Scientific Papers. Series A. Agronomy, Vol. LXIII, No. 2, 2020
ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785

USING LIVE BACTERIAL BIOPREPARATIONS ON SEED AND PLANTING MATERIAL OF TOMATOES AND PEPPERS IN THE RESEARCH AND DEVELOPMENT STATION FOR VEGETABLE BUZAU

George TOADER[1, 2], Viorica CHIURCIU[2], Valentina FILIP[2], Nistor MAIEREAN[2], ElenaVioleta TOADER[4], Constantin PETRE[3], Emilian MIREA[3], Mitel-Dumitru TOMA[3], Leonard ILIE[1]

[1]University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Marasti Blvd, 011464, Bucharest, Romania
[2]Romvac Company S.A., 7 Centura Road, Voluntari, Romania
[3]Research-Development Station for Vegetable Growing Buzau, 23 Mesteacanului Street, Buzau, Romania
[4]Academy of Economic Studies in Bucharest, Faculty of Agri-Food Economics, Mihail Moxa Building, 5-7 Mihail Moxa Street, 010961, Bucharest, Romania

Corresponding author email: toadergeorge92@gmail.com

Abstract

The excessive use and increasing doses of chemical fertilizers has led to the emergence of phenomena such as pollution of soil, groundwater, the environment, as well as the health of humans and animals. Excessive consumption of chemical fertilizers has led to the acidification of soils but especially to their degradation and, implicitly, affect the flora and bacterial activity in its structure. Farmers wishing to obtain crops and produce as much as possible did not take into account the negative effects that the chemization has, their activity being focused on maximizing the profit and less on the protection of the soil and the environment. Thus, in order to help stop soil pollution and its degradation, the Romanian producers came to the market with new products and innovative technologies in the agricultural field, namely organic fertilizers (biofertilizers) and organic plant protection products (bioinsecticides). These products are formulated either in liquid or granulated (lyophilized) form, these products containing in their composition live bacterial cultures. The bacteria in the composition of these products already exist in the soil structure. Biofertilizers have the role of ensuring a recolonization of the bacterial flora of the soil, the bacterial activity in the soil having the effects of soil ecology, the decomposition of complex compounds, the fixation of atmospheric nitrogen in the soil as well as a support for the growth, development and stopping of pests or diseases attacks on cultures. The use of these products in the research and development stations in agriculture in Romania has led to much better results compared to the classical chemical fertilizers (increasing agricultural production, increasing mineral elements in soil, looser soil, soft texture, growing plants, stopping the attacks of certain pests, diseases, etc.).

Key words*: biofertilizers, bioinsecticides, organic farming, sustainability, bioeconomy, live bacterial biopreparations.*

INTRODUCTION

The approaches of the agricultural specialists on biological, ecological control and using genetic methods of pest control and soil fertilization involve certain processes to improve genetic resources in order to reduce chemical fertilizers with the help of microbiological means used in both conventional agriculture and the ecological one (Andrieş et al., 2007).

The use of bacterial biopreparations is aimed at microbiologically protecting agricultural crops and replacing classical chemical fertilizers with live bacterial preparations for the purpose of soil colonization. Modern agriculture is an important, strategic area for both human and animal safety. The problems of today's agriculture and the safety of agri-food products have become more and more accentuated, the human demand for food becoming more and more (Larkin, 2010).

One of the obstacles facing the use of bacterial biopreparations in conventional agriculture is the reluctance of farmers regarding the effect of these bacterial biopreparations on harmful organisms in agricultural crops but especially on replacing chemical fertilizers with these bacterial biopreparations meant to replace excessive chemization (Matei et al., 2010).

Agriculture is based on the use of different chemical means on the soil in order to increase fertility as well as to fight diseases and pests in agricultural crops. To all these aspects were applied widely chemical fertilization products as well as plant protection products, products that contributed to the deterioration of the living conditions of both soil and human and animal structures (Tomoioagă, 2013).

In parallel with combating pests from agricultural crops and soil fertilization processes, the use of chemical fertilizers and plant protection products causes serious imbalances in soil and crop ecosystems. Pesticides and chemical fertilizers applied in agricultural crops reduce the bacterial flora of the soil, the change of soil pH towards its acidification, genetic changes of pests but especially the increase of the resistance of pests to the application of pesticides and chemical fertilizers. The use of these excess chemicals has had negative effects on humans and animals, effects such as decreased human immunity, other diseases, etc. (Volosciuc, 2009b).

In order to reduce the irreversible effects on soil, agricultural crops and humans and animals, agricultural researchers have developed a series of ecological products, based on live bacterial cultures have allowed the rebalancing of soil ecosystems, agricultural crops as well as reducing pollution on agri-food products. Bacterial biopreparations used as biofertilizers, bioinsecticides or biofungicides have the effect of ecologically controlling pests in agricultural crops, without side effects for soil, environment, plants, humans and animals (Volosciuc, 2009a). The substitution of chemical fertilizers with organic fertilizers based on bacterial preparations will lead to a greening of the soil, to the colonization of the soil fauna in order to support the growth of mineral elements in the soil in order to support the growth and development of plants and the increase of agricultural production (Volosciuc et al., 2015).

MATERIALS AND METHODS

The researches were carried out within the Research-Development Station for Vegetable Growing Buzau. Here, together with the team of researchers from Research and Development Station for Vegetable Growing Buzau, a series of experiments were carried out regarding the action of bacterial biopreparations on the seed material, the propagating material, the soil and the plants (2018-2019).

Following the inoculation of the seed material in different solutions, three categories were delimited: control batch - germination seed material, chemical lot - seed seed inoculated with a solution based on complex 16:16:16 0.200 ml/l water, seed germination material and biological lot - seed material inoculated in solution of *Azospirillum lipoferum* 0.100 ml/l water, germinated seed material (SCDL Buzau).

Following the use of direct observation measurements, biometric measurements and determinations made in tomatoes and peppers, a series of quantitative differences (number of germinated seeds) as well as qualitative (height, vigor, color, etc.) were identified.

RESULTS AND DISCUSSIONS

Following the inoculation of the seed material with solution based on chemically complex and *Azospirillum lipoferum*, on the seeding material different structural changes were identified regarding the color, height, number of leaves, number of absorbent brushes, etc. the first research was performed on tomato seed material. Following inoculation of the seed material in the two solutions followed the process of seeding in the alveoli.

Between the three batches (control batch, chemically inoculated batch, biological inoculated batch) there was a difference between the germination period. Thus, in the control-uninoculated group, the germination of the seed material lasted 11 days. The germination of the chemically inoculated lot lasted 8 days, the germination of the biologically inoculated lot in the solution of *Azospirillum lipoferum* (solution provided by the researchers from Romvac Company S.A.) was 4 days (SCDL Buzau).

In order to prove the efficacy of the bacterial biopreparate offered by Romvac Company S.A., the researchers from SCDL Buzau made both a series of photographs of the tested lots and determinations related to the number of leaves, the number of absorbent perch, height, stem thickness or color, as follows (Figures 1-3).

Figure 1. Germinated seed material - control batch, uninoculated

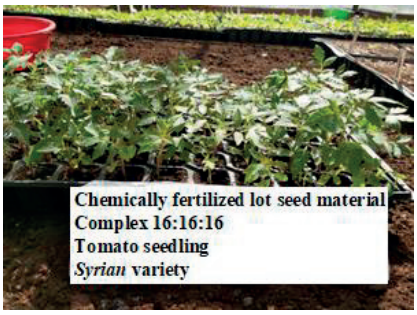

Figure 2. Germinated seed material - chemically inoculated batch

Figure 3. Germinated seed material-batch in Organic Focused: *Azospirillum lipoferum*-Rom-Agrobiofertil NP solution, Romvac Company S.A.

The second research was carried out in SCDL Buzau, with the same team of researchers. The culture tested was the pepper culture, the arum variety. As in tomato culture, the same parameter was monitored, the researchers performing the same treatment for pepper culture. The germination of the seed material from the control-uninoculated group lasted 13 days. In the inoculated chemical lot with the same amount of solution as in the tomato culture, the germination of the seed material lasted 10 days. In the lot where the seed material was inoculated with solution of *Azospirillum lipoferum*, solution taken from the set of Rom-Agrobiofertil NP product (Romvac Company S.A.), the germination time was 7 days. The germination period (the shortest of the three batches) of the seed material and the emergence of the seeding material showed that the activity of the bacterial biopreparate led to the stimulation of the germination processes in the seed structure as well as the acceleration of the occurrence and support of the growth of the seeding material (Figures 4-6).

Figure 4. Germinated seed material - control batch, uninoculated

Figure 5. Germinated seed material- chemically inoculated batch

Figure 6. Germinated seed material - organic inoculated lot: solution of *Azospirillum lipoferum*-Rom-Agrobiofertil NP, Romvac Company S.A.

Following the biometric determinations carried out by the researchers, the following aspects related to the plant structure of the two cultures

were also found. Thus, the following increases have been recorded in tomato and pepper planting material (Tables 1 and 2).

Table 1. Biometric determinations of planting material, tomato crop, Syriana variety

Lots	Plant height (cm)	No. root hairs	No. leaves
Control, uninoculated (M)	4	8	3
Chemical inoculated (IC)	9	13	5
Biologically inoculated (IB)	13	17	11
Growth (%) IC vs M	125.0%	62.5%	66.7%
Growth (%) IB vs M	225.0%	112.5%	266.7%
Growth (%) IB vs IC	44.4%	30.8%	120.0%

Table 2. Biometric determinations of planting material, pepper culture, Arum variety

Lots	Plant height (cm)	No. root hairs	No. leaves
Control, uninoculated (M)	2	3	2
Inoculat chimic (IC)	4	7	5
Biologically inoculated (IB)	7	11	8
Growth (%) IC vs M	100.0%	133.3%	150.0%
Growth (%) IB vs M	250.0%	266.7%	300.0%
Growth (%) IB vs IC	75.0%	57.1%	60.0%

From both tables we can see that between the three groups there are major differences in the first determinations made in the experiments. This aspect represents an advantage in using bacterial preparations over chemical fertilizers. The use of certain bacterial preparations on the seed material has led to changes in the seed material as well as on the plant itself.

CONCLUSIONS

Following the application of the treatment with *Azospirillum lipoferum* solution from the set Rom-Agrobiofertil NP (set provided by Romvac Company S.A.) on the seed material of tomatoes and pepper, there were numerous differences.

The foundation of bacterial biopreparations and the use of biological production and protection systems represented a very important step in combating pests in agricultural crops as well as converting the chemization to organic fertilization, biological fertilization.

Among the new methods of combating or, according to the modern scientific language, of managing the density of harmful organisms, biological ones are more efficient, through biological agents and which include a wide range of processes. They include the introduction and acclimatization of live bacterial biopreparations (bacteria, viruses, fungi, etc.) in order to combat pests in agricultural crops as well as to replace the classic chemical fertilizers with certain organic, environmentally friendly biological, organic fertilizers that have the role of ecologize the soil, to support a high production of agricultural crops, as well as to support the growth and development of plants.

In the cultures in which the experiments were performed in SCDL Buzău, major differences were observed between the two groups. The effects of *Azospirillum lipoferum* solution on the seed material proved to be beneficial. The inoculation of the seed material hastened the germination process of the seed material. The pre-germination planting material proved to be higher, with a much better developed root system, which means that the seedlings will benefit from a supply of mineral elements necessary for their growth and development.

At the same time, the height of the plants showed fluctuations between the three groups, the most vigorous plant, with a much more intense color and more resistant to the pedoclimatic factors being that of the group fertilized with the organic solution of *Azospirillum lipoferum.*

The use of a bacterial biopreparate in the agricultural field, from the self-inoculation of the seed material to the fertilization of the crop itself will lead to the appearance of significant growths of the plants but especially to the ecology of the soil, the decomposition of the complex compounds as well as the mineral elements that the plants need in their growth and development. A large number of elements, the resistance of the plants to the attack of some pests as well as the increase of the agricultural productions denotes the beneficial effect that the bacterial biopreparations have on the soil and, implicitly on the plants.

ACKNOWLEDGEMENTS

Ec. Lidia MIHAI - Economic Manager of Romvac Company S.A.

Dr. Biol. Floarea BURNICHI - Scientific Secretary of Research and Development Station for Vegetable Growing Buzau.

REFERENCES

Andrieş, S., Boincean, B., Jigău, Gh. (2007). *Cod de Bune Practici Agricole*. Chişinău: Mediul ambiant, 120 p.

Larkin Hansen Anne (2010). *The Organic Farming Manual*. 437 p.

Matei, S., Matei, G.M., Cogălniceanu, G., Brezeanu, A., Carasan, M., Helepciuc, F. (2010*). In vitro systems for the study of plant defense response induced by fungal elicitors*. Editura Sitech, Craiova, 73 p.

Tomoiagă, L. (2013). *Ghidul fitosanitar al viticultorii*. Ed. a 2-a, rev. Cluj-Napoca: Academic Pres. 143 p.

Voloșciuc, L. (2009a). *Biotehnologia producerii şi aplicării preparatelor baculovirale în agricultura ecologică*. Chişinău: Mediul ambiant, 262 p.

Voloșciuc, L.T. (2009b). *Probleme ecologice în agricultură*. Chişinău. 264 p.