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Influence of biostimulator treatments applied by rape seeds pelleting, on certain biometric parameters of plants in field conditions

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Abstract
This study is the continuation of a laboratory research, in which various ways of pelleting rape seeds (Harry variety) were tested, a process that included their treatment with biostimulating products based on collagen (bioactive formulas – F1/F2/F3), as well as their mixture with classical fungicides (Tiram 480 g/l). The aim of this paper is to show the effect of the treatments included in the rape seeds pelleting material, in field conditions. To do this, an experience consisting of 21 plots, respectively 7 treatment variants (V1-V7), in 3 randomized repetitions, has been placed in south Romania. Biometric analysis included the evaluation of rape plants from emergence moment up to the winter. The measurement at 60 days after sowing have been the most conclusive, with the mention that the plants development trend has been constant during the first stages of vegetation. Data were statistically processed and presented in tables and graphs.
Keywords: *Biostimulators, Rape, Pelleted Seeds, Plant Measurements.*

1. Introduction

Plants are frequently exposed to unfavorable environmental conditions, which induce stress, triggering their specific or nonspecific reactions [1, 2], and rapeseed is one of the sensitive crops to biotic and abiotic indices [3] that they face with during a whole vegetation cycle.
Biostimulators aren't considered fertilizers because they don't provide nutrients directly, instead they support metabolic processes in plants and soil, facilitating nutrition and crop protection [4]. Biostimulator treatments have also been shown to support better plant development and productivity by reducing adverse reactions to stresses [5, 6], as well as restoring soil structure and fertility [7]. Obtaining bioactive substances for plants from residues left over from tannery is a relatively new practice [8], but which has so far proved its effectiveness and continues to do so, being the subject of several studies [9, 10]. Their application to the seed, through the pelleting process [11, 12], as a substitute or adjuvant for classical treatments, has the role of facilitating the access of water to the seed and stimulating germination [13, 14].
A lot of researches are carried out exclusively in the laboratory [10], where an attempt is made to simulate field conditions, but most of the time the results don't correspond to those in agricultural practice [15]. Each agricultural year comes with new challenges, reveals the shortcomings that we face with and puts us in the situation of finding increasingly unconventional solutions. This is also the case for the tested bioactive products [16, 17], which help not only crops, but also the environment, both through their nutrients that enrich the soil and plants, and by the fact that they don't become sources of pollution.

2. Materials and Methods

Field research has been located in southern Romania, in Calarasi County. Considering the structure of the agricultural year, the sowing of the research lots with pelleted rape seeds took place in autumn 2019, more precisely in the first decade of September. Harry variety was used. Previous plant was wheat. The sowing rate was 60 germinating grains/sqm.
For a greater accuracy of the results, 3 repetitions have been used, in randomized system, with the variants mentioned in the Figure 1 legend.

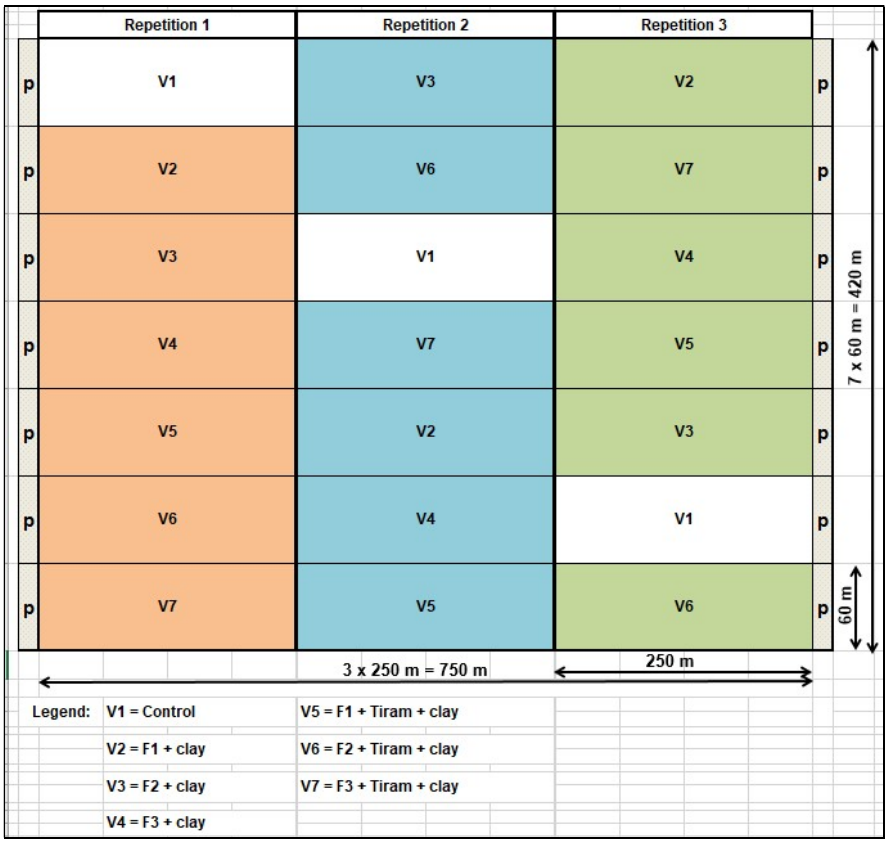

Figure 1. Technological scheme of experimental plots of rape sown with pelleted seed located in Calarasi – autumn 2019

Each plot had an area of 15,000 sqm (1.5 ha), ie 60 x 250 m. Thus, in each of the repetitions were placed 6 plots, plus one control version (untreated).
Total number of sown plots was 7 x 3 = 21 plots.
Total sown area: 21 plots x 1.5 ha = 31.5 ha.
All seeds have been pelleted before the sowing time, in the following variants:

→V1 = control, pelleted with water and clay;
→V2 = F1 (ratio of 2:8 with water/t seed) + clay;
→V3 = F2 (ratio of 2:8 with water/t seed) + clay;
→V4 = F3 (ratio of 2:8 with water/t seed) + clay;
→V5 = F1 + Tiram 480 g/l (ratio of 3,5:6:5 – 2 l test product + 1,5 l Tiram + 6,5 l water/t seed) + clay;
→V6 = F2 + Tiram 480 g/l (ratio of 3,5:6:5 – 2 l test product + 1,5 l Tiram + 6,5 l water/t seed) + clay;
→V7 = F3 + Tiram 480 g/l (ratio of 3,5:6:5 – 2 l test product + 1,5 l Tiram + 6,5 l water/t seed) + clay.

The aim of the paper is to follow the effect of the treatments included in the rape seeds pelleting material, as well as that of the combination between the tested biostimulators and the classic fungicides, in field conditions.
Biometric analysis of rape plants has been performed at every 10 days, from sowing until winter. 10 plants have been taken from each experimental plot, randomly. Whole plants have been measured, but also the root separately, their development being decisive for the way in which the crop will look in the next spring. The data have been statistically processed using the analysis of variance, calculated with the Anova program and presented as tables and graphs.

3. Results and Discussions

The autumn of 2019 offered special climatic conditions, characterized by prolonged drought, which delayed the emergence of rape plants, in some places being inhomogeneous, according to the water supply. It should be noted that the pelleted rape seed remained in the soil, in the initial state, until the first significant rains.

After emergence, on a background of moderate humidity and high temperatures for this time of year, the crop developed normally (Figure 2), and germination has been evaluated at about 75% in the control variant and V5-V7, exceeding 90% in V2-V4.

Figure 2. Optimal emergence in the plots where the pelleted rape seed has been sown – Calarasi

Research field has been kept under close observation, and every 10 days 10 plants have been taken in order to evaluate them, especially by measuring the length, but also to observe if there are pests or disease attack. Measurements' results are shown in Figure 3, where are clearly presented the differences between the tested variants.

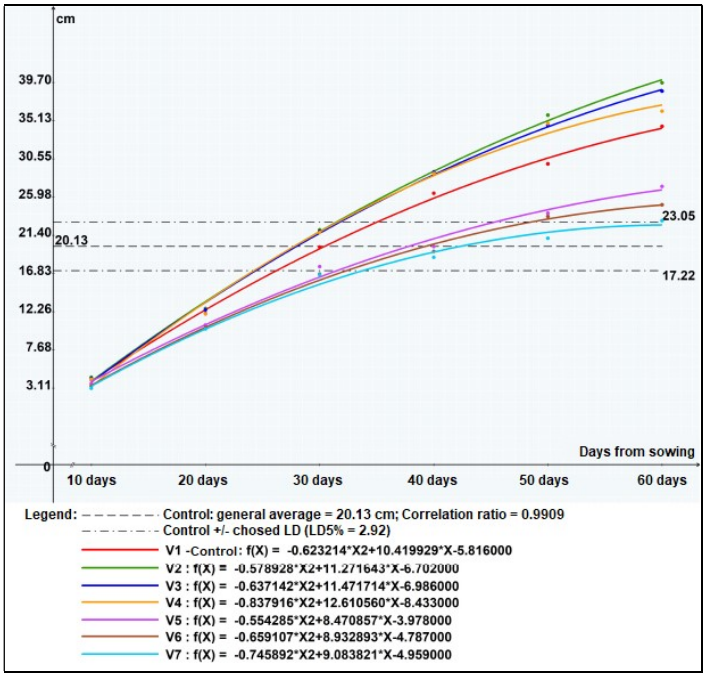

Figure 3. Analysis of rape plant growth, depending on the seed treatment versions

It should be noted that in control version aren't the least developed plants, but in the plots in which the combination of bioactive product and classic fungicide (V5-V7) has been used. As in the laboratory, it seems that also in the field, in the long run, this mixture leads to an inhibition of plant growth, delaying their development.

The measurement of the plants and, separately, of the roots, at 60 days after sowing have been the most conclusive and important in terms of showing the extent to which the crop is prepared to withstand the extreme conditions of winter. All data have been entered into Anova's statistical analysis program, presenting the results through tables and graphs.

First, the whole plants have been measured (Table 1 and Figure 4), and then the roots measurements have been performed (Table 2 and Figure 5).

Table 1. Values of rape plants length at 60 days after sowing

Treatment version	Length average (cm)	Control ratio (%)	Difference (cm)	Significance
V1	34.50	100.00	0.00	Control
V2	39.70	115.07	5.20	* * *
V3	38.70	112.17	4.20	* * *
V4	36.30	105.22	1.80	
V5	27.30	79.13	–7.19	o o o
V6	25.10	72.75	–9.39	o o o
V7	23.20	67.67	–11.30	o o o
		Limit difference	LD5% = 2.1632	
			LD1% = 2.8810	
			LD0.1% = 3.7521	

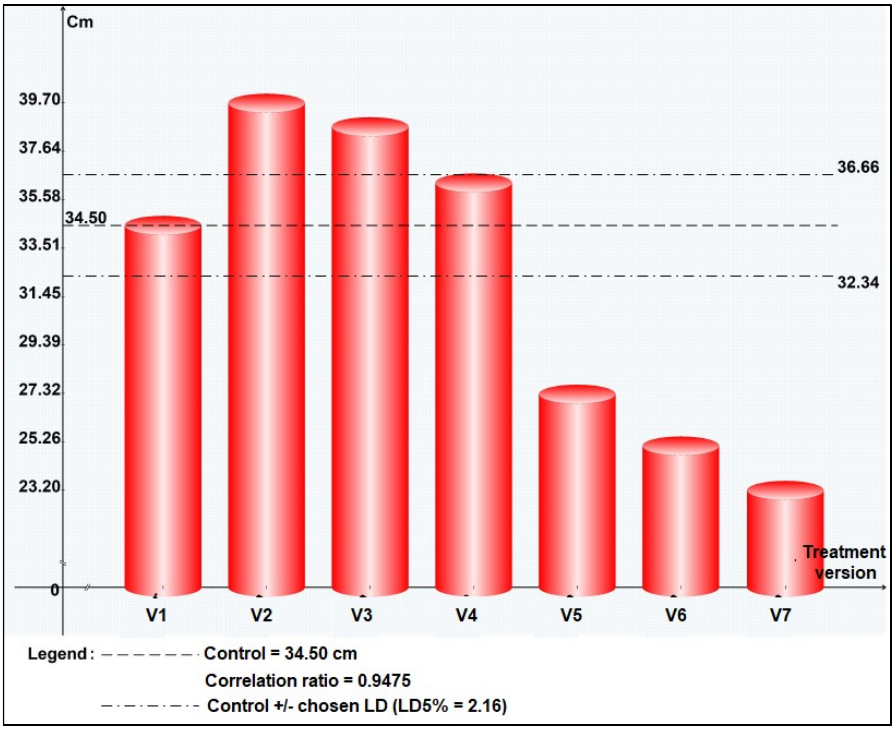

Figure 4. Graph presenting the rape plants length at 60 days from sowing time

Table 2. Values of rape roots length at 60 days after sowing

Treatment version	Length average (cm)	Control ratio (%)	Difference (cm)	Significance
V1	17.30	100.00	0.00	Martor
V2	20.30	117.34	3.00	* *
V3	18.90	109.25	1.60	
V4	18.00	104.05	0.70	
V5	14.80	85.55	–2.50	o
V6	14.00	80.92	–3.30	o o
V7	13.40	77.46	–3.90	o o o
		Limit difference	LD5% = 1.9093	
			LD1% = 2.5429	
			LD0.1% = 3.3117	

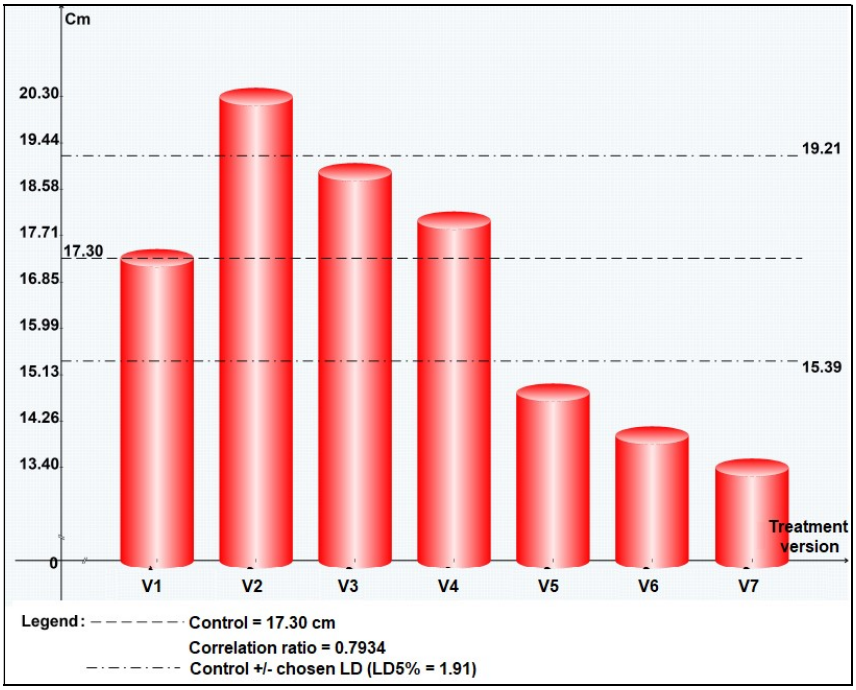

Figure 5. Graph presenting the rape roots length at 60 days from sowing time

The overall development of the plants, both aerial and underground, has been constant and much better highlighted than the control version in the case of seeds pelleted with newly tested products (F1/F2/F3) and clay. Adding fungicide in the seed treatment mix, there has been a delay in the development of plants, including their root system, which can create certain problems in the subsequent evolution of the crop, leading to lower yields in quantity and quality.

4. Conclusions

We can conclude that the development trend of rape plants has remained relatively similar from germination to the time of the last determination, respectively the one from 60 days after sowing, for all the tested variants, the most significant being the V2, followed by V3, V4 and control. Treating rape seeds with a mixture of biostimulator (F1/F2/F3) and fungicide (Tiram 480 g/l) led to a slowdown in plant growth (V5-V7), observed especially when measuring the whole plant.

It should also be mentioned that plants with a weak development, with a poorly developed root system, present the risk of not being able to withstand the winter conditions, the crop becoming uneconomic. Overall, we consider that the plants have had a very good emergence, due to the use of pelleted seeds, the crop managing to reach the optimum stage of vigor, so as not to be affected by possible extreme frosts in the coming months.

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