

# The Effect of the Different Substrates and Size of the Module's Cells in the Morphological Parameters of the Pepper Seedlings' (Capsicum Annum L.)

Skender Ramadani<sup>1</sup>  
Agriculture University of Tirana,  
Tirana, Albania

Thoma Nasto<sup>2</sup>, Vahid Avdiu<sup>3</sup> Gyner Murati<sup>4</sup>  
<sup>2,4</sup>Agriculture University of Tiran;  
<sup>3</sup>Faculty of Agriculture & Veterinary,  
University of Pristina,  
<sup>2,4</sup>Tirana, Albania; <sup>3</sup>Pristina, Kosovo

**Abstract** - The objective of the study was evaluation of the impact of combinations of substrates and volume modules on some morphological parameters of pepper seedling. The experiment was conducted in 2011 in Shtime, Kosovo. Seeds were planted in polisterol modules with volume combinations as follows: 75 ml volumes; 55 ml and 25 ml. For each variation of the volume of these modules were used combinations of substrates: peat 100%; peat 75% + vermiculite 25%; peat 50% + vermiculite 50%; peat 25% + vermiculite 75%; peat 25% + vermiculite 25% + vermicompost 50%. For the planting were used hybrid pepper seeds of "Bounty F1" of Seminis Company. The experiment was set on randomized block scheme in three repetitions. During the experiment the following properties were evaluated: plant height (cm), root length (cm), stem diameter (mm) and leaf area (cm<sup>2</sup>). According to the derived results, in the seedling stage of the pepper maturity (age 50 days), the volume of modules and combination of substrates have had significant impact on the development of vegetative parameters. The best combination has proved to be with the following module combinations turf 100% and combination peat 25% + vermiculite 25% + vermicompost 50% and volume 75%.

**Keywords:** Seedlings, Modules, Substrate, Vermiculite, Vermicompost.

## I. INTRODUCTION

Under the continental climate conditions, the pepper is cultivated mainly through the prior preparation of the seedlings. The growth of the pepper planted area in protected environments has had a positive effect on the specialization of the greenhouses and the growth of their capacity in producing seedlings. The pepper (*Capsicum annum* L.) is considered to be a usual vegetable and is used widely for fresh and industrial consumption [5]. Increasing more and more is also the use of modules and alternative substrates in the preparation of seedlings, which has a positive effect on the time and quality of the production. Different substrates are consisted of some materials, which indirectly or directly affect the growth and development of plants [13]. The substrates used on the preparation of the pepper seedlings have a great importance as regards their qualitative and quantitative parameters. The reports that such substrates as peat, perlite, vermicompost and cocopeat or their mixture in different relations have had a significant effect on the height of the plants, the number of their leaves, chlorophyll index

and the total pepper production [1]; [2]. This is because the quality of the seedling can affect directly the productivity of the pepper. The data brought by [6] identify the fact that pepper seedlings, on the moment of the change, must be characterised by the presence of an elastic stem of height 16 – 20 cm, as well as to have formed 6 – 10 well-developed leaves. The preparation of the seedlings in modules of styrofoam filled with peat, can affect positively on the growth of the pepper productivity up to 14.2% [6]. In order to have a good development of the seedlings of peppers, the volume of the cells must not be smaller than 85.3 cm<sup>3</sup> [4]. The density of seedlings must be between 94 and 125 plants/m<sup>2</sup> and volume of the cells between 15.6 and 99.2 cm<sup>3</sup> [3]. Further studies have concluded that the mixtures with different content of vermicompost can be considered suitable to use as alternative substrates on the preparation of the pepper's seedlings, where it is recommended to be used not more than 50% vermicompost [7]. This study was conducted to define the effects of the mixture of peat and vermiculite and vermicompost as well as the best volume of the cells of module in the characteristics of the seedlings of the pepper, in the protected environmental conditions.

Modules with smaller volumes reduce the cost of the production but since the seedlings from modules with smaller volume have small root systems, they affect also the quality of the seedlings [11]. , highlight that substrates from Klasmann respectively Potgrond-H are characterised with very good structure, content of food with all the needed microelements and very high porosity [12].

## II. MATERIAL AND METHOD

The experiment was conducted in the seed plot specialized on the preparation of seedlings "Nursery of Godanc" Godanc, municipality of Shtime, Kosovo. In the experiment, as substrate, it was used the peat "CLASMANN POTGROND-H", mixed with vermiculite of German production and vermicompost. For the planting of the pepper's seeds were used styrofoam modules with volume of cells 25 ml, 55ml dhe 75 ml filled with peat, vermiculite and vermicompost as follows: Peat 100% (P 100%); Peat 75% + Vermiculit 25% (P 75% + V 25%); Peat 50% + Vermiculit 50% (P 50% + V 50%); Peat 25% + Vermiculit 75% (P 25% + V 75%)

and Peat 25% + Vermiculit 25% + Vermikompost 50% (P 25% + V 25% + Vc 50%). As plant material, hybrid seeds of the cultivar of the pepper “BOUNTY” were used, produced by the “Seminys” company, with germination power 95%. The seeds were planted on the 17 of February 2011 under greenhouse conditions. The average daily temperature during the period of seedling’s preparation was 23-26 °C during the day, whereas 15-17°C during the night, while the air humidity was 60-65%. The experiment was raised with three repetitions, according to randomized block scheme with divided variants. The investigated parameters for the age of the seedlings 30, 40 and 50 days old were: height of the seedlings (cm), length of the root (cm), diameter of the stem (mm), and the surface of the leaves (cm<sup>2</sup>). For the definition of these indicators were used 10 seedlings for each variant. The taken results were analyzed using the analysis of variance according to (ANOVA) with the programme JMP 10.

### III. RESULTS AND DISCUSSION

In the Table no. 1 are presents data of some morphological parameters for age 30-day seedlings, which corresponds to the stage of formation four true leaves. From these data show that the best indicator associated with seedling height (cm) were achieved in the version of combination T 100%, vol. 25ml While greater leaf area (cm<sup>2</sup>) the seedlings have formed the variant T 100% vol. 75ml and 55 ml. Mixtures of these options have given higher results compared with variants where peat is found in small percentages.

From the acquired data which are connected to the indicator of the length of the roots (cm), better results and with significant values are identified in the variant with mixture P 75% + V 25%, vol 25 ml, compared to the indicators of the three other variants (P 50% +V50%, vol.25ml;P 25% +V75% vol.25ml; P 25% +V 75% , vol.55ml ). Whereas the stem of the seedling’s diameter (mm) acquired the biggest value in the variant P 75% + V 25% , vol 55ml. These data can be explained with the fact that in this phase of growth and development of the seedling, the substrate’s structure has an important role, where in general the highest percentage of the peat and the lowest percentage of the vermiculite, has greater effect on the development of the seedling.

Table 1. The effect of the type of substrate and the module’s volume in the indicators of the development of pepper’s seedlings of 30 days of age

Variantes		Plant height (cm)	Root length (cm)	Stem thickness (mm)	Leaf area (cm <sup>2</sup> )
T 100%,	vol.75ml	13.32 bc	9.86 bc	2.33 abcd	25.16 a*
	vol.55ml	15.38 ab	9.96 bc	2.81 a	24.24 a
	vol.25ml	16.94 a	9.18 bc	2.61 ab	23.16 ab
T 75% V25%	vol.75ml	11.08 cde	10.16 bc	1.95 d	14.24 bcd
	vol.55ml	11.94 cde	11.46 abc	2.27 bcd	14.96 bcd
	vol.25ml	11.06 cde	14.25 a	2.35 abcd	16.56 abcd
T 50% V50%	vol.75ml	13.12 bc	10.96 abc	2.37 abcd	22.44 abc
	vol.55ml	9.53 e	9.38 bc	2.04 cd	9.56 d
	vol.25ml	13.10 bc	7.60 c	2.43 abcd	14.40 bcd
T 25% V75%	vol.75ml	11.10 cde	11.13 abc	2.07 cd	10.68 d
	vol.55ml	9.94 e	10.82 abc	2.17 bcd	10.48 d
	vol.25ml	11.00cde	10.84 abc	2.21 bcd	10.64 d
T 25% V25% VC50%	vol.75ml	11.62 cde	11.84ab	1.97 cd	14.00 cd
	vol.55ml	10.56 d	10.68abc	2.46 abc	13.44 cd
	vol.25ml	12.58cd	11.90 ab	2.42 abcd	17.00 abcd

\*Numbers having the same alphabetical letters within each column are not different at (0.05) level of significance.

Even the volume of the module has a special importance on this phase of the development of the seedlings, where better results in general are shown in the variants where modules have bigger volume (75ml and55ml). This can be explained with the fact that in this phase of the development of the seedlings, the requests for water and food start increasing.

With the data shown on table no.2, it can be seen that in the 40 days of age of seedlings (the phase of the formation of the six real leaves), better results are identified in the seedlings of variant P 100%,vol. 75 ml; 55 ml and 25 ml. Also, better results are shown in the variant of the vermicompost mixture. These data are explained with the fact that peat as well as vermicompost has a significant effecton the growth parameters of the development of the seedlings. Also, positive effect has the size of the volume of the modules’ cells

Table 2. The effect of substrate and the module's volume in the indicators of the development of the seedlings of 40 days of age

Variantes		Plant height (cm)	R root length (cm)	Stem thickness (mm)	Leaf area (cm <sup>2</sup> )
T 100%	vol.75ml	15.78 a	10.80 a	2.66 ab	31.08abc*
	vol.55ml	15.78 a	8.56 bc	2.71 a	38.10 a
	vol.25ml	15.56 a	7.60 c	2.50 abc	32.16ab
T 75% V25%	vol.75ml	11.10 cd	9.20 abc	2.28 bcd	22.02bcde
	vol.55ml	10.94 cd	8.18 bc	2.29 bcd	17.52cde
	vol.25ml	11.62 bc	10.00 ab	2.10 cd	20.34bcde
T 50% V50%	vol.75ml	12.32 bc	9.64 abc	2.39 abc	20.80bcde
	vol.55ml	8.78 d	8.40 bc	1.91 d	10.92 e
	vol.25ml	12.52 bc	8.28 bc	2.22 cd	23.64bcde
T 25% V75%	vol.75ml	12.44 bc	9.80 ab	2.22 cd	17.10 de
	vol.55ml	10.14 cd	8.14 bc	2.14 cd	16.32 de
	vol.25ml	11.24 cd	8.36 bc	2.15 cd	16.74 de
T 25% V25% Vc50%	vol.75ml	11.38 cd	10.28 ab	2.31 abcd	18.12cde
	vol.55ml	11.08 cd	8.94 abc	2.15 cd	17.92cde
	vol.25ml	14.18 ab	8.30 bc	2.25 cd	25.14abcd

\*Numbers having the same alphabetical letters within each column are not different at (0.05) level of significance.

Table 3. The effect of substrate and the module's volume in the indicators of the development of the seedlings of age 50 days old

Variantes		Plant height (cm)	Root length (cm)	Stem thickness (mm)	Leaf area (cm <sup>2</sup> )
T 100%	vol.75ml	15.26 abc	10.42 a	2.51 ab	41.04abc*
	vol.55ml	16.12 ab	8.80 abc	2.59 ab	44.40 a
	vol.25ml	18.10 a	8.54 abc	2.62 a	42.00ab
T 75% V25%	vol.75ml	11.16 de	9.08 abc	2.34 ab	32.56abcd e
	vol.55ml	12.88 bcde	7.78 c	2.41 ab	29.92abcd e
	vol.25ml	12.76 bcd	8.08 abc	2.35 ab	33.36abcd e
T50% V50%	vol.75ml	13.74 bcd	10.26 ab	2.55 ab	35.68abcd
	vol.55ml	9.74 e	8.04 bc	2.10 b	18.32 e
	vol.25ml	13.84 bcd	8.06 abc	2.28 ab	27.76bcde
T25% V75%	vol.75ml	11.72 cde	10.04 abc	2.32 ab	24.08cde
	vol.55ml	11.16 de	9.34 abc	2.45 ab	23.20 de
	vol.25ml	11.68 cde	8.64 abc	2.17 ab	26.00cde
T25% V25% Vc50%	vol.75ml	14.84 bcde	10.34 abc	2.52 ab	39.60abcd e
	vol.55ml	15.46 de	8.86 abc	2.62 ab	33.92cde
	vol.25ml	16.57 ab	8.12 abc	2.63 ab	33.44abcd e

\*Numbers having the same alphabetical letters within each column are not different at (0.05) level of significance.

#### IV. CONCLUSIONS

- Seedlings prepared in substrates containing only industrial peat had better morphological parameters, in all the phases of their development
- Morphological characteristics of the pepper's seedlings such as their height, root's length, stem's diameter, leaf's surface were characterized by smaller numerical values, by growing the percentage of the vermiculite in substrate and decreasing peat.
- Positive effect on the improvement of morphological characteristics of the pepper's seedlings has had the usage of the combination of the substrate, peat 25%, vermiculite 25% dhe vermicompost 50%.
- Among all the analyzed variants for the study, on the modules with cell's volume 75ml, pepper's seedlings have displayed better performances of the morphological parameters analyzed above.

From the data shown on table no.3, for the age of 50-day-old seedlings respectively the phase eight of the real leaves it can be concluded that for the seedling's height indicators (cm) and stem's diameter (mm) variant P 100%, vol. 25ml has resulted more successful. For the indicator of the leaves' surface (cm<sup>2</sup>), better results has had the variant P 100%, vol. 55ml, compared to other variants. Whereas for the parameter of the root's length (cm) better results have been seen with the variant P 100%, vol. 75 ml. For all the analyzed parameters of the study it is evidenced the fact that better indicators, except the variants with peat, are acquired even in the variants of the mixture of peat – vermiculite – vermicompost (P25% V25% Vc50%). This explained with the fact that in this phase of the development of the seedlings, they have greater requests not only for the feeding elements which are secured from vermicomposto but also for a bigger volume for a better development of the root's system. The 50-day-old seedlings have given larger results in these parameters: plant's height (cm), fresh weight of the root, fresh weight of the leaves etc[8]. The ideal time of the changing of the pepper's seedlings on the field is 6-8 weeks [9]. The ideal pepper's age is 8 weeks after the germination of the seed giving better and more qualitative product whereas they do not prefer the age older than 10 weeks [10]; [11].

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