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EVALUATING THE ROLE OF THE LIQUID ORGANIC FERTILIZER, OBTAINED FROM WORM COMPOST, ON THE PHYSIOLOGICAL DEVELOPMENT, QUALITY AND THE MAIZE HARVEST

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Abstract

The purpose of work consisted in the evaluation of the role of liquid organic fertilizer obtained from crude worm compost and drinking water in a ratio of 1: 100, on the process of emergence, physiological development and maize productivity. The experiment was conducted in the field conditions of Technological and Experimental Station "Maximovca". As a material for research was used a variety of maize M-450 and liquid organic fertilizer obtained from worm compost. In the experiment were included three lots: one control (with natural background) and two experimental: experimental I - maize seeds were macerated and fertilized, in three rounds, with liquid organic fertilizer (from considerations 4t / ha); experimental II - the seeds macerated in the same fertilizer without additional fertilization. It was found that macerating of seeds in extract obtained from crude worm compost and water and its administration as additional food, in triplicate, accelerated the emergence of maize, had improved physiological development and increased maize harvest with 18.26%. On the lot where were used only macerated seeds but not performed the supplementary feeding the maize harvest surpassed that of the control lot with 10.72%. So, it was found the beneficial influence of liquid organic fertilizer obtained from crude worm compost on the process of maize development.

Key words: *crude worm compost, liquid organic fertilizer, harvest, maceration, maize*

INTRODUCTION

Sustainable development of agriculture aims to achieve ecological agricultural production, which is a social issue of global importance. Global ecological situation, including regional, worsened in the last century due to industrialization and chemicalization of agriculture, enlargement of the number of means of transport, storage, maintenance and irrational use of organic waste etc. These have resulted in environmental pollution and its components [4]

A special role in improving the environmental situation lies with the bioconversion of organic waste by worm cultivation and use of its products in order to solve problems in the agrarian sector industries [1].

The technology of bioconversion of organic waste by worm cultivation deserves a particular attention to fundamental research, because it solves some important problems of the zootechnical and phytotechnical sector improving the situation of the environment, enhancing the soil fertility and improving the quality of agricultural production [8, 9].

Science and world practice had conducted researches directed towards the reduction of negative influence of harmful substances on organisms, paying particular attention to the issues of bioconversion of organic waste, a particular importance being assumed to the bioconversion technology of these by worm cultivation. The purpose of this biotechnology is to obtain ecological organic fertilizer, worm compost [3].

It is known that a serious problem in zootechny is the lack of proteins in food rations of animals and poultry, which has as a consequence the using in greater quantities of different types of forage. Therefore, this issue requires additional costs for the zootechny.

The resources of animal protein in zootechny are limited. For this reason, in recent years, in many countries increases the interest towards the technology of bioconversion of organic

waste by worm cultivation, which is an additional source for obtaining vegetable and animal protein for balancing the food rations for livestock, poultry, fish etc. [5].

Worm cultivation can become the base of the efficient production of ecological forage. Analyzing the results of previous investigations it was found that in crops fertilized with worm compost, total nitrogen content and crude protein exceeded that from the plants of control lot and the content of nitrosocompounds decreased essentially [6; 7].

In the result of the research it was found that the worm compost embedded in the soil in dose 3-4 tonnes/ha increases the soil's capacity to supply plants with nutrients and growth, having a long-acting (3-4 years). The results of multiple studies have found that the use of worm compost as a fertilizer in vegetable growing leads to the increasing of vegetables harvest cultivated with 37-51%, sugar content with 15-20% sugar and vitamin C with 15-20%. It was found that worm compost shortens the phenological phases of plant development increases plant resistance to the attack of phytopathogenic agents and to the unfavourable climatic conditions, improves the quality of production and increases the productivity of crop yields [2; 7].

In the literary sources are presented data which support that from the worm compost is obtained a liquid organic fertilizer with high efficiency. The use of liquid fertilizer positively influences on the growth process, photosynthesis, increasing the productivity and quality of agricultural production [12]. This was the reason for effectuation of research in aim to determine: the technological process for obtaining liquid fertilizer, assessing his role on the process of seed germination, peculiarities of physiological development and maize harvest.

MATERIALS AND METHODS

In order to assess the influence of liquid organic fertilizer obtained from crude worm compost on the process of seed germination, physiological development features and the harvest of maize in the field conditions of Techno-Experimental Station „Maximovca" was organized an experiment in which as materials for research were used the variety of maize M-450, crude worm compost and liquid organic fertilizer obtained from it. For obtaining liquid organic fertilizer was used crude worm compost and drinking water in a ratio of 1: 100. In order to assess the role of liquid organic fertilizer on the process of emergence and increasing of maize productivity, according to the scheme of the experiment (Table 1), in it were included three experimental lots having an area of 0.5 acres (one control and two experimental). For lot I (control) were used the seeds us macerated and natural fund; lot II (experimental - I) was seeded with macerated seeds in liquid fertilizer and during the process of development was conducted a supplementary feeding (in three rounds) of maize with the same fertilizer and for the lot III (experimental - II) were used macerated seeds without affecting the supplementary feeding of the crops during the experimental period.

Before sowing the maize seeds were subjected to the maceration process, for a period of 12 hours, in the liquid organic fertilizer, prepared from worm compost, and then was conducted the sowing according to the usual technology for the mentioned crop. According to maize cultivation technology, after emergence of total plants, at each meter, were left 3 plants. During the vegetation period, in dependence on phenological stages of maize grown on the lot II, was performed a supplementary feeding with liquid organic fertilizer (from considerations of 4t / ha) obtained from crude worm compost and water. During the vegetation period supplementary feeding was carried out in three rounds (first round - the plants had 4.3 leaves, second round – before the ear emergence, the third round - beginning of the emergence of cobs.

At the initial stage and during the experiment were made observations on the physiological process of emergence and development of maize, and at the final stage by weighing was determined the obtained harvest.

Table 1. Scheme of the experiment

No	Lots	Type of crops	Investigations during the experiment
1	Lot I (control)	The seeds us macerated and plants cultivated with natural fund.	Were determined: a) the quality worm compost and liquid fertilizer; b) the development of plants in various phenological phases; c) the maize productivity.
2	Lot II (experimental I)	The seeds macerated and fertilized the maize (in three rounds) with extract obtained from crude worm compost and water, in a ratio of 1:100	
3	Lot III (experimental II)	The seeds macerated in the extract obtained from crude worm compost and water in a ratio of 1:100, without supplementary feeding	

During the vegetation period in dependence on phenological stages (ear formation, the formation of cobs in the milk phase and in the wax phase) corn samples were taken for the determination of some qualitative indicators in accordance with the usual methods [10; 11].
The duration of the experiment depended on the vegetation period of maize

RESULTS AND DISCUSSIONS

The researches carried out regarding to the evaluation of role of the influence of liquid organic fertilizer (aqueous extract), obtained from crude worm compost on the process of emergence, physiological development, and maize harvest were conducted in order: to determine the quality worm compost the study of process of emergence and physiological development determining the quality and harvest of maize. In the results of the conducted investigations in order to determine the quality of crude worm compost and aqueous extract made from it (in the ratio 1: 100) it was found that their active acidity constituted respectively 7.20 and 7.24 conventional units and total nitrogen content - 3.14% and 0.10%. Humus content, potassium, magnesium and phosphorus in crude worm compost constituted respectively 22.8%, 1.90%, 0.85% and 1.83%.
In order to speed up the process of germination of seeds, for 12 hours, they were macerated in the liquid fertilizer obtained from crude worm compost and water in a ratio of 1:100. After 12 hours of macerating, the seeds were incorporated into the soil.
As a result of observations carried out on the process of plant emergence it was found that the maize on the experimental lot I and II had emerged respectively with 3 days and 5 days earlier and had developed better than plants on the control lot (Photo 1).

Photo 1. Physiological development of maize plants:
a) the control lot; b) the experimental lot I;
c) the experimental lot II

In a result of counting plants in each row during the phase of emergence there were found the following (Table 2): the number of maize plants emerged on the experimental lots I and II after 16 days from sowing had exceeded that of the control lot , respectively with 20.69% and 0.86%.

Table 2. The evaluation process of emergence of maize

No	Lot version	Period and number of emerged plants		
		16 days	19 days	25 days
		Number of plants	Number of plants	Number of plants
1	Control	11.6	18.3	35.66
2	Experimental I	14.0	23.6	42.33
3	Experimental II	11.7	22.0	41.66

After 19 days from sowing, the number of emerged plants had increased in all lots, but the ratio of emerged plants on experimental lots I and II exceeded that of the control lot, respectively with 28.96% and 20.22%. There

were noted changes in the number of emerged plants and after 25 days from sowing. But the difference, both between control and experimental lots and between the experimental lots I and II, had reduced. However, in the experimental lots I and II, the number of maize plants exceeded that of the control lot, respectively with 18.70% and 16.83%.

Therefore, the results obtained regarding to the process of the emergence of plants, the seeds of which had been macerated in liquid fertilizer made from crude worm compost demonstrate that its influence was beneficial accelerating the germination process and plant emergence.

In the experimental lot I cultivated with maize additional fertilization, was given in three rounds: I - three to four leaves appearance; II- before the advent of ear; III - after the emergence of ear. Observations on the physiological development of maize were carried out over four phenological stages. As a result of research concerning the development of phases of maize plants from the experiment was found that in the first two phenological phases, the key differences between the physiological state of the plants growing on the control lot and those experimental were not found. Some differences began to appear in the third phenological stage of the development of maize when it was found that in the experimental lot I, were kept more green plants than in the control lot and in the experimental lot II (Photo 2) .

Photo 2. Physiological development of crops in the third phenological phase.
a) the control lot; b) the experimental lot I;
c) the experimental lot II

This occurred under the influence of the liquid fertilizer obtained from worm compost used in three rounds for supplementary feeding of maize, which in arid climatic conditions maintained the moisture in the soil.

In early September, during the getting of maize harvest (the fourth phenological stage) it was found that on the experimental lot I the green plants constituted - 2.22%, on the experimental lot II - 1.98%, while on the control lot - 0.74 %.

Therefore, from the results of research it was found that liquid organic fertilizers used for additional fertilization of maize prolonged the phase of physiological development of maize.

Researches concerning on the evaluation of some qualitative indicators of maize from the experiment (Table 3) demonstrated that in the first two phenological stages in maize samples collected on the experimental lots I and II, the humidity reduced, respectively with 0.78% - 2.51% and 0.26% - 2.35% in comparison with plants of control lot. In the last phenological phase of maize development, the humidity value, in maize samples collected from experimental lots was more heightened with 2.37% (experimental lot I) and 1.11% (experimental lot II) than in plants of control lot. The value of total nitrogen in plants on the experimental lot I in all 3 phases exceeded the one of plants in the control lot, respectively with 65.41%; 59.40% and 66.67% and the crude protein content of the same sample increased respectively with 65.40%; 59.45% and 66.76%. The same regularity was ascertained regarding to the total nitrogen and crude protein content in the samples collected on the experimental lot II. The value of total nitrogen and crude protein in samples of this lot had exceeded, respectively with 31.45% and 31.38% (phase I); 29.09% 29, 09% (phase II), and 24.56% and 24.63% (phase III) the one from the samples of maize collected from the control lot.

In the result of researches concerning the content of nitrate in maize samples it was found that the value of nitrates in plants collected on the experimental lots had diminished in phenological phases I, II and III

respectively with 4.33%; 33.24% and 9.71% (experimental lot I) and with 1.93%; 3.08% and 6.32% (experimental lot II).

Table 3. The evaluation of the quality of maize in addiction on phenological phases

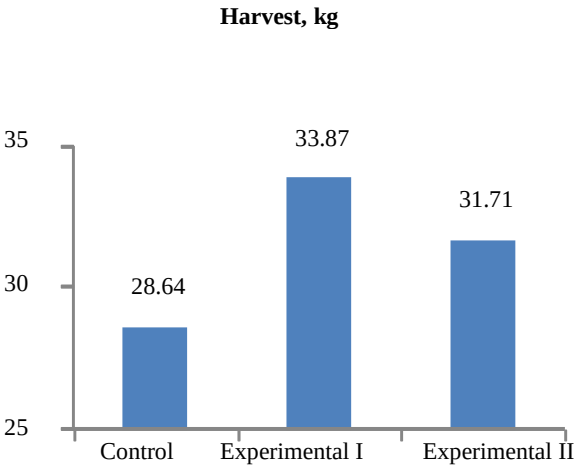
Lots	Phases	Biochemical indicators			
		Humidity, %	Total nitrogen %	Crude protein, %	Nitrates, %
Control	I	86.72±0.7	1.59±0.2	9.94±1.4	42.08±3.5
	II	81.80±0.3	1.65±0.1	10.31±0.7	31.52±0.4
	III	63.20±0.2	1.71±0.0	10.68±0.0	15.74±0.8
Experimental I	I	86.05±0.3	2.63±0.2	16.44±1.4	40.26±3.5
	II	79.75±0.3	2.63±0.2	16.44±1.1	21.04±0.5
	III	64.70±0.5	2.85±0.2	17.81±1.1	14.21±0.5
Experimental II	I	86.58±0.74	2.09±0.2	13.06±0.9	41.26±1.4
	II	79.90±0.2	2.13±0.1	13.31±0.5	30.55±0.4
	III	63.90±0.2	2.13±0.1	13.31±0.5	14.74±0.1

Note: I – ear formation; II – cobs in the milk phase; III – cobs in the wax phase; 13.31 - $P \leq 0{,}001$

Therefore the quality of maize cultivated with the use of macerated seeds in the extract obtained from crude worm compost and the administration of this as additional food, in three rounds is superior to that in the control lot and to the lot in which were used only macerated seeds.

Analyzing the results concerning to the harvest of maize obtained on the surface unit (Fig. 1) it was found that the one collected on experimental lots I and II surpassed that of the control lot, respectively with 18.26% and 10.72 %.

It has also been found a difference and between the harvest of maize collected on the experimental lot I and that collected on control lot and on experimental II.



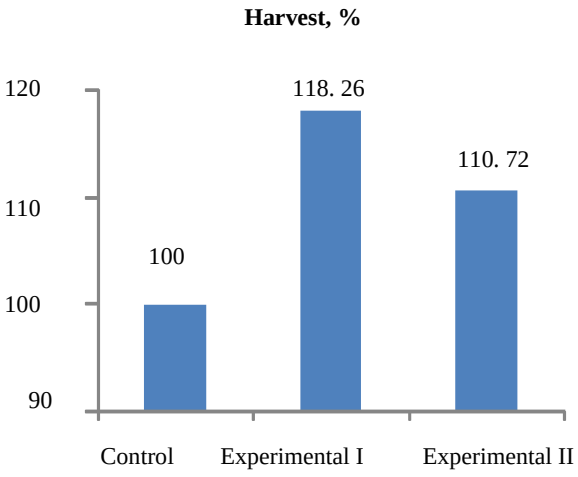


Fig.1. The evaluation of maize harvest

In this case the maize harvest collected on control lot and experimental II were respectively with 15.6% and 6.38% lower than that collected on the experimental lot I.

The results presented in the table 4, shows that in comparison with harvest collected on the experimental lot II was different from the other two lots. Analyzing the obtained data it was found that the harvest on the control lot was with 8.92% lower, while the one on the experimental lot I had surpassed with 6.81% that of the experimental lot II.

Table 4. The evaluation of maize harvest used in the experiment

No	Lots	Harvest	
		kg	In a ratio with control lot, %
1	Control	28,640	100.00
2	Experimental I	33,870	118.26
3	Experimental II	31,710	110.72

Thus the analysis of obtained results demonstrates that on the lots in which the seeds before sowing had been macerated with the aqueous extract obtained from crude worm compost in a ratio of 1: 100, and the plants were fertilized with the same extract, the maize harvest was greater than that on the control lot

Therefore, analysing the results obtained in the field experiment it was found that the liquid organic fertilizer prepared from crude

worm compost and water in a ratio of 1: 100, used for macerating of maize seeds before sowing and for fertilizing with this of plants, in three rounds, during the vegetation period beneficially influenced as on the process of emergence and physiological development of plants, as well as on the maize harvest.

CONCLUSIONS

Following the researches it was found that liquid organic fertilizer obtained from crude worm compost and drinking water in a ratio of 1: 100:

- Contributed to the early emergence of maize seed and its physiological's development;
- Prolonged the phase of the ripeness of maize;
- improved the maize qualitative indicators;
- increased the harvest of maize collected from the experimental lots I and II surpassing the one on the control lot, respectively with 18.26% and 10.72%;
- it may be used in a quality of fertilizer for macerating of seeds and supplementary nutrition of agricultural crops, in accordance with the proposed scheme.

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