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EVALUATION OF PHYSIOLOGICAL DEVELOPMENT OF THE PEAS UNDER THE INFLUENCE OF WORM COMPOST

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Abstract

In order to evaluate the influence of the worm compost on the physiological development of the peas, depending on the phenological phases, the researches were carried out during the first year of action of two types of worm compost: worm compost I - obtained using as the bio transformer of the Red Hybrid of California and worm compost II – using descendant F_2 of the new line of earthworms, obtained by crossing the California Red Hybrid earthworm with local rubbish earthworm. Materials for research were: worm compost, the soil and the peas variety "Renata". The worm compost was incorporated into the soil, early spring, on the autumn plowing taking into account the dose of 4 t / ha (or 40kg/acres). Previously the worm compost and soil samples taken according to the usual methods were subjected to biochemical analyzes. At the end of the experiment, essential changes in the soil samples were not found, except for the content of organic matter and humus, which in the soil samples of the experimental lots exceeded that in the samples of the control lot, respectively by 10.00% -21, 12%; 10.34% -22.05% and 17.14% -19.74%; 11.43% -13.16%. As a result of the study of the phenological phases of the development of peas, it was found that peas cultivated with worm compost fund (experimental lots) developed for 5-9 days earlier than the cultivated with natural background (the control lot).
Thus, using the usual methods, the influence of worm compost on the physiological development of peas was evaluated.
Key words: *organic fertilizer, peas, phenological phases, soil, worm compost.*

INTRODUCTION

Obtaining organic farming is a social issue of global importance. The global environmental situation, including the region, has worsened in the last century due to the industrialization and chemicalisation of agriculture, the increase in the number of means of transport, the storage, the preservation and the non-use of organic waste, etc. These have resulted in pollution of the environment and its components.

A special role in the improvement of the environmental situation lies to the technology of bioconversion of organic waste by worm-cultivation and the use of its products in order to solve problems in the agrarian sector [1], [2].

Bioconversion of organic waste through worm cultivation as a new direction of science and agro biological practice deserves a special attention with fundamental research [3], [4]. Science and world practice conducted research aimed at moving the negative influence of harmful substances on the organisms, paying special attention to the problems of bioconversion, through worm cultivation, of organic waste from various branches of the national economy, including agriculture. The aim of this biotechnology is the obtaining of the organic ecological fertilizer, the worm compost, the incorporation of which in the soil increases the amount of humus [11].

In recent years there has been a significant decrease in the amount of humus in the soil. The loss of annual humus in soil constitutes 0.5-0.7 t/ha. In order to bring the humus balance to the level without deficit (zero), it is necessary to incorporate in soil about 6.3 t/ha of the obtained compost [10].

The amount of humus in the soil is one of the main indicators of soil fertility. Humus has a multilateral influence on agrochemicals, hygroscopic, thermal, technological and biological soil activities. In humus, are concentrated up to 98% of nitrogen reserves, 60% phosphorus, 80% sulphur, essential

quantities of other micro- and microelements.
Under natural conditions the accumulation of humus in the soil flows very slowly. For the formation of one centimetre of soil it is necessary to pass a period of 100 years. Under the influence of the anthropogenic factor, this process may take 3-5 years. The incorporation into the soil of the traditional compost obtained from the manure of different animals is effective but costly because only 20 kg of humus is formed from a tone of compost [7].
The incorporation of the worm compost in a dose of 4-8 tons/ha, depending on the amount of humus contained in the soil, essentially improves its quality, because in a tone of worm compost it is contained from 270 to 300 kg of humus. Therefore, the use of worm compost allows the essential reduction of the period of completing the humus deficit in the soil [10].
According to the research carried out, it has been found that the incorporation of the worm compost into soil increases not only the quantity of nutrients but also the biological activity of the soil. Also, the worm compost reduces soil density (from 2.70 to 2.67g / cm^3), maintains the humidity in the soil. The incorporation of the worm compost into the soil contributes to the reanimation of soil fertility and its purification of toxic substances [10].
As a result of the research it was found that the worm compost has a beneficial effect on the physiological development of crops, quality, quantity of production, acceleration of the baking process, resistance to unfavorable climatic conditions and different diseases of agricultural crops, but also to the process of obtaining ecologic agricultural production [5], [6].
The article presents the results of the research conducted on the evaluation of the physiological development of peas, in various phenological phases, in the first year of action of the worm compost, incorporated into the soil, taking into account the dose of 4 t/ha (or 40 kg/acre).
It has been found that worm compost reduces the duration of plant phonological phases, increases plant resistance to phytopathogenic attack and unfavorable climatic conditions, improves production quality and increases crop productivity [10].

MATERIALS AND METHODS

For conducting research on the evaluation of the physiological development of peas, in various phenological phases, in the first year of action of the worm compost, under the practical conditions of the TES "Maximovca", was organized an experiment according to the scheme outlined in the Table 1.

Table 1.Experiment Scheme

The lot number	The conditions of the experiment	Investigations during the experiment
I. Control	Natural background	- Biochemical investigations of worm compost (active acidity, humidity, dry substance, organic matter and humus); - Observations on the physiological development of peas
II. Experimental I	Worm compost I – 40 kg/acre	
III Experimental II	Worm compost II – 40 kg/acre	

Source: Own design.

The research material served: the soil, two types of worm compost (worm compost I - obtained using as the bio transformer the Red Hybrid of California earthworm and worm compost II - using F_2 descendants of the new line of earthworms, obtained by crossing the Red Hybrid of California earthworm with the rubbish local earthworm) and peas soul "Renata". In the experiment were used three lots with the surface of one are, including a control lot and two experimental lots. On the control lot the plants were cultivated with natural background, and on experimental lots - with a worm compost background.
In the experimental lots, until the sowing of the peas were incorporated as fertilizers worm compost I and worm compost II, at a dose of 40 kg /acre, taking into account the dose of 4 t/ha. Until the incorporation of fertilizers into

the soil their biochemical quality was determined. From each lot, up to the incorporation of fertilizer, and 3 months after incorporation, soil samples were taken from the depth of 0-10 cm and 15-20 cm for the purpose of determining the active acidity, moisture content, dry matter, organic substance and humus. During the experiment, observations were made on the physiological development of peas depending on four phenological phases (emergence, beginning of blooming, end of blooming and beginning of pods formation and final baking). The duration of the experiment constituted 3 months.

The biochemical analysis of worm compost and soil was performed according to the usual methods presented in Razumov B.A.'s manual „Handbook of the laboratory assistant chemist for analysis on feeds" [12] and in the Standards [8], [9].

RESULTS AND DISCUSSIONS

Analyzing the obtained results regarding the quality indicators of the I and II worm compost (Table 2), it was found that the value of the active acid (pH) does not differ essentially. The content of humidity, dry matter, organic matter and humus in the samples of the worm compost I are different from those of worm compost II.

Table 2.Quality indicators of worm compost

Crt. No.	Indicators	Name of fertilizers	
		worm compost I	worm compost II
1	Active acidity, u.c.	7.23 ± 0.002	7.21± 0.02
2	Humidity, %	61.08 ± 0.05	51.20± 0.01
3	Dry substance, %	38.92± 0.05	48.80±0.01
4	Organic substance, %	30.85 ± 1.65	28.40 ± 0.90
5	Quantity of humus,%	36.40 ±4.20	30.87 ± 2.27

Source: Own results.

Thus, it was found that the value of humidity, organic matter and humus in the samples of the worm compost I increased, corresponding to 19.30%; 8.63% and 17.91%, and the content of dry matter decreased by 20.25%, compared to the same indicators of worm compost II.

As a result of the analysis of the obtained data (Table 3), it was found that in soil samples collected from lots, from the deep of 0-10 cm and 15-20 cm till the sowing of the peas, the quality indicators are not essentially different.

The results of the research shown in Table 4 demonstrate that after 3 months of the incorporation of the fertilizers, the biochemical indicators of the soil taken from different levels during the experimental.

Table 3. Particularities of the biochemical composition of the soil until the incorporation of the fertilizer

Lots and sampling depth, (cm)	Biochemical indicators, (M ± m)				
	Active acidity, u.c.	Humidity, %	Dry substance, %	Organic substance, %	Humus content, %
I – control a) 0-10 b)15-20	 7.22± 0.10 7.28± 0.12	 13.10± 0.07 17.10± 0.10	 86.90± 0.07 82.90±0.10	 4.38±0.07 4.43±0.09	 3.30± 0.08 3.50± 0.40
II – exp. a) 0-10 b)15-20	 7.21± 0.05 7.14± 0.10	 12.20±0.00 15.55±0.14	 87.80±0.00 84.45±0.14	 3.68±0.26 5.37±0.10	 3.50± 0.12 3.50 ±0.07
III – exp. a) 0-10 b)15-20	 7.30 ± .05 7.25 ± .08	 8.11± 0.10 17.45±0.05	 91.89± .10 82.55±0.05	 5.28±0.10 5.28±0.10	 3.30± 0.12 3.70 ± .15

Source: Own results.

The results of the research shown in Table 4 demonstrate that after 3 months of the incorporation of the fertilizers, the biochemical indicators of the soil taken from different levels during the experimental period did not change significantly. However, the value of organic matter and humus in samples taken from the depth of 0-10 cm of experimental lots II and III increased respectively, by 10.00%; 22.05% and 19.74%; 13.16%, and in the ones taken from the depth of 15-20 cm respectively increased by 21.12%; 10.34% and 17.14%; 11.43%, compared to the same soil indicator of the control lot.

So, as a result of the research, it was found that in the first year of action of the worm compost soil fertility was partially improved by increasing the amount of organic substance and humus.

Table 4. Particularities of the biochemical composition of the soil after incorporation of the fertilizer

Lots and sampling depth, (cm)	Biochemical indicators, (M ± m)				
	Active acidity, u.c.	Humidity, %	Dry substance, %	Organic substance, %	Humus content, %
I – control a) 0-10 b)15-20	 7.17 ± 0.28 7.29 ± 0.50	 13.55±0.18 17.42±0.34	 86.45±0.18 82.58±0.34	 4.40±0.03 4.45±0.02	 3.80± 0.15 3.50 ± 0.07
II – exp. a) 0-10 b)15-20	 6.93 ± 0.24 7.01± 0.20	 13.73±0.19 18.03±0.41	 86.27±0.19 81.97±0.41	 4.84±0.10 5.39±0.02	 4.50± 0.01 4.10 ± 0.15
III – exp. a) 0-10 b)15-20	 6.80 ± 0.17 6.82 ±0.17	 9.81± 0.16 18.98±0.34	 90.19±0.16 81.02±0.34	 5.37±0.02 4.91±0.11	 4.30± 0.07 3.90 ± 0.07

Source: Own results.

As a result of the conducted observations during the first year of action of the fertilizers on the phenological phases (Table 5), it was found that the peas cultivated with the worm compost fund of the experimental lots I and II had properly grown on the 10-th and 11-th day after sowing. Peas from the control lot cultivated with natural background began to rise on the 16-th day after sowing.

Table 5. Evaluation of the influence of the worm compost on the phenological phases of peas

Lots	The period of the phenological phase (after sowing) – days			
	Emergence	Beginning of blooming	Beginning of pods formation	final baking
Control (natural background)	16	49	57	88
Experimental I (worm compostl I)	10	40	48	80
Experimental II (worm compost II)	11	41	49	81

Source: Own results.

From the above mentioned it was found that the peas cultivated on the lots with the worm compost I and II, rose by 6-5 days earlier than the one on the control lot.

The blooming of peas on experimental lots I and II (with a worm compost background) (photo 1 and photo 2) started properly on the 40-th and 41-th day, after sowing.

Photo 1. The physiological development of cultivated peas with a worm compost background (the I experimental lot), in the second phenological phase
Source: Original.

Photo 2. The physiological development of cultivated peas with a worm compost background (the II experimental lot), in the second phenological peas
Source: Original.

Analyzing the results in the Table 5, it was found that the plants in the control lot (Photo 3) began to blossom on the 49-th day after sowing.

Photo 3. The physiological development of cultivated peas with natural background, in the second phenological phase
Source: Original.

Thus, as a result of the observations, it was found that in this phenological phase the peas on the experimental lots, with a worm compost background, developed by 9-8 days earlier than the one cultivated with natural background (the control lot). The mass blooming of the plants and the formation of the pods grown on the lots with a worm compost background took place after 48 and 49 days, and on the control lot after 57 days after sowing. According to the obtained results in this phenological phase, the physiological development of peas, on the experimental lots, took place by 9 and 8 days earlier than the one on the control lot.

As a result of the observations made, it was found that the same phenomenon was also manifested in the last phenological phase of peas development (the final baking phase). Peas on experimental lots reached the final baking stage by 8 and 7 days earlier than that on the control lot.

Therefore, as a result of the carried out research, it was found that in all phenological phases peas on experimental lots cultivated with organic fertilizer background (worm compost I and II) had an earlier development than that on the control lot.

Thus, the physiological development of peas was evaluated under the influence of the worm compost in its first year of action.

CONCLUSIONS

As a result of the research it was found that: - the value of humidity, organic matter and humus in the samples of the worm compost I increased, corresponding to 19.30%; 8.63% and 17.91%, and the content of dry matter decreased by 20.25%, compared to the same indicators of worm compost II;

-in soil samples collected from lots, from the deep of 0-10 cm and 15-20 cm till the sowing of the peas, the quality indicators are not essentially different;

-after 3 months of the incorporation of the fertilizers, the biochemical indicators of the soil taken from different levels during the experimental period did not change significantly, however, the value of organic matter and humus increased compared to the same soil indicator of the control lot;

-in the first year of action of the worm compost soil fertility was partially improved by increasing the amount of organic substance and humus;

-the fertilization of the soil with two types of worm compost (worm compost I - obtained using as the bio transformer the Red Hybrid of California earthworm and worm compost II - using F_2 descendants of the new line of earthworms, obtained by crossing the Red Hybrid of California earthworm with local rubbish) improved soil quality and reduced the duration of the physiological development of the peas: emergence for 5-6 days, the beginning of the bloom, the appearance of the pods and the final baking by 8-9 days.

REFERENCES

[1]Cremeneac, L., Abramova, V., Bahcivanji, M., 2002, Bioconversion of organic waste and environmental protection. Recommendations, Chisinau.
[2]Cremeneac, L., 2003, Bioconversion of organic waste in Moldova, Science information, Chisinau.
[3]Cremeneac, L., Boclaci, T., Chiruneț, Z., 2012, Technology of bioconversion of organic wastes and the use of the obtained products. Recommendations.

Typography „Print-Caro”, Chisinau.
[4]Cremeneac, L., Boclaci T., 2013. General aspect of management of organic waste in sustenable development of agriculture, Scientific bulletin. Series F. Biotechnologies, Volume XVII, Bucharest, 43-49.
[5]Cremeneac, L., Boclaci, T., Brad, T., 2014, Evaluation of the quality and productivity of maize grown with worms compost. Book of abstract. 12th International Symposium of Animal Biology and Nutrition. Balotești, România, 31.
[6]Cremeneac, L., Boclaci T., 2015, The role of worm compost in improving the quality and increasing the productivity of maize. Magazine Moldovan agriculture, No. 1, 26-28
[7]Gorodnyi, N., M., 1996, Bioconversion in the management of agroecosystems. Kiev.
[8]GOST 26204-84 - 262013-84, 1984. Soils. Methods of analysis, Moscow.
[9] GOST 26712-94,1988. Organic fertilizers. Methods of analysis, Moscow.
[10]Kosolapova, A., 1996, Worms culture and its capabilities, Ryazan, 20-25
[11]Melnik, I.,A., 1996, Bioconversion of organic waste and environmental protection. Abstracts of the IV International Congress "Bioconversion of Organic Waste and Environmental Protection", Kiev, 2-5.
[12]Razumov V., 1986, Handbook of the laboratory ssistant chemist for analysis on feeds „Rosselkhozizdat”, Moscow, 89-92; 144-148