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ESTIMATION OF PRODUCTION KWS MAIZE HYBRIDS USING NONLINEAR REGRESSION

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Abstract

This article approaches the model of non-linear regression and the method of smallest squares with examples, including calculations for the model of logarithmic function. This required data obtained from a study which involved the observation of the phases of growth and development in KWS maize hybrids in order to analyze the influence of the MMB quality indicator on grain production per hectare.

Key words: nonlinear regression, variables, logarithmic function, hybrids, physical analysis, the mass of 1000 grains(MMB)

1. Introduction

The extension and importance of maize crops over the world has been determined by its many uses and by some of its biological and phytotechnical features. Maize has great production capacities and extensively uses its resources while also contributing to soil consolidation.

2. Theoretical background

Due to its ecological, biological and phyto-technical features, corn is considered the leader of the cereal group. But the efficient use of natural resources for this culture in order to obtain economically viable productions requires the judicious localization of hybrids and the application of an appropriate technology which should be available for farmers.

There are studies [2] which used KWS hybrid biologic material to analyze their behavior in areas with a wide range of climatic hazards due to the geographic conditions of the area in which the studies were conducted. The studies were intended to identify hybrids which adapt faster to adverse / extreme conditions such as drought / a reduction in soil moisture and high temperatures and it was found that, due to the short vegetation period, early hybrids used more ground water reserve accumulated in the winter, compared to the semi-late and late hybrids which irrigation to complete their water requirement [2].

The highest water consumption is recorded during the period beginning with the formation of the male inflorescence until the first growth stage, then the consumption is significantly reduced because temperature has the decisive role in the complete maturation of the grains [1].

The adaptation of maize hybrids to diverse environmental conditions is an important contribution to the growth and stability of production, by exploring natural resources and reducing stress factors that can cause significant damage [7].

A quality indicator which helps determine the amount of seed per hectare, but also assess maize production, along with other indicators (no of spices per m^2, number of grains in the spice etc.) is the mass of 1000 grains - MMB.

At present there are researches that have highlighted the positive correlation between MMB and the level of seed production [8].

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 logarithmic function. [9].

The smallest square method allows us to obtain

some estimators that lead to satisfactory results because they generally have no optimal property [3, 5].

2.1 Research methodology

The practical stage of the research consisting of an experiment with KWS maize hybrids (Zea mays L.) in the area of Mures River. The elements which the experiment aimed to focus on included the influence of the mass of 100 grains on production. Observations were made in 2 phases for 5 maize hybrids, sown in 3 stages, applying classical technology.

2.2 Experimental results obtained

Table 1: MMB influence over maize hybrid production obtained in three different stages

Maize hybrids	MMB			PRODUCTIONS		
	Stage I	Stage II	Stage III	Stage I	Stage II	Stage III
KARNEVALIS	317,7	316,3	325,9	13131	13791	11773
KWS9361	328,2	321,1	328,5	13671	13408	12781
KINEMAS	380,1	372,5	364,3	14563	13935	12093
KWS6471	362,8	344,0	387,7	14199	14321	12883
KASSIUS	332,8	356,2	356,3	15284	15132	12289

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 logarithmic variation.

The general form for logarithmic regression $f(x) = a \ln x + b$.

Since the results of the research do not develop linearly, we will use the nonlinear regression model using the least squares method for logarithmic function to optimize the production of maize hybrids sown at 3 different epochs, depending on the mass of 1000 grains obtaining the graphs presented (figure 1, 2, 3).

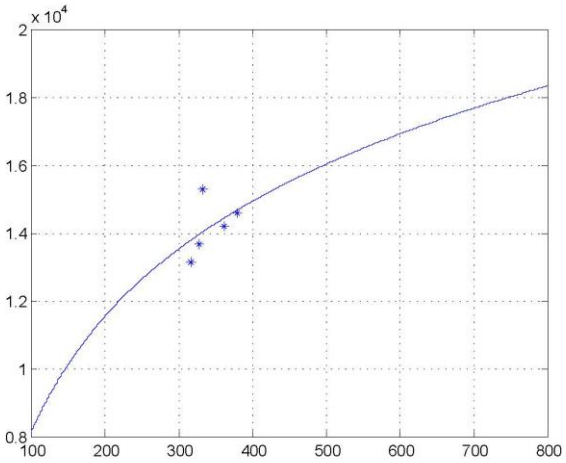

Fig. 1: Mathematical modeling of the Epoch I

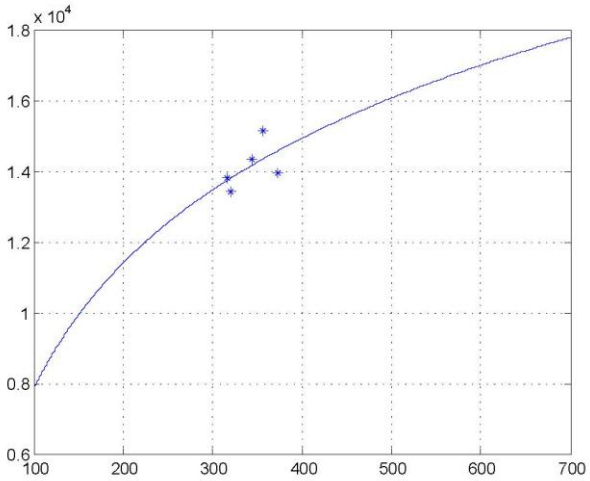

Fig. 2: Mathematical modeling of the Epoch II

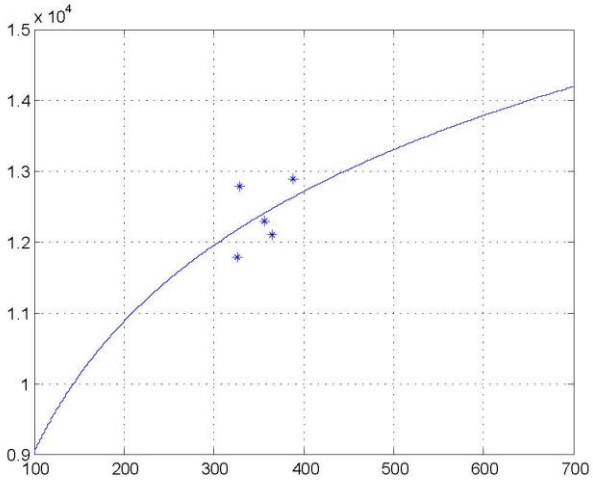

Fig. 3: Mathematical modeling of the Epoch III

Graphs (figures: 1, 2, 3) resulting from mathematical modeling of the values in Table 1 using the Matlab software [4, 6].

3. Conclusions

The observations and interpretations obtained from the study suggest that the seeds of hybrid Kassius recorded, in the first sowing stage, an MMB value which is lower by 23,4-23,5 grams compared to the other two stages, but the production obtained in this stage was the highest (15284 kg/hectare).

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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