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STUDY OF THE INFLUENCE OF MICROBIOLOGICAL PREPARATION BIO–ONE IN SPRING FORAGE PEAS *(Pisum SativumL.)* UNDER THE CONDITIONS OF ORGANIC FARMING

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Abstract. The microbiological preparation BIO–ONE is a 100% natural liquid concentrated microbiological product providing 20 kg of active nitrogen/decar. It facilitates the absorption of the residual phosphorus and potassium and retains moisture. BIO–ONE does not contain genetically modified organisms. It is recognized by all organizations controlling the organic farming, including OMRI Institute. It could be used both in organic and traditional agriculture. With its gradual application in soil the microbiological preparation BIO–ONE contributes to increasing soil organic matter and also protects it from wind erosion. The application of the microbiological preparation BIO–ONE helps for obtaining the maximum efficiency of the used mineral fertilizers. The microbiological preparation BIO–ONE has a positive impact on the yield of peas seeds. After treatment of the crop with the microbiological preparation BIO–ONE the highest yield was obtained at a dose of treatment of 0.9 g/100 m^2–185.0 kg/da, followed by the variants treated at a dose of 0.12 g/100 m^2–167.0 kg/da and 0.6 g/100 m^2–165.0 kg/da. At the lowest dose of treatment of 0.3 g/100 m^2 and the fertilized control the yield was equal–158.0 kg/da. The lowest yield was obtained from the control variant. It increases the wheat yield as after–effect after treatment of peas at concentration of 0.6 to 0.12 g/100 m^2 as the wheat yield is raised by 43 kg/da compared to the untreated control. The highest yield was obtained for the variant of peas fertilized with N_4P_8–as the yield exceeded by 57 kg/da the control that was not fertilized and treated. It is noticed also that at lower doses of treatment the quantity of siftings is lower as it goes up at higher doses of treatment.

Key words: fertilizing, bacterial fertilizers, peas.

Introduction

Preparation Bio–One was created and produced in the United States as a result of eight years of research and development and it is a microbiological product. It consists of live organisms.

It is harmless as microorganisms live freely in nature. They are of two kinds:

- Aerobic–Azotobactervinlandii
- Anaerobic–Clostridiumpasterianum

The microorganisms capture nitrogen from the air and process it to an extent to be absorbed and thus they nourish the plants. Conditions for anions and cations exchange in the soil are obtained [POSTGATE 1982, ABBASS *at al.*, 1993].

It is effective in pastures, gardens, flowers, etc. Animals prefer pastures treated with microbiological preparation BIO–ONE [PACOVSKY 1990].

The oil extraction from unit production is increased for the oleaginous plants.

In fruits and vegetables it facilitates sugar accumulation resulting in better taste and aroma of the fruit [BROWN, 1974, BASHAN, 1998].

Gradually with its application in soil the microbiological preparation BIO–ONE contributes to increasing soil organic matter and also protects it from wind erosion.

Application of microbiological preparation BIO–ONE helps also for the maximum impact of the used mineral fertilizers.

The microbiological preparation BIO–ONE is a 100% natural liquid concentrated microbiological product providing 20 kg of active nitrogen/decar.

It facilitates the absorption of the residual phosphorus and potassium and retains moisture. It does not contain genetically modified organisms.

It is recognized by all organizations controlling the organic farming, including OMRI Institute. It could be used both in organic and traditional agriculture.

Objective: Study of the influence of preparation Bio–One of getting healthy agricultural products, increasing the productivity of the arable land and reducing the production costs.

Material and methods

For the achievement of the set objective, a field experiment was carried out in the period 2012–2013 with peas in the Second Experimental Field of the Institute of Forage Crops (IFC) with yield plots of 4 m^2, in four replicates and the following variants:

1) Control–not treated
2) Control–fertilized with N_4P_8, in accordance with the assumed technology for peas growing.
3) Background fertilizing components + 1 dose +"VARNA"–biological activation product humic acid
4) Background fertilizing components + 2 doses + "VARNA"–biological activation product humic acid
5) Background fertilizing components + 3 doses + "VARNA"–biological activation product humic acid
6) Background fertilizing components + 4 doses + "VARNA"–biological activation product humic acid
7) Background fertilizing components + 5 doses + "VARNA"–biological activation product humic acid

Solution for 100 sq. m.–1 dose of 0.3 g/100 m^2, 2,3,4,5–fold increasing of the dose. The areas were treated before or after precipitation.

Simultaneously with the microbiological preparation BIO–ONE it was obligatory to be added the organic component "VARNA"–biological activation product humic acid.

The biometrical indicators for seed productivity (yield) were determined after the methodology of Nikolov [Nikolov, *et al.* 1981].

The monitored indicators were:

1) Seeds yield and structural analysis of seed yield;
2) Observed diseases on peas
3) Soil indicators–humus; phosphorus and potassium content; physical characteristics of the soil

Results and discussion

The experiment was located on the second terrace of the Vit River.

The soil is leached chernozem (Haplic Chernozems, loamy) with medium strong humus horizon.

The mechanical structure was medium to heavy sandy–clay as the content of physical clay in the top layer was 47–49% and of clay about 29% as large powdery fraction and fine sand prevailed.

Data in Table 1 provide information about the agrochemical soil condition before setting the trial. The soil had very poor nitrogen content, poor phosphorus content and good potassium content.

Soil pH was neutral to slightly alkaline. In content of organic carbon it ranged from 1.30 (2.24%) to 1.85 (3.19%).

The agrochemical soil characteristic is presented in:

Table 1.

Agrochemical soil characteristic

Sample	pH_{H_2O}	pH_{KCl}	Nitrogen mg/1000g soil		Phosphorus mg/100 g soil	Potassium mg/100 g soil	Dry	Humus %
			ammonia	nitrate				
1.	6.26	5.03	9.80	7.28	2.64	42.22	1.00	1.72
2.	6.25	5.04	8.68	16.24	2.40	43.47	1.34	2.31
3.	6.44	5.24	7.84	16.52	2.50	45.34	1.33	2.29
4.	6.66	5.44	7.84	4.76	2.56	50.96	1.07	1.85
5.	6.61	5.33	11.06	8.68	2.59	42.72	1.08	1.86
6.	6.48	5.34	5.46	1.68	2.81	50.34	1.34	2.31

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The phase full germination occurred fifteen days later after sowing of peas.

Crop was treated with microbiological preparation BIO–ONE with increasing doses from 0.3 to 0.15 g/100 m^2 plus the organic component "VARNA" (as prescribed by the manufacturer crops were treated before or after precipitation) (Table 2).

Table 2.

N, P, K, pH and organic carbon content before setting and treating of the experiment with the microbiological preparation BIO–ONE in spring forage peas

Sample No.	pHH_2O	Total Nitrogen mg/1000g soil	Phosphorus mg/100 g soil	Potassium mg/100 g soil	Dry	Humus %
1. Control	8.13	16.80	4.81	42.22	1.64	2.83
2. Fertilized with N_4P_8	8.29	18.90	4.47	43.47	1.30	2.24
3. 0.3 g/100 m^2	8.30	16.10	4.84	45.34	1.63	2.81
4. 0.6 g/100 m^2	8.19	18.20	5.44	50.96	1.59	2.74
5. 0.9 g/100 m^2	7.67	19.95	4.50	42.72	1.85	3.19
6. 0.12 g/100 m^2	7.34	20.30	4.26	50.34	1.60	2.76
7. 0.15 g/100 m^2	7.00	20.65	3.70	34.63	1.58	2.72

The phase full germination occurred fifteen days later after sowing of peas.

Crop was treated with microbiological preparation BIO–ONE with increasing doses from 0.3 to 0.15 g/100 m^2 plus the organic component "VARNA" (as prescribed by the manufacturer crops were treated before or after precipitation).

Ten days after crop treatment soil samples were taken for monitoring the changes in the soil under the effect of the microbiological preparation (Table 3).

The analysis showed that the soil acidity changed from slightly acidic to neutral. The nitrogen content in control variant increased to 19.9 5 mg/1000 g soil.

In the treated variants with the lowest dose the rate of increase was up to 26.60 mg/1000 g soil while in the rest variants with increasing the dose of treatment, the raise of nitrogen went down as it reached its minimum at the highest dose of 0.9 g/100 m^2 of 24.50 mg/1000 g soil.

Phosphorus content during pea vegetation season had decreased both in the control variant as well as in the variants treated with lower doses as it was within the range from 1.80 for the control to 2.76 mg/100 g soil at a dose of treatment of 0.9 g/100 m^2.

In the variants with higher doses of treatment its quantity was preserved as in the last variant with a dose of treatment of 0.15 g/100 m^2 its quantity increased from 2.53 to 2.73 mg/100 g soil [SAMFIRA *et al.*, 2013, ANDREEA *et al.*, 2012; BURNARIU and BOSTAN, 2011].

That suggested the mobilization of the reserves in the soil under the influence of anaerobic microorganisms of the genus–*Clostridium pasterianum* during drought in the summer months.

Table 3.

N, P, K, pH and organic carbon content during vegetation after treating of the experiment with the microbiological preparation BIO–ONE in spring forage peas

Sample No.	pHH_2O	Total Nitrogen mg/1000g soil	Phosphorus mg/100 g soil	Potassium mg/100g soil	Dry	Humus %
1. Control	6.63	19.95	1.77	30.80	1.63	2.81
2. Fertilized with N_4P_8	6.50	24.15	1.80	32.40	1.62	2.79
3. 0.3 g/100 m^2	6.55	26.60	1.86	33.50	1.58	2.72
4. 0.6 g/100 m^2	6.60	25.55	1.80	40.00	1.62	2.79
5. 0.9 g/100 m^2	6.60	24.50	2.76	35.40	1.62	2.79
6. 0.12 g/100 m^2	6.57	24.85	2.53	33.50	0.78	1.34
7. 0.15 g/100 m^2	6.60	25.20	2.73	33.50	0.76	1.31

Reduction was observed in the organic carbon amount, respectively, the content of humus.

That phenomenon could be explained by the increased microbiological activity aiming to mineralize larger quantities of organic matter and residues to nourish the growing needs of the crop during the vegetation season [SAMFIRA *et al.*, 2013, BUTNARIU *et al.*, 2008; BOSTAN *et al*., 2013].

The structural analysis (Table 4) revealed that the phase onset of flowering occurred the earliest in the control variant –55 days.

In the fertilized control the phase onset of flowering occurred on the 67th day while in treated variants that period continued 66 days–in variants treated with a dose of 0.3 and 0.6 g/100 m^2.

At a dose of treatment of 0.3 g/100 m^2 it was 59 days, as it gradually went down for highest doses of the treatment.

Table 4.

N, P, K, pH and organic carbon content during vegetation after treating of the experiment with the microbiological preparation BIO–ONE in spring forage peas

Variants Indicators	Control	Control treated with N_4P_8	0.3 g/100m^2	0.6 g/100^2	0.9 g/100m^2	0.12 g/100 m^2	0.15 g/100m^2
Height during phase onset of flowering (cm)	42.0	44.0	41.0	45.0	39.0	40.0	38.0
Plant height (cm)	96.3	88.8	101.8	96.4	113.1	120.0	123.5
Height of the 1st pod (cm)	43.1	34.2	53.4	49.1	47.4	66.2	55.4
Number of offshoots per 1 plant	0.6	0.6	0.2	0.1	0.3	0.3	0.4
Offshoot length (cm)	27.3	42.5	16.6	2.7	32.1	13.8	22.9
Number of pods from 1 plant	11.2	12.1	7.9	10.8	10.8	11.8	11.2
Number of seeds pr 1 plant	37.6	45.2	34.9	37.2	39.9	45.0	43.9
Weight of seeds from 1 plant (g)	5.36	5.41	6.00	6.89	6.80	6.63	6.72
Mass of 1000 seeds (g)	153.2	153.6	156.1	150.1	154.7	155.7	153.9
Yield kg/da	194.0	199.0	199.0	202.0	**203.0**	203.0	194.0

The microbiological preparation BIO–ONE had a positive effect on the plant height.

Plants treated with a dose of 0.12 and 0.15 g/100 m^2 were the highest–120.3 and 123.5 cm, followed by the variant of 0.3 g/100 m^2.

The fertilized control–88.8 cm had the lowest result.

The indicator height of the first pod, it was set the highest in the fertilized variant–104.0 cm, followed by the variants with a dose of treatment–0.12 and 0.15 g/100 m^2–66.2 and 55.4 cm.

The preparation did not have an impact on the pea offshoots.

The highest number of offshoots on the average–0.6 pieces was found in the variant fertilized with N_4P_8, while the lowest number was in the variant with dose of treatment 0.6 g/100 m^2.

The offshoot length however was affected by the concentration of the microbiological preparation.

The offshoot length decreased with increasing the concentration as the length was the smallest–0.2 cm with the dose of treatment of 0.6 g/100 m^2.

Data on the number of seeds per plant were comparatively close, as the greatest number of 45.2 and 45.0 pieces was found in the variant, fertilized with N_4P_8, and the one with a dose of treatment 0.12 g/100 m^2.

For the indicator seed weight per plant it was observed a raise in the weight after the treatment of the plants.

Data showed that the highest weight was obtained in the variants treated with a dose of 0.6 and 0.9 g/100 m^2–respectively 6.89 and 6.80 g, followed by 0.12 g/100 m^2–6.63g.

Concerning the mass of 1000 seeds those treated with a dose of 0.3 and 0.12 g/100 m^2 were the heaviest–156.1 and 155.7g.

The yield of pea seeds after the treatment of the crop with the

microbiological preparation BIO–ONE showed that the highest yield was obtained with the dose of treatment 0.9 and 0.12 g/100 m^2–203.0 kg/da, followed by the dose of treatment 0.6 g/100 m^2–202.0 kg/da, while for the rest variants the results were almost similar to those of the control.

Table 4.

Yield of wheat after harvesting of peas treated with the microbiological preparation BIO–ONE, field experiment

Yield Variants	Hopper kg/da	Siftings kg/da	Yield kg/da	Yield exceeding the control kg/da
1. Control	471	129	343	–
2. Fertilized with N_4P_8	500	100	400	+ 57
3. 0.3 g/100 m^2	443	86	357	+ 14
4. 0.6 g/100 m^2	471	86	386	+ 43
5. 0.9 g/100 m^2	486	100	386	+ 43
6. 0.12 g/100 m^{22}	486	100	386	+ 43
7. 0.15 g/100 m^2	486	129	357	+ 14

For tracing the differences in the effects of the various doses of treatment with the microbiological preparation BIO–ONE after harvest of peas, the soil was prepared for sowing of wheat.

The soil was not fertilized before and after wheat sowing which was on 27 September, 2012.

Wheat germination occurred simultaneously as the phase of tillering occurred in late October and early November 2012.

In the spring of 2013 the vegetation proceeded normally.

The harvest was on 20 June 2013, with grain moisture 11.1%. The results of the harvest are shown in Table 5.

It is seen that the treatment of peas with the preparation BIO–ONE at a concentration of 0.6 to 0.12 g/100 m^2 increased the yield of wheat by 43kg/da compared to the untreated control.

It was also observed that at lower doses of treatment there was a smaller amount of siftings while the ratio of the siftings increased with at the higher doses of the treatment.

Conclusions

It could be concluded that the microbiological preparation BIO–ONE had a positive effect on:

- The yield of pea seeds after treatment of the crop with the microbiological preparation BIO–ONE showed that the highest yield was obtained at a dose of treatment of 0.9 g/100 m^2–185.0 kg/da, followed by the variants treated at a dose of 0.12 g/100 m^2–167.0 kg/da and 0.6 g/100 m^2–165.0 kg/da.
- At the lowest dose of treatment of 0.3 g/100 m^2 and the fertilized control the yield was equal–158.0 kg/da.
- The lowest yield was obtained from the control variant.

It increased the wheat yield as after–effect after treatment of peas at concentration of 0.6 to 0.12 g/100 m^2 as the wheat yield was raised by 43 kg/da compared to the untreated control.

The highest yield was obtained for the variant of peas fertilized with N_4P_8–as the yield exceeded by 57 kg/da the control that was not fertilized and treated.

It was noticed also that at lower doses of treatment the quantity of siftings is lower as it goes up at higher doses of treatment.

References

1. Abbass, Z., Okon, Y. Plant growth–promotion by *Azotobacter paspali* in the rhizosphere. *Soil Biol. Biochem*. **1993**. 25, 1075–1083.
2. Andreea, G. Samfira, I. Butnariu, M. Corneanu M. The morphological features influence on *Phalaris arundinacea* green mass and dry

matter yield, **2012**, *Journal of Biotechnology*, 161, 35.
3. Bashan Y., Holguin G. Proposal for the division of plant growth–promoting rhizobacteria into two classifications: biocontrol–PGPB (plant growth–promoting bacteria) and PGPB. *Soil Biology and Biochemistry*, **1998**. 30, 1225–1228.
4. Bostan, C.; Butnariu, M;. Butu, M.; Ortan, A.; Butu, A. Allelopathic effect of *Festuca rubra* on perennial grasses. *Romanian Biotechnological Letters*. **2013**, 18 (2), 8190–8196.
5. Brown, M.E., Seed and root bacterization. *Annu. Rev. Phytophatol*. **1974**. 12, 181–197.
6. Butnariu, M. Armon, E. Tonea R. Quantity determination of molybdenum from *Pisum sativum* plants and the influence of heavy metal to chemical elements accumulation. *Jurnal Lucrări Ştiinţifice–Zootehnie şi Biotehnologii, Universitatea de Ştiinţe Agricole şi Medicină Veterinară a Banatului Timişoara*, **2008**, 41(1), p. 735–743.
7. Butnariu, M.; Bostan C. Antimicrobial and anti-inflammatory activities of the volatile oil compounds from Tropaeolum majus L. (Nasturtium). *African Journal of Biotechnology*, **2011**, 10 (31), 5900–5909.
8. Pacovsky R.S. Development and growth effects in the Sorghum–*Azospirillum* association. *Journal of Applied Bacteriology* **1990**. 68, 555–5.
9. Postgate J.R. Biological nitrogen fixation: fundamentals. *Philosophical Transactions of the Royal Society of London*, **1982**. Series B 296, 375–385.
10. Samfira, I. Gaitin, D. Butnariu, M. The microelements dynamics in a collection of varieties of Alfalfa in the Romanian Banat plain conditions, **2013**, *Current Opinion in Biotechnology,* 24.
11. Samfira, I. Ghica, A. Butnariu, M. The dynamic content of the chemical compounds in *Phalaris arundinacea* in the plain conditions (western part of Romania), *Current Opinion in Biotechnology*, **2013**, 24.

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