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To Study the Effect of Different Growing Media on Papaya (*Carica papaya*) Seedling on Germination Percentage under Protected Condition cv. Pusa Nanha

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A B S T R A C T

The present experiment was carried out during June-August in 2019-2020 in Central horticulture research farm of Department of Horticulture, SHUATS, Prayagraj. The experiment was conducted in Randomized Block Design with 10 treatment replicated thrice. The treatments were T_0(control), T_1(Soil + Vermicompost (1:2)), T_2(Soil + Perlite (1:2)), T_3 (Soil + Cocopeat (1:2)), T_4 (Soil + Sand (1:2)), T_5 (Soil + Vermicompost + Perlite (1:2:1)), T_6 (Soil + Perlite + cocopeat (1:2:1)), T_7 (Soil + Pond soil + vermicompost (1:2:1)), T_8 (Soil + Pond Soil + Perlite (1:2:1)), T_9 (Soil + Pond Soil + Cocopeat (1:2:1)), T_{10} (Soil + Perlite + cocopeat + Vermicompost +Pond Soil (1:1:2:2:1)). From the present investigation it is found that treatment T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) was found superior in terms Day of Germination (9.00), Germination percentage(95.00), No. of leaves per seedling(16.00), Length of seedling (17.10), Girth of seedling (7.53), Seedling vigor index(1989.00), Fresh weight of seedling(27.00), Dry weight of seedling(8.66), Dry weight of root(0.94).

Introduction

Papaya, papaw or papita *(Carica papaya L.)* originated from tropical America, has become apopular fruit due to its fast growth, high yield, long fruiting period and high nutrient value as well. In addition it has been use as vegetable, fruit processing, and papain production at immature stage. It can be a highly profitable crop now. The papaya plant has male, female, hermaphrodite (bisexual flower) and some other complex forms. Male plants do not bear any fruit, normally the fruit shape from female plant is shorter, but the fruit shape from hermaphrodite (bisexual flower) plant is longer. The seeds of following varieties we offer in grow in mixture of female plants and hermaphrodite plants.

It is dicotyledonous, polygamous diploid species with a small genome of 372 Mbp/1C5 having nine pairs of chromosomes and was introduced to India in the 16th century. India is the largest producer of papaya covering an area of 1.15 lakh ha, producing 49.12 lakh

tones/ ha NHB 2018.It is extensively grown in the states of Tamil Nadu, Andhra Pradesh, Assam, Bihar, Maharashtra, Uttar Pradesh, Gujarat, Punjab, West Bengal, Madhya Pradesh, Karnataka etc. It is largely consumed locally although it has huge potential for export. It has long been grown primarily for its delicious fruits which are the rich source of carbohydrate, minerals, vitamin A, and ascorbic acid. The fruits can be used in the preparation of products like jam, jelly, tuty-fruity, marmalade, nectar, wines, syrup, dehydrated flakes and baby foods. The digestive enzyme papain, obtained from latex is an industrial ingredient used in pharmaceuticals, brewery, meat, dairy, textile, photographic, optical, tanning, cosmetic, detergent, food and leather industries and so there is a growing demand for the papain. Papaya is a short duration fruit crop, owing to its high productivity and high returns, it is becoming very popular with many growers.

Seedling vigor is affected by many factors like seed quality and seed treatments, type of substrate used, environmental factors etc. Some of the problems faced by papaya growers are slow, erratic and incomplete germination of papaya and high initial seedling mortality. Thus increasing the germination percentage and producing healthier seedling of papaya. It is mainly propagated through seeds. The quality of seedlings obtained from a nursery influences re-establishment in the field and the eventual productivity of an orchard. Plant vigour depends on the seedling vigour. Hence attention has to be given from nursery stage itself in order to improve the seedling vigour. An effective potting media for papaya should be physically very stable, should not interfere with plant nutrition, light in weight for easy transport and can minimize the soil borne diseases. A good media should have the qualities to be intact with the root system when the seedlings are uplifted for transplanting.

Growing media are an integral part of most horticultural production systems. Soil, Vermicompost, vermiculite, perlite, cocopeat etc. is included as different growing media in the present study. The soil is generally used as a basic medium because it is cheapest and easy to procure supplementing of the soil which is aimed to make media more porous while the organic matter (Vermicompost, Vermiculite, Perlite, Cocopeat) is added so as to enrich adequate nutrients for the seedlings.). A growing medium is a substance through which roots grow to extract water & nutrients. The growing medium also plays an important role in seed germination not only it does act as a support, but also a source of key nutrients for plant growth. The composition of the medium influences the quality of the seedlings, Perlite and vermiculite have been used for years to amend professional potting soils made from peat moss (called "soilless" mixes or artificial soils because they literally contain no soil). They also have been used in outdoor mixes, in turfgrass and outdoor planting for gardens. Essentially perlite and vermiculite are used in the horticultural industry because they both provide aeration and drainage, they can retain and hold substantial amount of water and later release it as needed. They are sterile and free from diseases, having a fairly neutral pH (especially perlite which is neutral), and readily available, non-toxic, safe to use, and relatively inexpensive. Likewise, Vermicompost refers to a mixture of worm casting, organic material, humus, living earthworms, their cocoons and other organisms. Earthworm reduces C: N ratio, increase humic acid content, cation exchange capacity and water soluble carbohydrates (Talashilkar *et al.,* 2007). Similarly, cocopeat is an agricultural by-product obtained after the extraction of fiber from the coconut husk (Benito *et al.,* 2006). As a growing medium, it can be used to produce a number of crop species with acceptable quantity in the tropics

(Johnson *et al.,* 2010). Cocopeat is considered as a growing medium component with acceptable pH, EC and other chemical attributes. Cocopeat has good physical properties, high total pore space, high water content, low shrinkage, low bulk density and slow biodegradation (Zaller, 2007) suggested Vermicompost as an environmentally friendly potting media.

Vermicompost contains water soluble nutrients and is a nutrient rich organic fertilizers and soil conditioner. Itis the product of the composting process using various species of worms, usually red wigglers, white worms, and other earthworms, to create a mixture of decomposing vegetable or food waste, bedding materials, and Vermicompost

Cocopeat is known for its high water holding capacity which is upto 8 times as compare to soil also it promotes root growth of the plant. It increases aeration, water retention, improves soil texture, productivity and reduces root diseases. *Cocopeat* normally used for soil amendments. It's made from the husks of coconuts. It's a beneficial product for plant growers and provides an alternative growing medium.

Perlite is an amorphous volcanic glass that is having high water content and used as best soil amendment, typically formed by the hydration of obsidian. It occurs naturally and has the unusual property of greatly expanding when heated sufficiently. It is an industrial mineral and a commercial product useful for its low density after processing.

Pond soil contains different types of microorganism like algae which is beneficial in growth of plant. The pond soil is the nutrient medium of bottom of pond. One the one hand the nutrient medium is of importance for the development of micro-organisms, and on the other the pond soil should contain enough nutrients for optimum and constant growth of your plants.

Materials and Methods

The Experiment was conducted in Randomized Block Design (RBD) with one control and 10 treatments at the central research farm of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences Prayagraj during 2018-2019. Total no. of treatments were 9+1 *viz.* T_0 (control), T_1(Soil + Vermicompost (1:2)), T_2(Soil + Perlite (1:2)), T_3 (Soil + Cocopeat (1:2)), T_4 (Soil + Sand (1:2)), T_5 (Soil + Vermicompost + Perlite (1:2:1)), T_6 (Soil + Perlite + cocopeat (1:2:1)), T_7 (Soil + Pond soil + vermicompost (1:2:1)), T_8 (Soil + Pond Soil + Perlite (1:2:1)), T_9 (Soil + Pond Soil + Cocopeat (1:2:1)), T_{10} (Soil + Perlite + cocopeat + Vermicompost +Pond Soil (1:1:2:2:1))

Climatic condition in the experimental site

The area of Prayagraj district comes under subtropical belt in the south east of Utter Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to 46^o C-48^o C and seldom falls as low as 4^{o}C- 5^{o}C. The relative humidity 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.

Results and Discussion

The efforts have been made in this chapter to compare and interpret the result of various experiment carried out during the course of investigation with the findings of the other research works. The data recorded on various characters during “July to August” 2019, the course of investigation have been presented in

this chapter along with appropriate tables, figures and illustrations**.** The present investigation entitled To study the effect of different growing media on papaya (Carica papaya) seedling on germination percentage under protected condition cv. Pusa Nanha.

In terms of Day of germination, the minimum no of days taken for the germination from the day of sowing was observed in the treatment T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) with 9.00 days followed by T_8 (Soil + Pond Soil + Perlite (1:2:1) and the maximum was observed in T_0 (Control) with 20 days. This study is supported by the findings of Biradar *et al.,* (2001) and Baghel *et al.,* who reported the minimum no. of days taken for the germination in neem and phalsa respectively.

In terms of germination percentage the maximum germination percentage was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum germination percentage obtain 95.00 % followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which germination percentage is 90.33 % and the minimum germination percentage observed in T_0 (Control) with 71.00%.This study is supported by the findings of Govind *et al.,* (2005), who reported maximum germination percentage in khasi mandarin.

The maximum no. of leaves per seedling was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum no. of leaves per seedling obtain 16.00 followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which no. of leaves per seedling is 15.00 and the minimum no. of leaves per seedling observed in T_0 (Control) with 8.00. This study is supported by the similar finding of Man Bihari*et.al.,* (2009) who reported that maximum no. of leaves in Aonla.

The maximum length of seedling was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum length of seedling (cm) obtain 17.1 followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which length of seedling (cm) is 13.4 and the minimum length of seedling(cm) observed in T_0 (Control) with 7.96.This study is supported by the similar finding of Annapurna, *et al.,* (2007) who reported the maximum length of seedling in Peach crop. The maximum shoot growth might be attributed to the conducive effect of this media composition on water holding capacity porosity, soil aeration and supplying substantial amount of nutrient specially nitrogen and micro nutrients for good root and shoot growth over soil alone (Chopde *et al.,* 1999).

Increase in number of leaves might be mainly due to corresponding increase in plant height (Govind and Chandra, 1993). The results of study are in close agreement with the findings of Wong and Lee (2000) in *Nepenthes ampullaria*, Kumar and Arora (2007) in peach, Pio, *et al.,* (2007) in pears, Lopes, *et al.,* (2007) in passion fruit, Li *et al.,* (2008). Further the vermicompost and soil also provides close contact between seed and media, increases stable moisture supply facilitates, root respiration and encourages overall root growth of roots (Chatterjee and Choudhari 2007). The findings of this experiment are in close conformity of Baghel *et al.,* (2004) in phalsa, and NawaBahar (2008) in *Cupaniopsis anacardioides.*

The maximum girth of seedling was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum girth of seedling obtain 7.53 followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which length 6.53 and the minimum girth of seedling observed in T_0 (Control) with 3.53. This study is supported by the similar finding of Annapurna, *et al.,* (2007) who reported the maximum length of seedling in Peach crop.

Table.1 Effect of different growing media on germination of papaya

Notation	Treatment combination	Day of germination	Germination %	No. of leaves per seedling	Length of seedling (cm)	Girth of seedling (mm)	Seedling vigor index	Fresh wt. of seedling (g)	Dry weight of seedling(g)	Dry weight of Root (g)
T_0	Control (soil)	20.00	71.00	8.00	7.96	3.53	447.35	9.00	2.00	0.26
T_1	Soil + Vermicompost **(1:2)**	20.00	75.00	9.00	8.23	4.26	474.71	10.66	3.00	0.36
T_2	Soil + Perlite **(1:2)**	18.00	73.66	9.66	8.06	4.23	473.50	11.66	4.00	0.39
T_3	Soil + Cocopeat **(1:2)**	18.67	71.33	11.00	8.83	4.66	548.21	11.00	4.00	0.50
T_4	Soil + Sand **(1:2)**	17.33	71.00	10.66	9.53	5.40	527.94	13.33	5.00	0.58
T_5	Soil + Vermicompost + Perlite (1:2:1)	17.33	83.66	12.00	9.46	5.20	546.53	15.33	5.00	0.55
T_6	Soil + Perlite + cocopeat **(1:2:1)**	16.33	76.66	10.00	10.23	5.13	513.53	18.66	6.33	0.39
T_7	Soil + Pond soil + Vermicompost **(1:2:1)**	18.33	82.33	11.33	11.73	5.93	1232.66	20.00	5.00	0.54
T_8	Soil + Pond Soil + Perlite **(1:2:1)**	11.33	90.33	15.00	13.40	6.53	1328.03	20.66	7.66	0.88
T_9	Soil + Pond Soil + Cocopeat **(1:2:1)**	9.00	95.00	16.00	17.10	7.53	1989.00	27.00	8.66	0.94
T_{10}	Soil + Perlite + cocopeat + Vermicompost +Pond Soil **(1:1:2:2:1)**	15.33	82.33	10.33	13.66	5.70	883.12	22.00	6.00	0.76
	CD	3.801	6.35	2.74	0.84	0.68	190.23	2.942	2.35	0.10
	SeD	1.81	3.02	1.30	0.40	0.324	90.55	1.404	1.11	0.50
	F-Test	S	S	S	S	S	S	S	S	S

The maximum seedling vigor index was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum seedling vigor index obtain 1989.00 followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which seedling vigor index is 1328.03 and the minimum seedling vigor index observed in T_0 (Control) with 447.35.This study is supported by the similar finding of Biradar *et al.,* (2001)who reported maximum seedling vigor index in neem.

The maximum fresh weight of seedling was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum fresh weight of seedling obtain 27.00 followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which fresh weight of seedling is 20.66 and the minimum fresh weight of seedling observed in T_0 (Control) with 9.00.This study is supported by the similar finding of Abharim *et al.,* (2010)who reported maximum fresh weight of seedling in Nutmeg (*Myristicafragrans* Houtt).

The maximum dry weight of seedling was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum dry weight of seedling obtain 8.66 followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which dry weight of seedling is 7.66 and the minimum dry weight of seedling observed in T_0 (Control) with 2.00. This study is supported by the similar finding of Ameri *et al.,* (2011)reported maximum dry weight of seedling in strawberry. The maximum dry weight of root was recorded in T_9 (Soil + Pond Soil + Cocopeat (1:2:1)) in which maximum dry weight of root obtain 0.94 g followed by T_8 (Soil + Pond Soil + Perlite (1:2:1)) in which dry weight of root is 0.88 g and the minimum dry weight of root observed in T_0(Control) with 0.26 g.This study is supported by the similar finding of Paratap (2015)who reported the maximum dry weight of root in pyrethrum.

The maximum germination attributes might be due to beneficial effect of all combination in improving physical, biological and chemical properties of media. Soil provides natural support to plant, sand provides proper aeration in media, cocopeat and vermiculite given warm condition, high water holding capacity and vermicompost as a source of organic manure provided better nutrition to the germinating seedlings (Hartmann and Kester, 1997).

Vermicompost and soil provides a uniform physical structure which ensures close contact between seeds and media, increases balanced moisture supply, facilitates root respiration and encourages overall plant growth (Chatterjee and Choudhari, 2007).

It exhibits a beneficial effect on soil health and all these germination parameters which might have enhanced the seed germination and seedling growth of papaya at the initial stage. The similar results reported by Bisla *et al.,* (1984) in ber as they observed highest germination of ber seeds with media sand + soil + organic manure in 1:1:1 proportion and Lima *et al.,* (2007)

On the basis of result obtained, It is concluded that the treatment T_9 (Soil + Pond Soil + Cocopeat (1:2:1) found to be best in terms of Day of Germination, Germination percentage, No. of leaves per seedling, length of seedling (cm),

Application of growing media like soil, Vermicompost, perlite, cocopeat, and pond soil in combination is now become a powerful tool to modify several physiological processes in plants which are extensively and profitability used in horticultural crops. They also used for increasing plant growth, and increase in fruit yield per hectare while mending the health of the soil.

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