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Biofertilizers use - a cheap and safe alternative to conventional chemical fertilizers *Pisum sativum* l. and *Phaseolus vulgaris* L.

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Abstract

Agricultural production is threatened by declining productivity of agricultural land as a result of unconventional practices of land use and water and constant release of chemicals more toxic to humans and animals. One way to avoid this danger is to use biofertilizers. It consist in inclusion of agricultural microbiocenoses from Arad vegetable area, the populations of symbiotic nitrogen fixers and / or members of the genus Rhizobium species *Pisum sativum* L. and *Phaseolus vulgaris* L. Biofertilizers study were: Biotrofin, Ecofertil p. and Azotofertil.

Keywords: biofertilizers, vegetable complex, nitrogen fixers

1. Introduction

Biotechnology is considered an area of sustainable agriculture and ecological theory and practice that expands ever more becoming a great future science and practice . As the domain of convergence of fundamental science with applied biotechnology as a direction in research, technology and economics.

Agricultural production is threatened by declining land productivity as a result of non-standard operating practices of soil and water and consistent administration of chemicals becoming more toxic to humans and animals . One way to avoid this process is to use biofertilisers . This consists of including in agricultural microbiocenoses populations symbiotic nitrogen fixing and / or members of the *Rhisobium genera*, *Azsoperillium*, etc. . Biological nitrogen fixation causes economic affordable healthy environmental practices .

2. Materials and Methods

The agri-environmental Arad area is characteristic of the western part of the country in growing vegetable species . Numerous studies have shown that some bacteria associated with root surfaces can stimulate plant growth and development of the legume family . The mechanisms by which rhizobacteries can stimulate plant growth and development are not yet fully elucidated, but knowing that they may include the ability to produce phytohormones , nitrogen fixation, stimulation of active nitrogen-fixing nodules, solubilization of inorganic phosphorus and other nutrients.

Pisum sativum L. and *Phaseolus vulgaris* L. are species of great economic value and because different types of chemical treatment applies both on seeds and vegetation, our research was conducted in order to evaluate the effects of induced unapproved strains of rhizobacteria (biofertilizers) on the growth and development of plants of peas and beans in the garden.

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The experiment took place during the period of 2011-2012 using the *Pisum sativum* L. Bőrdi variety and at the *Phaseolus vulgaris*, Valja variety, compliance each year of cultivation recommended technology for these species. The study comprised a single graduate factor (monofactorial), by the method subdivided parcels , with variants in four repetitions (witness without chemical fertilizers). Recovery data was done by the method of analysis of variance for each year and a series of single factor experiments performed several years at the same location.

The biofertilizers Biotrofin is a live bacteria that has two components, nitricphosphoric traps bacteria which secures the necessary nitrogen from the atmosphere and second, *Bacillus megaterium*, which solubilized tricalcium phosphate making it accessible to plants. Ecofertil P product is a suspension of spores and vegetative cells of Bacillus megaterium, phosphaticum variety that solubles the insoluble products of phosphorus, iron, magnesium, potassium and zinc. The Azotofertil product is a liquid culture of two nitrogen fixing bacteria, *Azotobacter chroococcum* and *Azospirilim lipoferum*, is a product that provides nitrogen, growth factors and phytohormones required plants development.

Table 1.The influence on production biofertilizers in *Pisum sativum* L. in the ecological area Arad

V	Biofertilizer	Dose l/ha	Application mode			T/ha	%	Dif. t/ha	Significance	
			Seed	Soil prep.	Vegetation				S_E^2	S^2_{VA}
1	Classic Technology(M)	-	-	-	-	4,35	100 92,1	Mt_1 -0,372	-	-
2	Biotrofin	10	Yes	-	-	4,75	108,9 100,4	0,392 0,020	xxx	xxx
3	Biotrofin	10	-	Yes	-	4,78	109,7 101,1	0,422 0,050	xxx x	xxx x
4	Ecofertil P	15	-	Yes	-	4,67	107,2 98,7	0,312 0,060	xxx x	xxx xx
5	Ecofertil P	15	-	-	Yes	4,70	107,9 99,4	0,343 0,029	xxx	xxx
6	Azotofertil	15	-	Yes	-	4,73	108,5 100,0	0,372 -	xxx	xxx
7	Azotofertil	15	-	-	Yes	4,80	110,0 101,4	0,432 0,065	xxx xx	xxx xx
8	Biotrofin Ecofertil P	10 15	- -	Yes -	- Yes	4,82	110,6 101,9	0,462 0,090	xxx xx	xxx
9	Biotrofin Azotofertil	10 15	- -	Yes -	- Yes	4,90	112,3 103,5	0,537 0,135	xxx xxx	xxx xxx
10	Azotofertil Ecofertil P	15 15	- -	Yes -	- Yes	4,80	110,3 101,6	0,447 0,075	xxx xx	xxx xx
Media						4,73	-	-	-	-
							100	Mt_2	-	
						DL5%	DL 1%		DL 0,1%	
						0,061	0,087		0,109	
						0,042	0,053		0,093	

Table 2. Biofertilizers influence on the yield of *Phaseolus vulgaris* L. in Arad agro-ecological area

V	Biofertilizer	Dose l/ha	Application mode			T/ha	%	Dif. t/ha	Semnification	
			Seed	Soil prep.	Vegetation				S_E^2	S^2_{VA}
1	Classic Technology(M)	-	-	-	-	2,26	100 83,1	Mt_1 -0,459	000	000
2	Biotrofin	10	Yes	-	-	2,76	121,9 101,4	0,496 0,037	xxx	xxx
3	Biotrofin	10	-	Yes	-	2,80	123,9 103,0	0,541 0,082	xxx x	xxx xx
4	Ecofertil P	15	-	-	-	2,67	118,1 98,2	0,410 -0,049	xxx	xxx
5	Ecofertil P	15	-	-	Yes	2,63	116,3 96,7	0,368 -0,091	xxx 0	xxx 00
6	Azotofertil	15	-	Yes	-	2,72	120,6 100,2	0,465 0,006	xxx	xxx
7	Azotofertil	15	-	-	Yes	2,74	121,2 100,8	0,480 0,021	xxx	xxx
8	Biotrofin Ecofertil P	10 15	- -	Yes -	- Yes	2,87	127,0 105,6	0,610 0,151	xxx xxx	xxx xxx
9	Biotrofin Azotofertil	10 15	- -	Yes -	- Yes	2,91	128,7 107,0	0,650 0,191	xxx xxx	xxx xxx
10	Azotofertil Ecofertil P	15 15	- -	Yes -	- Yes	2,83	125,2 104,1	0,570 0,111	xxx xx	xxx xxx
Media						2,72	-	-	-	-
							100	Mt_2	-	-
						DL5%	DL 1%		DL 0,1%	
						0,071	0,097		0,132	
						0,053	0,076		0,109	

3.Results and Discussion

Yields obtained in this study were influenced by the factors studied , and the climatic conditions of the years of research, *Pisum sativum* L. and *Phaseolus vulgaris* L. the crops where climate factors positively or negatively affect yields . According to the data in Table 1., The studies conducted in the two years , compared to available alternatives differ significantly both separately and in various combinations . Analyzing biofertilizers factor with effect from seed in seedbed preparation and vegetation (10 cm height) , highly significant results were observed in all the products tested against the first witness (Mt. - classical technology without fertilization).

The differences in output from the witness Mt1 is between 312 and 537 kg / ha of seed of the garden pea . Compared to the second witness (Mt_2 -media versions), results have only Biotrofin version, 101/ha applied to prepare the ground + Azotofertil, 15/ha applied plant vegetation height of 10 cm. The difference in production, this witness is 165 kg/ha.

When tested in cultured *Phaseolus vulgaris* L. , Table 2 ., biofertilizers use have marked effects of growth condition of the crop, highly significant statistical coverage to witness Mt_1 (classical technology without fertilization). Differences compared to the control output (Mt_1) is between 368 and 650 kg seed. The average variants witness (Mt_2) have significant differences to the Biotrofin variants 10 l / ha applied in preparing the land and Ecofetil P or Azotofertil, 15 l / ha, applied in vegetation 10 cm plant height , yield differences were of 151-191 kg / ha of seed.

During the vegetation analysis was performed of biochemical parameters such plant height, number of leaves and leaf area . Analysis using biometrics , at *Pisum* and *Phaseolus vulgaris* L. demonstrates that inoculation with tested biofertilizers, in condition of unused fertilizers can stimulate plant growth. In the tested plants inoculated variants have developed

better height, have produced a greater number of leaves.

Also was pursued and tested the influence of rhizobacteria on the training process of nitrogen-fixing nodules (number of active nodules). Determinations revealed the presence of a larger number of active nodules treated variants , such as peas and beans in the garden (average ranging between 79.8 and 194.3) compared with the control group plants (average ranging between 53.8 and 83.7) the differences being statistically significant. Similar results were obtained by analyzing the action of symbiotic process . Thus, during the first 15 days (R_2) is formed mainly on root nodules , these being active functional small percentage (15-25%) . In the following stages of development (R_3 , R_4 , R_5) are nodules on the roots of the weight side , which are fixed 72-83 % .

4. Conclusion

1. Effect of inoculation with nitrogen-fixing microorganisms becomes evident to the extent that it provides the first full survival of bacteria on seeds scattered on the ground to germinate, that specific moment when the infection process.
2. The use of Biotrofin biofertilizersr, Ecofetil P and Azotofertil, alone or with the Administration's associative seeds, seedbed preparation and/or vegetation of conditioning effects notable increase in yield from the two species tested.
3. Considerations biological, technical, economic and health attributes intense exploitation of bacterial symbiosis (biofertilizers) compensation instrumental deficiencies of nitrogen on crops of *Pisum sativum* L. and *Phaseolus vulgaris* L.
4. Stimulation by rhizobacteria used point forming nodules on the roots of garden pea plants and garden bean exerts direct effects on fixation of atmospheric nitrogen on plant growth indirectly by increasing the atmospheric nitrogen fixed .
5. Changing the rhizosphere microbiota has direct effects on the formation and viability of nitrogen-fixing nodules .
6. Analysis using biometrics demonstrate stimulation processes of plant growth and development , the average number of pods / plant, seeds / pod and leaf area due to variants tested are superior control (12-22 %).

Compliance with Ethics Requirements

Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human and/or animal subjects (if exists) respect the specific regulations and standards.

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