Ministerul Educației Naționale
ROMÂNIA
UNIVERSITATEA DE MEDICINĂ, FARMACIE, ȘTIINȚE ȘI TEHNOLOGIE DIN TÂRGU MUREȘ

Scientific Bulletin of the „Petru Maior" University of Târgu Mureş
Vol. 15 (XXXII) no. 2, 2018
ISSN-L 1841-9267 (Print), ISSN 2285-438X (Online), ISSN 2286-3184 (CD-ROM)

# MATHEMATIC MODELING OF EXPERIMENTAL RESULTS ON THE INFLUENCE OF SOME FACTORS ON RAPE PRODUCTION (BRASSICA NAPUS)

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## Abstract

*This article discusses the nonlinear regression model, the method of the smallest squares with examples, and it includes calculations for the quadratic function model. We used data obtained from a study which analyzed the behavior of rape plants (Brassica napus) - the Bolero variety seeded by 200 germinable seeds / m2, and different fertilization doses. The experimental results were mathematically interpreted using the "variance analysis" method. The study shows that the yields and therefore the profit rate for the studied rapeseed variety depended on the level of fertilization, as well as on the pedo-climatic conditions of the area.*

**Key words**: nonlinear regression, variables, quadratic function, "variable analysis" method, factor, profit

## 1. Introduction

Rape culture is one of the most productive agricultural crops due to the productive potential that has grown substantially in "00" varieties, hybrids and transgenic forms. EU countries are interested in this culture due to the ecological, economic and agronomic importance that characterizes it. In the past 30 years, rapeseed has become an important agricultural product, being considered as the world's third major source for both vegetable flour and oil (Koike, 2007). The seeds of the newest varieties contain more than 45% of oil, which is the raw material for many industries: the food industry, the dye industry, the cosmetics, the transport, the chemical industry, etc. [2].

## 2. Theoretical background

The EU stragey on the replacement of classic fuel with biofuel has stimulated the development of areas and yields per hectare for rape crops (Brassica napus) lately, and there are good reasons for producers to attach greater importance to this energy crop. Rape forms are generally resistant to harsh conditions and exhibit great ecological plasticity. The autumn varieties can benefit from the moisture accumulated in the soil during the cold period of the year, avoiding as far as possible the effects of stress caused by drought during the rest of the vegetation period. The effects of stress caused by lack of water depend on the genotype, the stages of plant development, the intensity and duration of stress, and implicitly the weather conditions [7].

Plant density, the supply of macro-elements and microelements, the presence of weeds in culture are other factors that influence rape plant resistance to stress. There is research aimed at studying the effect of plant density and nitrogen doses on the ability of rape to compete with weeds.

The results indicated that different levels of plant density (150 and 270 plants / m2) together with 138kg / hectare of nitrogen may lead to a significant increase in the ability of rape plants to compete with weeds [6].

R. Haddad et al. have conducted research which has shown that the growth stage of rape may influence the activity of the CaMV 35S promoter, which plays an important role in ensuring the quality of oilseeds [4].

Based on the experimental data, we will study the variations of two parameters by mass production of 1000 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 y = f (x), using the quadratic function. [9].

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*

The "variance analysis" method (based on English statistician R.A. Fisher) was used to analyze the experimental results.

*2.2 The results of agricultural observation*

Table 1: Values of Bolero production, seeded by 200 b.g./$m^2$ according to fertilization and plant weight.

| Variety /Rehearsal | Density b.g./$m^2$ | Fertilization – NPK - | Avarege plant weight (*g*) | Seed production/ ha (kg/ha) |
|---|---|---|---|---|
| Bolero – R.I | 200 | $N_0P_0K_0$ | 1,64 | 1162 |
| | | $N_{90}P_{90}K_{90}$ | 4,04 | 1368 |
| Bolero – R. II | 200 | $N_0P_0K_0$ | 3,14 | 760 |
| | | $N_{90}P_{90}K_{90}$ | 2,43 | 1715 |
| Bolero – R. III | 200 | $N_0P_0K_0$ | 1,98 | 586 |
| | | $N_{90}P_{90}K_{90}$ | 2,97 | 2442 |
| Weighted Arithmetic Mean | 200 | $N_0P_0K_0$ | 2,17 | 836 |
| | | $N_{90}P_{90}K_{90}$ | 3.06 | 1841 |

R- Rehearsal

*2.3 Mathematical interpretation*

References must be listed at the end of the paper. Do not begin them on a new page unless this is absolutely necessary. Authors should ensure that every reference in the text appears in the list of references and vice versa. Indicate references by [1] or [2, 3] in the text.

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 $(x) = ax^2 + bx + c$ .

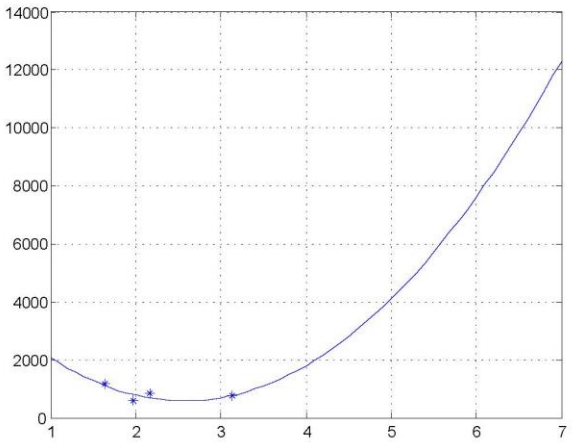


Fig. 1: The productive capacity of the Bolero – RI, RII, RIII according to mass

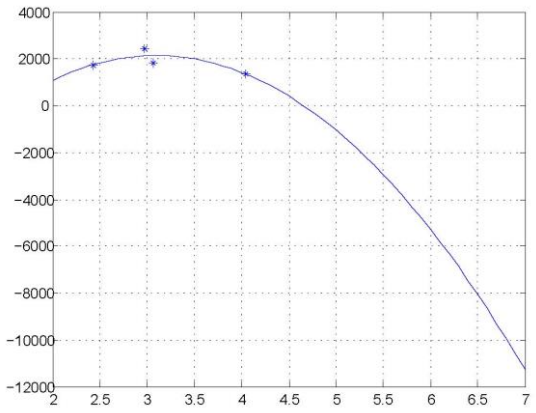


Fig. 2: The productive capacity of the Bolero weighted arithmetic mean according to mass

As the results of the research do not develop linearly, we will use the nonlinear regression model using the least squares method for the patch function to optimize the productive capacity of the Bolero variety sown with 200 germinable grains/$m^2$, obtaining the graphs presented (figure 1, 2).

## 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 experiment-tal data, it was used to make predictions.

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