

## The role of worm compost in the process of reducing contamination of the maize with smut

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### Abstract

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The article reflects the influence of the worm compost on the degree of contamination of the maize with smut (*Sorosporium reilianum f. Zeae*) in the first year of fertilizer's action. During the conducted observations it was found that in the first year of action of the fertilizer, on lots with a background of worm compost 1.51% of the plants were contaminated with smut, while on the control lot (with natural background) – 3.86 % of the plants grown on the lot were contaminated.

Thus, it was found that on the lot with natural background (the control lot) the degree of contamination of the plants with smut was by 2.50 times higher than on the lots where the worm compost was used.

Analysing the obtained results, it was found that corn cobs harvest in the first year of the experiment, on fertilized lots with worm compost, was respectively by 23.15%-29.07% higher than the one on the control lot.

Therefore, as a result of the carried out research, it was found that, under the influence of the worm compost incorporated in the soil, the degree of contamination of maize with smut (*Sorosporium reilianum f. Zeae*) was reduced and the harvest on the surface unit increased significantly.

*Keywords:* cobs; contamination; maize; productivity; smut; worm compost

### Introduction

The technology of bioconversion of organic wastes by worm cultivation deserves special attention and profound research, taking into consideration the spectrum of environmental problems that can solve: the complex processing of organic wastes; reanimation of degraded soils; obtaining long-lasting organic fertilizer; increasing crop production; obtaining organic farming; plant protection (Gorodnyi, 1996).

Through research it was found that the worm compost, one of the final products obtained by using the bioconversion technology of organic wastes by worm cultivation, is a valuable organic fertilizer. Its use is a real means of sustainable development of agriculture and prevention of environmental

pollution(Boclaciet al., 2013) The appreciation of the quality of worm compost has a particular importance for improving quality and increasing the productivity of agricultural crops (Cremeneac et al., 2012). It is known that smut attacks cereal crops, including maize and contaminates the stem, inflorescences (ears) and maize cobs. Contaminated the ears are transformed into a mass of black spores, the cobs in a conglomerate black in the form of a cone consisting of stigma and spores, which are kept until corn baking (Kalashnikov, 1992).

It has been found that the process of contamination of maize with smut inhibits plant growth, causing poor development, saplings formation, lack of cobs and decreased productivity.

The purpose of this work was to determine the role of the worm compost in the process of reducing the degree of

contamination of maize with smut (*Sorosporium reilianum* f. *Zae*) and its productivity in the first year of fertilizer's action.

## Materials and Methods

For research, purposes concerning the determination of the role of the worm compost on the degree of contamination of the maize with smut and on the corn productivity. The use of worm compost as an organic fertilizer has a particular importance for enhancing the productivity and quality of crop production, including forage crops, which subsequently promotes the production of quality livestock (Cremeneac et al., 2010, 2013). Often the quality and productivity of corn is influenced by the contamination of plants with smut *Sorosporiumreilianum* f. *Zae* (Karatygin, 1986).

In order to evaluate the role of the worm compost on the quality and productivity of maize, an experiment was conducted under the field conditions, where the research materials were used: organic fertilizer – worm compost, in different doses and agricultural crops – maize of the sort *M-450*. The research was carried out under the field conditions of the Technological-Experimental Resort „Maximovca”. In the experiment were included three lots with the surface of one acre: one - control and two experimental (Table 1). The research on physiological development, contamination grade of corn with smut and harvest of cobs has been conducted over three years. In the article are presented the research results only in the first year of action of the worm compost.

On the experimental lots, before sowing, was incorporated worm compost, the organic fertilizer (from 3 tons/ha - the experimental lot I and 4 tons/ha - the experimental lot II) obtained as a result of the bioconversion of the organic wastes by worm cultivation. On the control lot, the plants were grown with natural background. For the sowing, were used maize seeds of the sort *M-450*. Observations on the degree of contamination of maize with smut and the productivity of the crops on each lot were carried out throughout the growing season of the first year of the experiment.

Permanently, in the various vegetation phases, including and at the end of the vegetation phase, observations have been made on the quality of maize, taking into account the number of plants contaminated with smut.

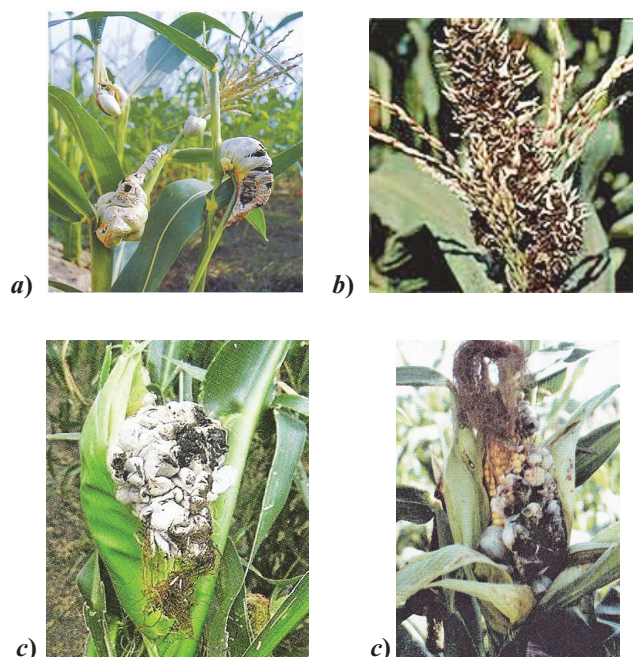
**Table 1. Experiment scheme**

No.	Lots	The conditions of the experiment	Conducted research
1	Control	Natural background	Were determined: – the degree of contamination of maize with cheese; – the harvest of corn cobs
2	Experimental I	With a worm compost background – 3 t/ha	
3	Experimental II	With a worm compost background – 4 t/ha	

At the end of the physiological period, by weighing was evaluated the harvest of the corn cobs collected from each lot.

## Results and Discussions

As a result of the research carried out during the experiment in the first year of action of the worm compost, it was found that its use had a beneficial effect on the reduction of the degree of contamination of the maize with smut, thus improving the quality of the cultivated maize. It is known that for the successful protection of cereals from contamination with smut it is necessary to carry out a series of agro-technical measures. The most effective of these are: permanent practice of crop rotation, which prevents accumulation in the soil of the spores of smut; use of varieties and hybrids resistant to contamination; the sowing time; the depth of incorporation of plant seeds into the soil; crop density; collection methods and so on (Karatygin, 1986).



**Fig. 1. The plants of maize contaminated with smut: a) the stem; b) the ear; c) the cobs**

**Table 2. Grade of contamination of maize with smut**

No.	Experiment variants	The conditions of the experiment	Contamination of maize with smut	
			Number of plants	Reported to the total number of plants on the lot, %
1	Control	Natural background	18	3.87
2	Experimental I	With a worm compost background – 3 t/ha	7	1.51
3	Experimental II	With a worm compost background – 4 t/ha	7	1.51

During the experiment, observations were made about the physiological development of the plants, highlighting those contaminated with smut. As a result of the researches it was found that the corn spore of smut were formed in different phenological phases on different parts of maize (stem, ears, cobs), causing the destruction of ears and cobs, turning them into black spore bags of smut (Figure 1a, 1b, 1c).

The number of plants of maize contaminated with smut on the control and experimental lots was different.

Thus, the quantity of plants contaminated with smut, found on the control lot, was higher than on experimental lots I and II, where the maize was cultivated with a worm compost background (Table 2).

Thereby, on the experimental lots I and II, with a worm compost background, in the first year of its activity, were contaminated with smut, only seven plants, which constituted 1.51% of grown maize plants, and on the control lot (with natural background) contamination constituted 18 plants or 3.86% of the plants grown on the lot. Based on the above, it was found that on the control lot (with natural background) the degree of contamination of the maize with a smut has exceeded 2.5 times that of the plants grown on the lots with a

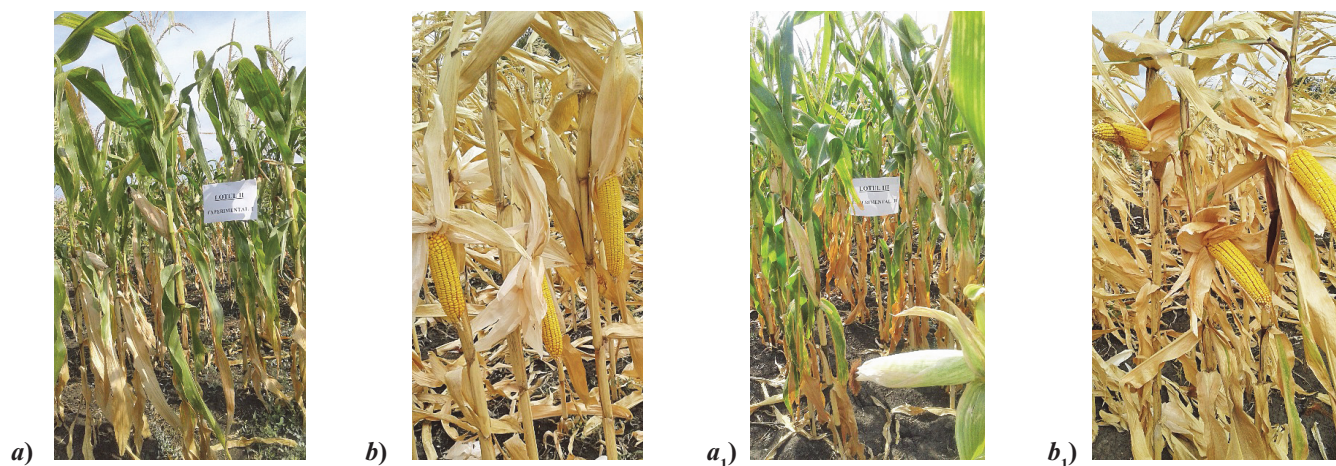
worm compost, thus diminishing the quality of the production.

Therefore, the incorporation of the worm compost into the soil has diminished the degree of contamination of the plants with smut. This has improved the quality of corn and then the fodder prepared from it.

Data are known that in Moldova in 1980-1990 the contamination of maize sowing seeds with smut oscillated from 1.6% to 30.00%. As a result of the influence of this disease, the loss of the seed harvest of maize, constituted 35.00% (Kalashnikov, 1992).

In the Figures 2a, 2b and 2a<sub>1</sub>, 2b<sub>1</sub> are presented the maize plants from experimental lots I and II, in the different phenological phases, which have not been contaminated with smut.

As a result of the observations it was found that the maize-contaminated by smut influenced both the development of the whole fodder crop and the harvest of the cobs (Table 3). This directly resulted in a decrease in the amount of cobs harvest at the surface unit. Analysing the presented results in Table 3, it was found that the harvest of cobs obtained from lots with worm compost background (experimental lot I and experimental lot II) in its first year of action was respectively by 23.15% and 29.07%, higher than the one collected on the control lot.



**Fig. 2. The maize from experimental lot I (a and b) and II (a<sub>1</sub> and b<sub>1</sub>)**  
 a); a<sub>1</sub>) the wax phenological phase of the corn cobs;  
 b); b<sub>1</sub>) the phenological phase of the final baking of corn cobs

**Table 3. Evaluation of harvest of maize cobs**

No.	Experiment variants	The conditions of the experiment	Harvest of maize cobs	
			total (kg)	reported to the control lot, %
1.	Control	Natural background	54.000	100.00
2.	Experimental I	With a worm compost background – 3 t/ha	66.500	123.15
3.	Experimental II	With worm compost background – 4 t/ha	69.700	129.07

It follows from the above that the worm compost incorporated in the soil at the rate of 3 t/ha and 4 t/ha improved the quality of the obtained production by diminishing the contamination of the maize with smut and increased the crop yield to the surface unit.

## Conclusions

As a result of the research it was found that the incorporation into the soil of the worm compost in a dose of 3 t/ha and 4 t/ha in the first year of its activity contributed to:

- ✓ a decrease of 2.50 times of the degree of contamination of the maize with smut;
- ✓ improving the quality of maize production, through the low degree of contamination with the smut;
- ✓ increase of the harvest of the corn cobs by 23.15% – 29.07%.

## References

**Boclaci, T., Cremeneac, L.,** 2013. Worm cultivation – important factor in the sustainable development of agriculture. Materi-

als of the 3<sup>rd</sup> International Scientific Practical Conference „*The zootechnical science: history, problems, perspective*” Kamenets Podolsky, 2013, p.339-340. (UK).

**Cremeneac, L., & Boclaci, T.** (2010). Influence of the worm compost and ammonia silicate on the quality and quantity of fodder crops. The Collection of scientific papers *The role of leguminous and fodder crops in the agriculture of the Republic of Moldova*. Resp.ed. V.Vozian. Ch.: SE.S.F.E. – P. „Central Printing House”, Balti, pp. 246-269 (Md).

**Cremeneac, L., Boclaci T., & Chirune, Z.** (2012). Technology of bioconversion of organic wastes and the use of the obtained products. *Recommendations*. Typography „Print-Caro”, Chisinau, pp. 72 (Md).

**Cremeneac, L., Boclaci, T.,** 2013. The Effective influence of worm compost on the quality and yield of the maize. Materials of the 3rd International Scientific Practical Conference „*The zootechnical science: history, problems, perspective*”. Kamenets Podolsky, 2013, pp. 341-342. (UK).

**Gorodnyi, N. M., Tivonchuk S. A., Barry, E. S., & Bykin, A. V.** (1996). Bioconversion in the management of agro ecosystems. *Kiev*, pp. 108-132 (En).

**Kalashnikov, K. Ya., & Shapiro, I. D.** (1992). Pests and diseases of maize. Ed. *Agricultural Literature*, Leningrad, pp. 189 (Ru).

**Karatygin, I. V.** (1986). The causative agents of the cereal crops, Science, Leningrad, pp. 112 (Ru).