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MATHEMATIC MODELING OF EXPERIMENTAL RESULTS ON THE INFLUENCE OF TECHNOLOGICAL FACTORS ON PRODUCTION IN SOME ENERGY CROPS

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Abstract

The present article, based on data obtained from a study which analyzed the influence of technological and ecological factors on rape plants (Brassica napus) production capacity - the Bolero variety – approaches the model of linear regression and the model of the smallest squares. 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 was of up to 55, 05%, depending on the seeding density (in this case: 100 germinable seeds / m^2), level of fertilization, as well as on the pedo-climatic conditions of the area.

Key words: biological material, linear regression, variables, notifications, parameters

1. Introduction

Rape (Brassica napus) is a culture characterized by great ecological importance due to native morphological and biological features, as well as to the specific technology and the breadth of development processes and techniques. A series of research has been carried out for the purpose of using it in the phyto-remediation of polluted soils. The results are quite spectacular because rape has a capacity for bioaccumulation of heavy metals much higher than other cultivated plants.

There are studies according to which it is possible to obtain satisfactory yields even when the fertilizers, especially those with nitrogen, are applied in small quantities, an aspect to be considered due to the reduction of expenses [6, 7].

2. Theoretical background

Rape, as an oil plant, play an important role in the world economy, being ranked third, after palm and soybean, in the category of plants which are sources of vegetable oil. But it is sensitive to soil compaction, so it is advisable to carefully prepare the germination bed and, at the same time, to apply the grain to the soil before sowing, which favors seed germination. This can ultimately lead to a good yield. [2] taking into account the forecasts made by the Food and Agriculture Organization of the United Nations, which estimate that world demand for food will increase by 70% in the next 40 years, and growth will be more higher in developing countries [4].

In the EU, rapeseed is one of the crops unaffected by the "overproduction crisis" and is therefore subsidized, both as an oil plant and as a protein plant. The appreciation of rape varieties is also due to the VCU (cultivation and use value) index, which includes both the quality of oil (erucic acid content and glucosinolates) as well as seed production, oil content, resistance to diseases and wintering. During vegetation, winter crops can be affected by a number of factors such as attack by pests or low temperatures. But by using complex measures (chemical control, appropriate density and nutrition, etc.), the effect of the mentioned factors can be reduced [3]. But extensive research is still needed in the field, in order to demonstrate that rapeseed has a high ecological plasticity and resists in tough conditions. Semi-high hybrids, such as MAXIMUS® hybrids, are preferred, because compared to conventional hybrids they have lower processing costs, harvesting is easier, less fuel consumption, which ultimately results in increased efficiency [9].

The smallest square method allows us to obtain some estimators that lead to satisfactory results because they generally have no optimal property [1, 8].

2.1 Research methodology

The biological material of the study was Bolero, a 00-type spring variety, seeded with 100 germinable seeds / m2. The "variance analysis" method was used to analyze the experimental results. In consists of separating the general fluctuation of the experimental data into several parts, according to the causes which produce it and according to the contribution brought by each factor and the interactions among these factors.

2.2 Results of agricultural observations

Table 1: Production values according to the factors used

Variety	Density b.g./m^2	Fertilization – NPK -	Avarege plant weight (*g*)	Production grains/ ha (kg/ha)
Bolero/variety – R.I	100	$N_0P_0K_0$	0,31	503
		$N_{90}P_{90}K_{90}$	3,54	1494
Bolero/variety – R.II	100	$N_0P_0K_0$	5,51	859
		$N_{90}P_{90}K_{90}$	6,14	1586
Bolero/variety – R.III	100	$N_0P_0K_0$	1,51	605
		$N_{90}P_{90}K_{90}$	3,37	1351
Weighted Arithmetic Mean	100	$N_0P_0K_0$	2,94	656,33
		$N_{90}P_{90}K_{90}$	4,41	1477

R-Repetition

2.3 Mathematical interpretation

We observe that the experimental results are almost linear, so we can use the linear regression by applying the least squares method. Thus we can correlate the experimental technological factors, respectively the quality indicators (density, fertilization, average weight of the plant) and seed production per hectare.

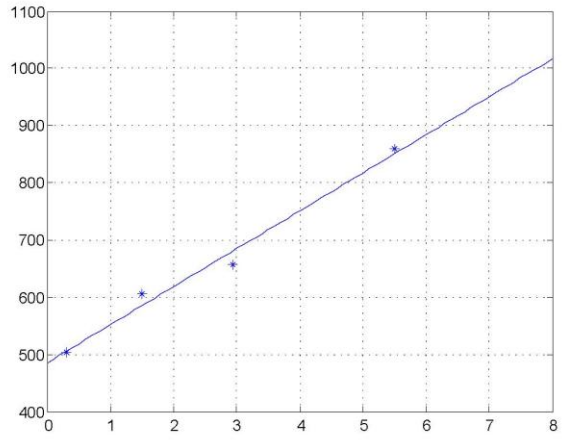

Fig. 1: Mathematical modeling of the values corresponding to the variant I

Graphs (figures 1, 2) resulting from mathematical modeling of the values in Table 1 using the Matlab software [5, 10].

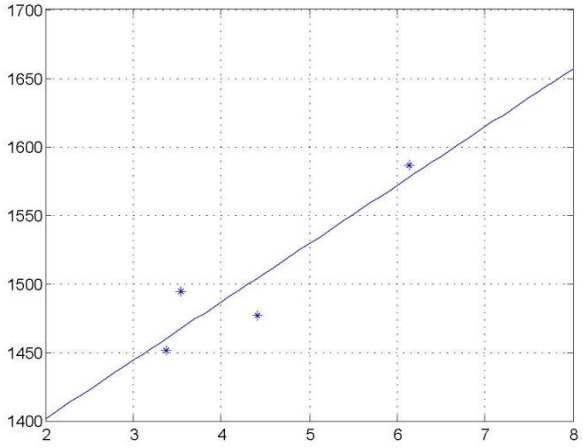

Fig. 2: Mathematical modeling of the values corresponding to the variant II

3. Conclusions

The profit rate for the Bolero rapeseed ranged from 25.92% to 55.0% depending on the sowing density, the fertilization level, and the pedo-climatic conditions of the area. Since harvesting densities are lower than sowing densities (86.1 plants per 100 seeds sown per m2), it is necessary to take this into account when setting sowing densities.

The applied mathematical method from this paper shows an obvious correlation. According to graphical representations (Fig. 1, 2) the experimental results correspond almost linearly.

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