Original Research Article

Evaluation of Growing Media and Dormancy Breaking Chemical on the Seedling Growth of High Chill Peach

ABSTRACT

The present study entitled "Evaluation of Growing Media and Dormancy Breaking Chemical on the Seedling Growth of High Chill Peach" was conducted atDept. of Horticulture, College of Agriculture and Horticulture Research Centre, G.B.P.U.A & T, Pantnagar, Uttarakhand during the year 2022-23. The experiments were carried out in Factorial Complete Randomized Design (FCRD) with 3 replications per treatment. Under seedling growth studies, the total numbers of treatment were 16 with 2 factors comprising of four growing media (soil: sand: FYM, soil: sand: vermicompost, soil: sand: cocopeat and soil: FYM: vermicompost: cocopeat) and four chemical treatments (control, GA_3 @ 500 ppm, kinetin @ 50 ppm and thiourea @ 5000 ppm). In the experiment the maximum seedling length,shoot fresh weight, shoot dry weight, root length, root fresh weight and root dry weight was recorded in soil: FYM: vermicompost: cocopeat, GA_3 @ 500 ppm and interaction M_4C_3 (soil: FYM: vermicompost: cocopeat + GA_3 @ 500ppm) while the minimum values were recorded in soil: sand: cocopeat, control and M_3C_1.Result from this study discovered that GA_3 @ 500 ppm along with the growing media soil: FYM: vermicompost: cocopeat recorded the maximum seedling length, diameter, number of leaves, leaf area, shoot fresh weight and shoot dry weight which can be recommended for raising the rootstocks for the production of quality planting material of peach for seedling rootstock.

Keywords: growing media, vermicompost, kinetinand cocopeat

INTRODUCTION

Prunus persica(L.) Batsch, a member of the Rosaceae family, is the third most important fruit crop grown worldwide in temperate and subtropical regions, after apples and pears. These are extremely nutrient-dense fruits that are abundant in sugar, protein, vitamins and minerals. Peach cultivation is most successful in latitudes between 30˚ and 45˚. Cultivars are classified as high or low chilling according on the rate of chilling they require. For normal blooming and fruiting, high chill peaches typically require 500–1000 chilling hours below 7.2˚C. They are cultivated in the Himalayan regions of Uttarakhand, Jammu and Kashmir.

Many temperate fruit seeds are dormant when they are harvested, this means that even under ideal conditions, the embryo will not germinate, possibly because of a hard seed coat or the presence of growth inhibitors. Dormant seeds contain a lot of growth inhibitors, during stratification, their concentration, nature, or both are altered Lipe and Crane, 1966 and Diaz and Martin, 1972. Abad *et al*. 2002, Agbo and Omaliko, 2006 and Wilson *et al*., 2001 reported that ABA levels in embryonic axes declined during stratification and use ofgrowth regulators like GA_3, kinetin and thiourea decrease ABA levels, enhancing germination and seedling growth. GA_3 stimulates enzyme synthesis, weakening the endosperm and mobilizing enzyme reserves (Hota *et al*., 2018, Imani *et al*. 2011, Abou *et al*. 2021 and Parvin *et al*. 2015). Cytokinins aid in nutrient mobilization and plant growth (El-Badawy and El-Aal 2013). Thiourea breaks dormancy and enhances stress tolerance, gene expression and signaling processes, making it effective under environmental stress (Chang and Sung, 2000; El-Keblawy, 2013; Pallavi *et al*., 2022;Cetinbus and Koyuncu 2006 and Thakur and Singh 2015).

To produce high-quality nursery plants, a suitable growth medium must be used. It has an immediate impact on the germination, growth and maintenance of the large, well-functioning roots system. According to Abad *et al*. (2002), a robust growth medium would provide the plant with enough anchoring or support, serve as a reservoir for nutrients and water let oxygen reach the roots and provide gas exchange between the roots and the surrounding atmosphere. The medium composition affects the quality of the seedlings (Wilson *et al*., 2001). To improve seedling growth, media such as soil, cocopeat (Netam *et al*., 2020), vermicompost (Vandana 2019), FYM (Khot *et al*., 2022) and sand are employed.

This study aims to seedling growth attributes of high-chill peach, focusing on the effects of different growing media and growth regulators on promoting seedling growth.

MATERIALS AND METHODS

In 2022–2023, the experiment was carried out in the Department of Horticulture, College of Agriculture and Horticulture Research Centre, G.B.P.U.A & T, Pantnagar, Uttarakhand. Pantnagar is situated in the Himalayan Mountains at 29° North latitude and 79.3° East longitude. In summer, the temperature varies from 30 to 43°C, while in winter, it ranges from 0 to 9°C. Peach seeds gathered from KVK in Pithoragarh were employed as experimental material in these studies. In September 2022, when the peach was fully mature, the seeds were harvested and de-fleshed in preparation for stone extraction. The fruit stones were thoroughly cleaned with water after three to four days. The shade dried the pristine stones. The seeds were carefully removed by carefully breaking the stone (endocarp) from the ventral suture with a tiny hammer after they had dried for five to ten days in the shade.Along with use of media like Sand, soil, FYM, vermicompost and cocopeat were used as growing media in various proportions such as; Soil: sand: FYM (2:1:1), Soil: sand: cocopeat (2:1:1), Soil: sand: vermicompost (2:1:1) and Soil: cocopeat: vermicompost: FYM (2:1:1:1) were autoclaved under 15 psi pressure for 15 minutes followed by drenching in 0.2% Bavistin solution and filled in poly bags (Size 15 x 30 cm).

The following chemical solutions were made for research purposes in accordance with the protocol:

i. Gibberellic acid (GA_3 500 ppm): 500 mg of the chemical was dissolved in N/10 NaOH solution and the pH was adjusted to 7.0 using N/10 HCl. Distilled water was added to the mixture, increasing the final capacity to one liter.

ii. Kinetin (50 ppm): 50 mg of the chemical was dissolved in distilled water and the volume was increased to one liter using distilled water.

iii. Thiourea (5000 ppm): 5 g of the chemical was dissolved in distilled water and the amount was increased to 1 liter using distilled water.

In the experiment, focused on seedling growth studies, there were a total of 16 treatments involving two factors as well. The first factor was the growing medium, which included four combinations: soil: sand: farmyard manure (FYM), soil: sand: vermicompost, soil: sand: cocopeat and soil: FYM: vermicompost: cocopeat. The second factor was the chemical treatment, which remained consistent with the first experiment control, GA_3 at 500 ppm, kinetin at 50 ppm and thiourea at 5000 ppm.

List 1 :The treatments combinations were as follows

Sl. No.	Symbol Used	Treatments Combination	Growing Media withSeed Treatment
1.	T_1	M_1C_1	Soil: Sand: FYM + Control
2.	T_2	M_1C_2	Soil: Sand: FYM + GA_3 @ 500 ppm
3.	T_3	M_1C_3	Soil: Sand: FYM + Kinetin @ 50 ppm
4.	T_4	M_1C_4	Soil: Sand: FYM + Thiourea @ 5000 ppm

5.	T_5	M_2C_1	Soil: Sand: Vermicompost + Control
6.	T_6	M_2C_2	Soil: Sand: Vermicompost + GA_3 @ 500 ppm
7.	T_7	M_2C_3	Soil: Sand: Vermicompost + Kinetin @ 50 ppm
8.	T_8	M_2C_4	Soil: Sand: Vermicompost + Thiourea @ 5000 ppm
9.	T_9	M_3C_1	Soil: Sand: Cocopeat + Control
10.	T_{10}	M_3C_2	Soil: Sand: Cocopeat + GA_3 @ 500 ppm
11.	T_{11}	M_3C_3	Soil: Sand: Cocopeat + Kinetin @ 50 ppm
12.	T_{12}	M_3C_4	Soil: Sand: Cocopeat + Thiourea @ 5000 ppm
13.	T_{13}	M_4C_1	Soil: FYM: Vermicompost: Cocopeat + Control
14.	T_{14}	M_4C_2	Soil: FYM: Vermicompost: Cocopeat + GA_3 @ 500 ppm
15.	T_{15}	M_4C_3	Soil: FYM: Vermicompost: Cocopeat + Kinetin @ 50 ppm
16.	T_{16}	M_4C_4	Soil: FYM: Vermicompost: Cocopeat + Thiourea @ 5000 ppm

RESULTS AND DISCUSSION

It is also evident from the data presented in table 1 and 2 and graph 1 the effect of different growing media and seed treatment on seedling length and diameter was found to be significant.The maximum seedling length and diameter was reported inM_4 (81.81 cm and 7.6 mm),C_2 treated seeds was also help to enhance seedling length and diameter*i.e.*,94.92 cm, 9.2 mm and combination effectM_4C_2 was reported maximum seedling length was 98.70 cm but the diameter was found to be non-significant.While the minimum seedling length and diameterwere recorded under M_3(73.13 cm and 7.0 mm), C_1 (56.03 cm and 4.1 mm)and M_3C_1(49.18 cm), respectively.The combined use of cocopeat, vermicompost and FYM was more effective than individual because each have their own properties like; vermicompost improves physical properties and water holding capacity, while supplying adequate nutrients to the plants (Vandana, 2019). Similarly, FYM also contain organic matter, which binds soil particles and contain good source of soil nutrients, having a beneficial impact on plant growth (Khot *et al.*, 2022) and cocopeat having good porosity, water holding capacity and aeration which increases the photosynthetic activity of functional leaves and thus improves the girth of the seedlings (Mishra *et al.*, 2017 and Netam *et al.*, 2020). Shrivastava *et al.* (2021) concluded in papaya that suitable growing media i.e., soil: sand: FYM: vermicompost recorded the highest seedling length. Patel *et al.* (2019) also reported the significant increase in seedling length with the use of suitable growing media like soil: FYM: vermicompost. The results of our investigation from similar inspections were also reported by Haribhau*et al*. (2022) showing the positive impact of growing media, enhancing plant diameter rangpur lime seedlings.Similar perceptions are also proclaimed by gibberellic acidtreated seeds shows higher plant height as compare to control (untreated seeds) might be due to GA_3 seems to activate metabolic processes or neutralize the impact of a growth inhibitor by causing cell multiplication and elongation in the cambium tissue of the internodal region (Hota *et al*., 2018). Singh (2020) observed that it activated the amylase and protease enzymes, which helped to convert stored starch into simple sugars and transfer them to the developing embryo, where they provided energy for seedling growth. These findings are also in agreement with Imani *et al*. (2011), who observed maximum seedling length in peach with application of GA_3 500 ppm. Similar, observations were also reported by Abou *et al*. (2021) in bitter almond, Negi *et al*. (2017) in walnut and Parvin *et al*. (2015) in black walnut.The above findings are also in line with Wani *et al*. (2014) and Rai *et al*. (2018) reported the positive effect of GA_3 @ 500 ppmon increasing the seedling diameter of apple andKhirni respectively.

It is evident from the data presented in table 3 and 4 and graph 2 that there is significant effect of growing media and chemicals on number of leaves and leaf area. The maximum number of leaves and leaf area(198.92 and 6 cm^2 respectively,) were counted under the M_4whereas the GA_3 treated seeds was also found maximum leaves and leaf area were 240.25 and 6.47 cm^2 and treatment combination the maximum leaves was found in M_4C_2 (298) while the leaf area was found non-significant under interaction. While the minimum number of leaves and leaf area were recorded under M_3 (140.83 and 5.32 cm^2), C_1 (77.83 and 4.57 cm^2)and M_3C_1 (67.67), respectively. The physical and chemical properties ofsoil is improved by application of organic manure which may supply adequate nutrients to the plants and encouraged the vigorous vegetative growth i.e., more number of leaves per plant and alsoincreasing the leaf area is better availability of moisture and nutrients to the plants thereby increased plant growth (Nainar*et al*. 2021). Our present finding are in line with the earlier finding of Vandana (2019) who studied that media containing soil: sand: FYM: vermicompost produces maximum number of leaves per plant in mango cv. Totapuri. They also found the positive influence of growth promoters on increasing the number of leaves might be due to $GA_{3,}$ which enhance plant's physiological processes, thereby encouraging the rapid development of new leaves (Mishra *et al*., 2017). The increase in leaf area with GA_3 application may be because it promotes cell multiplication and cell elongation. These findings also support the result of Negi *et al*. (2017), Wani *et al*. (2014) and Sanaullah *et al*.

(2020) were observed that GA_3 to be most effective in increasing number of leaves in walnut, apple and rough lemon.

The critical inspection of the data on shoot fresh and dry weight of high chill peach seedlings as influenced by growing media (Table 5 and 6) and the highest shoot fresh and dry weight (21.65 g and 12.49 g) in M_4,GA_3 treatedseed found maximum (31.08 g and 18.16 g) and treatment combination M_4C_2 (36.90 g 22.07 g) while, the least was recorded in M_3(15.19 g and 8.76 g), C_1 (7.21 g and 3.61 g) and M_3C_1 (5.47 g and 2.90 g).They promote higher rate of water and nutrient mobilization leads to increased photosynthetic activity and translocation to various plant parts (Rameteke*et al*., 2015). Similarly, combination of vermicompost and FYM enhances the production of leaves and chlorophyll content, which could improve the photosynthetic rate and favours more production of fresh and dry weight of plant (Patel *et al*., 2019). These finding are in agreement with the prior finding of Nainar*et al*. (2021) Netam *et al*. (2020) in acid lime and pomegranate cultivar Super Bhagwa, reported the maximum fresh weight and dry weight of shoots with soil: sand: vermicompost. Anjanawe*et al.* (2013) also observed that soil: sand: FYM enhance shoot fresh weight and shoot dry weight in papaya. Similarly, Sanaullah *et al*. (2020) also found that GA_3 helps in enhancing absorption and redistribution of nutrients in plants which improves vegetative growth. These resuults also elucidate the finding of Rameteke*et al*. (2015) and Rai *et al*. (2018) who proved that application of GA_3 increases shoot fresh weight and dry weight in papaya cv. Coorg Honey Dew and *khirni*, respectively. Similarly, Singh (2020) observed the maximum fresh weight and dry weight of shoot under GA_3 in aonla.

CONCLUSION:

Thus, the finding in this experiment *i.e.,* seedling growth studies carried with the high chill peach, the seed treatment with GA_3 @ 500 ppm along with the growing media soil: FYM: vermicompost: cocopeat (2:1:1:1) recorded the maximum seedling length, diameter, number of leaves, leaf area, shoot fresh weight and shoot dry weightwhich can be recommended for raising the rootstocks for the production of quality planting material of peach on seedling rootstock.

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Table 1: Effect of growing media and seed treatment on seedling length (cm) of high chill peach at 150 days after seed germination

Sl.	Growing Media	Chemical

No		Control (C_1)	GA_3 (C_2)	Kinetin (C_3)	Thiourea (C_4)	Mean
1.	Soil: Sand: FYM (M_1)	54.06	93.95	73.20	84.80	76.50
2.	Soil: Sand: Vermicompost (M_2)	58.36	96.57	76.65	86.81	79.60
3.	Soil: Sand: Cocopeat (M_3)	49.18	90.47	70.36	82.50	73.13
4.	Soil: FYM: Vermicompost: Cocopeat (M_4)	62.53	98.70	78.59	87.43	81.81
	Mean	56.03	94.92	74.70	85.39	
		Media(M)	**Chemical (C)**	**Interaction (MxC)**		
C.D. (5%)		1.39	1.39	2.78		
S.Em±		0.48	0.48	0.96		

Table 2: Effect of growing media and seed treatment on diameter (mm) of high chill peach seedlings at 150 days after seed germination

Sl. No	Growing Media	Chemical				
		Control (C_1)	GA_3 (C_2)	Kinetin (C_3)	Thiourea (C_4)	Mean
1.	Soil: Sand: FYM (M_1)	4.0	9.0	7.5	8.2	7.2
2.	Soil: Sand: Vermicompost (M_2)	4.2	9.3	7.6	8.3	7.4
3.	Soil: Sand: Cocopeat (M_3)	3.9	8.9	7.4	8.0	7.0
4.	Soil: FYM: Vermicompost: Cocopeat (M_4)	4.3	9.6	7.8	8.5	7.6
	Mean	4.1	9.2	7.6	8.3	
		Media(M)	**Chemical (C)**	**Interaction (MxC)**		
C.D. (5%)		0.1	0.1	NS		
S.Em±		0.14	0.14	0.07		

Table 3: Effect of growing media and seed treatment on number of leaves per plant of high chill peach seedlings at 150 days after seed germination

Sl. No	Growing Media	Chemical				
		Control (C_1)	GA_3 (C_2)	Kinetin (C_3)	Thiourea (C_4)	Mean
1.	Soil: Sand: FYM (M_1)	67.67	222.67	123.33	192.33	151.50
2.	Soil: Sand: Vermicompost (M_2)	85.33	228.33	128.67	198.00	160.08
3.	Soil: Sand: Cocopeat (M_3)	55.00	212.00	119.00	177.33	140.83

4.	Soil: FYM: Vermicompost: Cocopeat (M_4)	103.33	298.00	142.00	252.33	198.92
	Mean	77.83	240.25	128.25	205.00	
		Media(M)		**Chemical (C)**		**Interaction (MxC)**
C.D. (5%)		1.85		1.85		3.70
S.Em±		0.90		0.90		1.81

Table 4: Effect of growing media and seed treatment on leaf area (cm^2) per leaf of high chill peach seedlings at 150 days after seed germination

Sl. No	**Growing Media**	**Chemical**				
		Control (C_1)	**GA_3 (C_2)**	**Kinetin (C_3)**	**Thiourea (C_4)**	**Mean**
1.	Soil: Sand: FYM (M_1)	4.39	6.45	5.50	6.00	5.58
2.	Soil: Sand: Vermicompost (M_2)	4.75	6.50	5.65	6.29	5.79
3.	Soil: Sand: Cocopeat (M_3)	4.03	6.23	5.27	5.73	5.32
4.	Soil: FYM: Vermicompost: Cocopeat (M_4)	5.12	6.68	5.76	6.46	6.00
	Mean	4.57	6.47	5.54	6.11	
		Media(M)		**Chemical (C)**		**Interaction (MxC)**
C.D. (5%)		0.39		0.39		NS
S.Em±		0.13		0.13		0.27

Table 5: Effect of growing media and seed treatment on shoot fresh weight (g) of high chill peach seedlings at 150 days after seed germination

Sl. No	**Growing Media**	**Chemical**				
		Control (C_1)	**GA_3 (C_2)**	**Kinetin (C_3)**	**Thiourea (C_4)**	**Mean**
1.	Soil: Sand: FYM (M_1)	7.10	29.87	12.05	22.10	17.78
2.	Soil: Sand: Vermicompost (M_2)	7.50	32.20	13.20	24.68	19.39
3.	Soil: Sand: Cocopeat (M_3)	5.47	25.33	9.95	20.04	15.19
4.	Soil: FYM: Vermicompost: Cocopeat	8.75	36.90	15.78	25.17	21.65

	(M_4)					
	Mean	7.21	31.08	12.74	23.00	
		Media(M)		**Chemical (C)**	**Interaction (MxC)**	
C.D. (5%)		1.24		1.24	2.48	
S.Em±		0.43		0.43	0.86	

Table 6: Effect of growing media and seed treatment on shoot dry weight (g) of high chill peach seedlings at 150 days after seed germination

Sl. No	**Growing Media**	**Chemical**				**Mean**
		Control (C_1)	**GA_3 (C_2)**	**Kinetin (C_3)**	**Thiourea (C_4)**	
1.	Soil: Sand: FYM (M_1)	3.23	16.81	6.32	12.87	9.81
2.	Soil: Sand: Vermicompost (M_2)	3.51	18.28	7.78	13.49	10.76
3.	Soil: Sand: Cocopeat (M_3)	2.90	15.48	5.00	11.64	8.76
4.	Soil: FYM: Vermicompost: Cocopeat (M_4)	4.82	22.07	8.10	14.98	12.49
	Mean	3.61	16.01	7.77	11.17	
		Media(M)		**Chemical (C)**	**Interaction (MxC)**	
C.D. (5%)		0.72		0.72	1.44	
S.Em±		0.25		0.25	0.50	

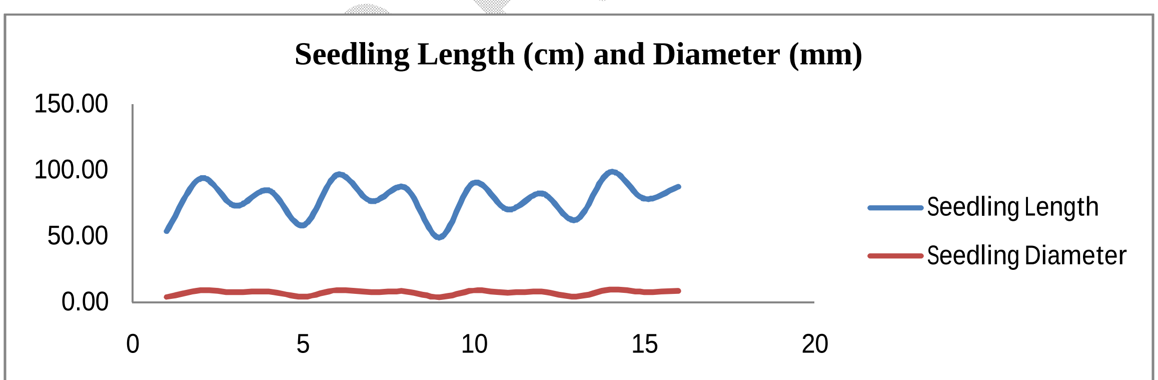

Fig 1: Effect of growing media and seed treatment on seedling length (cm)and seedling diameter (mm) of high chill peach

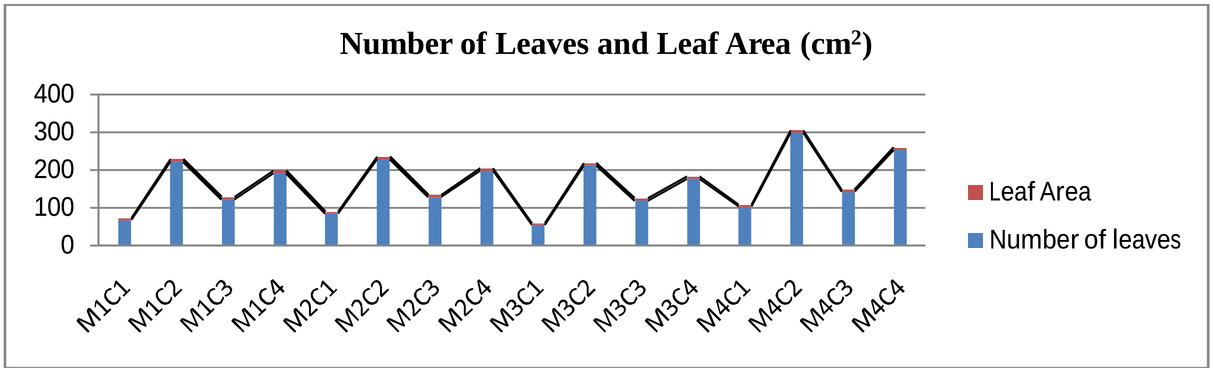

Fig 2: Effect of growing media and seed treatment on number of leaves and leaf area (cm^2) of highchill peach seedlings

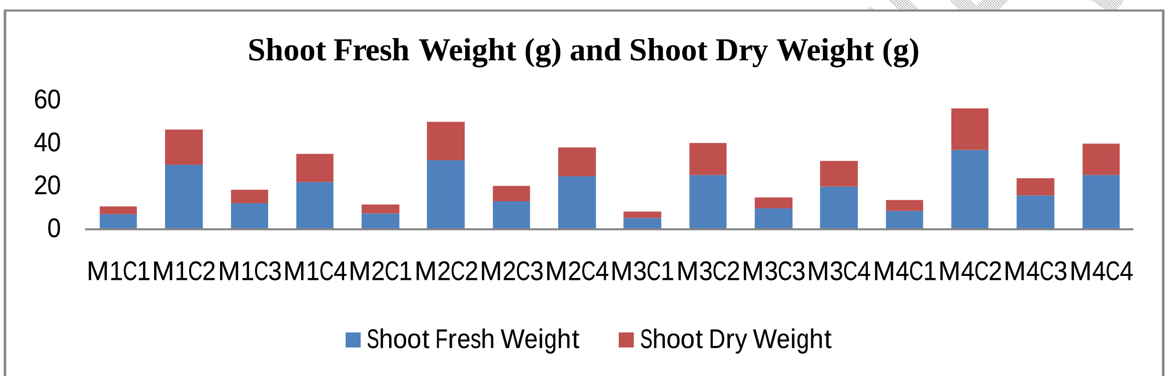

Fig 3: Effect of growing media and seed treatment on shoot fresh weight (g)and shoot dry weight (g) of high chill peach