BACTERIAL BIOPREPARATIONS - A "GREEN REVOLUTION" FOR AGRICULTURE

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Abstract. *Approaches to new technologies in the field of agriculture (technologies proposed by specialists in the field) in order to protect plants, increase productivity, greening the soil and reduce the impact of pollution of agricultural ecosystems are green, non-polluting technologies to be implemented by farmers to reduce costs in agriculture. polishing, obtaining healthy, ecological products and supporting the restoration of processes carried out in the soil, increasing beneficial microbial populations, all in order to achieve an intensive system of sustainable agriculture. Excessive use of fertilization and plant protection products in agriculture has led to the emergence of soil acidification, a phenomenon that has accentuated forms of damage to soil, plants, agricultural products, beneficial soil fauna but especially with negative effects on man and animals. Excessive fertilization and application of PPP products without respecting the indicated doses have irreversible effects on the environment. Soil acidification is a big problem for farmers. The fact that the areas affected by this phenomenon are expanding from year to year detonates "a minus" for current systems and technologies in the agricultural field of our country. The use of alternative fertilization and plant protection technologies such as natural composts, seaweed, as well as the use of microorganisms -bacterial biopreparations- will lead to the occurrence of agricultural ecosystems, to soil recolonization (useful and beneficial fauna restoration soil) but especially an increase in the level of organic elements and microelements in the soil, the solubilization of insoluble compounds in order to provide plants with the mineral elements necessary for their growth and development and, implicitly, agricultural production and obtaining much healthier products for humans and animals. This paper aims to present the main advantages of using bacterial biopreparations, both economically and in terms of crop productivity, aspects related to plant biometrics but especially the benefits that these bacterial cultures have on agricultural ecosystems, namely soil, plants, environment, man and animals.*

Keywords*: Bacterial biopreparation, alternative technologies, ecology, increasing agricultural productivity*

INTRODUCTION

Agriculture is the basic field for food production. Intensive agriculture systems have the role of producing food and raw materials for both humans and animals and for the agricultural processing industry. The growth of the population, the increasing requirements for food have led to the demand and overload of the agricultural field and, implicitly, of the farmers. in order to meet these growing requirements, farmers are increasingly required to use certain technologies in order to achieve much higher productivity. As a result, farmers to obtain large yields have used a number of technologies both fertilizing crops, but especially to increase agricultural productivity in order to meet the needs and consumption requirements of the processing industry, humans and animals.

To achieve much higher productivity, farmers must use certain fertilization technologies with certain doses well established by specialists. Lately, farmers have been using increasing doses of fertilizers in order to obtain higher and higher yields. The use of higher than recommended doses led to a semi-significant increase in soil acidification, which affected crops and, consequently, their production. Another aspect is the spontaneous abortion of flowers and fruits in crops. Acidification of the soil as a result of the use of excess chemical fertilizers, results in the disorder of the vegetative system of plants that manifests itself in several forms: fruit fall,

resistance of pests to PPP products, the occurrence of burns in plants, etc. All of these effects occur due to the excessive use of chemical fertilizers in agricultural crops.

MATERIAL AND METHODS

As research materials were used live bacterial cultures that have specific roles in the agricultural ecosystem, namely: Azotobacter chroococcum- atmospheric zot fixator, Azospirillum lipoferum- decomposer of complex soil compounds, Bacillus megaterium- decomposer of organic matter in and on the surface soil, Bacillus thuringiensis- bioinsecticide. As research material, a series of experiments were performed on legume crops, technical plants and cereals in the research and development stations for agriculture in Romania.

RESULTS AND DISCUSSIONS

From an optimo-economic point of view, the use of bacterial biopreparations in agricultural crops has the direct effect of increasing agricultural production by stimulating the growth and development of plants so that the yields of biologically fertilized lots will be higher than chemically fertilized lots. From the economic point of view (of the profit) for the crops tested within the research-development stations for agriculture we have the following optimo-economic situations:

Table 1

Lots differences

Objectives	**Biologically fertilized lots**		**Chemically fertilized lot**	**Batch production differences (%)**			
	V1-Rom-Agro	**V2-Azoter**	**V3-NPK**	**V1 vs V3**	**V2 vs V3**	**V3 vs V1**	**V3 vs V2**
Plant height (cm)	46.33	49.33	45.22	2.46	9.09	-2.40	-8.33
Plant diameter (cm)	44.89	42.67	39.89	12.53	6.96	-11.14	-6.51
Number of leaves	142.00	120.11	108.11	31.35	11.10	-23.87	-9.99
Leaf length (cm)	17.68	17.48	16.58	6.64	5.43	-6.22	-5.15
Leaf width (cm)	6.88	7.08	6.89	-0.16	2.74	0.16	-2.67
Buds number	25.56	19.22	18.56	37.72	3.59	-27.39	-3.47
Number of fruits	6.89	5.44	6.56	5.08	-16.95	-4.84	20.41
Number of flowers	7.78	5.44	6.33	22.81	-14.04	-18.57	16.33
Stem diameter (cm)	1.11	1.11	1.16	-3.85	-3.85	4.00	4.00
Total production t / ha	20.50	18.70	12.30	66.67	52.03	-40.00	-34.22

Figure 1. Plant chemically fertilized lot NPK 16:16:16

Figure 2. Plant chemically biologically fertilized plant lot 1-Rom-Agro

Figure 3. Plant chemically biologically fertilized plant lot 2-Azoter

Figure 4. Plant chemically fertilized lot NPK 16:16:16

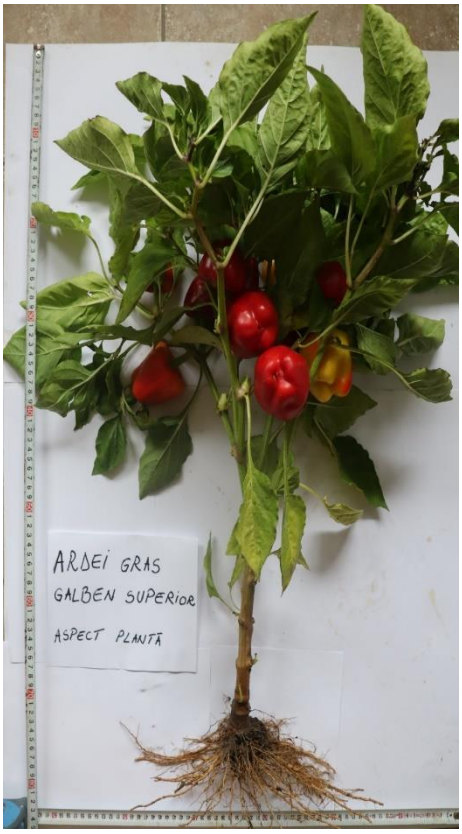

Figure 5. Plant chemically biologically fertilized plant lot 1-Rom-Agro

Figure 6. Aspect of the root system - biological lot 2- Azoter

Table 2

Anova: two replicating factors: superior yellow bell pepper

SUMMARY	V1-Rom-Agro biological fertilizer	V2-Azoter biological fertilizer	V3-NPL 16:6:16 chemically fertilizer	Total
Plant height (cm)				
Count	3	3	3	9
Sum	233.22	212.11	193.22	638.56
Average	77.74	70.70	64.41	70.95
Variance	3097.46	1841.93	1439.62	1628.12
Leaf length (cm)				
Count	3	3	3	9
Sum	50.11	43.78	42.02	135.911
Average	16.70	14.59	14.01	15.101
Variance	87.93	43.12	38.98	44.015
Number of fruits				
Count	3	3	3	9
Sum	15.78	12.00	14.04	41.82
Average	5.26	4.00	4.68	4.65
Variance	13.10	6.26	9.34	7.47
Total				
Count	9	9	9	
Sum	299.11	267.89	249.29	
Average	33.23	29.77	27.70	
Variance	1938.38	1436.58	1146.28	

ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Sample	22873.88	2.00	11436.94	15.65	0.00	3.55
Columns	140.85	2.00	70.43	0.10	0.91	3.55
Interaction	140.54	4.00	35.14	0.05	1.00	2.93
Within	13155.47	18.00	730.86			
Total	36310.75	26.00				

Economic efficiency of bacterial biopreparations in agricultural crops

From an optimo-economic point of view, the use of bacterial biopreparations in agricultural crops has the direct effect of increasing agricultural production by stimulating the growth and development of plants so that the yields of biologically fertilized lots will be higher than chemically fertilized lots. From the economic point of view (of the profit) for the crops tested within the research-development stations for agriculture we have the following optimo-economic situations:

Table 3

"Buzău" seed cabbage cultivation

Lots	Average seed production kg / ha	Sale price / kg	Seed price / ha	MMB g	No seeds / 1 g
V1 – Chemically fertilized control	422.46	300	126738	4.11	243
V2 - Rom-Agrobiofertil NP	1171.76	300	351528	6.76	147.8
Growth (%)	**177.37**	**0.00**	**177.37**	**64.48**	**-39.18**

Lot	Total value of seeds / lei
V1 – Fertilized control	126,738.00
V2 - Rom-Agrobiofertil NP	351,528.00
Growth (%)	**177.37**
Profit	**224,790**

Table 4

"Buzau 1600"tomato culture

Lots	No fruit / plant	Fruit weight (g)	Total seed production (kg / ha)	Price kg of seeds	Profit lei
V1 – Fertilized control	8.4	123.9	550	1000	550000
V2 - Rom-Agrobiofertil NP	10.6	137.9	897	1000	897000
Growth (%)	**26.20%**	**11.29%**	**63.09%**	**0.00%**	**63.09%**

Lots	Total value of seeds / lei
V1 – Fertilized control	550,000.00
V2 - Rom-Agrobiofertil NP	897,000.00
Growth (%)	**63.09**
Profit	**347,000**

Direct economic advantage

Bacterial biopreparations have many more advantages over fertilizers or fertilizers and plant protection products based on chemical compounds. But the biggest advantage of using bacterial products is their economic part. From a series of comparisons by chemicals with similar action as a biological fertilizer (bacterial biopreparation) their biggest advantage is the PRICE. Thus, from table 6 we can identify a number of differences in the price of chemicals compared to bacterial biopreparations.

Table 5

Competitive advantage chemical fertilizer vs biological fertilizer (price)

Type of fertilization product	Culture of	Dose / ha	Presentation form	Total ha (bags / bottles)	Bag / bottle price (lei)	Total cost/ ha	Cost: Chemical fertilizer vs biological fertilizer/ ha	Cost: Biological fertilizer vs chemical fertilizer ha
Chemical Fertilizer (Complex 16:16:16)	Rape	300	Bag x 50 kg	6	85	510	**11.57**	**-10.37**
NPK-20-20-0	Barley and triticale	300	Bag x 50 kg	6	92	552	**20.76**	**-17.19**
NPK-15-15-15		400	Bag x 50 kg	8	95	760	**66.26**	**-39.85**
NPK-15-15-15	Corn	500	Bag x 50 kg	10	95	950	**107.83**	**-51.88**
NPK-22-10-10+B+Zn		300	Bag x 50 kg	6	80	480	**5.01**	**-4.77**
NPK-20-20-0		400	Bag x 50 kg	8	92	736	**61.01**	**-37.89**
NPK-15-15-15	Sunflower	500	Bag x 50 kg	10	95	950	**107.83**	**-51.88**
NPK-20-20-0		350	Bag x 50 kg	7	92	644	**40.89**	**-29.02**
Organic Fertilizer (Rom-Agrobiofertil NP)	All crops	15	Bottle x 10 l	3	152.37	**457.11**	0	0

In terms of (direct) economic advantage, bacterial biopreparations have a much lower price than conventional chemical fertilizers. Referring to the activity that bacteria have on the soil, we can say that to achieve or achieve the same bacterial processes in the soil, farmers must use certain products that have the same role (more or less) as chemical fertilizers. . Thus, in order to reduce costs in agriculture, specialists propose the use of these bacteria. The production of enzymes, acids, hormones by them play an important role in the agricultural ecosystem. In order to achieve the same performance with chemicals, farmers should invest a much larger amount but without knowing if they will get a higher production or, implicitly, an additional profit.

Indirect economic advantage

Amino acids. Compared to a chemical fertilizer, bacterial preparations have the advantage of producing certain amino acids with an important role in plant growth, stimulation of seed material (germination), stimulation of plant fruiting and (all in an ecological system based on

bacterial activity in the soil and their interaction with plant roots). Among the most important acids produced by the activity of bacterial biopreparations we mention: glutamic acid, succinic, lactic, oxalic, butyric acid, etc.Production of phytohormones (phytohormones produced by the microorganism have a role in plant respiration processes, essential plant processes - photosynthesis / chemosynthesis - plant metabolism, acceleration of plant root absorption system, influence of seed germination, plant growth, height inflorescence and increasing the number of fruits per plant).The production of antibiotics (certain species of bacteria such as Bacillus spp. have a role in the production of phenazine antibiotics, which have the role of balancing the nutrient reserves of the soil, induces a resistance of the root to certain diseases and pests, contributes to antagonistic activity against certain phytopathogens).

CONCLUSIONS

Bacterial biopreparations used in agricultural ecosystems have a role in stimulating plant growth, restoring soil structure, restoring soil fertility, recolonizing active soil fauna and a growth and support of plants in their growth, development and production. The fact that bacteria lead to the activation of many processes in the soil structure, which are able to produce enzymes, proteins, acids and even the solubilization of insoluble compounds in the soil into soluble compounds, is a significant reduction in costs for farmers. Purchasing products that have the same role as the processes and activity of soil microorganisms is an additional cost for a farmer, a cost that is constantly increasing. The fact that farmers want to get high yields for much higher profits will use a large amount of chemical fertilizers, in increasing quantities / doses.

The microorganisms proposed by agricultural specialists have the role of balancing the soil balance, to ensure the nutrients that plants need in their processes and to ensure a greening of the soil by breaking down complex compounds in the soil. The fact that the farmer uses a scarification technology (plowing between 30-70 cm) so as to bring to the surface the harpoon (resulting from soil compaction and leaching of complex compounds) for him will represent an additional cost. The use of microorganisms will lead to the weakening of the soil, to the decomposition of complex compounds in the soil as well as to the destruction of the harp and the obtaining of a weakened, malleable soil with a much higher permeability. Approx. 65% of Eastern Europe's agricultural land suffers from compaction. This phenomenon will lead to production losses between 15% and 35%. As a result, the farmer, with additional costs can obtain either a production enough to bring him a certain profit but also a loss caused by these aspects. Referring to this aspect, we can say that a farmer who has about 1000 ha of land cultivated with corn, wheat and soybeans the losses would be very high (table 6 and 7).

Table 7

Soil compaction- production affected

Culture of	Harvest tons / ha	€/ tone	Profit/ha	Loss per harvest per 1000 ha		
				15%	25%	35%
Grain	5	€ 150	€ 750	€ 113	€ 188	€ 263
Corn	7	€ 140	€ 980	€ 147	€ 245	€ 343
Soya	2.2	€ 330	€ 726	€ 109	€ 182	€ 254

Table 8

Soil compaction-yield reduction

Culture of	Harvest tons / ha	€/ tone	Profit/ha	Loss per harvest per 1000 ha		
				15%	25%	35%
Grain	5000	€ 150	€ 750	€ 113,000	€ 188,000	€ 263,000
Corn	7000	€ 140	€ 980	€ 147,000	€ 245,000	€ 343,000
Soya	2200	€ 330	€ 726	€ 109,000	€ 182,000	€ 254,000

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