IMPACT OF DIFFERENT GROWTH MEDIA ON GERMINATION AND GROWTH CHARACTERISTICS OF PAPAYA (*Carica papaya L.*) *cv.* Red Lady IN JALANDHAR DISTRICT OF PUNJAB

Abstract

The experiment was set up in Agriculture Research Farm Sant Baba Bhag Singh University, Jalandhar in the years 2021–2022, with coordinates of 31º25'37.8"N 75º48'34.8"E. This area is in the short, cold, and dry agroclimatic zone. Papaya seeds were sown on 24 September 2021 in polybags and transplanted to the field on 21 March 2022. During the papaya growing season, the mean daily temperatures varied between 28^0C to 35^0C, and the relative humidity 75 percent. The average USWB class per hour evaporation value ranged from 2.3 to 7.3 hrs mm. The experiment was conducted in Randomized Block Design with 6+1 (control) treatment replicated thrice. Vermicompost, cocopeat, FYM, perlite and poultry manure was used as treatments in different ratio. From the present investigation, it was found that treatment [T_4 : Soil + FYM (3:1)] was found best in the terms of the least time required for imbibition (4.8 days), germination percentage (32.33), seedling height (7.3 and 9cm), number of leaves (6.6 and 7.3), seedling vigour (31.54), number of roots (6.6 and 8.6), root length (6.6cm), survival percentage (32.54) and rate of seedling emergence (26.26).

Keywords: Growth, Media, Seedling, Cocopeat and Vermicompost and FYM.

Introduction

Papaya (Carica papaya L.) is an important tropical commercial fruit crop of India. It is native to the tropics of the Americas. It is 7th important fruit crop of the country after Mango, Citrus, Banana, Apple, Guava and Sapota. According to National Horticulture Board (2020-21), It occupies a cultivated area of 146 (000 ha) with an annual production of 5540 (000 MT/ha) in india (Anonymous, 2021). Papaya seed faces some problems in planting and has more seeds required due to damping off disease in the nursery. Planting failure and early death are the reasons for the reduced survival rate of papaya seedlings. The growth medium composition affects seed germination and seedling quality (Wilson et al, 2001). 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 and Cocopeat) is added 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). Cow urine contains about 1.21% N, 0.01% P_2O_5 and 1.35% K_2O (Subramaniyam, 2005) with micronutrients Fe, Mn, Zn and Cu (Yawalkar, 1996). Media is a substrate that provides the required elements and physical support to the growing plants. Propagation media used in raising horticultural plants in the nursery are mostly organic or inorganic in nature. Papaya is normally propagated by seed and it is interested by researchers due to the presence of gelatinous sarcotesta preventing

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germination. Perlite and vermiculite have been used from years to amend professional potting soils made from peat moss called "soilless" mixes or artificial soils. 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 (Talashilkar et al., 1999). The effect of media on seed germination and seedling growth has been workout by various workers (Srivastava et al., 1998 and Annapurna et al., 2007). However, no information is available on cow urine as organic seeds priming and its combination effect with media on germination and growth of the seedlings. Therefore, the present study was initiated to find out seed germination and seedling growth of papaya in GA3 and cow urine with different media filled in plug trays. Similarly, cocopeat is an agricultural by-product obtained after the extraction of fibre from the coconut husk (Abad et al., 2002). Cocopeat is considered as a growing medium component with acceptable pH, EC and other chemical attributes (Abad et al., 2002).

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Materials and Methods

Present investigation was conducted at Sidhu Farm, district of Hoshiarpur, during the year 2021– 2022. The experiment was laid out in a Completely Randomized Design (Factorial) with treatment combinations T_0: Garden Soil, T_1: Soil+ Poultry Manure (3:1), T_2: Soil + Neem Cake (3:1), T_3:(Soil + Vermicompost (3:1), T_4: Soil+ FYM (3:1), T_5: Sand + Cocopeat (3:1), T_6: Soil+ perlite (3:1) and replicated thrice were used. Fully mature and healthy fruits of papaya cv. Red lady 786 were collected. Different growing media viz., garden Soil, Vermicompost, Poultry manure, neem cake, FYM, cocopeat and Perlite were used in different proportion. Seeds are extracted and shade drying till completely dried. Black polythene bags of 10”× 15” size were filled with different mixture of growing media according to the treatments. Two seeds of the papaya were dibbled at about 1 to 2 cm depth in each polythene bag. Observations were recorded with respect to first germination from the date of sowing up to germination of the first seedling, germination percentage at 10 and 20 DAS by counting number of papaya seeds germinated out of total seed dibbled into the plug trays and its average was calculated, height of seedlings was measured by metric scale from the top of the shoot to the tip of root of the seedling, length of roots was measured by metric scale from the base of the shoot to tip of the roots, stem diameter was measured with the help of vernier caliper at 1cm above ground level, leaf area are measured with the help of leaf area meter, fresh weight of shoot was weighed on digital weighing balance and fresh weight of root was weighed on digital weighing balance at 30 and 45 days after sowing and its average value was calculated. Emergence rate was finding out in papaya seedlings according to a method proposed by Krishna N. Reddy in 2004. Emergence rate = No. of seedling emerged 5 days after sowing/No. of seedling 15 days after sowing×100. The growth ratio was estimated by multiplying the total number of seed sowed by 100 and dividing the total number of growing seed by the total number of seed sown. Germination % =Total number of seeds germinated/Total number of seeds sown×100. The total number of disease-free seedlings was divided by the total number of seedlings, and the result was multiplied by 100 to determine

the seedling vigour. Seedling Vigour = Total number of healthy seedlings /Total number of seedling×100. Five plants from each treatment were transplanted in the field to observe the germination of papaya seeds, and the percentage of plants that survived for up to 10 days after transplanting was calculated using the formulas as follows: Survival percentage = Total number of surviving seedlings/Total number of transplanted seedling×100. The data was analyzed by OPSTAT software. One way analysis of variance (ANOVA) procedures was used to compare the differences among the treatments. The differences were considered to be significant if $P < 0.05$.

Results and Discussion:

Effect of treatments on germination parameters:

The experimental results (Table 1 and Figure 1) reveal that varied growing conditions had a substantial impact on the ratio of papaya seeds that emerged. Treatment T_4 recorded the highest rate of emergence, which was far better than the rates for all other treatments except T_3. The T_0 therapy produced the lowest rate of emergence. According to the findings in table 1, the germination percentage of papaya was significantly influenced different conditions. The highest rate of germination was seen in T_4 which was greater than T_1, followed by T_2 &T_3, but statistically comparable with T_0. The maximum seedling vigour was obtained higher under treatment T_4, which was determined to be statistically at par with treatment T_3 but significantly greater than the other treatments. However, under treatment T_1, the lowest seedling vigour was observed. The treatment T_2 showed a lower in seedling vigour. The data in Table 1 show that the use of growth media considerably increased the survival percentage of papaya seedlings at 10 days after field transplantation. Treatment T_4 had the highest survival rate, whereas T_0 recorded the lowest. The T_4 treatment outperformed than T_1, T_3, and T_0.

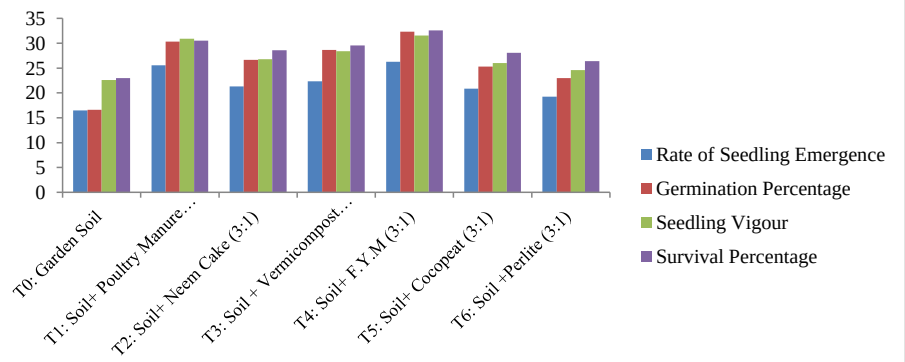

Figure 1: Effect of treatments on germination parameters of Papaya.

The treatment T_4 was found to be the best in comparison to T_3 with regard to germination behaviour because these media have suitable physical properties and good water logging capacity that support the seed germination of papaya seeds, possibly as a result of FYM. In this experiment, papaya seedlings had the best rate of emergence, highest germination

percentage, highest germination index, highest seedling vigour, and the shortest time needed for imbibing. In comparison to other medium combinations, the treatment T_4 permitted higher germination parameters from the start of the trial until the finish. High organic matter content, which maintains soil humidity, enhanced nutrient content, and improved soil structure are the reasons for FYM optimum performance. Additionally, it boosted water absorption and sustained ideal levels of cell elongation, turgidity, and respiration, which promoted favourable seed sprouting. Additionally, it increases the medium's capacity to store nutrients, which in turn enhances the plant's ability to use them. FYM is said to include bioactive elements that are thought to be advantageous for root development, and it has been believed that this will lead to greater root initiation, higher germination, larger biomass, enhanced growth and development, as well as balanced nutritional composition. Due of the high organic matter content, soil aggregation increases permeability and ventilation in the polybags and may lower soil temperature. Additionally, seed germination and root development are made simpler at that certain depth, allowing plants to absorb more water and nutrients (Bachman and Metger, 2008) and (Bharadwaj and well, 2014)

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Table 1: Effect of treatments on germination parameters of Papaya.

Treatments	Rate of Seedling Emergence	Germination Percentage	Seedling Vigour	Survival Percentage
T_0: Garden Soil	16.46	16.60	22.56	23.00
T_1: Soil+ Poultry Manure (3:1)	25.53	30.33	30.90	30.54
T_2: Soil+ Neem Cake (3:1)	21.33	26.66	26.76	28.60
T_3: Soil + Vermicompost (3:1)	22.33	28.66	28.40	29.54
T_4: Soil+ F.Y.M (3:1)	26.26	32.33	31.54	32.54
T_5: Soil+ Cocopeat (3:1)	20.82	25.30	26.02	28.04
T_6: Soil +Perlite (3:1)	19.24	23.00	24.61	26.40
C.D	0.595	0.716	0.013	1.001

Effect of treatments on Physical parameters:

The information in table 2 demonstrated that Growing media T_4 recorded noticeably increased seedling height at 30 and 45 DAS as compared to the rest of the treatment. Similarly, the number of leaves per plant was considerably impacted by various growing media. At 30 and 45 DAS, treatment T_4 recorded the most leaves per plant, while T_3 recorded the fewest. T_4 had more roots per plant than the other treatments, while still being on par with treatment T_3. However, the treatment T_0, or normal soil, was found fewest roots. Data in table

2 clearly showed that treatment T_4 at 45 DAS of papaya seedlings had much longer roots than the T_0 but at par with T_1 (Figure 2).

The data demonstrated that the use of various growing media had a substantial impact on the growth and development of papaya seedlings. With reference to seedling growth characteristics such maximum seedling height and number of leaves per plant, T_4 showed the greatest differences amongst the various treatments. Maximum root length and number per plant were recorded in T_4. Farmyard Manure, as previously mentioned, improves the physical, biological, and water-holding capacities of soil by providing necessary nutrients. Bhardwaj (2014) also reported a comparable outcome. Additionally, the combination of Soil+ FYM application significantly impacted the seedling growth parameters and plant biomass probably due to the synergistic combination of these factors improving the physicals conditions of the media and nutrient factors (Desai et al., 2017). These results finding by Bhardwaj (2014) and Abirami (2010) who suggested that since coir dust is low in nutrients when mixed with vermicompost, provide a better growth medium for papaya plant establishment. Because of the correct oxygenation of the seedling's root zone and the T_4 treatment's improved physical characteristics and nutrient level, this treatment combination was also useful in minimising the damping off disease in seedlings and eventually developed more successfully.

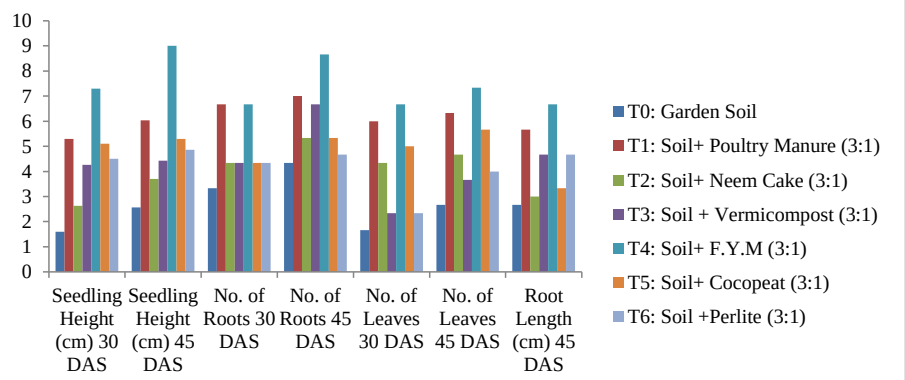

Figure 2: Effect of treatments on physical parameters of Papaya.

Table 2: Effect of treatments on physical parameters of Papaya.

Treatments	Seedling Height (cm) 30 DAS	Seedling Height (cm) 45 DAS	No. of Roots 30 DAS	No. of Roots 45 DAS	No. of Leaves 30 DAS	No. of Leaves 45 DAS	Root Length (cm) 45 DAS
T_0: Garden Soil	1.6	2.567	3.333	4.333	1.667	2.667	2.667
T_1: Soil+ Poultry Manure (3:1)	5.3	6.033	6.667	7	6.000	6.333	5.667

T_2: Soil+ Neem Cake (3:1)	2.633	3.7	4.333	5.333	4.333	4.667	3
T_3: Soil + Vermicompost (3:1)	4.267	4.433	4.333	6.667	2.333	3.667	4.667
T_4: Soil+ F.Y.M (3:1)	7.3	9	6.667	8.667	6.667	7.333	6.667
T_5: Soil+ Cocopeat (3:1)	5.1	5.3	4.333	5.333	5.000	5.667	3.333
T_6: Soil +Perlite (3:1)	4.5	4.867	4.333	4.667	2.333	4.000	4.667
C.D	0.702	1.042	1.503	1.415	2.243	2.266	1.199

Effect of different growing media on imbibition period

Seed germination parameters in papaya as affected by growth media mixture and use of Soil + FYM are presented in Table 3. Treatment T4 was found to be the best, followed by T5 as for germination parameters, as, these media had suitable physical properties and a good water holding capacity to supports papaya seed germination (Table 3 and Figure 3). Germination commenced at an average of 4.8 days after sowing. Using soil +FYM, which offers the plant nutrition environment and water holding capacity beneficial to seed and plant system, can shorten the imbibItion period. According to Awang et al. and Bharadwaj, the seedling thrived on a medium made of soil and FYM because it was the most ideal for Propagation. FYM has higher nutrient content than soil, so when it is mixed with soil, it provides a more balanced nutrition for promoting early germination and plant establishment.

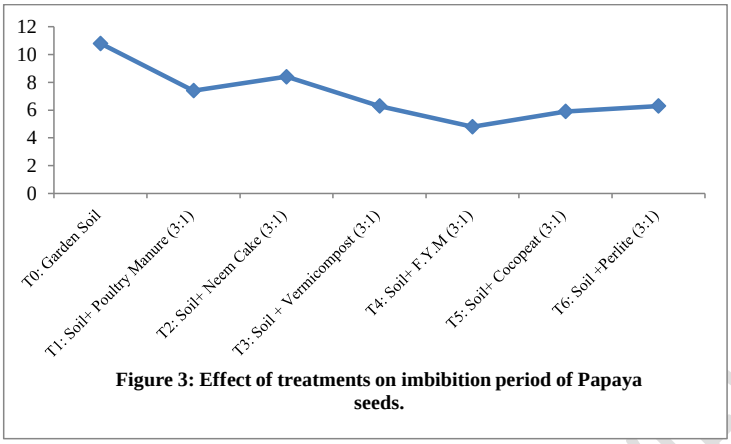

Figure 3: Effect of treatments on imbibition period of Papaya seeds.

Table 3: Effect of treatments on imbibition period of Papaya seeds.

Treatments	Imbibtion Period
T_0: Garden Soil	10.8
T_1: Soil+ Poultry Manure (3:1)	7.8
T_2: Soil+ Neem Cake (3:1)	8.4
T_3: Soil + Vermicompost (3:1)	6.3
T_4: Soil+ F.Y.M (3:1)	4.8
T_5: Soil+ Cocopeat (3:1)	5.9
T_6: Soil +Perlite (3:1)	6.3
C.D	1.10

CONCLUSION

The papaya fruits are widely consumed and marketable throughout the world. Keeping this view, the present study has been out to evaluate the impact of various growing media under agro climatic condition of Hoshiarpur. Different growing media were used. The effect of different growing media on seed germination and seedling growth of papaya has been observed. It has been observed that the maximum seed germination and seedling growth were found in T_4. Mixing of garden soil and FYM are the best medium than other growing medium. Tmaximum quality in number of leaves, length of root, germination percentage, survival percentage, seedling vigour, performance of growing media including soil + FYM better over other treatments in all the germination and growth parameters of papaya seedlings can be inferred from the experiment's results. On the basis of above given results we strongly recommend for this media for seedling and nursery preparation.

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