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Effect of Different Growing Media with Soil and Sand in Polybags on Seed Germination, Seedling Growth and Survival Percentage of Papaya (*Carica papaya*) *cv.* Pusa Nanha

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A B S T R A C T

The present experiment was carried out during July 2019 to March 2020 in horticulture research farm of Department of Horticulture, SHUATS, Prayagraj. The experiment has conducted in Randomized Block Design with 12+1 (control) treatment replicated thrice. Vermicompost, cocopeat, FYM, sand and pond soil was used as treatments in different ratio. From the present investigation it is found that treatment T_3 (Sand+ Vermicompost +Soil (1:2:1) was found best in the terms of , Germination percentage, shoot length, seedling length, Seedling girth, number of leaves, seedling vigor index, fresh weight of seedling, dry weight of seedling and survival percentage.

Introduction

The papaya, papaw or pawpaw (*Carica papaya* L.) is one of the 22 accepted species in the genus carica of the family caricaceae. Papaya not only helps to improve the farm income but also serves as a cottage industry. It is also grown extensively as a filler plant in orchards. It requires less area for tree, comes to fruiting in a year, is easy to cultivate and provides more income per ha next to banana.
Papaya is originated from tropics of America and it was introduced in India during 16th century from Malacca. The cultivated papaya might have originated as a cross between two species of the genus *Carica*.

Presently the papaya is one of the most important fruit crops of Hawaii, Malaysia, Burma, Shrilanka, India, Queens land, South Africa and other tropical and sub-tropical Country.

In India, It is successfully grown all over the country and is available round the year. Papaya occupies 2.0 percent of the total fruit

crop area and 5.3 percent of total fruit production in India. It occupies a cultivated area of 132 thousand hectares with 5667 thousand MT of production with average productivity of 43 t/ ha. (Anonymous, 2015-16). as vegetable and fruit processing. It is a very wholesome, refreshing and delicious fruit and rich in nutrient content and highly valued for its digestive properties. The nutritive and medicinal properties of papaya are well known. Papaya fruit is very low in calories (43 calories/100g) and contains no cholesterol; however, it is a rich source of phytonutrients, minerals and vitamins. 100g edible portion of papaya contains 89.6 per cent moisture, 9.5 per cent carbohydrate, 0.5 per cent proteins, 0.1 per cent fat, 4.0 per cent calorific value, 0.4 per cent minerals, (0.01% calcium, 0.01% phosphorus, 0.4mg iron), 2020 IU Carotene (Vit. A), 40 IU Thiamine (Vit. B) 250 IU Riboflavin (vit. B2), 85 mg Ascorbic acid (vit. C), and 0.2 IU Nicotinic acid (Ram, 2007).

Further, papain a well known byproduct is prepared from dried latex of its immature fruits is used in meat tenderizing, manufacture of chewing gum, cosmetics, for degumming natural silk and to give shrink resistance to wool. Besides, it is also used in pharmaceutical & textile industries and garment cleaning paper and adhesive manufacture, sewage disposal etc. Papaya juice has an in-vitro anti-proliferative effect on liver cancer cells, possibly due to papaya juice and Lycopene (Asmah *et al.,* 2002). Leaves of papaya tree are used for treating nervous pains and elephantoid growth.

Papaya is commercially propagated by seed, which are enclosed with in a gelatinous sarcotesta. The best time of raising seedling is June to September but in North India frost is a common problem, therefore seedlings can be raised from February to May (Singh and Dahiya,2000).

Due to awareness of multifold uses of papaya for table and extraction purposes, it is slowly emerging from the status form of a homestead crop to that of commercial crop. The major production constraint encountered in papaya is difficulty in maximizing yield with in unit time. Balanced nutrition plays a vital role on plant growth, yield and fruit quality. Therefore the applications of different growth media and inorganic fertilizers at nursery stage along with organic manures at later stage are the key factors to enhance the production. During seedling stage it requires a fertile soil or suitable growth media for better growth and development of the plants. The development of root system is suppressed and plants are more susceptible to soil borne diseases in heavy soils without drainage (Beattie and White, 2003). Therefore, the use of suitable growing media for sowing of seed plays an important role in seed germination and subsequent vegetative growth of seedlings (Srivastava *et al.*, 2003).

The effect of media on seed germination and seedling growth has been worked out by various workers under different agro-climatic conditions. A good growing medium anchorage or support to the plant, serves as reservoir for nutrients and water allow oxygen diffusion to the roots and permit gaseous exchange between the roots and atmosphere outside the root substrate (Abad *et al.,* 2002). The quality of seedlings obtained from a nursery influences re-establishment in the field and eventual productivity of an orchard (Baiyeri and Mbah, 2006).

Similarly, the plant growth regulators are also profoundly influence the growth and differentiation of plant cells, tissues and organs. The role of PGR"s has been well recognized in agriculture production. Among the plant growth regulators auxins stimulate cell elongation and influence a host of other developmental responses, such as root

initiation vascular differentiation tropic responses, apical dominance and the development of auxiliary buds, flowers and fruits (Dasand Das, 2006). Auxins are synthesized in stem or root apices and transported through the plant axis. The principal auxin present in the plants is indole-3 acetic acid (IAA).

Several often indole derivatives all as precursors to IAA are known to express auxin activity probably by converting to IAA in the tissues. Furthermore, the other PGRs like gibberellins are also responsible to cause stem elongation and flowering of the plants (Shanmugavelu, 2001). They are also prominently involved in mobilization of endosperm reserves during early embryo growth and seed germination.

Materials and Methods

The area of Prayagraj district of Uttar Pradesh comes under subtropical belt, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46℃-48℃ and seldom falls as low as 4℃-5℃. The relative humidity (RH) ranges between 20 to 94 %. The average rainfall in this area is around 1013.4 mm annually. However, occasional precipitation is also not uncommon during winter months.

The present investigation was carried out on the "Effect of Different growing media with Soil and Sand in polybags on seed germination, seedling growth and survival percentage of Papaya (*Carica papaya*) *cv.* Pusa Nanha." under Prayagraj agro-climatic conditions. The experiment was conducted in Randomized Block Design (RBD) with one control and thirteen treatments and three replications at the Research Farm of Department of Horticulture. Total no. of treatments was 12+1(control).

Treatment details

The treatment which were used are T_1 (Soil), T_2 (Sand+ Vermicompost +Soil 1:1:1), T_3 (Sand+ Vermicompost +Soil (1:2:1)), T_4 (Sand+ FYM +Soil (1:1:1)), T_5 (Sand+ FYM +Soil (1:2:1)), T_6 (Sand+ Cocopeat +Soil (1:1:1)), T_7(Sand+ Cocopeat +Soil (1:2:1)), T_8(Sand+ Vermicompost +Soil (1:1:1)), T_9 (Sand+ Vermicompost +Soil (1:2:1)), T_{10}(Sand+ FYM +Soil (1:1:1)), T_{11}(Sand+ FYM +Soil (1:2:1)), T_{12}(Sand+ Cocopeat +Soil (1:1:1)), T_{13}(Sand+ Cocopeat +Soil (1:2:1)).

Results and Discussion

It is evident that the Germination percentage was influenced by different treatments. Among the treatment applied T_3 (Sand+ Vermicompost +Soil) in which maximum germination percentage obtain 95.83 % followed by T_{10} (Sand+ Farm Yard Manure+ Soil) in which germination percentage is 91 % and the minimum germination percentage observed in T_1 (Control) with 29.16%. From the data presented in table 1 Clearly indicate that, Papaya seeds sowing in polybag with the Ratio of 1:2:1 (Sand: Vermicompost: Soil). Similar effect of organic manure and container on seed germination, seedling vigour in papaya have been reported by Barche *et al.*, (2010). These results are in accordance with the findings of Deb *et al.*, (2001).

At 15 days after germination, maximum shoot length was observed in T_3 [Sand + Vermicompost +Soil (1:1:1)] with 16.83 cm followed by T_{10} [Sand + Farm Yard Manure +Soil (1:1:1)] with 15.93 cm and the minimum shoot length was T_1 (Control) with 8.33 cm. At 30 days after germination, maximum shoot length was observed in T_3 [Sand + Vermicompost +Soil (1:1:1)] with 20.83 cm followed by T_{10} [Sand + Farm Yard Manure +Soil (1:1:1)] with 19.43 cm and the

minimum shoot length was T_1 (Control) with 12.88 cm. At 45 days after germination, maximum shoot length was observed in T_3 [Sand + Vermicompost +Soil (1:1:1)] with 26.50 cm followed by T_{10} [Sand + Farm Yard Manure +Soil (1:1:1)] with 24.76 cm and the minimum shoot length was T_1 (Control) with 17.90 cm. Similar effect of organic manure and container on seed germination, seedling vigour in papaya have been reported by Barche *et. al.,* (2010). These results are in accordance with the findings of Deb *et al.*, (2001).

At 45 days after germination, maximum seedling length was observed in T_3 (Sand:Vermicompost :Soil) 1:2:1 with 31.26 cm followed by T_{10} (Sand: Farm Yard Manure: Soil) 1:1:1 with 29.73 cm and the minimum shoot length was observed in T_1 (Control) with 22.73 cm length. Similar effect of organic manure and container on seedling length in black pine have been reported by Atilla *et al.,* (2015).

At 45 days after germination, maximum seedling length was observed in T_3 (Sand:Vermicompost:Soil) 1:2:1 with 31.26 cm followed by T_{10} (Sand: Farm Yard Manure: Soil) 1:1:1 with 29.73 cm and the minimum shoot length was observed in T_1 (Control) with 22.73 cm length. Similar effect of organic manure and container on seedling length in black pine have been reported by Atilla *et al.,* (2015).

At 15 days after germination, maximum Seedling girth was observed in T_3 Sand+ Vermicompost +Soil (1:2:1) with 16.83 cm followed by T_{10} (Sand +FYM +Soil 1:1:1) with 15.93 cm and the minimum Seedling girth was T_1 (Control) with 8.33 cm. At 30 days after germination, maximum Seedling girth was observed in T3 Sand+ Vermicompost + Soil (1:2:1) with 20.83 cm followed by T10 Sand +FYM +Soil (1:1:1) with 19.43 cm and the minimum Seedling girth was T_1 (Control) with 12.88 cm. At 45 days after germination, maximum Seedling girth was observed in T_3 Sand+ Vermicompost +Soil (1:2:1) with 26.50 cm followed by T10 Sand +FYM +Soil (1:1:1) with 24.76 cm and the minimum Seedling girth was T_1 (Control) with 17.90 cm. Similar effect of organic manure and container on seed germination , Seedling girth in papaya have been reported by Barche *et. al.,*(2010). These results are in accordance with the findings of Deb *et al.*, (2001).

At 30 days after germination, maximum No. of Leaves was observed in T_3 (on FYM) with 16.33 followed by T_{10} (Sand + FYM + Soil (1:1:1)) with 15 and the minimum No. of Leaves was T_1 (Control) with 7.33.Growing media and plant growth regulator were found significantly results on fresh weight & dry weight of papaya roots as well as no. of leaves per seedling Anjanawe *et. al,*.(2012)

The maximum seedling vigor index was recorded under treatment T_3 Sand+ Vermicompost+ Soil (1:2:1) with 2997.5, followed by T_{10} Sand +FYM +Soil (1:1:1) with 2727.5 and the minimum seedling vigor index 663.75 was noted under the treatment T_1 (control). Seedling vigor index was influenced significantly with the use of growing media and plant growth regulators ,these results were confirming the investigation of Meena *et al.,* (2017).

The maximum fresh weight of papaya seedling (25.667gm) was recorded under treatment T_3 (Sand +Vermicompost +Soil (1:2:1)), followed by T_{10} (Sand +Farm Yard Manure + Soil 1:1:1) with 22gm and the minimum fresh weight of papaya seedling (9.33gm) was recorded under the treatment T_1 (Control). Fresh weight of papaya seedling significantly with the use of growing media and plant growth regulators, these results were confirming the investigation of Meena *et al.,* (2017) (Table 2).

Table.1 The effect on growing media on germination percentage, seedling length, shoot length, and seedling girth

Notion	Treatment	G%	Seedling length	Shoot length			Seedling Girth		
				15 DAS	30 DAS	45 DAS	15 DAS	30 DAS	45 DAS
T_1	Control	29.16	22.73	8.83	12.80	17.90	1.63	2.66	3.06
T_2	Sand + VC+ Soil (1:1:1)	66.66	23.96	10.36	13.73	18.30	1.93	2.96	3.46
T_3	Sand + VC +Soil (1:2:1)	95.83	31.26	16.83	20.80	26.50	4.70	5.43	6.43
T_4	Sand + FYM + Soil (1:1:1)	45.83	24	11.63	14.52	19.20	2.60	3.60	4.00
T_5	Sand + FYM + Soil (1:2:1)	54.16	26.56	13.46	16.93	21.73	2.10	3.10	4.13
T_6	Sand+Cocopeat +Soil (1:1:1)	50.00	25.03	12.46	15.40	19.90	2.36	3.26	4.30
T_7	Sand+Cocopeat +Soil (1:2:1)	58.33	25.90	14.50	16.60	20.93	2.43	3.26	3.73
T_8	Sand + VC +Soil (1:1:1)	54.16	26.10	14.06	17.16	21.00	3.16	3.80	4.66
T_9	Sand + VC +Soil (1:2:1)	58.33	26.83	13.26	18.10	22.03	3.43	4.16	5.30
T_{10}	Sand +FYM +Soil (1:1:1)	91.66	29.73	15.93	19.43	24.76	4.16	4.86	5.90
T_{11}	Sand +FYM +Soil (1:2:1)	79.16	28.26	13.40	17.60	23.30	3.00	3.70	4.70
T_{12}	Sand+Cocopeat +Soil(1:1:1)	75.00	27.00	13.76	16.30	21.26	3.16	3.96	5.00
T_{13}	Sand+Cocopeat + Soil (1:2:1)	70.83	27.86	14.53	16.80	23.10	2.30	3.50	4.63

Table.2 The effect on growing media on number of leaves, seedling vigor index, fresh and dry weight of seedling and survival percentage

Notion	Treatment	Number of leaves	Seedling vigor index	Seedling fresh weight	Seedling dry weight	Survival Percentage
T_1	Control	7.33	663.75	9.33	2.66	75.00
T_2	Sand + Vermicompost + Soil (1:1:1)	10.00	1620.00	12.66	3.00	88.86
T_3	Sand +Vermicompost +Soil(1:2:1)	16.33	2997.50	25.66	6.33	95.23
T_4	Sand + FYM + Soil(1:1:1)	9.66	1097.92	14.33	3.33	91.66
T_5	Sand + FYM + Soil(1:2:1)	11.00	1435.42	13.66	4.66	77.76
T_6	Sand +Cocopeat +Soil(1:1:1)	10.66	1245.42	15.33	4.00	82.2
T_7	Sand +Cocopeat +Soil(1:2:1)	12.00	1520.00	18.66	3.66	75.76
T_8	Sand +Vermicompost +Soil(1:1:1)	11.33	1423.75	20.00	4.33	87.76
T_9	Sand +Vermicompost +Soil(1:2:1)	12.33	1545.42	20.66	4.66	67.13
T_{10}	Sand +FYM +Soil(1:1:1)	15.00	2727.50	22.00	6.00	90.46
T_{11}	Sand +FYM +Soil(1:2:1)	13.00	2244.58	14.66	5.00	78.53
T_{12}	Sand +Cocopeat +Soil(1:1:1)	10.00	2031.25	14.00	4.33	78.56
T_{13}	Sand + Cocopeat + Soil (1:2:1)	11.00	2010.00	16.33	4.00	80.83

The maximum Dry weight of papaya seedlings (6.33 g) was recorded with treatment T3 (Sand+ Vermicompost +Soil, 1:2:1) and followed by T10(Sand + FYM + Soil 1:1:1) with 6gm, while minimum was found under T1 (Control) with 2.66gm. The treatment T3 [Sand+ Vermicompost + Soil, (1:2:1)] was significantly superior over all the Treatment. weight of papaya seedling significantly with the use of growing media and plant growth regulators ,these results were confirming the investigation of Atilla *et al.*, 2015).

The maximum survival percentage (95.23%) was recorded in treatment T3 (Sand+ Vermicompost + Soil1:2:1) and followed by T10(Sand+ FYM + Soil1:1:1) with 90.46%, while minimum was observed under T1 (Control) with 75%. The treatment T3 was significantly superior over all the Treatment. These results are consistent with findings by Anjanawe *et al.*, (2013) and Acharjeera *et al.*, (2015). Who found the best Papaya transplants were produced with organic manures boron rates <0.13 mg per Transplant.

On the basis of results obtained, it was concluded that the treatment T_3 (Sand + Vermicompost + Soil/1:2:1) was behold to the best of maximum germination percentage (95.83), High shoot length (26.50cm), High seedling length (31.26cm), maximum seedling girth (6.43mm), more number of leaves per seedling (16.33), maximum seedling vigor Index (2997.50), maximum fresh weight of seedling (25.66 gm), maximum Dry weight of seedling (6.33 gm) and maximum survivability percentage is 95.23% of Papaya *(Carica papaya)* Plant *cv.* Pusa Nanha.

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