

EFFECT OF DIFFERENT GROWING MEDIA ON GERMINATION AND ESTABLISHMENT OF SEEDLINGS OF PAPAYA (*CARICA PAPAYA* L.) CV. MADHU BINDU UNDER NET HOUSE CONDITIONS

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ABSTRACT

The study was carried out to find the effect of growing media on germination and establishment of seedlings of papaya (*Carica papaya* L.) under net house conditions. The experiment result showed that the treatment T_8 ($M_1 + M_4$)- control + cocopeat (3:1) took significantly minimum days (7.00 days) for initiation of germination with significantly maximum germination count (34.33 and 37.33), vigour index-I (1007.08 and 2114.42) at 15 and 30 DAS, respectively and vigour index-II (1.04) at 15 DAS. The treatment T_{13} ($M_3 + M_4$) - sphagnum moss + cocopeat (3:1) recorded significantly maximum vigour index-I (4797.85), vigour index-II (105.58) at 45 DAS, number of leaves (23.17 and 28.20), height of seedling (61.50 cm and 75.80 cm) at 30 and 45 DAT, respectively as well as establishment in main field (100%) at 45 DAT. The treatment T_{11} ($M_2 + M_4$) - vermiculite + cocopeat (3:1) noted significantly maximum vigour index-II (13.73) at 30 DAS. Where as significantly maximum germination count (38.67) of papaya seeds at 45 DAS was noted in treatment T_{15} ($M_4 + M_5$) - cocopeat + vermi compost (3:1). On the basis of experimental results it can be concluded that the treatment containing cocopeat as an ingredient of growing media i.e. T_8 , T_{11} , T_{13} and T_{15} found to be most suitable for raising the papaya seedlings as it gives better germination, vigour and survival of seedlings in field.

INTRODUCTION

Papaya (*Carica papaya* L.) belongs to family Caricaceae is an important tropical commercial fruit crop of India. It is 7th important fruit crop of the country after mango, citrus, banana, apple, guava and sapota. The fruit is extensively grown in various states of India, mainly in Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, West Bengal, Chhattisgarh, Tamil Nadu, Assam and Kerala. Papaya occupies 1.9 per cent of total fruit crop area and 6.6 per cent of total fruit production in India. It occupies a cultivated area of 132 thousand hectares with 5382 thousand MT of production with an average productivity of 40.7 MT/ha (Anon., 2013). Among the various varieties of papaya, Pusa Dwarf, Taiwan, Pusa Delicious and Madhu Bindu (Honey Dew) have attained the commercial status throughout the country. Papaya is propagated by seed only. Seed germination is affected by many factors, which include type of substrate used, environmental factors such as oxygen, water, temperature and for some plant species, light (Hartmann *et al.*, 2001). The germination of seeds of papaya (*Carica papaya*) is frequently reported to be slow, erratic and incomplete (Chako and Singh, 1966; Lange 1961). Growing medium is a substrate that provides the required elements and physical support to the growing plants. All soils used for media are not always perfect for the germination of seeds and subsequent growth of seedling therefore use of suitable growing media or substrate is essential for production of quality horticultural crops. Vermicompost provides sufficient

levels of oxygen to roots, adequate storage of water and nutrient for the plants; humic substances significantly increase nutrients availability and consequently affect growth, yield and quality of plant. FYM is having good water holding capacity as well as sufficient porosity, thus permitting adequate moisture and exchange of gases between the germination growth media and the embryo (Anjanawe *et al.*, 2013). Cocopeat is considered as a good growing media component with acceptable pH, electrical conductivity and other chemical attributes (Abad *et al.*, 2002). Sphagnum moss is the dehydrated remains of acid hog plants and has three genera, growing naturally in damp humid forest lands. It is relatively sterile, light in weight and has a very high water holding capacity. Normally, it absorbs and holds water 20 times to its weight. It is acidic in nature having pH about 3.5. It also contains a fungistatic substance which is useful to inhibit damping off. Moss is soaked in solution containing fungicide and is impregnated with nutrient solution before being used for propagation. Vermiculite is the micaceous mineral which expands significantly when heated. Chemically it is hydrated magnesium, aluminium, iron, silicate. When expanded it is very light in weight. It is neutral in reaction and has good buffering properties. It is insoluble in water. Vermiculite is available in 4 Grades, out of which the Horticultural Grade No. 2 should be used for rooting and No. 4 for seed germination. It directly affects the development and later maintenance of the extensive root system. A good growing medium would provide sufficient anchorage or support to the

plant, serves as reservoir for the nutrient and water, allow oxygen diffusion to the roots and permit gaseous exchange between root and atmosphere outside the root substrate (Abad *et al.*, 2002). Nursery potting media influence quality of seedling produced (Agbo and Omaliko, 2006). The quality of seedling obtained from a nursery influences re-establishment in the field and the eventual productivity of an orchard (Baiyeri, 2006). Net house structure, provides totally or partially controlled environmental condition suitable for better seed germination and subsequent seedling growth. There fore, the present study was initiated to find out the suitable media for seed germination and seedling growth of papaya.

MATERIALS AND METHODS

The present investigation "Effect of different growing media on germination and establishment of seedling of papaya (*Carica papaya* L.) cv. Madhu Bindu under net house condition" was carried out at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand during the year 2014. The experiment was laid out in Completely Randomized Design (for nursery trial) and Randomized Block Design (for Field trial) with fifteen treatment combination. All treatments were replicated thrice. The treatments comprised of fifteen levels of growing media viz., T₁ (M₁)- soil + FYM (1:1) (Control), T₂ (M₂)- vermiculite, T₃ (M₃)- sphagnum moss, T₄ (M₄)- cocopeat, T₅ (M₅)- vermi compost, T₆ (M₁+M₂)- control + vermiculite (3:1), T₇ (M₁+M₃)- control + sphagnum moss (3:1), T₈ (M₁+M₄)- control + Cocopeat (3:1), T₉ (M₁+M₅)- control + vermi compost (3:1), T₁₀ (M₂+M₃)- vermiculite + sphagnum moss (3:1), T₁₁ (M₂+M₄)- vermiculite + cocopeat (3:1), T₁₂ (M₂+M₅)- vermiculite + vermi compost (3:1), T₁₃ (M₃+M₄)- sphagnum moss + cocopeat (3:1), T₁₄ (M₃+M₅)- sphagnum moss + vermi compost (3:1), T₁₅ (M₄+M₅)- cocopeat + vermicompost (3:1) filled in black polythene bags of (4" × 6") size. Each treatment has 40 polybags. Two seeds of the papaya were dibbled at about 2 to 3 cm depth in each polythene bag in the month of august. The experiment was conducted under net house condition during initial 45 days

and then seedlings are transplanted in field to find out the suitable media for seedling establishment in main field. Total five number of plants per treatment were transplanted in main field. The bags were watered by water cane at a regular interval. The data on days required for initiation of germination recorded accordingly. However, data on germination count, vigour index-I and vigour index-II were recorded at 15, 30 and 45 DAS while seedling establishment parameters viz., number of leaves and height of seedlings were recorded at 30 and 45 DAS, while survival percentage of seedling were recorded at 45 DAT. The germination count is calculated by counting total germinated seeds out of total seed sown. Seedling vigour was calculated based on the following formula (Bewley and Black, 1982).

Vigour index I = Per cent germination × Length of seedling

Vigour index II = Per cent germination × Total dry weight of seedling

Survival per cent was recorded by using following formula;

$$\text{Survival \%} = \frac{\text{Total survived seedling}}{\text{Total transplanted seedlings}} * 100$$

The recorded data were analysed statistically using various techniques as described by Panse and Sukhatme (1985). The treatment means were compared with C.D. at 5 per cent level.

RESULTS AND DISCUSSION

The results showed that growing media had beneficial effect on seed germination and seedling establishment of papaya. Among different growing media significantly minimum days (7.00 days) were taken to initiate first germination by treatment T₈ (M₁+M₄)- control + cocopeat (3:1). It might be due to retention of more water and air by media helped in quick and early enzymatic action for synthesis of metabolites for cell multiplication and also enhanced the breakdown of the seed

Table 1: Effect of different growing media on germination parameters of papaya seeds

Treatments	Days required for initiation of germination	Germination count at			Vigour index-I at			Vigour Index-II at		
		At 15 DAS	At 30 DAS	At 45 DAS	At 15 DAS	At 30 DAS	At 45 DAS	At 15 DAS	At 30 DAS	At 45 DAS
T1	8.33	25.67	28.67	32.00	601.93	1311.4	3226.96	0.64	6.59	44.78
T2	7.30	27.67	29.67	33.33	770.20	1482.33	3538.58	0.80	8.78	65.86
T3	7.13	29.67	31.67	34.67	741.21	1469.17	3558.75	0.76	7.79	52.31
T4	7.13	32.33	35.67	37.00	915.06	1864.08	4271.18	0.96	11.44	82.68
T5	7.17	30.33	34.33	36.00	756.90	1589.17	3782.10	0.78	8.72	60.23
T6	7.23	29.33	30.67	33.67	819.75	1539.42	3785.93	0.86	9.20	69.60
T7	7.13	29.67	31.67	34.00	784.46	1563.08	3676.07	0.85	9.35	65.20
T8	7.00	34.33	37.33	38.00	1007.08	2114.42	4735.73	1.04	13.23	85.50
T9	7.17	30.00	32.67	35.33	768.46	1601.08	3747.86	0.86	9.27	60.80
T10	7.17	28.67	30.00	33.33	835.67	1689.00	4008.17	0.85	11.37	82.20
T11	7.10	30.33	33.67	36.00	916.42	1995.79	4488.14	0.95	13.73	84.08
T12	7.20	29.33	30.33	33.67	774.75	1496.08	3609.38	0.85	9.08	64.11
T13	7.10	32.67	35.33	38.33	980.79	2011.37	4797.85	1.01	13.54	105.58
T14	7.20	31.33	35.00	36.67	822.50	1731.25	3983.44	0.91	10.77	73.36
T15	7.07	33.67	36.33	38.67	931.08	1970.42	4576.38	0.98	11.82	88.60
S. Em ±	0.16	1.06	0.96	1.09	40.22	61.49	130.94	0.04	0.38	3.59
C. D.at5%	0.47	3.06	2.77	3.13	116.15	177.56	378.12	0.11	1.09	10.37

Table 2: Effect of different growing media on growth and survival percentage of seedlings of papaya in main field

Treatments	No. of leaves		Height of seedlings		Survival percentage At 45 DAT
	At 30 DAT	At 45 DAT	At 30 DAT	At 45 DAT	
T1	19.10	25.00	52.89	65.21	80.00
T2	18.33	23.78	50.13	62.70	73.33
T3	19.73	24.87	53.93	64.99	86.67
T4	20.23	25.67	56.17	67.17	80.00
T5	19.43	25.03	54.65	65.29	80.00
T6	20.07	25.33	55.14	66.66	80.00
T7	22.33	27.67	58.00	71.60	86.67
T8	23.00	28.13	61.01	75.43	93.33
T9	20.53	26.27	57.64	69.93	80.00
T10	21.73	27.47	59.54	72.21	86.67
T11	22.17	27.90	59.92	74.49	86.67
T12	20.87	25.60	56.19	67.94	80.00
T13	23.17	28.20	61.50	75.80	100.00
T14	23.00	28.00	59.33	72.33	80.00
T15	21.53	26.67	58.05	70.69	86.67
S. Em ±	0.75	0.82	2.01	2.22	6.52
C. D. at 5 %	2.17	2.37	5.82	6.42	NS

coat resulting in the transformation of embryo into a seedling early enough (Hasan *et al.*, 2010). Similar results were also obtained by Parasana *et al.* (2013) in mango. This treatment also recorded significantly maximum germination count (34.33 and 37.33) of papaya seeds at 15 and 30 DAS, respectively. Whereas, T₁₅ (M₄+M₅) - cocopeat + vermicompost (3:1) recorded the maximum germination count (38.67) of papaya seeds at 45 DAS. It might be because of media possess higher level of available nutrient, moisture and some acids have helped in enhancement of physiological processes in seeds which result to better germination (Bisla *et al.*, 1984). Similar results were also obtained by Devaranavadi *et al.* (2010) in various tree species, Andrade-Rodriguez *et al.* (2008), Bhardwaj (2013a), Bhardwaj (2013b), Kumawat *et al.* (2014), Ramteke *et al.* (2015) and Arvind *et al.* (2015) in papaya. Similarly maximum seed vigour index-I (1007.08 and 2114.42) at 15 and 30 DAS respectively and vigour index-II (1.04) at 15 DAS was noted in treatment T₈ (M₁ + M₂)- control + cocopeat (3:1). It might be due to retention of more water and air by media helped in quick and early enzymatic action for breakdown of the seed coat resulting in the transformation of embryo into a seedling early enough and there by seed vigour also (Hasan *et al.*, 2010). Whereas vigour index-I (4797.85) and vigour index-II (105.58) at 45 DAS was noted in T₁₃ (M₃+M₄) - sphagnum moss + cocopeat (3:1). While treatment T₁₁ (M₂+M₄) - vermiculite + cocopeat (3:1) recorded significantly the maximum vigour index-II (13.73) at 30 DAS. The similar results were obtained by Hasan *et al.* (2010) in papaya, Abirami *et al.* (2010) in nutmeg, Bhardwaj (2013a), Bhardwaj (2013b) and Arvind *et al.* (2015) in papaya when they used cocopeat as an ingredient of the growing media. Significantly maximum number of leaves (23.17 and 28.20) and height of seedling (61.50 cm and 75.80 cm) at 30 and 45 DAT, respectively in main field was noted in treatment T₁₃ (M₃+M₄) - sphagnum moss + cocopeat (3:1). Maximum survival (100%) of seedling in field after 45 DAT was also recorded in this treatment T₁₃. This might be attributed due to general improvement in the physical and chemical properties of the rooting medium which improved the growth of the seedlings and produced healthy

seedlings. This treatment was also helpful in reducing damping off disease in seedlings due to proper aeration in root zone of the seedling and produced maximum establishment of seedling. These results are in close agreement with Bhardwaj (2013a) and Bhardwaj (2013b) in papaya seedlings.

From the foregoing discussion it can be concluded that the treatment containing cocopeat as an ingredient of growing media *i.e.* T₈ (M₁+M₂) *i.e.* Control + Cocopeat (3:1), T₁₁ (M₂+M₄) *i.e.* Vermiculite + Cocopeat (3:1), T₁₃ (M₃+M₄) *i.e.* Sphagnum Moss + Cocopeat (3:1) and T₁₅ (M₄+M₅) *i.e.* Cocopeat + Vermicompost (3:1) found to be most suitable for raising the papaya seedlings as it gives better germination, vigour and survival of seedlings in field.

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