

Cultivation Technology of Melony Tree Seedling in Cups with Artificial Substrates

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Abstract: This scientific article reveals experimental materials on the use of artificial substrates and their volumetric ratios for growing papaya seedlings in plastic cups of various sizes from 392 cm³, 2649 cm³. As a result of scientific research to identify the optimal sizes of cups filled with artificial substrates, a positive effect on the development of papaya seedlings was revealed when they are grown in plastic bags with diameter and height of 15 cm, filled with sand and humus in the ratio of artificial components (sand-humus, sawdust, rice husk) 1:3.

Keywords: papaya, seedling, artificial, substrate, volume, growth, development

Introduction

In recent years, in many agrarian developed countries of the world, scientific research is being carried out on the cultivation of high-quality certified seedlings of fruit plants in low-volume containers using artificial substrates.

This technological method makes it possible to significantly increase the culture of nurseries due to a significant reduction in the land area for growing seedlings, a high concentration and coefficient of land use, obtaining plants that are even in development with good survival rate of seedlings after planting in the ground at a permanent place of growth and their subsequent intensive development and fruiting [1, 2, 3, 7].

Research methodology. The experience was laid with the Solo, AdjoBunder, and Guyaratpapaya varieties according to the following scheme:

1. Growing seedlings in soil.
2. Growing seedlings in plastic bags with a diameter and height of 5cm.
3. Growing seedlings in plastic bags with a diameter and height of 10cm.
4. Growing seedlings in plastic bags with a diameter and height of 15cm.
5. Papaya seeds, according to the above scheme, were sown in the substrate at one time.

River sand was used as a substrate for growing seedlings in the following volumetric ratios of 1:3.

In the second experiment, papaya seedlings of the Solo variety were grown in plastic cups with a diameter and height of 15 cm.

Experience bookmarking scheme:

1. Turfland-control
2. Peat
3. Humus
4. Vermicompost
5. Turfland-sand-humus (0,4:0,2:0,4)
6. Vermicompost-sand-humus (0,4:0,2:0,4)
7. Peat-sand-humus (0,4:0,2:0,4)
8. Humus-sand (0,9:0,1) - control

In each variant of the experiment 25 seeds were sown in cups.

The experiment was repeated four times.

Research results. When growing planting material in artificial substrates, an important technological method is properly selection of environment where the root system of the plant will subsequently develop [4, 5, 6].

Our studies with the cultivation of varietal papaya seedlings in plastic cups of various volumes (392,785 and 2649 cm³) filled with an artificial substrate consisting of three parts of sheep and one part of coarse river sand revealed that the development of papaya seedlings is in direct proportion to the volume of the cups.

From the experimental data given in table 1, it can be seen that the best conditions for the development of

papaya seedlings are created in the variant of the experiment, where the seeds are sown in plastic cups with a volume of 2649cm³.

In this case, the effective development of both the aboveground and root systems of seedlings is ensured.

For example, if in the variant of growing seedlings in cups with a volume of 392cm³, the growth of five monthly seedlings was 18,8-26,3 cm, then in the volume of 2649 cm³ it was 23,5-26,0 cm(pic.1).



Pic. 1. Development of three-month-old Solo papaya seedlings when grown in substrates of various sizes

The number of leaves formed by varietal seedlings also correlated with the conditions for the development of the root system, i.e the volume of the substrate.

When growing plants in large plastic bags (2649cm³), their number reached 18 pieces, and with a smaller one (392cm³)- 13 pieces.

The development of the root system of the seedlings had the same tendency as the aboveground part.

It was most developed in the variants of sowing seeds in the soil of the greenhouse and with the volume of the artificial substrate of the cups 2649 cm³-4,67-5,17 grams.

In the variant of the substrate volume of the cups of 392 cm³, the mass of the roots was only 1,98-3,6 grams, i.e. 30,4% less (table.1).

Table 1 the influence of the volume of artificial substrates on the overall development of papaya seedlings, 2018-2020.

Indicators of development of papaya seedlings	Experience options			
	growing seedlings in soil	in plastic bags with a diameter and height of 5 cm	in plastic bags with a diameter and height of 10 cm	in plastic bags with a diameter and height of 15 cm
Variety Solo				
Seedling growth, cm	26,3	21,3	24,3	26,0
Leaves per plant, pieces	19,6	16,6	18,0	19,7
Root system mass, g	5,15	2,14	3,42	5,02

Variety AdjoBunder				
Seedling growth, cm	23,2	17,0	20,9	23,5
Leaves per plant, pieces	16,7	13,1	14,2	16,5
Root system mass, g	4,82	1,98	3,51	4,67
VarietyGuyarat				
Seedling growth, cm	26,4	18,8	24,0	26,2
Leaves per plant, pieces	18,2	15,1	16,2	18,1
Root system mass, g	5,17	2,72	3,60	4,95

Studies on the development features of papaya seedlings, under the condition that grown on various artificial substrates, have shown that the overall development of plants depends on their species and combination ratio.

The root system of seedlings of the tested papaya varieties in mono-substrates developed more efficiently in substrates such as peat and humus.

In these variants of the experiment, the raw weight of the roots of papaya seedlings at the age of three months in context of cultivated varieties ranged from 14,27 to 15,12 grams.

In these variants of the tested varieties of papaya, the most developed root system was possessed by the seedlings of the Solo variety - up to 15,12 grams, the smaller AdjoBunder variety - 14,88 grams (pic. 2).



Pic.2. Development of three-month -old Solo papaya seedlings in mono substrates.

In the combined variants of using artificial substrates in ratios of 0,4: 0,2: 0,4, seedlings of collection varieties formed a well-developed root system when using such artificial substrates as peat-sand-humus and vermin compost-sand-humus (pic.3).



Pic.3. Development of three-month- old Solo papaya seedlings in combined substrates.

In these variants, the root system of plants reached 15,57-17,53 grams, i.e., 27,5-30,4% higher than the development of the best options for using monosubstrates (peat and humus).

Of the substrates used, the weak development of the root system of varietal plants was observed when plants were grown in such a substrate as turf land.

In this case, the raw weight of seedling roots was only 12,96-15,56 grams, which is on average 1,9 times less than the options for using peat-sand-humus and vermicompost-sand-humus.

The development of the aboveground part of papaya seedlings had the same correlation dependence as the root system of plants.

The best conditions for the development of seedlings in the experiments were created using such of them as vermicompost-sand-humus and peat-sand-humus(table.2).

Table 2 The influence of types of artificial substrates on the development of individual parts of three-month-old papaya seedlings, 2018-2020

Experience options	Seedling total weight, g	Aboveground part		Root system	
		g	%	g	%
Solo variety					
Turf land -sand-humus (0,4:0,2:0,4)	30,76	25,41	82,61	15,35	17,39
Vermicompost-sand-humus (0,4:0,2:0,4)	34,83	28,08	80,64	16,75	19,36
Peat-sand-humus (0,4:0,2:0,4)	35,77	28,2	78,85	15,57	21,15
Humus-sand (3:1)	26,31	22,04	83,78	14,27	16,22
Peat	28,52	23,4	82,05	15,12	17,95
Humus	27,24	22,73	83,46	14,51	16,54
Vermicompost	24,73	20,66	83,58	14,07	16,42
Turf land	19,99	17,01	85,09	15,56	14,91
AdjioBunder variety					
Turf land-sand-humus(0,4:0,2:0,4)	27,03	21,93	81,13	15,1	18,87
Vermicompost-sand-humus (0,4:0,2:0,4)	31,11	24,6	79,07	16,51	20,3
Peat-sand-humus (0,4:0,2:0,4)	32,05	24,72	77,12	17,33	22,88

Humus-sand (3:1)	23,4	18,56	79,31	14,84	20,69
Peat	24,8	19,92	80,32	14,88	19,68
Humus	23,52	19,25	81,84	14,27	18,16
Vermicompost	21,01	17,18	81,77	13,83	18,23
Turf land	16,49	13,53	82,04	12,96	17,96
Guyarat variety					
Turf land -sand-humus(0,4:0,2:0,4)	28,53	23,23	81,42	15,3	18,58
Vermicompost-sand-humus (0,4:0,2:0,4)	32,61	25,9	79,42	16,71	20,58
Peat-sand-humus(0,4:0,2:0,4)	33,55	26,02	27,55	17,53	22,45
Humus-sand(3:1)	24,9	19,86	79,75	15,04	20,25
Peat	26,3	21,22	80,68	15,08	19,32
Humus	25,02	20,55	82,13	14,47	17,87
Vermicompost	22,51	18,48	82,09	14,03	17,91
Turf land	17,99	14,83	82,43	13,16	17,57

The wet mass of the aboveground part of plants developing under such conditions by a three-month period, depending on the varietal characteristics, was 25,90-35,77 grams.

The most powerful above ground part in the experiment had the papaya variety Solo-75,77 grams.

The cultivar AdjioBunder was less developed in this respect-31,11 grams.

Growing seedlings in turf land turned out to be acceptable in the experiment, since in this case the obtained seedlings were the least developed in all parameters of morphological development.

Under optimal conditions for growing seedlings in artificial substrates (peat-sand-humus and vermicompost-sand-humus) in terms of general development, the seedlings of these variants of the experiment exceeded the variant with growing plants in turf land by 53,0-56,0%.

Conclusion

1. The use of different volumes of artificial substrates for growing papaya seedlings revealed that the best conditions for their development are created by sowing seeds in plastic cups 15x15 cm in size or 2649 cm³ in volume. In this case, papaya seedling at three months of age reached a height of 26,0 cm, with 16-18 leaves and a root system weight of 4,67-5,02 grams. The use of small volumes of substrates reduces the overall development of papaya seedlings by up to 30,4%.
2. The root system of seedlings of the tested varieties of papaya develops more efficiently in mono-substrate such as peat and humus. In these variants of the experiment, the raw weight of papaya seedlings at five months of age in the context of cultivated varieties ranges from 14-15 grams.
3. In the combined variants of using artificial substrates, seedlings of collection varieties

forma well-developed root system when using such artificial substrates as peat-sand-humus and vermicompost -sand-humus in ratios of 0.4:0.2:0.4, the root system of plants reaches 15,57-16,75 grams, i.e., their development was the best options for using mono substrates (peat and humus) by 27,5-30,4%.

4. The wet mass of the above ground part of plants developing in such artificial substrates as vermicompost-sand-humus and peat-sand -humus by a five-month period, depending on varietal characteristics, was 24,6-28,2 grams. The most powerful aerial part in the experiment had the papaya variety Solo was 28,2 grams.

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