

**INFLUENCE OF DIFFERENT TYPES OF SUBSTRATES IN GROWTH
INTENSITY OF SEEDLINGS FOR DIFFERENT HYBRIDS
OF TOMATO (*Lycopersicon esculentum* Mill.)**

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SUMMARY

Tomato together with pepper is main vegetable crop in Kosovo. Yearly tomato is planted on around 2.000 ha. Quality preparation of seedling is important precondition for successful production of tomato. Substrates used in Kosovo for production of tomato seedlings are different (it is same for other different vegetables). With the aim to test the effect of feeding substrate in growth and development of seedlings during different phases three types of substrates were used: loam (soil mixed with decomposed organic manure 50:50) - SP1, Peat 100% - SP2, and mixed loam + peat (50:50) - SP3. These substrates were tested in three tomato hybrids (Graziella, Big Beef and Amati). Design of experiment was based on case block system with three repetitions for every treatment (RBDE). Analysis included: roots fresh weight, root length, seedling height, internodes length, fresh stalk weight. Regarding roots fresh weight and roots length different results were achieved for different cultivars. Average general values for all three cultivars were 8.72 g and for length 22.22 cm. Hybrid Graziella for two parameters realized average values: maximal value for root fresh weight of 13.90 g (SP2) and root length of 27.83 cm (SP1). Amati achieved lower values of weight in substrate (SP3) 5.03 g. Graziella achieved lower values for root length in substrate SP1 18.23 cm. Difference for root fresh weight and roots length were highly significant at level 0.05 and 0.01, respectively. Also for seedling height and distance between nodules the results between substrates were significant at the level 0.05 and 0.01.

Key words: tomato, substrate, hybrid

INTRODUCTION

The trend of present day horticultural production of tomato is to be based entirely on artificial substrates rather than in soil which was the common practice up to fifteen years ago (Wilson 1986). The possibility of using different substrates materials which

are locally available and less costly than those imported with no pollution limitations, but adequate physical and chemical properties could lead toward a solution to the above problems (Blanc 1981).

After pepper tomato is the main vegetable in Kosovo. Main type of cultivation is open field. In protected areas tomato is mainly produced simply in polytunnels. Feeding substrate together with hybrids of high genetic potential at tomato presents an important factor of chain in intensive vegetable production in protected areas. Tomato together with some other vegetables including pepper is main vegetable cultivated in Kosovo in open fields and protected areas. Every year tomato is planted in around 2000 hectares. One of the main preconditions for successful and intensive for tomato is selection, production and quality of cultivar. Manolov et al (2005) give some results for the using of natural minerals for production of substrates or as amendments for existing substrates is possible solution for this problem. The natural zeolites with their specific properties – high CEC, high content of macro and microelements are one of good alternatives to the traditional potting media. Also Zaller (2007) in his results for the vermicompost was obtained significantly influenced, specifically for each tomato variety, emergence and elongation of seedling stage and one field – growth tomato variety. Main purpose of our research was to evaluate reaction of three tomato cultivars in three different types of substrates for some quantitative parameters and different production phases.

MATERIALS AND METHODS

In research three different types of tomatoes were used Graziella(G) Big-Bef(B-B), Amati (A), that are covering 90 % of production areas with tomato (especially in protected areas). Seed of three hybrids was planted in three types of substrate: Soil + treset (50:50) – SP1, 100 % treset – SP2 and Soil (material mixed with organic materials) – SP3. Chemical content of substrates was: SP1(pH 7, N 400 mg/l, P₂O₅ 530 mg/l, K₂O 800-1100 mg/l), SP2 (pH 5-6.5, N 350 mg/l, P₂O₅ 450 mg/l, K₂O 300-600 mg/l), SP3 (pH 6, N 480 mg/l, P₂O₅ 650 mg/l, K₂O 1050 mg/l). Research was realized in protected areas (heated greenhouse in form of tunnel). This research took place during 2006 and 2007 in Shtime locality 28 km from Prishtina. Experiment was set in a block model case with three repetitions for each hybrid and substrate. Combining formula for research was: 3 Hybrids (H) x 3 Feeding Substrates (SP) x 3 repetitions (3P) x 5 parameters (P) = 135 combinations. Research included: for each hybrid three repetitions (3R) x three hybrids (3H) = 9 experimental fields x three types of substrates (3S) = 27 experimental fields (FE). Standard measures of cultivation (agro technique) were applied for all hybrids with same treatment. Analyzed parameters in research were: Weight of fresh root (RW), root length (RL), seedling height (HS), distance between nodes and fresh stalk weight (FSW). For every hybrid and for every type of

feed 10 plants were weighted and measured for each experimental field x 3 repetitions = 30 plants or for one hybrid in three types of substrate 90 measurements were realized.

MINITAB and EXCEL was used and realized for statistical analysis, while differences between treatments in statistical aspect was done based on LSD test for level of probability 0.01 and 0.05 level. Part of correlation analysis for parameters between fresh root weight with root length and fresh stalk weight was done based on the correlation coefficient from Pearson.

RESULTS AND DISCUSSION

Weight of fresh root

Weight of fresh root is a quantitative parameter representing biological volume of plant underground part. During the research of three tomato cultivars (Graziella, Big Bef and Amati) in different cultivation substrates (Soil + Treset 1:1, 100 Treset, and Soil) different results were achieved. Average value for three cultivated cultivars was 8.72 g of root plant⁻¹. High quantitative value of fresh weight root (FWR) realized cultivar Graziella(G) in substrate 100% treset (SP2) with value 13.90 g root plant⁻¹, while for low value it was cultivar Amati (A) dominating in substrate mixed type Soil + Treset (SP1) with weight of fresh root 5.03 g root plant⁻¹. Differences between extreme values achieved during our research were 9 g root plant⁻¹, in favor of Graziella hybrid realized in substrate SP2 (Table 1 and 2). High significant value for the correlation coefficient was achieved between weight of fresh root (FWR) and root length (RL) of value $r = 0.94^{**}$. In general for three tomato cultivars for three types of feeding substrate, higher average value for fresh root weight within hybrids under research, was achieved with combination of SP2 type of feeding substrate, with average value of 10.62 g root plant⁻¹, while with low value we had substrate of combined feeding substrate SP1 with value 6.14 g root plant⁻¹. Differences between grand mean value and average maximum and minimum value in different treatments was between +0.69 and -2.58 g/root/plant or 0.07 and 0.29 %. Statistical analysis for interpreted results for three types of cultivars in three different substrates for this parameter shows significance between them at level of probability 0.05 and 0.01 (2.51 and 3.52). Fenandez et al (2006) was as described for the some treatments; commercial sphagnum peat moss mix (TUR) 97.83%, compost and coconut coir dust mixes 2:1 v/v(MCA21); 94.75%, 1:1 (MCA11); 87.08% and 1:2 (MCA12); 93.92%, sandy loam soil (CVG): 95.42% and traditional nurseries (AT) : 57.16%. Seedlings from seeds germinated on TUR, MCA21 and CVG reached the highest initial growth values 10 DDS, measured as shoot height, stem base diameter, true leaves and dry weight.

Root length

Total average value for root length in research for three grown cultivars in three different types of substrate was 22.22 cm. Root length in treatment SP3 for cultivar

Graziella had extreme values 27.83 and 18.23 cm. Variation in the same substrate and for same hybrid was ± 9 cm, significant difference within hybrid for level of probability 0.05 (3.65). Highest average genotype value for all feeding treatment for root length was realized again from Graziella hybrid (25.18 cm), while for low value (19.99 cm) Amati was dominant. Differences between two hybrids in different substrates were + 6 cm. In substrate SP3 Graziella was different from other hybrids with value of 22.87 cm, while for low value SP2 type had value of 21.078 cm, what in fact represent significant difference for level 0.05. Compared with total average value in our research for extreme maximum and minimum values differences were +0.65 and – 1.14 or 0.02 and 0.05% (Table 1).

Table 1 Average value for quantity parameters for root weight and length
Tablica 1. Srednje vrijednosti kvantitativnih parametara težine i dužine korijena

Substrate Supstrat	Weight of fresh root Masa svježeg korijena (g)			Root length Dužina korijena (cm)		
	Graziella	Big Bef	Amati	Graziella	Big Bef	Amati
SP1	6.73	6.66	5.03	26.81	21.66	19.66
SP2	13.90	11.73	6.23	20.92	23.33	22.10
SP3	9.36	10.30	8.56	27.83	22.56	18.23
<i>average</i>	<i>9.99</i>	<i>9.56</i>	<i>6.60</i>	<i>25.18</i>	<i>22.51</i>	<i>19.99</i>
LSD						
0.05		2.51			3.65	
0.01		3.52			5.12	

Stalk height

Stalk represents ground part that together with root system represent biological mass. Average total value in our research for all treatments was 31.49 cm. High value was realized at tomato Graziella cultivar in substrate with combination formula SP1 with value 38.83 cm, while for low value we had Amati with value 27.83 cm in type SP2 of substrate. Differences between two extreme values were +11 cm, significant difference for the level 0.01 of probability. Higher average value for three cultivars was realized at SP3 type of substrate with value of 32.32 cm, while for lower value was realized in type SP2 of substrate with value of 30.31 cm, variation between them was of minimum value +2.01 cm, that in statistical aspect doesn't represent such a significant difference for the level 0.05 and 0.01 (3.03, 4.25). Compared with total average realized genotype values for extreme maximum and minimum values in our research were with differences +0.83 and -1.18 or 0.02 and 0.03 % (Table 2). Marković et al (2004) were studied ten substrates, two types of peat, compost, a mixture of peat and compost, and

mixture of compost, peat and enriched zeolites. Tomato seedlings produced on the same substrates had an average height of 27.5 cm, five leaves an above – ground mass of 5.7 g and 9.9% dry matter. With the same seedlings obtained average yield fruit of 47.6 t/ha, average plant height of 99.7 cm. If compared with our results the difference was only +1.20 cm.

Table 2 Average values for height, internodes length and weight of fresh stalk
Tablica 2. Srednje vrijednosti visine stabljike, dužine internodija i težine svježe stabljike

Substrate <i>Supstrat</i>	Seedling height <i>Visina presadnice</i> (cm)			Internodes length <i>Dužina internodija</i> (cm)			Weight of fresh stalk <i>Težina</i> <i>svježe</i> <i>stabljike</i> (g)		
	Graziella	Big Bef	Amati	Graziella	Big Bef	Amati	Graziella	Big Bef	Amati
SP1	38.83	28.16	28.56	10.57	7.80	8.46	30.20	17.21	15.10
SP2	34.50	28.61	27.83	8.55	7.43	8.03	20.71	18.76	14.10
SP3	35.23	32.01	29.73	7.70	8.56	9.19	23.43	16.93	14.61
<i>Average</i> <i>Prosjek</i>	<i>36.18</i>	<i>29.59</i>	<i>28.70</i>	<i>8.94</i>	<i>7.93</i>	<i>8.56</i>	<i>24.78</i>	<i>17.63</i>	<i>14.60</i>
LSD									
0.05		3.03				1.01			2.35
0.01		4.25				1.42			3.29

Internodes length

Average total value for researched cultivars was 8.48 cm, while cultivar that realized highest value for internodes length was Graziella in substrate type SP1 with value of 10.57 cm, while with lower value was cultivar Big Bef with value 7.43 cm, while differences between them were +3.14 cm, significant differences between cultivars for 0.05 level of probability. Analysis for genotype values for all three cultivars in three different types of substrate was: SP1 (Soil + Treset-X1), SP2 (100% Treset-X2) and SP3 (Soil –X3) with values 8.94 cm, respectively 8.0 cm and 8.48 cm). Differences between them were X1-X2= +0.94 cm, X1-X3= +0.46 cm, X2-X3= -0.48 cm, minimum statistical differences that do not represent important differences for 0.01 and 0.05 level of probability (1.01 and 1.42) (Table 2). Variation between total experimental value and maximum and minimum values for distance between nodes was +0.46 and – 0.001 respectively 0.05 and 0.0001%.

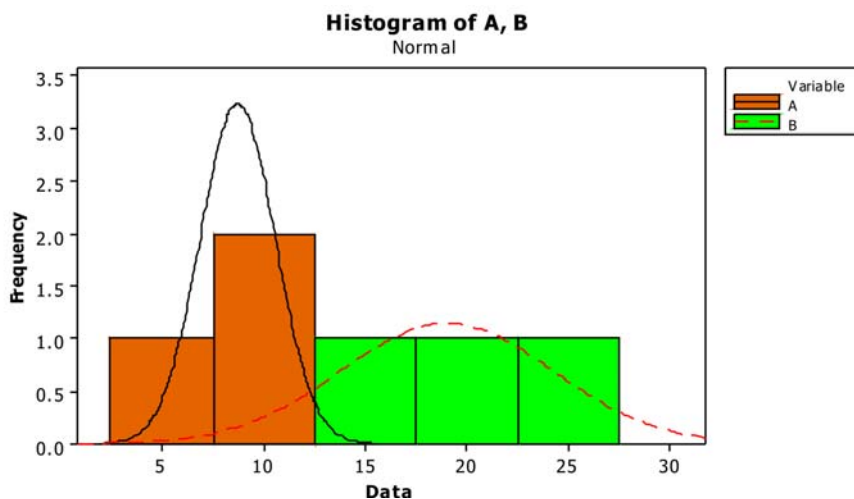
Weight of fresh stalk

Weight of fresh stalk represent total ground biological mass or volume, but at the same time production potential of biomass for cultivar. Total average value for treatments in research was $19.43 \text{ g plant}^{-1}$. For average extreme values maximal and minimal dependent from feeding substrate Graziella was dominant with value $30.20 \text{ g plant}^{-1}$ in combined substrate SP1 and Amati with value $14.60 \text{ g plant}^{-1}$, in substrate SP3. Differences between them were $+ 15.60 \text{ g plant}^{-1}$, representing high significant difference for 0.01 (3.29) level of probability. High genotype value between cultivars was realized in feeding substrate SP1 with value $20.83 \text{ g plant}^{-1}$, while for lower value were achieved in substrate SP3 with value $18.32 \text{ g plant}^{-1}$, with differences of $+ 2.51 \text{ g plant}^{-1}$, representing significant results for 0.05 (2.35) level of probability. This results compared with total average value with maximum and minimum value in our research realized were $+1.4 \text{ g plant}^{-1}$ and $-1.11 \text{ g plant}^{-1}$ respectively 0.07 and 0.05% (Table 2). Value of correlation coefficient based on Pearson for fresh root weight parameters and fresh stalk weight value had value of $r = 0.80^{**}$.

Graph of normal distribution between two parameters for weight of fresh root and weight of fresh stalk shows that is presented in higher distance in substrates compared to the weight of fresh root (Graph 1).

Graph 1 Histogram of normal distribution for fresh weight root (A) and weight for fresh stalk (B) in different substrates

Grafiikon 1. Histogram normalne distribucije za težinu svježeg korijena (A) i težinu svježe stabljike (B) kod različitih supstrata



CONCLUSIONS

Results achieved during the research for three types of tomato hybrids cultivated in three different types of substrates provides information that cultivar Graziella for all quantitative parameters researched realized high values in SP1 (soil & treset) type of substrate compared with other types of substrates. This mind is explained as a reaction of cultivar on this type of substrate since he we are dealing with good combination of feed materials for seedling growth and development.

While low values in research showed cultivar Amati which in SP2 & SP3 type of substrate didn't show good results. But it is interesting the fact that while cultivar Graziella showed good results in SP1 type of substrate, cultivar Big Bef in same type of substrate realized very low value for the parameter of internodes length. This phenomena can be interpreted first because of low variation for two cultivars for cultivation in any type of feeding substrate, while for Graziella cultivar this is explained by fact that it has higher distance of variation of concordance toward different types of feed substrates.

UTJECAJ RAZLIČITIH TIPOVA SUPSTRATA NA INTENZITET RASTA PRESADNICA RAZLIČITIH HIBRIDA RAJČICE (*Lycopersicon esculentum* Mill.)

SAŽETAK

Rajčica i paprika najvažnije su povrtne kulture na Kosovu. Rajčica se godišnje uzgaja na oko 2.000 ha. Kvaliteta proizvedenih presadnica važna je predispozicija za uspješnu proizvodnju rajčice. Supstrati koji se na Kosovu koriste za proizvodnju presadnica su različiti. U cilju utvrđivanja utjecaja supstrata na rast i razvoj presadnica rajčice u različitim fazama korištena su tri tipa supstrata: ilovasto tlo SP1 (tlo pomiješano s razgrađenom organskom tvari 50:50), treset SP 2 i treset pomiješan s ilovastim tлом SP3 (50:50). Supstrati su testirani na tri hibrida rajčice (Graziella, Big Bef i Amati). Pokus je postavljen po shemi običnog bloknoeg rasporeda u tri ponavljanja. Analizirana je masa svježeg korijena, dužina korijena, dužina presadnice, dužina internodija i težina svježe stabljike.

Za težinu svježe stabljike i dužinu korijena ostvareni su različiti rezultati kod različitih hibrida. Prosječna težina svježe stabljike za sva tri hibrida bila je 8,72 g, a dužina korijena 22,22 cm. Hibrid Graziella je imao najveću masu svježeg korijena 13,90 g u supstratu SP2 i najduži korijen 27,83 cm u supstratu SP1. Hibrid Amati imao je najnižu masu svježe stabljike u supstratu SP3 a bila je 5,03 g dok je Graziella imala najmanju dužinu korijena pri uzgoju u supstratu SP1 od svega 18,23 cm. Statistički

visoko značajne razlike između supstrata utvrđene su za masu svježeg korijena, njegovu dužinu kao i dužinu internodija

Ključne riječi: rajčica, supstrat, hibrid

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