance analysis method has been used to process the results of biometric measurements, quality indicators such as MH and production.

Key words: hectolitric mass, biological material, nonlinear regression, variables, power function

1. Introduction

Global warming is recognized as an extremely worrying environmental problem by both the scientific community and the world population in general. A total increase in temperature of 3.2 °C is expected by the end of the current century. Also, the increase in CO_2 concentration in the atmosphere is in itself a worrying factor if we think that sustainable agricultural production and food security are one of the major challenges both at present and in the future. Assessing the effects of climate change on agriculture is a major concern especially in countries where extreme climatic conditions (temperature, precipitation) are registered [4, 9].

Corn (Zea mays L.) is an important food for the world population and, as such, emphasis is placed on achieving the highest yield. But this also depends on the agricultural technologies which are applied, because soil processing activities which are carried out inadequately lead to soil compaction, which leads to the increase of the soil density, the decrease of the total porosity, the air permeability, the quantity of water available to the plants and finally the yield obtained is not the one expected [12].

2. Theoretical background

Drought is a particularly significant phenomenon which limits plant production in all countries of the world. The negative effects of the drought depend, in particular, on its severity and the period of its occurrence, which causes a state of stress that influences production. The state of stress to which plants are subjected may vary from year to year depending on the amount of rainfall and the temperature of the air [8].

According to predictions, global cereal demand for water will increase. And this is because climate change is expected to increase global temperature by 4-6 °C [2]. There is currently extensive research suggesting alternatives to secure water supplies for soil and plants such as corn, a plant that plays a crucial role in human and animal nutrition [6]. Total world corn production was, according to FAO data, in 2014, for example, of about 1 billion tons and for this reason, the addition of irrigated water supply and the cultivation of drought-tolerant corn hybrids are among the most appropriate solutions [6].

But it is difficult to select drought-resistant corn genotypes, relying solely on their productive potential. It is necessary to analyze / study not only the physiological parameters but also their influence on the qualitative and quantitative indicators. A very important role in the production evaluation is held by the hectolitric mass (MH).

MH is one of the parameters taken into account in the evaluation of production, the size of the storage space, but also when establishing the purchase price. MH is influenced by humidity, geometric elements of the grain, foreign matter content, etc. It is the weight in kilograms of a grain volume of 0.1 m³ (equivalent to

the capacity of 100 liters). More and more recent research has highlighted the positive correlation between this indicator and the level of seed production [10, 11].

Based on the experimental data, we will study the variations of two parameters by mass production of 1,000 grains per three seasons, depending on the average plant weight / depending on the fertilization dose.

We will approximate the results of the experiment with the non-linear regression in the prediction of the parameter $\boldsymbol{y = f(x)}$, using the power function [13].

The smallest square method allows us to obtain some estimators that lead to satisfactory results because they generally have no optimal property [1,5].

2.1 Research methodology

Observations were made in 2 phases for 5 corn hybrids, seeded in 3 different periods, applying classical technology which is available to farmers.

The experimental biological material is represented by the following corn hybrids: Kornelius, Karmas, KWS 1394, KXB2482 / KWS2482, Konfites.

The results of biometric measurements, of quality indicators such as MH and production were statistically processed by the variance analysis method and the mathematical modeling by the quadratic regression method for the correlation between different variables.

2.2 Experimental results obtainded

Table 1: MH influence on corn hybrids seeded in three different stages

Corn hybrids	MH			PRODUCTIONS		
	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
KORNELIUS	778	771	741	13972	14860	13084
KARMAS	742	734	720	15491	14654	13974
KWS 1394	763	759	730	13963	14138	14009
KXB2482/KWS2482	763	741	714	15182	15883	13414
KONFITES	747	738	690	14570	15065	13080

2.3 Mathematical interpretation

Nonlinear regression will be discussed because the points suggest a curve.

It represents graphically in coordinates (x, y) the values of the observations and examines the shape of the points, if it indicates the polynomial variation.

The general form for power regression is polynomial function $f(x) = ax^n + b$, n belong to Z.

Since the results of the research do not develop linearly, we will use the nonlinear regression model using the least squares method for power function, $f(x) = ax^{-1} + b$, to optimize the production of corn hybrids sown at 3 different epochs, depending on the hectolitric mass obtaining the graphs presented (figure 1, 2, 3).

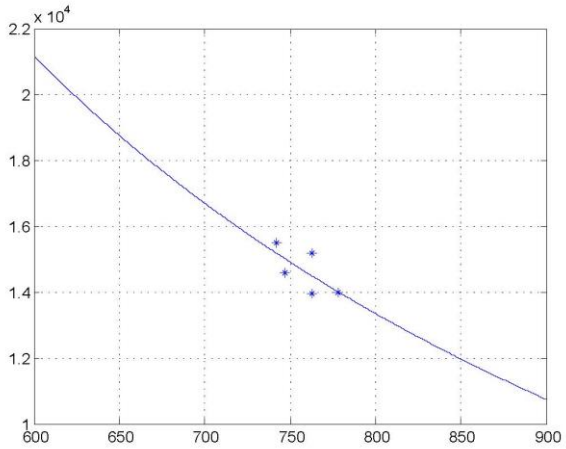

Fig. 1: Production of corn hybrids according to the hectolitric mass in Stage 1

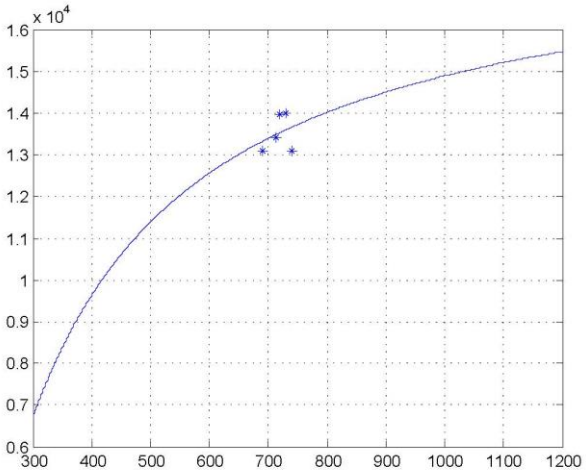

Fig. 2: Production of corn hybrids according to the hectolitric mass in Stage 2

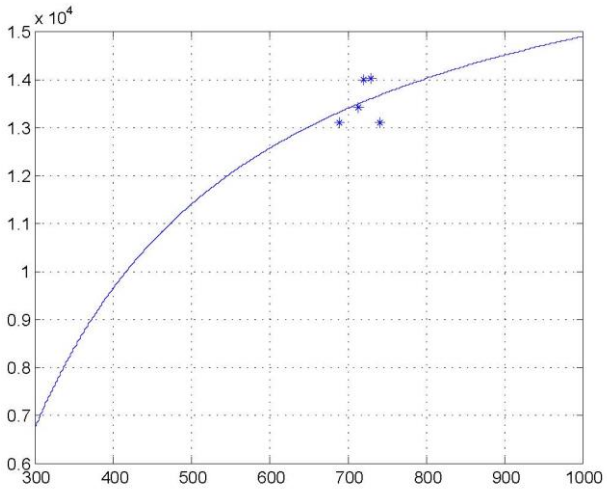

Fig. 3: Production of corn hybrids according to the hectolitric mass in Stage 3

Graphs (figures:1, 2, 3) resulting from mathematical modeling of the values in Table 1 using the Matlab software [3,7].

3. Conclusions

Since the quality of the mathematical model applied in the literature approximates the experimental data, it was used to make predictions.

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