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RESEARCH ON THE ACTION OF ROM-AGROBIOFERTIL NP BIOFERTILIZER ON AGRICULTURAL CROPS

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Abstract

The use of intensive chemistry in the agricultural field was a first cause of pollution in the agricultural field. In order to move towards sustainable, environmentally friendly agriculture, farmers took into account the use of alternatives to chemical fertilizers, green, green and non-polluting alternatives. Thus, so-called ecological fertilizers, green fertilizers, soil-friendly, agricultural crops, production and, implicitly, for humans and animals have emerged. The alternative to chemical fertilizers is fertilizer based on bacterial cultures. In agriculture, the main source of nutrition is the nutrients. These are the basis for the growth and development of cultural plants, and they are indispensable to any form of life. On the other hand, the amount of nutrients at some point in time may decrease or increase depending on certain pedo-climatic factors, soil typology, the ability of plants to return some of the nutrients consumed (by the decomposition of crop residues) and so on.

Key words*: biofertilisers, Azospirillium lipoferum, Azotobacter chroococcum, Bacillus megaterium, Rom-Agrobiofertil NP.*

INTRODUCTION

Biofertilizers are organic products that consist of living microorganisms (bacteria, fungi, fungi etc.), these biofertilizers providing the necessary microelements in the soil, better growth and development of agricultural plants, as well as obtaining healthy and higher yields and quantity of products) compared to chemically fertilized crops. Biofertilizers, being liquid substances, can be applied either on soil, seeds or on the surface of plants so that the microorganisms in their composition fit the best. Once these microorganisms are fixed on the organs of the plants, together with their activity there will be a contribution of elements necessary for the growth and development of the agricultural crops (Sunita et al., 2018).

Rom-Agrobiofertil NP is a fertilizer based on three bacterial strains: *Azospirillium lipoferum, Azotobacter chroococcum* and *Bacillus megaterium*. Each bacterium has its own role as well as action on soil and crops. Thus, *Azotobacter chroococcum* has the role of capturing atmospheric nitrogen on the basis of certain resources and exchanges of energy between the soil and the environment, fixing in the soil. In addition to this role, this bacterium also has the role of metabolizing phosphates in the soil, assimilating root exudates, and counteracting certain plant-damaging bacteria, existing bacteria in the soil (Levandovschi et al., 2017).

Azospirillium lipoferum has the role of metabolizing organic matter from soil to nutrients assimilable by plants (metabolism of cellulose, hemicellulose, lignin etc.). At the same time, as azotobacter, azospirillium is designed to capture nitrogen in the atmosphere and to place it in the soil. Under certain environmental and soil conditions, *Azospirillum* can positively influence plant growth, crop yields and N-content of the plant. This plant stimulatory effect exerted by *Azospirillum* has been attributed to several mechanisms, including biological nitrogen fixation and auxin production (Steenhoudt et al., 2000).

The mode of action of *Azospirillum* is most probably composed of multiple mechanism. The increased use of the various biological process in soil will decisively contribute to

make agriculture more productive with less harm to the environment (Attilla et al., 2010).
The last bacterium of the biofertilizator, *Bacillus megaterium*, plays a role in the decomposition of soil detriment, the solubility of insoluble phosphates from the soil into soluble phosphates, but also produces certain organic acids necessary for the growth and development of plants (lactic acid, glutamic acid etc.) and enzymes and minerals the role of acting as growth incentives for plants and agricultural production (Sbîrciog et al., 2017).
The isolation of phosphate solubilizing bacterial strains exhibiting high ability to solubilize soil phosphorus is a matter of great interest with high applicability. The use of phosphate solubilizing bacteria as inoculants simultaneously increase phosphate uptake by the plant and increase crop yield, Strains from the genera *Pseudomonas*, *Bacillus* and *Rhizobium* species are the most powerful phosphate solubilises (Patel et al., 2016).
Research on soil has found that in order to replace the chemical elements in the composition of classical fertilizers, researchers can use numerous bacteria found in the soil structure. Thus, following laboratory and open field tests, it has been found that by combining bacteria, much better results can be obtained than when applying a chemical fertilizer. Using these research and results on a large scale, researchers have created biofertilizers to reduce soil pollution, increase crop production, and protect human health.

MATERIALS AND METHODS

The first research on biofertilizers of Romvac Company S.A. was carried out at a research farm in agriculture, namely Vegetable Development Research Station Buzău. Within this resort, alongside Romvac collaborators Dr. Biol. Floarea Burnichi (Scientific Secretary of SSC Buzau) and Drd. Ing. Constantin Petre (Head of Mechanization Department of Vegetable Development Research Station Buzău) established the crops to which the Rom-Agrobiofertil NP biofertilizer was applied (cabbage and tomatoes).
Thus, in November 2017 the semicircular cabbage culture was ished, the "Buzau" variety in field tomatoes "Buzău 1600" and "Florina 44". In the spring of 2018 the first tranche of this biofertilizator was administered at a dose of 5 l/ha (3 types of product x 5 = 15 l/ha) for each crop.
The second research on biofertilizers of Romvac Company S.A. was carried out at a research farm in agriculture, namely Research and Development Station for Plant Culture on Sands Dăbuleni. Within this resort, alongside Romvac collaborators Dr. Ing. Aurelia Diaconu (General Manager of Research and Development Station for Plant Culture on Sands Dabuleni) and Dr. Ing. Milica Dima established the crops to which the Rom-Agrobiofertil NP biofertilizer was applied.

RESULTS AND DISCUSSIONS

Developing unit. Vegetable Development Research Station Buzau. *Main features*. The seedlings have a green, green-violet coloration. At planting, the seedling must have 40 days. Characteristic of seedling planting is the height of the plant, a mean height of 55-60 cm.
The diameter of the leaf rosette is high, ranging from 90-100 cm. The position of the rosette leaves is half-erect. The leaf is medium to large (27-29 cm). The base leaves are between 30 and 35 cm high, with a 12-15 cm long petiole, with 1-3 bracts. The leaf is greenish-bluish, elongated to the basal leaves and rounded to the middle leaves and top of the rosette.
The edges of the tongue are medium-wavy, slightly creased. The surface of the tongue is slightly embossed, with a prominent rib. The leaf is well covered with pruin. The diameter of the head records a medium variation with variation limits between 23 and 25 cm.
The height of the head has a medium variability, with limits between 17 and 19 cm. The shape index is between 0.7-0.9, with globular-capped head forms. Head weight fluctuates between 2.0-3.5 kg. The head is full, covered with leaves. Position of the rosette after the formation of the head: does not cover the head. The outer cochlea is 4-6 cm. The inner cochlea is medium, between 5.0 and 6.5 cm. The color of the leaves inside the head is yellowish-white. Leaves inside the head are very fine and thin. Semi-late variety, with a vegetation period of 135-140 days. The range from planting to maturity is 95-100 days. The

production potential is 70-80 tons/ha, under normal crop conditions, it is easy to achieve 50-60 tons/ha.

Crack resistance: 10-15 days after consumption maturity. This variety of cabbage is cultivated in all parts of the country, in southern areas it is cultivated in successive culture. "Buzău" variety shows good resistance to pathogen attack. The growing period of this variety is: at maturity (130 days) 14.06-20.10 and planting - maturity (95 days) 18.07-20.10. Production destination (Table 3): a well-known and well-known variety for fine leaves, very well-suited for fresh consumption or preserved by marinating (from the leaves of this variety, from the 1950s to the 1960s, traditional sausages are prepared).

Experimental variants: V_1 - Unfertilized (Control - Table 1, Figure 1) and V_2 - Rom-Agrobiofertil NP 5 l/ha (3 x 5 = 15 l - Table 2, Figure 2).

Table 1. Scheme of treatment for autumn cabbage culture "Buzău" variety

Scheme of cultivation of cabbage seedlings in the field					
No. treat.	**Date of application of the treatment**	**Applied product type**	**Name bacterial strain**	**Approved dose**	**The dose used**
1	4/25/2018	Organic fertilizer	*Azospirillum lipoferum*	5.0 l/ha	5.0 l/ha
		Organic fertilizer	*Azotobacter chroococcum*	5.0 l/ha	5.0 l/ha
		Organic fertilizer	*Bacillus megaterium*	5.0 l/ha	5.0 l/ha

Table 2. Biometric data recorded in autumn cabbage seed crop "Buzău" variety

Variant	**No. of the main shells**	**Average length of silicone**	**No. of silicone / plant media**	**No. seed / silica medium**	**Average seed / plant**	
					Nr. seeds / plant	**g/pl**
V_1 – Control	21	6.25	209	24	2021	8.31
V_2 - Rom-Agrobiofertil NP 5 l/ha x 3 = 15 l/ ha	23	7.80	424	29	6564	44.4
Growth like V_1 Control (%)	9.52%	24.8%	102.87%	20.83%	224.79%	434.3%

Table 3. Seed production at Autumn Cabbage semicircle "Buzau" variety, kg/ha

Variant	**Average seed yield kg/ha**	**Selling price/kg**	**Total value of the seeds lei**	**MMB g**	**Number of seeds/1 g**
V_1 – Control	422.46	500	211230	4.11	243.0
V_2 - Rom-Agrobiofertil NP 5 l/ha	1171.76	500	585880	6.76	147.8
Growth like V_1 Control (%)	177.4%			64.5%	

Developing unit. Vegetable Development Research Station Buzau. The year of approval of this variety was in 1977.

Main features. Semi-sweet variety of tomatoes for fresh consumption. The period of vegetation from the east to the consumer maturity of the first fruits is 125-130 days.

The plants have indeterminate growth, the height of 120-130 cm, vigorous, with characteristic green leaf. The fruit is large, firm, with an average weight of about 200 g (150-220 g), spherical, taste particularly pleasant due to its balanced sugar-acidity ratio. The surface of the fruit is smooth, uniform red. It is tolerant to the attack of the main pathogens.

Economic efficiency. The production potential is 60-80 t/ha; if improved technology is applied, production can grow up to 150 t/ha.

Scope. Fruits are intended for fresh consumption, in which case they are harvested in the spring stage and for industrialization (juices, paste etc.). It can be cultivated successfully in all areas favorable to tomato culture, being recommended primarily for households.

Potential beneficiaries. Vegetable Units and Private Producers.

Figure 1. Semi-cabbage crop, "Buzău" variety - control batch

Figure 2. Semi-sweet cabbage crop, "Buzău" variety - fertilized with Rom-Agrobiofertil NP

Figure 3. Semi-sweet cabbage crop, "Buzău" variety - differences between control and variant fertilized with Rom-Agrobiofertil NP

Results obtained in field tomato variety "Buzău 1600"

The culture was set up in May, in a gauntlet system, on the scrubber. Rom-Agrobiofertil NP was administered in spring, the second decade of May, in vegetation at a dose of 5 l/ha (3 x 5 = 15 l/ha). *Cultivation desimetry*: 30000 plants/ha. Fruit weight: 120-135 g. Experimental variants: V_1 - Control, V_2 - Fertilization variant with Rom-Agrobiofertil NP 5 l/ha x 3 types.

Developing unit. Buzau Vegetable Research and Development Station. *Variety*: tomatoes "Buzău 1600". *Characteristics of tomato variety,* "Buzău 1600" (Figure 4): Semi-sweet variety, vegetation period (sunrise on consumption) 125-130 days, is tolerant to attack by major pathogens and use in households. *Economic efficiency:* production of 60-80 t/ha, increase production to approx. 150 t/ha. *Usage area*: fresh consumption, for industrialization (juices, paste etc.).

It presents a positive response to Rom-Agrobiofertil NP biofertilizer, increase by approx. 1.4% against the control group of the crop plants, increase by approx. 6.8% against the control group, weight of the fruit on the plant with approx. 26.2%, the weight of the fruit in the variant fertilized with Rom-Agrobiofertil NP by approx. 6.8% (Table 4).

Table 4. Biometric data recorded on the "Buzău 1600" field tomato crop located on the trellis

Variant	Height of plant (cm)	No. inflorescences/ plant	Medium length (cm)	No. fruit / plant	Average fruit weight (g)	Total fruit production (t/ha)	TGW (g)	No. of seeds / 1 g
V_1 – Control	145.9	7.3	21.8	8.4	123.9	31.2	2.7	372.7
V_2 - Rom-Agrobiofertil NP 5 l/ha x 3	148.0	7.8	23.8	10.6	132.3	42.1	3.5	293.0
Growth with V1 Control (%)	**+1.4**	**+6.8**	**+9.2**	**+26.2**	**+6.8**	**+34.9**	**+9.6**	

Figure 4. "Buzău 1600" variety - fertilized with Rom-Agrobiofertil NP

Rom-Agrobiofertil NP effectiveness testing on peanut culture 2018

During vegetation, determinations were made on the plant's height, the number of shoots on the plant, the number of nodules per plant, and production determinations were made at harvesting (production was weighed on each variant and reported per unit area).

In the year 2018, the Rom-Agrobiofertil NP product was produced with 1402 kg/ha of pasta, surpassing the control variant with an significant production increase of 5.9% due to unfavorable weather conditions (abundant rainfall). It is recommended to resume the experiment so as to determine the action of Rom-Agrobiofertil NP biofertilizer on peanut culture (Table 5).

Table 5. Biometric determinations of peanuts under the influence of fertilization with Rom Agrobiofertil NP

Variant	Production of pods (kg/ha)	Relative production (%)	The difference from the control (kg/ha)
Control	1324	100	Ct.
Treated with Rom-Agrobiofertil NP	1402	105.9	+78

The plant's height was 15 cm in the untreated version and 19 cm in the variant treated with Rom-Agrobiofertil NP. The number of shoots per plant is the same in both treated and untreated versions. The number of nodosities is higher in the treated version (41 nodosities) compared to the untreated variant 37 (Table 6).

Table 6. Influence of fertilization with Rom-Agrobiofertil NP on peanut production

Variant	Plant height (cm)	Number of shoots/plant	Number of nodules/plant
Control	15	7	37
Treated with Rom-Agrobiofertil NP	19	7	41

Rom-Agrobiofertil NP effectiveness testing on potato culture 2018

Under the conditions of year 2018, the Rom-Agrobiofertil NP product was produced with a production of 1402 kg/ha of pasta, exceeding the control variant with an insignificant production increase of 5.9%.

The Rom-Agrobiofertil NP product was tested on three varieties: "Belarosa", "Riviera" and "Carera", among variants studied production differences were insignificant, statistically uninsured. Analyzing the influence of the treatment on the commercial production, the following results were obtained: 41.95 t/ha untreated and 45.81 t/ha in the plants treated with Rom-Agrobiofertil NP.

By analyzing the interaction between the variety and the treatment, an additional (commercial) production was obtained in the variants to which the product was applied:

+1.93 t/ha in the "Bellarosa" variety;
+8.21 t/ha in the "Riviera" variety;
+1.45 t/ha in the "Carera" variety.

CONCLUSIONS

All of the cultures responds positively to the action of bacteria in the bio-fertilizer content of Rom-Agrobiofertil NP.

The height of the plants showed an increase of approx. 1.4% against the unfertilized V_1 control. Increase of inflorescence in V_2 culture with approx. 6.8% vs. V_1. The increase in the number of fruit per plant on the V_2 crop with approx. 26.2%. Increase in the average weight of the group treated with Rom-Agrobiofertil NP (V_2) with approx. 6.8% vs. V_1 on the cabbage culture. It is recommended to resume the experiment for its long-term validation. It is necessary to repeat the experiments in order to validate the results obtained and to diversify them by introducing into study other vegetable species, in order to improve the applied crop technologies and to increase the economic efficiency of the crops.

Cabbage production

The recorded production (production increase) is very high (177.4%), from 422.5 kg/ha to 1171.8 kg/ha. The increase in length of silicve with approx. 24.8% against the non-fertilized V_1 control. Increasing the number of silicas per plant to V_2 by 102.9% compared to V_1. The increase in the number of seeds on silicone in variant V_2 by 20.8%.

Increase of the number of seeds per plant at the variant fertilized with Rom-Agrobiofertil NP by 224.79% against the control. Increase of the weight and average seed quantity per plant, from 8.3 g/plant to V_1 Control to 44.4 g/plant in variant fertilized with Rom-Agrobiofertil NP. To resume the experiment for its long-term validation.

"**Buzău 1600" tomato culture on the trellis**

It presents a positive response to Rom-Agrobiofertil NP biofertilizer, increase by approx. 1.4% against the control group of the crop plants, increase by approx. 6.8% against the control group, weight of the fruit on the plant with approx. 26.2%, the weight of the fruit in the variant fertilized with Rom-Agrobiofertil NP by approx. 6.8%.

Peanut production

Under the conditions of 2018 (a year full of precipitation in which the soil was saturated with water and the peanut culture was affected by the surplus water stored in the soil), the of Rom-Agrobiofertil NP product achieved a production of 1402 kg/ha, exceeding the control variant with an insignificant production increase of 5.9%.

Potato production

Potato culture responded well to the Rom-Agrobiofertil NP biofertilizer. The plants in the batch treated with this biofertilizer showed an

increase in the waist, an increase in the vegetal mass, and an inflorescence richer than the control group. The recorded production was different because three potato varieties were planted.

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