THE ANALYSIS OF THE REGRESSION COEFFICIENTS BETWEEN THE QUANTITY OF NITROGEN ADMINISTERED AND THE SEED YIELD DEPENDING ON POTASSIUM SOIL FERTILIZER BASE ON THE ARCHITECT RAPESEED HYBRID CROPED IN THE S-E AREA OF ROMANIA

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Abstract

In the south-eastern area of Romania, the Arhitect rapeseed hybrid was tested in trail fields, in order to determine its biological potential in the ecological conditions specific to this area. In this research, the influence of potassium and nitrogen fertilization on seed yield was analyzed and also the analysis of the regression coefficients between the amount of nitrogen administered and seed yield according to the potassium soil fertilizer base was determined. Thus, regardless of the potash soil reserve, nitrogen ensures an increase in seed yield at least in this rapeseed cultivar, with the most important increases in yield being recorded under conditions of the most abundant fertilization. From an economic point of view, the profit calculated from the difference in yield due to the application of fertilizers, was obtained only in the variants where 150 kg N s.a./ha was administered in conditions of abundance in potassium. In other words, the administration of potassium can bring an increase in profit, only in conditions of abundant fertilization with nitrogen, otherwise the application of potassium is not economically justified.

Key words**: **rapeseed, seed yield, regression coefficients

INTRODUCTION

Big rapeseed (rapeseed) is a species of Mediterranean origin, formed where the area of origin of the cabbage Brassica oleraceea (western Europe and north-western Africa) and Brassica rapa (Europe and Asia) intersected (Velican, 1952, cited by Muntean, 1997).

Rapeseed oil has the lowest content of saturated fatty acids compared to the most used vegetable oils, the erucic acid content being below 2%, and in the new "000" rapeseed genotypes below 1%. It is of superior quality, good for both cooking and salads, being the healthiest (Gustafson et al., 1993; CETIOM, 2010).

At the same time, thanks to the success of breeding programs carried out over the last 25 years, researchers have succeeded in increasing the percentage of polyunsaturated fatty acids, such as linoleic acid and linolenic acid from 15% to 20% and from 8% to 12%, respectively (Trautwein, 1997; Trautwein and Erbersdobler, 2007).

The adequate content in vitamin E and sterols gives this oil valuable qualities for human nutrition.

Due to the high content of unsaturated fats and their proven beneficial influence on human health, In October 2006T, he U.S., the Food and Drug Administration authorized the introduction of canola oil into the human diet.

Regarding the importance of using rapeseed oil as a biofuel, the pressure exerted by the need for energy generated by the oil crisis, which began in 1973, as well as by the high prices of fossil fuels, have increased the interest of the major consuming countries in alternative energy resources, the former being fuels based on alcohols and vegetable oils (Ciontu, 2005; Halmajan, 2006).

The need to find alternative solutions led to obtaining biofuels from biomass. In terms of

energy productivity, rapeseed clearly separates itself from other species (wheat, corn, sunflower) used for the production of biofuels, making very efficient use of the surface on which it is cultivated (Guș et al., 2003).

In a study where the purpose of the analysis was the classical and organic foliar fertilization influence on the groundnut yield, Soare M., et al., 2020 mention that by additional foliar fertilization all the genotypes registered superior results compared with the basic fertilization.

The concern for establishing a high-performance technology for autumn rape, adapted to the pedo-climatic conditions specific to each geographical region, is currently a priority, both for researchers, agronomists, and for the final beneficiaries of this technology: farmers, in the conditions in which rapeseed has become in the last decades an extremely attractive and economically satisfying crop.

Knowing that the Dobrogea area is an area with a poor rainfall regime and high temperatures, and fertilization is a key link in the technology of each crop, it is important to establish a suitable and effective fertilization scheme so that farmers in this region can benefit from the major advantages that this crop brings.

The general objective was to optimize the nutrition and fertilization conditions for autumn rapeseed on the typical calcareous, loamy-sandy castanosium, so that the cultivated hybrid (Architect-Limagrain) capitalizes with higher yields, in the specific pedo-climatic conditions of the area, the potential its genetic, by creating a complex and integrated fertilization system.

Other pursued objectives referred to:

- Highlighting nitrogen and potassium doses with the greatest impact on biological potential.
- Testing the yield capacity of the Arhitect hybrid in the pedo-climatic conditions of the Central-Northern Plateau of Dobrogea, Cerna-Mircea Vodă Depression, Cerna commune, Tulcea county, under the action of applying different doses of nitrogen and potassium.
- Establishing those doses of nitrogen and potassium that provide maximum economic efficiency in the autumn canola crop.

MATERIALS AND METHODS

The biological material was represented by the Arhitect-Limagrain hybrid, which is characterized by excellent branching capacity, superior resistance to silique shaking and very good winter resistance. It also has a very good start when the vegetation resumes in the spring. This hybrid has a very good adaptability to the different climate conditions in Romania, achieving large and stable productions from one ecological zone to another.

The experimented factors were nitrogen dose and potassium dose, respectively.

Factor A – Dose of potassium (K_2O) with three graduations:

a_1 - K_2O 0

a_2 - K_2O 50

a_3 - K_2O 100

Factor B: Nitrogen dose (N) with five graduations:

b_1 - N 0

b_2 -N 16

b_3 -N 50

b_4 -N 100

b_5 -N 150

The experience was located in an experimental plot on Ulmului Vally, in Tulcea county, in 2021-2023 the period, according to the method of subdivided plots with 2 factors, 15 variants x 3 repetitions. The dimensions of the experimental plots were 35 m^2, 3.5 m wide (15 rows) and 10 m long.

The determinations were made on a number of 5 plants from each variant/repetition. At maturity, the plants were harvested individually on each plot, the number of branches/plant, the number of siliques/plant, the number of grains/silique were determined and the resulting samples were weighed.

As a result of the influence of the solification factors, soils were formed in the experimental area that have a brown Am horizon (soft) as a diagnosis, with chromes

and values higher than 3.5 in the wet state and lower than 5.5 in the dry state, followed by a sub-horizon, which shows, at least in the upper part, mollic horizon colors (lighter brown) both at the surface and within the structural aggregates.

The climate in the research area is one with pronounced aridity, accentuated by the low level of precipitation (approx. 380 mm annually).

The aridity is also accentuated by the intensity of solar radiation, which here reaches the highest values in the country, namely 400÷500 Kj/cm^2.

The multiannual average temperature is 11.3^{o}C, the absolute minimum was -26.8^{0}C, and the absolute maximum was 39.8^{0}C.

From the point of view of statistical processing, there were computed the coef. Perason's correlation between nitrogen doses and seed yield according to the potash soil. The regression coefficients were also computed between the two variables.

RESULTS AND DISCUSSIONS

The average productions calculated during the three years of experimentation are shown in table 1.

Table 1. Variation of average yields calculated in the three years of trails (2021-2023) depending on the doses of fertilizers applied

Experimented factors		Average Yields (kg/ha)
B (nitrogen doses)	A (potassium doses)	
b_1-N_0	a_1- K_2O_0	1275±111.57
	a_2- K_2O_{50}	1355±128.37
	a_3- K_2O_{100}	1821±152.32
b_2-N_{16}	a_1- K_2O_0	1418±102.56
	a_2- K_2O_{50}	1536±142.36
	a_3- K_2O_{100}	2154±202.89
b_3-N_{50}	a_1- K_2O_0	1647±138.69
	a_2- K_2O_{50}	1861±152.86
	a_3- K_2O_{100}	2555±301.22
b_4-N_{100}	a_1- K_2O_0	2322±278.69
	a_2- K_2O_{50}	2650±289.30
	a_3- K_2O_{100}	2861±312.52
b_5-N_{150}	a_1- K_2O_0	2824±401.47
	a_2- K_2O_{50}	3182±389.55
	a_3- K_2O_{100}	3405±402.69

On the field without potassium fertilizers, the correlation coefficient between fertilizer dose and recorded seed yields was 0.874, with a regression coefficient of 8.649, which implies that, for each kg. of Nitrogen fertilizers it was recorded an increase in yield of 8.649 kg seeds/ha (Chart 1).

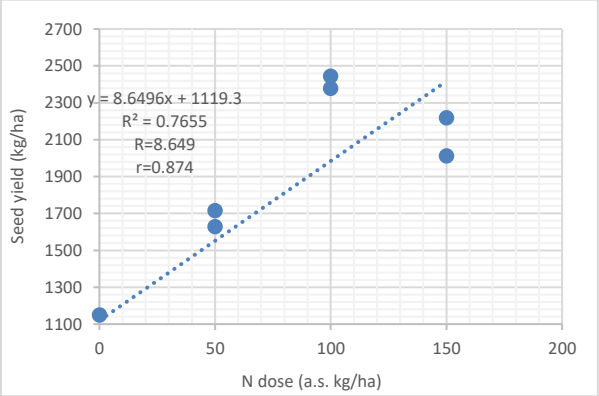


Chart 1. The variation of rapeseed yield on the Arhitect hybrid, depending on the dose of nitrogen administered, without potassium soil fertilizer base

On the 50 kg/ha potassium soil fertilizer base, the correlation coefficient between fertilizer dose and seed production recorded was 0.891, with a regression coefficient of 11.339, which implies that, for each kg of applied nitrogen fertilizer the yield increases with 11.339 kg seeds/ha (Chart 2).

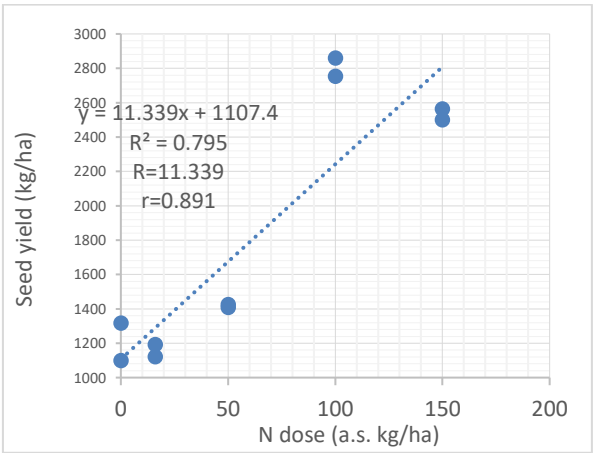


Chart 2. The Arhitect hybrid rapeseed yield variation depending on the fertilizer nitrogen dose on 50 kg/ha s.a. potassium soil fertilizer base

In a field study carried out in south of Romania in a rape-wheat rotation made in order to test the effect of different nitrogen doses on yield and quality of several new mutant/recombinant lines of winter wheat, Iancu Paula et al., 2019 mention that the gradual increase in wheat yield with increasing rates of nitrogen fertilization is

reflected by the increases in almost all other grain yield components.
On 100 kg/ha 100 kg/ha s.a. potassium soil fertilizer base, the correlation coefficient between fertilizer dose and seed production recorded was 0.991, with a Regression coefficient of 12.18, which implies that for each kg. of administered active substance nitrogen was obtained a yield increase of 12.18 kg seeds/ha (Chart 3).
Foliar application of fertilizers to some crops can lead to the obtaining of significant statistically increases in production compared to control variant as a result of the intensification of some physiological processes (Iancu Paula et al., 2024). They also state that this type of fertilization could be put in the practice by farmers relatively easy and the fertilization with micronutrients can lead to better growth and development of wheat plants, even in less favorable conditions.

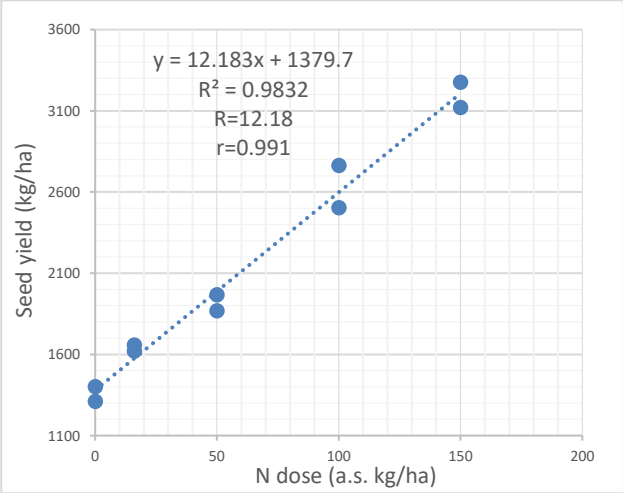


Chart 3. The Arhitect hybrid rapeseed yield variation depending on the fertilizer nitrogen dose on 50 kg/ha s.a. potassium soil fertilizer base

Related to the variation of the regression coefficients between the nitrogen fertilizer amount and the seed yield, depending on potassium soil fertilizer base, by far the highest value was calculated for the 100 kg K_2O s.a./ha, which obtains a significant difference compared to the other two recorded values, between which there is also a significant difference (Chart 4).

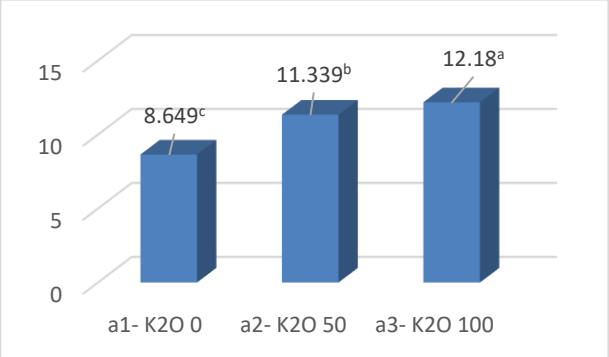
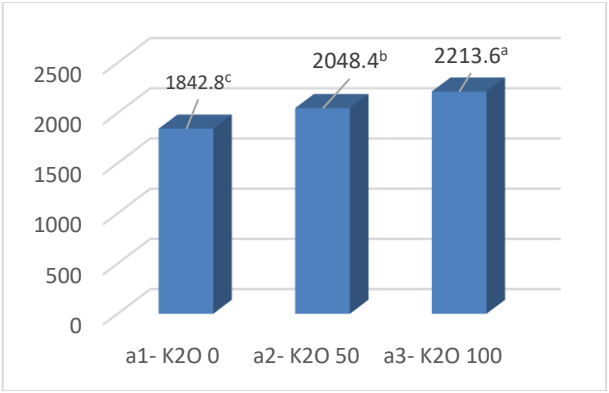


Chart 4. The variation Regression coefficients between the amount of nitrogen administered and the seed yield obtained by the Arhitect rapeseed hybrid, depending on potassium soil fertilizer base

Depending on the potassium soil fertilizer base, the highest average yield recorded was recorded on the 100 kg K_2O s.a./ha potassium soil fertilizer base, which differs significantly from the other two average values recorded (Chart 5).



LSD 5%= 290,15 kg/ha

Chart 5. The variation of seed yield on the Arhitect rapeseed hybrid, depending on potassium soil fertilizer base

Related to the variation of the seed yield differences depending on potassium soil fertilizer base and the nitrogen fertilizer doses, the biggest differences were recorded between the variants where there were administered 100 kg K_2O/ha a.s. and respectively, those to which no potassium was administered, being yield differences also between the variants to which 100 kg K_2O/ha was administered a.s. and respectively, those that were administered 50 kg K_2O/ha s.a. (Table 1).

Table 1. The variation of seed yield differences on the Arhitectect rapeseed hybrid depending on potassium soil fertilizer base and nitrogen fertilizer doses (kg/ha)

K_2O Dose / N Dose	Y **(a_2-a_1)**	Y **(a_3-a_1)**
N_0	-447	-855,75
N_{16}	-366	-594,75
N_{50}	-161,25	-405,75
N_{100}	111	-30
N_{150}	176,25	57,75

CONCLUSIONS

1. Nitrogen ensures the increase in seed yield, with the most important increases in yield being recorded under conditions of the most abundant fertilization.
2. Related to the variation of the regression coefficients between the amount of nitrogen fertilizer and the obtained seed yield, depending on potassium soil fertilizer base, by far the highest value was calculated for the 100 kg K_2O s.a./ha, which obtains a significant difference compared to the other two recorded values, between which there is also a significant difference.
3. Related to the variation of seed yield differences depending on potassium soil fertilizer base and the administered nitrogen fertilizer doses, the highest differences were recorded between the variants where 100 kg K_2O/ha s.a. were administered and respectively, those to which no potassium was administered, there being differences in yield also between the variants to which 100 kg K2O/ha was administered s.a. and respectively, those that were administered 50 kg K_2O/ha s.a.
4. The profit was obtained only on the variants where 150 kg N s.a./ha was administered on potassium soil fertilizer base. In other words, the administration of potassium can bring an increase in profit, only in conditions of abundant fertilization with nitrogen, otherwise the intake of potassium is not economically justified.

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