RESULTS REGARDING THE USE OF BIO-BACTERIAL PREPARATIONS TECHNOLOGY IN VEGETABLE CROPS: RESEARCHES INTO THE RESEARCH AND DEVELOPMENT STATION IN AGRICULTURE SUCEAVA AND BUZĂU

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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.*

Key words*: agricultural pollution, biofertiliser, azospirillium lipoferum, azotobacter chroococcum, bacillus megaterium, Rom-Agrobiofertil NP*

INTRODUCTION

Food safety, a normal objective for any man, farm and enterprise, is aimed to producing sufficient, varied and cheap food, corresponding to the physiological requirements and purchasing power of any person. In the developed countries, this objective has been achieved and often exceeded substantially by promoting intensive systems for both land cultivation, animal husbandry and veterinary medicine, as well as modern methods of processing and marketing agricultural products [1,7,2].

Mechanization, chemization, animal husbandry technologies, technologies for applying treatments, growing plants and raising more and more productive animals, and modernizing processing and marketing systems have contributed, first and foremost, to improving human living conditions, as much as volume. and diversity of agri-food products, as well as accessible to buyers [3,4].

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 [5,8,15].

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 [6,9,14].

MATERIALS AND METHODS

This paper has the role to promote certain sustainable production systems, diversified and balanced, in order to prevent pollution of agricultural crops, the environment, the conversion of agri-food waste (whey for example) into various

agricultural products, as well as the implementation of green, non-polluting technologies in the agricultural sector. The purpose of this work is to present and use the newest innovative technologies into the agricultural field and replace the traditional polluting products (chemical fertilizers) with biofertilizers, so that the farmers can reaches a much greater potential over the recorded productions.

RESEARCH RESULTS

Following the continuation of the collaboration protocol with the Research-Development Station in Vegetables Buzau and Research-Development Station in Suceava, on 2018-2019, the experiments in the testing of the product Rom-Agrobiofertil NP were continued. Thus, like the previous year the biofertilizer Rom-Agrobiofertil NP was tested on on a wide range of crops such as tomatoes, potatoes, corn or rape.

Thus, along with colleagues from the research and development station were established three groups: the witness lot, the fertilized with chemical fertilizers lot and the fertilized with the biofertilizer Rom-Agrobiofertil NP lot. There was a delimitation between the lots so that the treatment applied to each lot did not influence the characteristics of the varieties, the production on the lot and, implicitly the morphological characteristics of the soil and plants. The first tranche of this biofertilizator was administered at a dose of 5 l/ha (3 types of bacterial cultures x 5 = 15 l bacterial cultures/ha) for each crop, as we can see into the table 1 [6]:

Table 1.

Treatment scheme for Rom-Agrobiofertil NP biofertilizer

Treatment scheme for the use of the Rom-Agrobiofertil NP biofertilizer				
Nr.of treatment	**The type of product applied**	**Composition of the fertilizer**	**Recommended dose / ha**	**Used dose/ ha**
1	Biological fertilizer Rom-Agrobiofertil NP	*Azospirillum lipoferum*	5 l/ ha	5 l /ha
		Azotobacter chroococcum	5 l/ ha	5 l/ ha
		Bacillus megaterium	5 l/ ha	5 l/ ha

Source: Prospect Romvac Company S.A: Rom-Agrobiofertil NP product [5]

To prove once again the efficacy of the biofertilizers against to the chemical fertilizers, at the Suceava Agriculture Research Station, the product Rom-Agrobiofertil NP, biological fertilizer based on bacterial cultures was tested again on the rape and phelium crops. Following the measurements on the lots, numerous differences between the lots included in the experiment were identified. The first difference was identified on the leaves, both in size and appearance.

Figure 1. Differences between experimental groups (leaf)

The most important difference was recorded in crop production: rapeseed and phelium. Rapeseed culture (chemically fertilized, biologically fertilized) and Phelium culture (chemically fertilized, biologically fertilized) was established on the Suceava Research Station in Agriculture. Following the weighing of the productions of the two crops, both the chemically fertilized and the biologically fertilized lots, major differences were identified as you can see into the table 2:

Table 2.

Production obtained in S.C.D.A Suceava

Lot	Rape (kg/ha)	Phelium (kg/ha)
Chemical fertilized lot (complex 16:16:16)	3260	240
Organic fertilized lot (Rom-Agrobiofertil NP)	**3680**	**310**
Growth (%)	**12.88 %**	**29.17 %**
Lot differences kg / ha	**420 kg**	**70 kg**

Source: Suceava Research and Development Station in Agriculture., 2019 [6]

Another aspect is the reduction of agricultural costs. The use of biological fertilizers compared to chemical fertilizers leads to much higher yields and a reduction of costs (an economy) by up to 69.34% (table 3):

Table 3

Economic efficiency of biological fertilizer vs chemical fertilizer

Type of fertilization product	Culture of	Dose / ha	Presentation form	No applications/ ha	Total ha (bags / bottles)	Bag / bottle price (lei)	Total cost/ ha
Chemical Fertilizer (Complex 16:16:16)	Rape	400	Bag 50 kg	2	16	85	**1360**
Organic Fertilizer (Rom-Agrobiofertil NP)	Rape	15	Bottle 10 l	2	3	139	**417**
Cost reduction: Chemical vs biological fertilizer/ ha	**-69.34**						

The second experiment was carried out at the Buzau Research-Development Station in Vegetables. Together with the specialists of the station, the Rom-Agrobiofertil NP product was tested on a variety of vegetable crops. The first culture in which the biofertilizer based on the bacterial cultures Rom-Agrobiofertil NP was tested was the Buzău tomato culture, variety. Three lots were set up at Buzau Research-Development Station in Vegetables: the control lot, the chemical fertilized lot and the biological fertilized lot with Rom-Agrobiofertil NP and the biological lot with Rom-Agrobiofertil NP lot near the . Three lots were set up within the resort: the control lot, the biological fertilized lot. According to the interaction of the treatment with the tomato variety, according to the pedo-climatic factors existing on each lot, as well as following the biometric determinations, the following results were obtained (table 4 and 5):

Table 4

Tomato biometric measurements Buzau 1600 – part 1

Lots	Plant height (cm)	Shrub diameter (cm)	Nr. Leaves / plant	Nr. of Leaves under the first inflorescence	Leaf length (cm)	No. of inflorescents / plant	Nr. of Flowers / Inflorescences (t / ha)
V1 - Witness	115.50	41.00	22.1	4.4	33	5.15	3.55
V2 Biol. Fert Rom-Agrobiofertil NP	111.00	41.35	22.1	4.4	39.65	4.05	3.25
V3 Biol.fert. Rom-Agr+Inocul bact trichoderma harzianum	117.00	46.95	21.35	4.45	38.2	4.25	3.3
Growth biol.fert. Vs Wt (%)	**-3.90**	**0.85**	**0.00**	**0.00**	**20.15**	**-21.36**	**-8.45**
Growth biol.fert.+inocul vs Mt (%)	**1.30**	**14.51**	**-3.39**	**1.14**	**15.76**	**-17.48**	**-7.04**
Growth fer.biol.fert +inocul vs biol.fert (%)	**5.41**	**13.54**	**-3.39**	**1.14**	**-3.66**	**4.94**	**1.54**

Table 5

Tomato biometric measurements Buzau 1600 – part 2

Lot	Inflorescence distance (cm) / (g)	Fruit Abscission Area (cm)	Fruit height (cm)	Fruit diameter (cm)	Fruit Weight (g)	Insert diameter at the stem (cm)	Nr. Seminal Lodge	Thickness of the cap (cm)
V1 - Witness	16.45	0.305	5.75	5.94	0.13	0.5	5.8	0.32
V2 Biol. Fert Rom-Agrobiofertil NP	19.4	0.3425	5.94	6.41	0.14	0.8	5.8	0.30
V3 Biol.fert. Rom-Agr+Inocul bact trichoderma harzianum	19.68	0.3275	5.90	6.12	0.14	0.6	5.95	0.29
Growth biol.fert. Vs Mt (%)	**17.93**	**12.30**	**3.31**	**7.87**	**5.31**	**43.98**	**0.00**	**-5.51**
Growth biol.fert.+inocul vs Mt (%)	**19.60**	**7.38**	**2.61**	**2.99**	**2.47**	**17.87**	**2.59**	**-10.24**
Growth fer.biol.fert +inocul vs biol.fert (%)	**1.42**	**-4.38**	**-0.67**	**-4.53**	**-2.70**	**-18.14**	**2.59**	**-5.00**

In the resort of Buzau Vegetable Research and Development, was conducted an experiment on tomato variety Buzau in 1600, with organic products from the company Romvac on a surface of 350SqM. The culture was established in the Ecological Polygon, in a solarium discovered. The experience was organized in 3 experimental variants on 4 repetitions, as follows: V1 - control version, untreated, V2 - variant with ROMVAC treatments (ROM-AGROBIOFERTIL 5l / ha x 3 types), in which the seeds from which the seedlings with which the V2 variant was established were obtained were treated with a mixed bacterial inoculum provided by ICDPP Bucharest and V3 - variant with ROMVAC treatments (ROM-AGROBIOFERTIL 5l / ha x 3 types), in which the seeds from which the seedlings with which the V3 variant was established were obtained were treated with a fungal inoculum of Trichoderma provided by ICDPP Bucharest.

The three components of the Rom-Agrobiofertil NP product: Azospirillum lipoferum, Azotobacter chroococcum, Bacillus megaterium, were administered foliar, at an interval of 30 days. The first application was made after 10 days after planting. They have printed a vigorous growth, abundant flowering. In the first vegetation period, pests appeared: aphids (Aphys gossypii), tomato mining moth (Tuta absoluta), Moss fly (Liriomyza trifolii) and common red mite (Tetranychus urticae). Later, towards the end of the vegetation period, the phytopathogenic agents were manifested: tomato hand (Phytophthora infestans) and tomato alternaria (Alternaria solani)- (figure 2 and 3).

Figure 2. Differences between experimental groups (leaf)

Figure 3. Rom-Agrobiofertil NP + Trichoderma harzianum

CONCLUSIONS

At a global scale, the effects of continuous agricultural practices such as chemical fertilization can cause serious damage to the environment. Inoculation of the soil with benefical microorganisms is one of the most important sustainable practices in agriculture, because microorganisms establish associations with plants and promote plant growth by means of several beneficial characteristics. Microorganisms are suitable for inoculation, reflecting the ability of these organisms for plant colonization, and several studies have demonstrated the specific and intrinsic communication among bacteria and plant.

Modern agriculture involves usage of pesticides and chemical fertilizers with an essence of increasing the world's food production, as these serve as a fast food for plants causing them to grow more rapidly and efficiently. Continuous application of chemical fertilization leads to the decay of soil quality and fertility and might lead to the collection of heavy metals in plant tissues, affecting the fruit nutritional value and edibility [10,12].

This article aims to present the advantages of using organic fertilizers over chemical fertilizers. Chemical fertilizers and conditions for lowering soil fertility which can lead to mismatch of products with the requirements of plants and soil for the future. However, the use of excess chemical fertilizers in agricultural crops can pose a major risk to the environment and for the and animal human health.

The use of biofertilizers have the role of stimulating the bacteria in the soil structure, to ecologize the soil by decomposing complex compounds, restoring the fertility of the damaged soils but especially obtaining much higher yields than the chemical fertilizers and more safe and environmentally friendly with human and animals health. Biofertilizers are the alternative sources to meet the nutrient requirement of crops. In Biofertilizers, beneficial bacteria are Azotobacter, Azospirillium, Bacillus, Thricoderma which are very essential in crop production [11,13].

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