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Effect of different growing media on seed germination in papaya (*Carica papaya* L.) Cv. Pusa Nanha in Chhindwara district

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Abstract
The study was carried out to study the Effect of different growing media on seed germination and seedling growth of papaya (*Carica papaya* L) cv. Pusa Nanha in Chhindwara District The research was conducted at Department of Horticulture, School of Agricultural Sciences, G H Raisoni University, Saikheda, M.P during 2018 -2019. The experiment was laid out in Randomized Block Design (RBD) with ten treatment combinations and three replications. The treatments were prepared with combination between types of media with level of cocopeat having 20 polybags in each treatment and replication. The results showed that the medium of soil+vermicompost+vermiculite (1:1:1) with 2 cm cocopeat at top of polybags (T_5) gave maximum and significantly higher rate of emergence (278%), highest germination per cent (95), maximum germination index (3.85), seedling vigour (94.54) and least time required for imbibition (9.13 days).

Keywords: Papaya, seedling, plants growth, cocopeat, vermicompost, vermiculite

Introduction
Papaya (*Carica papaya* L.) is an important fruit crop belongs to caricaceae family and its native place is tropical America. It is 7th important fruit crop of the country after mango, citrus, banana, apple, guava and sapota. Papaya is also called papaw or pawpaw, an ideal fruit for growing in kitchen gardens, backyards of homes as well as in field, especially near the cities or big towns. It is also grown extensively as a filler plant in orchards. It is a quick growing typically single-stemmed, short lived, large, perennial herb, and starts bearings within 8-10 months of transplanting. It is one of the most popular commercial fruit of India.

In India, papaya is extensively grown thought out the country *viz*. Andhra Pradesh, Tamil Nadu, Assam, Bihar, Maharashtra, Gujarat, Haryana, Madhya Pradesh etc. occupying an area over 132.18 thousand hectares with annual production of 5381.73 thousand tones. Whereas, it is annual production of 464.67 thousand tones in Madhya Pradesh (National Horticulture Board). The 8th largest growing production of papaya is found in the exponential growth of papaya plantation to a large extent significantly. Madhya Pradesh with medium fertility gives the best quality sweetness in the pomegranate lovers.

Papaya is a quick growing, continuous fruiting, evergreen plant and requires a good fertile soil or growing media for better growth, development and quality of fruits. The use of suitable growing media or substrates for sowing of seeds directly affects the germination, development and functional rooting system. A good growing medium provides sufficient 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 sub0strate (Abad *et al.*, 2002) [1]. The quality of seedlings is very much influenced by growing media under nursery (Agbo and Omaliko, 2006) [3]. The quality of seedlings obtained from a nursery influences re-establishment in the field and the eventual productivity of an orchard (Baiyeri, 2006) [5].

Since papaya is commercially propagated by seeds, The various factors like type of substrate used, water, oxygen, temperature, light, plant species etc. are most important for successful production of the crop. (Hartman *et al*. 2001) [12]. The germination of papaya seeds was reported slow, erratic and incomplete (Chako and Singh, 1966) [9]. Growing media are an integral part of most horticultural production systems. Soil, vermicompost, vermiculite, perlite, cocopeat etc. are 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 (Wilson *et al.,* 2001) [18].

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. As a rule of thumb, perlite tends to last longer, has a more neutral pH, and functions much better in hydroponics, outdoor applications, lawns and gardens. Nevertheless, for decades both have been used by professionals, dedicated amateurs and gardeners. 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*., 1999) [17]

Similarly, cocopeat is an agricultural by-product obtained after the extraction of fibre from the coconut husk (Abad *et al*., 2002) [1]. As a growing medium, it can be used to produce a number of crop species with acceptable quantity in the tropics (Yahaya and Mohklas, 1999; Yau and Murphy, 2000) [19]. Cocopeat is considered as a growing medium component with acceptable pH, EC and other chemical attributes (Abad *et al*., 2002) [1]. Cocopeat has good physical properties, high total pore space, high water content, low shrinkage, low bulk density and slow biodegradation (Evans *et al*., 1996 and Prasad, 1997). The results of many experiments revealed that cocopeat used alone, or as a component of soil medium, is suitable for roses (Blom, 1999) [8], gerbera (Labeke and Dambre, 1998) [16], and also for vegetables.

Materials and Methods

Seed germination and seedling growth experiments of papaya were carried out at Department of Horticulture, School of Agricultural Sciences, GH. Raisoni University, Saikheda, Chhindwara, MP. during November, 2018 to March, 2019 under net house condition. The present experiment consists of 10 treatment combinations with three replications was laid out in RBD with allocation of treatments. The treatments with their combinations and symbols are described as under:- T0 - Soil + Vermicompost (1:1), T1 - Soil + Vermicompost (1:1) with 1 cm Cocopeat at top, T2 - Soil + Vermicompost (1:1) with 2 cm Cocopeat at top, T3 - Soil + Vermicompost + Vermiculite (1:1:1), T4 - Soil + Vermicompost + Vermiculite (1:1:1) with 1 cm Cocopeat at top, T5 - Soil + Vermicompost + Vermiculite (1:1:1) with 2 cm Cocopeat at top, T6 - Soil + Vermicompost + Perlite (1:1:1), T7 - Soil + Vermicompost + Perlite (1:1:1) with 1 cm Cocopeat at top, T8 - Soil + Vermicompost + Perlite (1:1:1) with 2 cm Cocopeat at top, T9 - Soil + Vermicompost + Vermiculite + Perlite (1:1:1:1). Seeds of papaya cv. „Pusa Nanha" were procured from Akola in 10 g air-tight polythene packing. "Pusa Nanha"- is a gynodioecious variety of papaya with 100% productive plants with good fruit yield and quality having excellent taste and good flavour also.

The experimental media consisted of ten different combinations of soil, vermicompost, perlite and vermiculite with two different (1 cm and 2 cm) layer of cocopeat on the top of the polybags. A mixture of growing media was prepared and polythene bags of 10x15 cm size were filled with mixture as per treatments. Polythene bags holes were made for leakage for gases. Seeds (one in each polybag) were sown at approximately 10-15 mm deep in the different growing.

The polybags were immediately irrigated after sowing and repeated every day till the final emergence. After the completion of germination the bag were irrigated once in 2 days.

Growth parameters ware recorded at the time of transplanting. Observation on germination was recorded from the first germination, units no further germination, at two day interval. the rate of emergence was calculated according to Islam *et al*. (2009) [13] by using the following formula.

$$\text{Rate of emergence} = \frac{\text{No. of seedling emerged 5 days after sowing}}{\text{No. of seedling emerged 15 days after sowing}} \times 100$$

Germination percentage was calculated by number of germination seeds divided by the total number of seeds sown in poly bags and multiplied by 100.The germination period was calculated as the difference between initial and final emergence (no. of day) recorded.

$$\text{Germination percentage} = \frac{\text{Total number of seeds germinated}}{\text{Total number of seeds sown}} \times 100$$

The Germination percentage was calculated by dividing the total number of germinated seeds by the total number of seeds sown and multiplied by100.

$$\text{Germination Index} = \frac{\text{No. of germinated seed}}{\text{Date of first count15DAS}} + \frac{\text{No. of germinated seed}}{\text{Date of last count 25DAS}}$$

The germination index was calculated by the method as described by the Association of Official seed Analysis (AOSA, 1983).

$$\text{Seedling Vigour} = \frac{\text{Total number of healthy seedlings}}{\text{Total number of seedling}} \times 100$$

Seedling vigour was evaluated by dividing the total number of healthy seedlings by the total number of seedlings and multiplied by 100.

Results and Discussion

Effect of different growing media on imbibition period

The result of present investigation revealed that use of different growing media reduced the imbibition period (Table 1). The data showed that application of soil+ vermicompost +vermiculite with 1 and 2 cm cocopeat layer at top significantly reduced the imbibitions period. The finding

clearly indicated that combination of growing media played a significant role for inducing early germination in papaya seeds.

Growing medium T_5 (soil+vermicompost+vermiculite with 2 cm cocopeat layer at top) had the best water holding capacity, porosity and nutrients which would have enhanced the availability of water, aeration and nutrition during germination of seed. Reducing in duration of imbibition period with application (T5) might be due to fact that vermicompost, vermiculite and cocopeat not only provided plant nutrients but also improved the physical conditions of mixture in respect of granulation, friability and porosity which developed a balanced nutritional environment favorable to seed and plant system.

This was also evident from reduced period of imbibition that combined application of soil, vermicompost, vermiculite and cocopeat layer at top were more advantageous than all other combinations. Thus, the seedling grew well in a medium containing cocopeat, vermiculite and vermicompost and was suitable for propagation as reported by Awang *et al*. (2009) [4], Abirami *et al*. (2010) [2] and Bhardwaj (2013) [6]. Findings of all the authors proved that, because of cocopeat is high in nutrients, when it mixed with soil, vermicompost and vermiculite it provided a more balanced nutrition for improving early germination and plant establishment

Effect of different growing media on seed germination parameters-

Seed germination parameters of papaya (*Carica papaya* L) as affected by different growing media and use of cocopeat are presented in table 1.The treatment T_5 was to be the best and at par with T_4 with regard to germination behavior as these media have suitable physical properties and good water holding capacity that supports the germination of papaya seeds, might be due to fact that cocopeat when mixed with soil, vermicompost and vermiculite has good characteristics (Garcia and Deverede. 1994) [11]

Germination started at 9.13 days after sowing on (T5) soil+ vermicompost+ vermiculite with 2 cm cocopeat layer at top during experimentation and recorded maximum rate of emergence (278%), highest germination per cent (95), maximum germination index (3.85) and maximum seedling vigour (94.54%) and least time required for imbibition (9.13 days) for Papaya seedlings. The soil+ vermicompost (1:1) without cocopeat and vermiculite showed the least results in most cases.

The treatment T_5 allowed increased germination parameters from the beginning to the end of experiment as compared to other media combination. The reason for the best performance of vermicompost, vermiculite and cocopeat are high organic matter content which preserve soil humidity, increase nutrient content and improve soil structure. It also increase water absorption and maintained the cell turgidity, cell elongation and increased respiration at optimum level, leading to favourable seed sprouting. In addition to this, it increases the nutrient holding capacity of the medium, which ultimately improve the utilization capacity of the plant Joiner and Nell (1982) [15] found similar results in peat+ perlite mixture for aglaonema and dieffenbachia.

The mixing of soil, vermiculite, vermicompost and cocopeat affects the soil physics, chemistry and biology and make granules. Thus these granules may developed the soil aggregation and granulation. Soil aggregation improved permeability and airflow in the polybags and may decreased soil temperature due to high organic matter. Further, seed germination and root growth becomes easier to the particular depth and plant may absorb more water and nutrients (Jo, 1990) [14]. Similar results were also found by Bachman and Metger, (2008) and Bhardwaj, (2013) [6].

Table 1: Effect of seedling growing media on seedling growth of papaya

Treatments	Imbition Period (Day)	Rate of Emergence (%)	Germination %	Germination Index	Seedling vigour (%)
T_0	13.65	148.00	69.66	3.06	69.55
T_1	12.77	167.00	78.00	3.11	77.31
T_2	12.02	174.00	81.00	3.18	81.15
T_3	10.74	203.00	84.33	3.26	83.33
T_4	9.88	271.00	91.66	3.49	91.15
T_5	9.13	278.00	95	3.85	94.54
T_6	13.86	167.00	66.66	2.72	72.91
T_7	12.74	179.00	73	3.24	75.16
T_8	12.02	186.67	79.44	3.38	79.11
T_9	10.95	218.00	80.44	3.05	77.97
$SEm_{\pm}$	0.21	02.64	3.11	0.08	2.14
CD at 5%	0.45	07.81	6.67	0.23	4.59

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