

## RESEARCHES REGARDING THE INFLUENCE OF VERMICOMPOST ON HORTICULTURAL PLANT SPECIES

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### Abstract

*Vermicompost is a new generation of organic fertilizer which is obtained by processing organic matter with the help of earthworms. The use of vermicompost contributes to the improvement of the physico-chemical properties of the ground through a better structuring of the soil, a decrease of the apparent density and an increase of the humus content in the soil. Vermicompost can replace chemical or organic fertilizers being very rich in nutrients and with a beneficial effect on the development of cultivated plants. The research was conducted in 2020 and aimed at the influence of vermicompost on the germination and development of tomato, pepper, eggplant and cucumber plants. There were used different variants: V1 - control, V2 - control treated with Tecamin Raiz, V3 - vermicompost 1 l/200 l water, V4 - vermicompost 1 l/150 l water and V5 - vermicompost 1 l/100 l water. The results obtained led to the determination of vermicompost doses for each species, being known that each group of plants has a certain need for nutrients.*

**Key words:** dose application, fertilisation, organic matter, soil fertility, vermicompost.

### INTRODUCTION

Vermicompost is a new generation of organic fertilizer that is produced with the help of earthworms. It is a concentrated, mineral-organic fertilizer, with no preservative in its composition (Munroe, 2007).

Earthworm humus is the best fertilizer as it contains high concentrations of beneficial bacteria and other microorganisms, many biologically active stimulants for plants, vitamins, amino acids, fulvic and humic acid, all added during the digestive process of the earthworm (Atiyeh et al., 2007). Earthworm humus completely replaces any chemical or organic fertilizer and contains 100 times more nutrients and microorganisms beneficial to plants (Subler, Scott et al., 1998; Indian Journal of Biotechnology, 2007).

Research carried out over several years in laboratories in several countries has concluded that earthworm humus is excellent in preventing diseases such as: *Alternaria* spp. (Alternariosis), *Botrytis* spp. (Gray mold), *Fusarium* spp. (Fusariosis), *Peronospora* spp (manna), *Phytophthora cinnamomi*, *Pythium* spp. (Root rot), *Pseudomonas syringae* (bacterial burning in peas), *Rhizoctonia solani* (rhizoctoniosis), *Septoria* spp. Inequalis,

*Thielaviopsis basicola* (black tobacco rot), *Venturia inaequalis* (apple rot) (Gershuny, 2011; Sudha, 2000).

Vermicompost does not contain or provide living conditions for *E. coli*, *Salmonella* or other pests (Journal of Agricultural Science, 2003).

Vermicompost is the only fertilizer, accepted in the EU as an amendment for organic farming, according to *Regulation (EC) no. 834/2007*.

Other benefits of using this organic fertilizer are: rapid germination, better developed and stronger root system, better water retention in plants, accelerated budding, faster growth and resistance to various bacteria and diseases. Liquid vermicompost prevents the appearance and growth of pathogenic micro-flora, reduces the nitrate content in fruits and vegetables, blocks the absorption of heavy metals from the soil by plants, increases the content of fructose, proteins and vitamins. Stimulates flowering, fertility, enriches the taste and resistance of products.

### MATERIALS AND METHODS

In order to obtain the vericompost in 2020, a platform with a thickness of 25 cm was built on which the substrate was prepared for the

earthworm bed. This substrate was prepared from cattle manure that was kept soaked for 4-5 months and loosening wheat straw. After the bed was prepared, the earthworms were brought and placed in the nest. After introduction, another layer of manure of about 10 cm was placed over the earthworms (Ilie, 2019).

The first feeding was done one month after the worms were introduced into the nest, after which they were fed 100 kg of manure and straw every 2 weeks. They had to be watered almost daily, especially during the summer. The aeration was done once a month and consisted of loosening the first 10 cm layer.

After 6 months the earthworms were moved to another nest, but the vermicompost was left for another 3 months after which it was removed, sifted to be crushed and loosened. After the previously mentioned actions, the vermicompost extract was turned into liquid.

After obtaining the solid vermicompost and making the liquid vermicompost extract, there was performed the physico-chemical and biological analysis of this pH-6.5, Humus 6.35, Soluble sprouts 0.303, N-NO<sub>3</sub> 1662.5 mg/kg, N-NH<sub>4</sub>-19.125 mg/kg, P-19.05 mg/kg, Ca 22 mg/kg and Mg 20 mg/kg.

The proposed variants for testing the liquid vermicompost for the vegetable seeds germination were: Liquid vermicompost dilution 1:30, Liquid vermicompost dilution 1:40. The seeds were kept in solution for 24 hours after which they were dried for 24 hours and then sown.

The variants that were used for vermicompost testing in seedling production: V1 - untreated control; V2 - control treated with Tecamin Raiz biostimulator; V3 - treated with vermicompost 1 l/200 l water; V4 - treated with vermicompost 1 l/150 l water; V5 - treated with vermicompost 1 l/100 l water. Tomato, pepper, cucumber and eggplant seeds were used and the substrate was Kekkila DSM 3W peat.

## RESULTS AND DISCUSSIONS

### The influence of vermicompost on seed germination.

It can be seen in Figure 1 that after 5 days, the percentage of germinated tomato seeds is higher in the vermicompost variant. In the other

days, the germination percentage is decreasing compared to the other variants.

In Figure 2 it can be seen that every day the percentage of germinated seeds is higher than in the other variants. From this it can be concluded that the best dose of vermicompost for the germination of tomato seeds is 1:40.

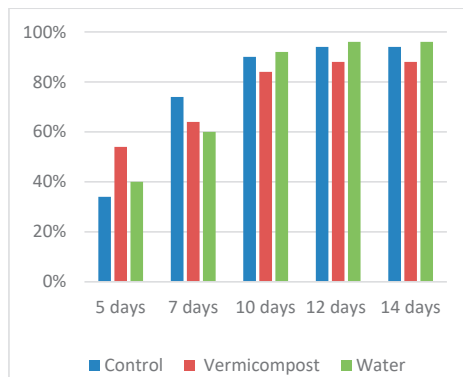


Figure 1. Germination of tomato seeds using vermicompost in dilution 1:30

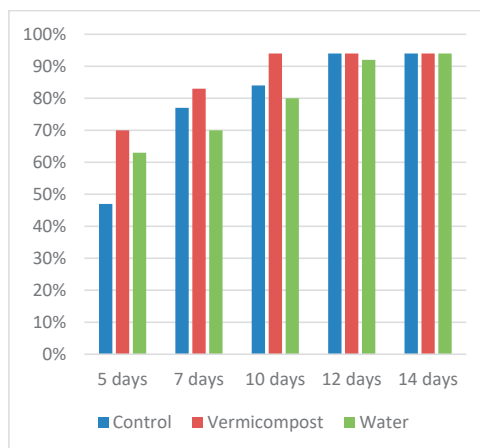


Figure 2. Germination of tomato seeds using vermicompost in dilution 1:40

### The influence of vermicompost on pepper seed germination.

The were used 50 pepper seeds from each variant (Figures 3 and 4).

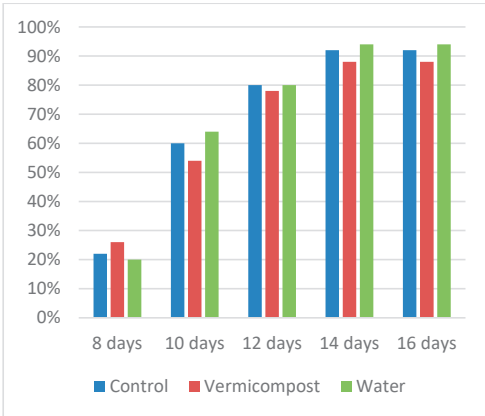


Figure 3. Germination of pepper seeds using vermicompost in dilution 1:30

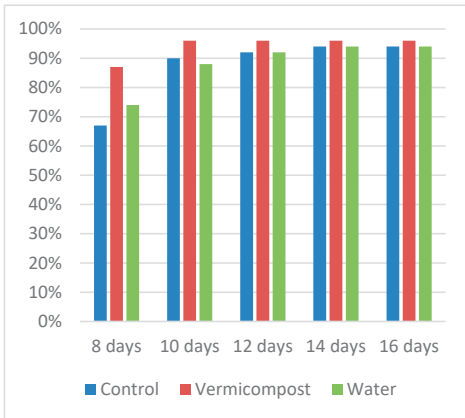


Figure 4. Germination of pepper seeds using vermicompost in dilution 1:40

In Figure 3 it can be observed that after 8 days, the percentage of germinated pepper seeds is higher in the vermicompost variant. In the other days, the germination percentage is decreasing compared to the other variants.

In Figure 4 it can be observed that after 8 days, the percentage of germinated pepper seeds is higher in the vermicompost variant and remains the same in the other days. It can be concluded that the best dose of vermicompost for the germination of pepper seeds is 1:40.

In Figures 5 and 6 can be seen the germination of cucumber seeds which have been kept for germination in different dilutions of vermicompost.

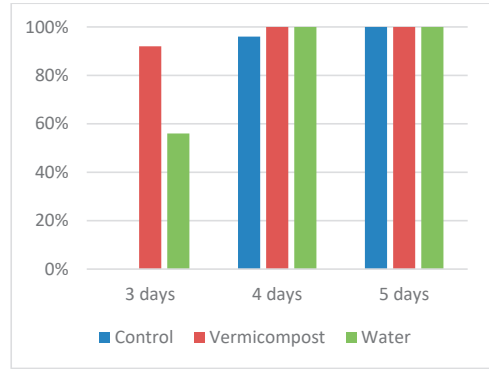


Figure 5. Germination of cucumber seeds using vermicompost in dilution 1:30

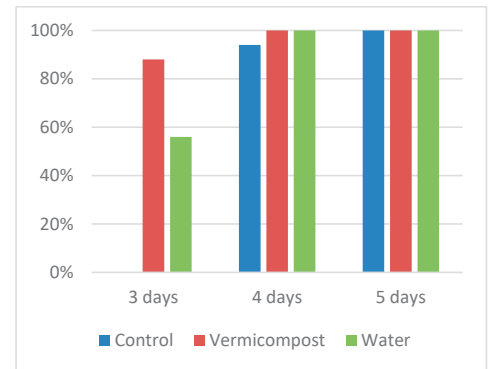


Figure 6. Germination of cucumber seeds using vermicompost in dilution 1:40

In Figure 5 can be seen that the variant in which vermicompost was used, the seeds germinated faster, on day 3 the percentage of germinated seeds was 92% compared to the control, in which the percentage was 0%.

Figure 6 shows that the variant in which vermicompost was used but in a concentration of less than 1:40, the percentage of seeds germinated on day 3 was 88% compared to the control, in which the percentage was also 0%. It can be concluded that for cucumber seeds germination the best dose of vermicompost is 1:30, but the dose of 1:40 is not bad being only 4% lower.

Figure 7 shows that the percentage of seeds germinated in the vermicompost version is lower than in the water version every day, but in recent days it is also lower than the control version.

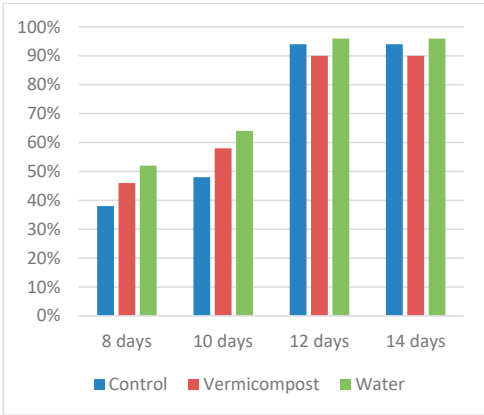


Figure 7. Germination of eggplant seeds using vermicompost in dilution 1:30

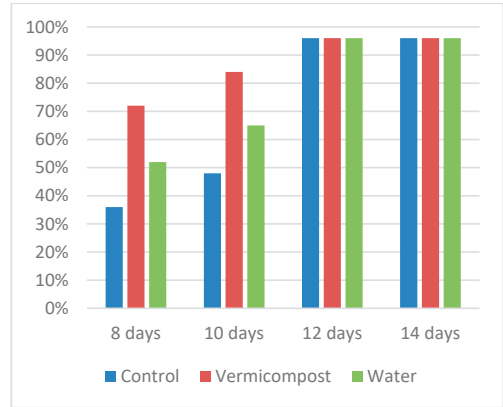


Figure 8. Germination of eggplant seeds using vermicompost in dilution 1:40

In Figure 8 it can be observed that the percentage of germinated seeds in the vermicompost variant is higher in the first days than in the other variants. It can be concluded that for the germination of eggplant seeds the best dose of vermicompost is 1:40, because the dose of 1:30 inhibits the germination of seeds.

**The influence of vermicompost on the growth and development of tomato, pepper, cucumber and eggplant seedlings.**

In Figure 9 it can be seen which variant was better for each plant.

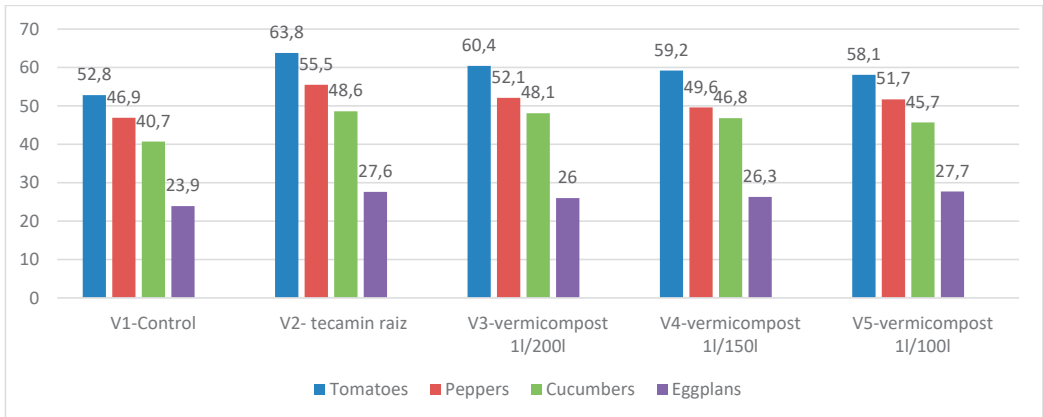


Figure 9. Total length of plants (cm)

Of the 3 variants with vermicompost, the best variant was: V3 for tomatoes with 60.4 cm; V3 for peppers with 52.1 cm; for cucumbers V3 with 48.1 cm and for eggplants V5 with 27.7

cm. Figure 10 shows in which variant the root system was better developed for each plants category.

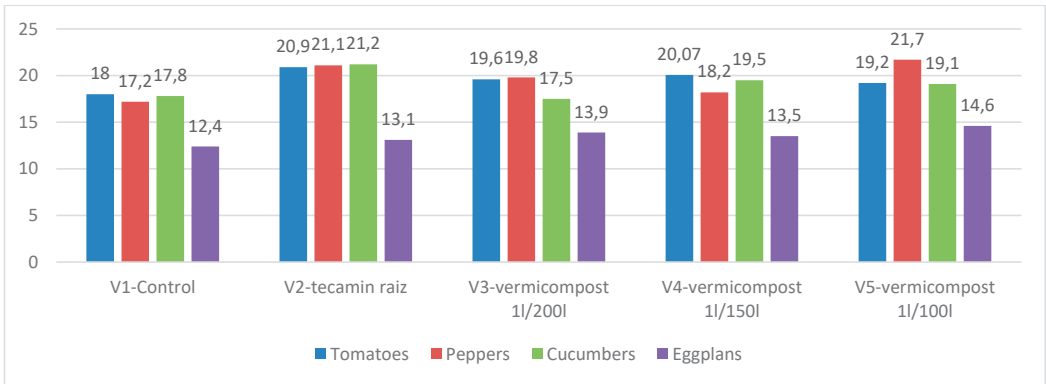


Figure 10. Plant root length (cm)

Among the variants with vermicompost, the best variant was: V4 for tomatoes with 20.07 cm; for peppers it was V5 by 21.7 cm; in cucumbers it was V4 with 19.1 cm and in

eggplants V5 with 14.6 cm. In Figure 11, the average stem length can be observed for each tested variant and for each category of plants.

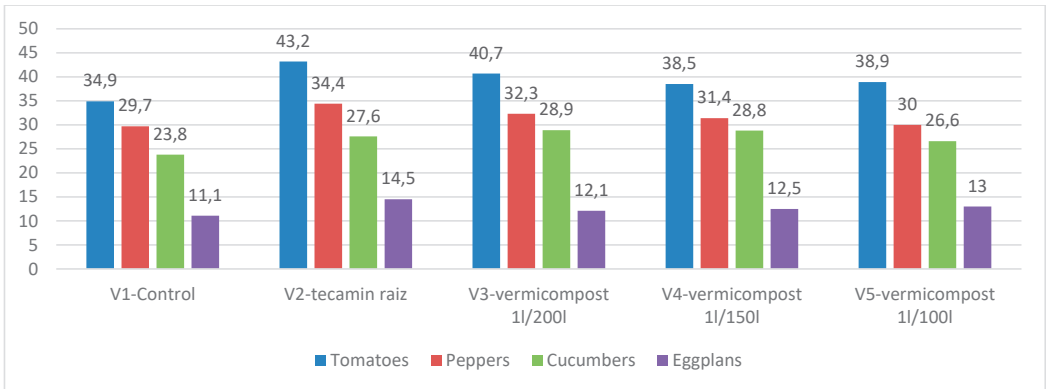


Figure 11. Length of plant stem (cm)

Among the variants with vermicompost, the best variant was: V3 for tomatoes with 40.7 cm; in peppers it was V3 by 32.3 cm; in cucumbers it was V3 with 28.9 cm and in

eggplants it was V5 with 13 cm. In Figure 12 you can see the thickness of the plant package for each variant.

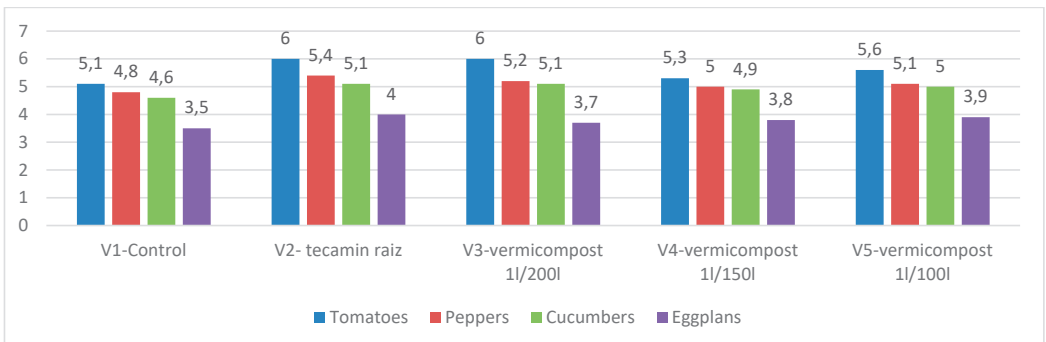


Figure 12. Plant package thickness (mm)

Among the vermicompost variants, the variant with the thickest package was: V3 for tomatoes with 6 mm; V3 for peppers with 5.2 mm; V3 for cucumbers with 5.1 mm and V5 for

eggplants with 3.9 mm. In Figure 13 it can be seen how the weight of the plants differs from one variant to another.

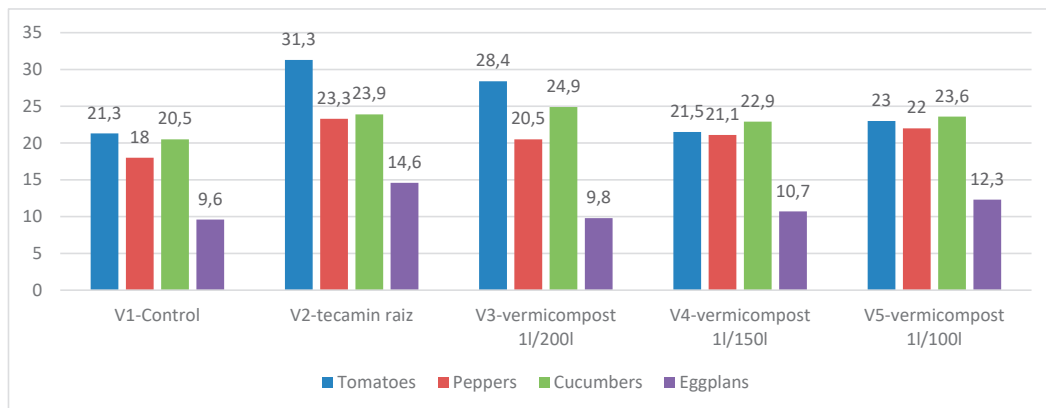


Figure 13. Total weight of plants (g)

Among the vermicompost variants, the variant with the best results was: V3 for tomatoes with 28.4 g; V5 for peppers with 22 g; V3 for cucumbers with 24.9 g and V5 for eggplants

with 12.3 g. In Figure 14 the weight of the plant stem can be seen in all the studied variants.

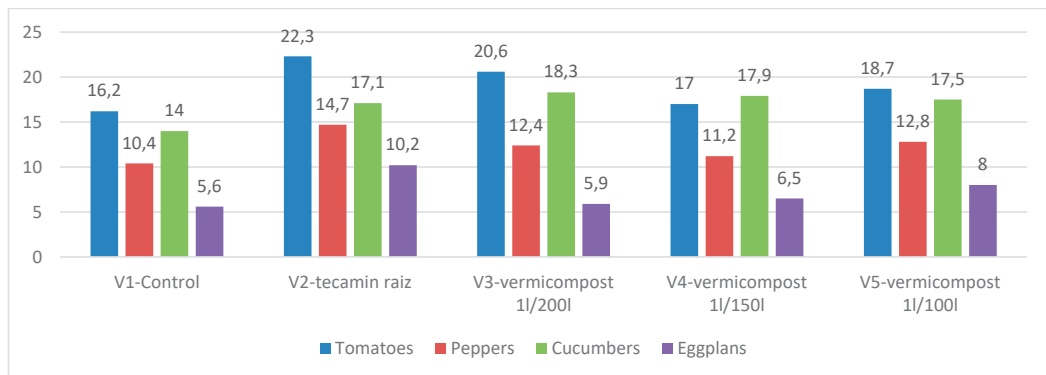


Figure 14. Weight of plant stem (g)

Among the variants with vermicompost, the variant with the best results was: V3 for tomatoes with 20.6 g; V5 for peppers with 12.8 g; V3 for cucumbers with 18.3 g and V5 for

eggplants with 8 g. In Figure 15 the weight of the plant root can be seen in each variant studied.

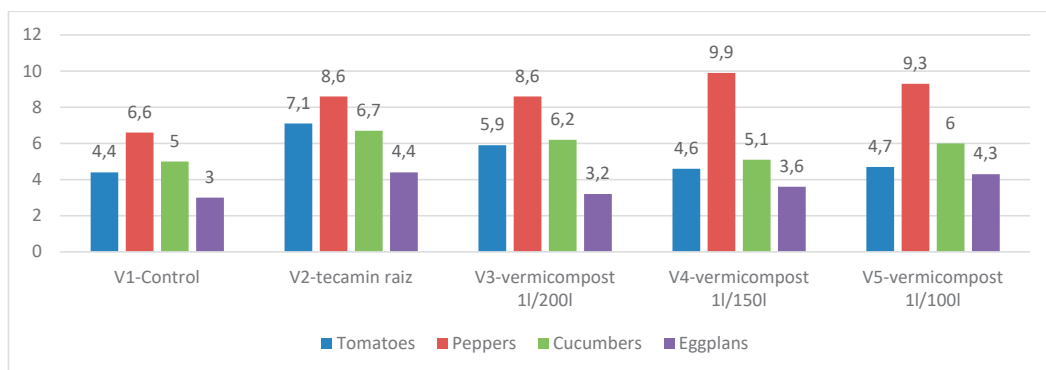


Figure 15. Weight of plant root (g)

Among the variants with vermicompost, the variant with the best results was: V3 for tomatoes with 5.9 g; V4 for peppers with 9.9 g;

V3 for cucumbers with 6.2 g and V5 for eggplants with 4.3 g. In Figure 16 the weight of the dried plants can be seen for each variant.

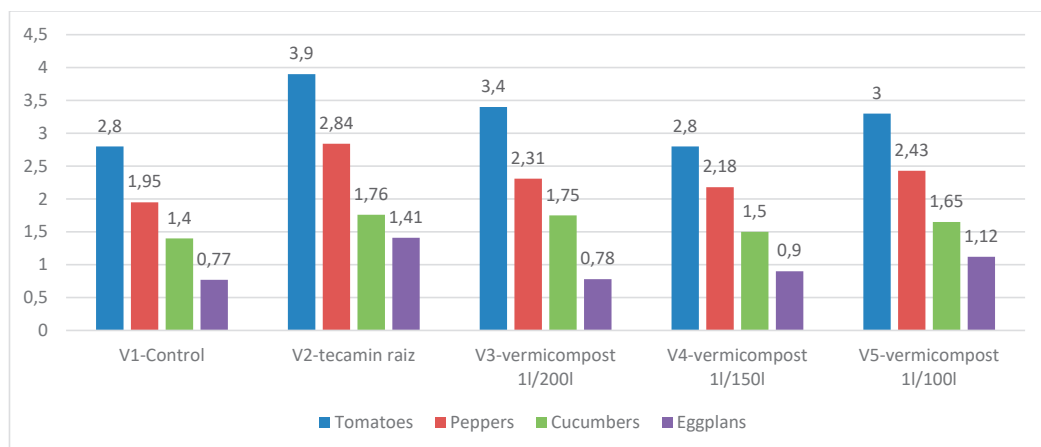


Figure 16. Weight of dry plants without roots (g)

Among the variants with vermicompost, the variant with the best results was: V3 for tomatoes with 3.4 g; V5 for peppers with 2.43 g; V3 for cucumbers with 1.75 g and V5 for eggplants with 1.12 g.

Table 1 shows the values obtained for V1 variant - untreated control, for V2 variant - control treated with Tecamin Raiz and for vermicompost, the variant with which were obtained the best results.

From the table it results that the variants with vermicompost are at a great distance from the variant V1 - untreated control, so the vermicompost has good results.

In the case of V2 variant - control treated with Tecamin Raiz, the variants with vermicompost

are at close values but lower than the value of V2 variant.

Out of the total of 32 measurements performed on the 4 groups of plants, the variants with vermicompost exceeded the value of the treated V2 control in 7 cases, in 2 cases they were equal and in 23 cases they were lower than the V2 variant.

The variant with vermicompost with the best results in total, was V3 - vermicompost 1 l/200 l - out of the total of 32 measurements in 17 was on the first place.

On the 2nd place was the variant V5 - vermicompost 1 l/100 l - with 12 measurements and on the 3rd place, the variant V4 - vermicompost 1 l/150 l - with 3 measurements.

Table 1: Determining the best variant with vermicompost in relation to the untreated control variant and the treated control variant

Test performed	Plant	Untreated witness V1	Witness treated with Tecamin Raiz V2	Vermicompost variant with the best results
Total length of plants	Tomato	52.8 cm	63.8 cm	V3 – 60.4 cm
	Pepper	46.9 cm	55.5 cm	V3 – 52.1 cm
	Cucumbers	40.7 cm	48.6 cm	V3 – 48.1 cm
	Eggplants	23.9 cm	27.6 cm	V5 – 27.7 cm
Plant root length	Tomato	18 cm	20.9 cm	V4 – 20.07 cm
	Pepper	17.2 cm	21.1 cm	V5 – 21.7 cm
	Cucumbers	17.8 cm	21.2 cm	V4 – 19.5 cm
	Eggplants	12.4 cm	13.1 cm	V5 – 14.6 cm
The length of the plant stem	Tomato	34.9 cm	43.2 cm	V3 – 40.7 cm
	Pepper	29.7 cm	34.4 cm	V3 – 32.3 cm
	Cucumbers	23.8 cm	27.6 cm	V3 – 28.9 cm
	Eggplants	11.1 cm	14.5 cm	V5 – 13 cm
The thickness of the plant package	Tomato	5.1 mm	6 mm	V3 – 6 mm
	Pepper	4.8 mm	5.4 mm	V3 – 5.2 mm
	Cucumbers	4.6 mm	5.1 mm	V3 – 5.1 mm
	Eggplants	3.5 mm	4 mm	V5 – 3.9 mm
Total weight of plants	Tomato	21.3 g	31.3 g	V3 – 28.4 g
	Pepper	18 g	23.3 g	V5 – 22 g
	Cucumbers	20.5 g	23.9 g	V3 – 24.9 g
	Eggplants	9.6 g	14.6 g	V5 – 12.3 g
The weight of the plant stem	Tomato	16.2 g	22.3 g	V3 – 20.6 g
	Pepper	10.4 g	14.7 g	V5 – 12.8 g
	Cucumbers	14 g	17.1 g	V3 – 18.3 g
	Eggplants	5.6 g	10.2 g	V5 – 8 g
The weight of the plant root	Tomato	4.4 g	7.1 g	V3 – 5.9 g
	Pepper	6.6 g	8.6 g	V4 – 9.9 g
	Cucumbers	5 g	6.7 g	V3 – 6.2 g
	Eggplants	3 g	4.4 g	V5 – 4.3 g
The weight of dried plants without roots	Tomato	2.8 g	3.9 g	V3 – 3.4 g
	Pepper	1.95 g	2.84 g	V5 – 2.43 g
	Cucumbers	1.4 g	1.76 g	V3 – 1.75 g
	Eggplants	0.77	1.41	V5 – 1.12 g

## CONCLUSIONS

Based on the research conducted with different doses of vermicompost on tomato seeds, peppers, cucumbers and eggplants and then on seedlings, the following emerged:

The best dose of vermicompost for the germination of tomato seeds, eggplant peppers and cucumbers is 1:40, because at a higher concentration it inhibits germination;

The height of the plants was influenced by the doses applied as follows: V3 for tomatoes by 60.4 cm; V3 for peppers with 52.1 cm; V3 for cucumbers with 48.1 cm and for eggplants V5 with 27.7 cm;

Regarding the length of the plant root - among the variants with vermicompost the best variant was: V4 for tomatoes with 20.07 cm; for peppers it was V5 by 21.7 cm; for cucumbers it was V4 with 19.1 cm and for eggplants V5 with 14.6 cm;

At the length of the plant stem - among the variants with vermicompost the best variant was: V3 for tomatoes with 40.7 cm; in peppers it was V3 by 32.3 cm; for cucumbers it was V3 with 28.9 cm and for eggplants it was V5 with 13 cm and for the thickness of the plant package - among the vermicompost variants, the variant with the thickest package was: V3 for tomatoes with 6 mm; V3 for peppers with



5.2 mm; V3 for cucumbers with 5.1 mm and V5 for eggplants with 3.9 mm;

The total weight of the plants - among the variants with vermicompost, the variant with the best results was: V3 for tomatoes with 28.4 g; V5 for peppers with 22 g; V3 for cucumbers with 24.9 g and V5 for eggplants with 12.3 g and related to the weight of the plant stem - among the variants with vermicompost, the variant with the best results was: V3 for tomatoes with 20.6 g; V5 for peppers with 12.8 g; V3 for cucumbers with 18.3 g and V5 for eggplants with 8 g;

From the obtained results it shows that the variants with vermicompost are at a great distance from the V1 variant - untreated control, so the vermicompost has good results; In the case of V2 variant - control treated with Tecamin Raiz, the variants with vermicompost are at close values, but lower than the value of V2 variant. Out of the total of 32 measurements performed on the 4 groups of plants, the vermicompost variants exceeded the value of the treated control V2 in 7 cases, in 2 cases they were equal and in 23 cases they were lower than the V2 variant.

The variant with vermicompost with the best results on the total, was V3 - vermicompost 1 l/200 l followed by the variant V5 - vermicompost 1 l/100 l. For cucumbers - V3 variant with 7 measurements out of the total of 8 performed;

From the results obtained it can be concluded that each group of plants has different

nutritional needs and that it is not possible to establish a single dose of vermicompost that is useful in all cases, but one can choose the dose that had the best results. As can be seen in the case of the variant treated with another product - although it is better, it is still not perfect, surpassing the variants with vermicompost in 7 cases.

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