Effect of different levels of cinder and vermicompost on germination and seedling growth of Papaya *(Carica papaya c.v* Red lady*)* its treatment with GA_3

Abstract

An experiment was conducted to find out suitable growth hormone and growing medium for germination and seedling growth of papaya. The treatments included soaking the seed of papaya variety Red lady in GA_3(200ppm) for 24.00 hours except for control. The perforated polythene bags of 4 x 5 cm size (150 gauges thickness) were used for sowing. The bags were filled with a mixture of Soil, Vermicompost, Cinder and Cocopeat in the ratio of 1:1:1, 1:2:1, 1:1:2 and 2:1:1. Experiment was laid out in Completely randomized design nine treatment with three replication. Findings indicate that treatment T_9 Soil +Cocopeat +Vermicompost +Cinder (1:1:1:1) +GA3 200ppm performed best in terms of growth parameters *viz.,* germination (77.37), days taken for completion of germination (15.27), seedling height (25.00 cm), number of leaves per seedling (13.53 cm), diameter of seedling (cm) (1.03), Leaf area (cm2) (97.64cm), Chlorophyll content (SPAD Value) (54.97), Length of longest tap root (4.52 cm) and Survival (%) (83.27) under Prayagraj agro-climatic condition.

Keywords: papaya, seedling growth, Different levels effect of cinder, tropical fruit

INTRODUCTION

The papaya is a tropical fruit belonging to the Caricaceae family that possesses both medicinal and nutritional qualities. a fast-growing, continuously fruiting tropical fruit crop that is evergreen. This tropical fruit, which is part of the Caricaceae family, is incredibly healthful, reviving, and tasty. The papaya, which is native to tropical America, is often referred to as pawpaw or papaw. Soil-based and organic-based growing media are the two main types available for use in container nurseries. In contrast to soil-based media that mostly consists of field soil, organic-based media—which is composed of organic materials mixed with inorganic ingredients—such as compost, peat, coconut coir, or other organic materials—promotes superior root development. For their growing media, nurseries in temperate regions have access to a large variety of commercial goods, such as premixed mixtures of peat moss, vermiculite, and perlite. However, most nurseries in tropical regions lack simple and economical access to these resources, and even nurseries in temperate regions are working to substitute more locally sourced and sustainably produced materials for some of these elements. Growers frequently make their own medium in the tropics using materials that are readily available nearby. **(Bharadwaj, 2014).** Gibberellic acid is essential to plants, particularly to fruit crops like papaya and grapes. Plant cell elongation and expansion, particularly in horticultural crops **(Bharadwaj, 2014).** One potential use for gibberellic acid is as a seed dormant breaker[13,14,15]. A highly powerful hormone called gibberellic acid is used to initiate fruit seed germination, particularly in papaya seeds. It is frequently utilized as a hormone

in the growing business to promote the development of larger bundles, particularly Thompson seedless grapes and papaya. **(Bharadwaj, 2014) and Mishra *et al.*, (2017).** Gibberellic acid (also known as Gibberellin A3, GA, and GA3) is a hormone that is present in both fungus and plants. Early in seed germination, GA3 seems to primarily stimulate the gluconeogenic enzymes' activity. Cow urine contains about 1.21% N2, 0.01% P2O5 and 1.35% K2O (Subramaniyam, 2005) with micronutrients Fe, Mn, Zn and Cu (Yawalkar, 1996). Media is a type of substrate that gives developing plants the necessary nutrients and structural support. Most of the propagation media used in nurseries to grow horticultural plants are either organic or inorganic. Typically grown from seeds, papayas pique the interest of scientists because they contain viscous sarcotesta that inhibits germination **Desai *et al.*, (2017).** Thus, the purpose of this study was to investigate the following objectives: to determine the effects of varying concentrations of cinder, vermicompost, and cocopeat on papaya seedling germination and growth, as well as to determine the culture costs of various treatments.

MATERIALS AND METHODS

The experiment was conducted at the Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences, Prayagraj, during the year 2023. The seed of papaya variety, Red Lady was purchased from the authentic sources in Prayagraj. The treatments included soaking the seed of papaya variety Red lady in GA_3(200ppm) for 24.00 hrs duration along with a control. Experiment was laid out
in Completely randomized design nine treatment with three replication. The treatment combination viz., T_0 Soil, T_1 Soil+Vermicompost +Cinder (1:1:1)+ GA_3 200ppm, T_2 Soil+Vermicompost +Cinder (1:2:1) + GA_3 200ppm, T_3 Soil+Vermicompost +Cinder (1:1:2) + GA_3 200ppm, T_4Soil+Vermicompost +Cinder (2:1:1) + GA_3 200ppm, T_5 Cocopeat+Vermicompost +Cinder (1:1:1) + GA_3 200ppm, T_6Cocopeat +Vermicompost +Cinder (1:2:1) + GA_3 200ppm, T_7Cocopeat +Vermicompost +Cinder (1:1:2) + GA_3 200ppm, and T_8 Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm and T_9Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA_3 200ppm. The polythene bags (4 x 5 cm 150 guage) were purchased from local market of Prayagraj. The perforated polythene bags of 4 x 5 cm size (150 gauges thickness) were used for sowing. The bags were filled with a mixture of Soil, Vermicompost, Cinder and Cocopeat in the ratio of 1:1:1, 1:2:1, 1:1:2 and 2:1:1. Before sowing the seeds in the polythene bags, soil were treated with fungicide, i.e. copper oxychloride @ 2%. Each polythene bag had two seeds put in it. Water cane was regularly irrigated softly in the morning and evening. At twenty-four hours, treated papaya seeds were planted in polythene bags that had been correctly filled, tagged, and arranged according to the plan. Papaya crops are typically irrigated every 8 to 10 days in the winter and every 4 to 5 days in the summer, depending on the soil and climate variations. Water-cane irrigation was used to keep the right moisture content in seedlings planted in polythene bags. The pre-sowing-dip technique was used to treat the seeds. Growth regulators in the appropriate concentrations were added in sufficient amounts to the designated beakers.

RESULTS AND DISCUSSION

The information is displayed in Table 1. It was evident that the application of varying concentrations of cinder and vermicompsot, along with seed treatment with GA3, had a noteworthy impact on papaya seed germination and seedling growth. When gibberellic acid is applied to the embryo, it stimulates the manufacture of hydrolyzing enzymes, which in turn promotes the growth of the embryo and increases germination. Similar finding were reported by **Bharche *et al.*, (2010), Babu *et al.*, (2010) in** papaya **and Mishra *et al.*, (2017).** It could be because the medium that include organic manures have organic acid in them. Consequently, higher germination percentages and minimum days to germination may have been aided by increased moisture availability and certain acids. Similar results were reported by **Prasana *et al.*, (2014)** in mango. Whereas, the maximum days taken for completion of germination (15.27) was recorded in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA_3 200ppm followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm, T_1 Soil+Vermicompost +Cinder (1:1:1)+ GA_3 200ppm and T_2 Soil+Vermicompost +Cinder (1:2:1) + GA_3 200ppm. However, T0 (Soil) reported the minimal number of days required for germination to be completed, which was 15.27. When gibberellic acid is applied to the embryo, it stimulates the manufacture of hydrolyzing enzymes, which in turn promotes the growth of the embryo and increases germination. Similar finding were reported by **Bharche *et al.*, (2010), Babu *et al.*, (2010) in** papaya **and Mishra *et al.*, (2017).** It could be because the medium that include organic manures have organic acid in them. Consequently, higher germination percentages and minimum days to germination may have been aided by increased moisture availability and certain acids. Similar results were reported by **Prasana *et al.*, (2014)** in mango. Whereas maximum seedling height was observed in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA_3 200ppm with 25.00 cm, followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm, T_3 Soil+Vermicompost +Cinder (1:1:2) + GA_3 200ppm, T_2 Soil+Vermicompost +Cinder (1:2:1) + GA_3 200ppm and T_1 Soil+Vermicompost +Cinder (1:1:1)+ GA_3 200ppm. While the minimum seedling height 18.77 cm respectively were observed in T_0 (Soil). The increased height observed in GA3 200 ppm seeds could be explained by the possibility that the papaya seedling's internal levels of GA3 synthesis were insufficient, and that the external application of GA3 increased cell multiplication and cell elongation, which improved plant growth **Mishra *et al.*, (2017).** Growing medium not only acts as a growing place but also as a source of nutrient for plant growth. Media composition used influences the quality of seedling **Wilson *et al.*, (2001).** Humic acids (vermicompost) applied in the medium increased plant height, leaf area and dry weight of peppers, tomatoes and marigold **Arancon *et al.*, (2004).** While as maximum Number of leaves per seedling was observed in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + $GA_3$200ppm with 13.53 cm, followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm, T_3 Soil+Vermicompost +Cinder (1:1:2) + GA_3 200ppm, T_2 Soil+Vermicompost +Cinder (1:2:1) + GA_3 200ppm and T_1 Soil+Vermicompost +Cinder (1:1:1)+ GA_3 200ppm. While the minimum Number of leaves per seedling 9.22 respectively were observed in T_0 (Soil). The explanation for the increase in leaves could be that GA3 stimulates the plant's physiological processes and chemicals' stimulatory effects to produce new leaves more quickly. Mishra & associates (2017). Growing media serves as a space for plants to grow as well as a supply of nutrients. The type of media utilized affects the seedling's quality, according to Wilson et al. (2001). When added to the medium, humic acids (vermicompost) improved the height, leaf area, and dry weight of tomatoes, peppers, and marigolds (Arancon et al., 2004). The maximum diameter of seedling

(cm) was observed in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA_3 200ppm with 1.03 cm, followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm, T_3 Soil+Vermicompost +Cinder (1:1:2) + GA_3 200ppm, T_2 Soil+Vermicompost +Cinder (1:2:1) + GA_3 200ppm and T_1 Soil+Vermicompost +Cinder (1:1:1)+ GA_3 200ppm. While the minimum diameter of seedling (cm) 0.50 respectively were observed in T_0 (Soil). The administration of GA3 may have caused the plant's diameter to expand because it increased the somatic absorption of nutrients, which led to cell elongation and a rise in plant height **(Faucht and Watson, 1958).** Similar, results were also recorded by **Dhankar and Singh (1996)** in aonla and **Bharche et al., (2010)** in papaya **Mishra *et al.*, (2017).** Growing media serves as a space for plants to grow as well as a supply of nutrients. The type of media utilized affects the seedling's quality **Wilson *et al.*, (2001).** When applied to the medium, humic acids (vermicompost) improved the height, leaf area, and dry weight of peppers, tomatoes, and marigold plants **Arancon *et al.*, (2004).** The maximum Leaf area (cm2) was observed in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA_3 200ppm with 97.64 cm, followed by Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm, Cocopeat +Vermicompost +Cinder (1:2:1) + GA_3 200ppm and Cocopeat +Vermicompost +Cinder (1:1:2) + GA_3 200ppm. While the minimum Leaf area (cm2) 56.51 respectively were observed in T_0 (Soil). The explanation for the increase in leaves could be that GA3 stimulates the plant's physiological processes and chemicals' stimulatory effects to produce new leaves more quickly. **Mishra *et al.*, (2017).** Growing media serves as a space for plants to grow as well as a supply of nutrients. The type of media utilized affects the seedling's quality **Wilson *et al.*, (2001).** When applied to the medium, humic acids (vermicompost) improved the height, leaf area, and dry weight of peppers, tomatoes, and marigold plants. Whereas, the maximum Chlorophyll content (SPAD Value) (54.97) was recorded in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA_3 200ppm followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) + GA_3 200ppm, T_4 Soil+Vermicompost +Cinder (2:1:1) + GA_3 200ppm and T_3 Soil+Vermicompost +Cinder (1:1:2) + GA_3 200ppm. While the minimum Chlorophyll content (SPAD Value) 44.71 respectively were recorded in T_0 (Soil). This appears to be the result of water and nutrients being mobilized and transported at a faster rate, which may have encouraged the synthesis of more photosynthetic products and moved them to different plant parts, potentially leading to improved seedling growth and an increase in fresh and dry weight. These results are consistent with the papaya research conducted by **Lay *et al.* (2015).** The different levels of GA3 did not affect significantly to increase chlorophyll content. Whereas, the maximum Length of longest tap root (cm) (6.50) was recorded in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) +GA3 200ppm followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) +GA3 200ppm, T_2 Soil+Vermicompost +Cinder (1:2:1) +GA3 200ppm and T_1 Soil+Vermicompost +Cinder (1:1:1)+GA3 200ppm. While the minimum Length of longest tap root (cm) 4.52 respectively were recorded in T_0 (Soil). This could be because GA3 promotes nutrient uptake by the somatic cells, which leads to cell elongation and an increase in the length and quantity of secondary roots in the tap root **Mishra *et al.*, (2017).** Whereas, the maximum Survival (%) (83.27) was recorded in T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) +GA3 200ppm followed by T_8 Cocopeat +Vermicompost +Cinder (2:1:1) +GA3 200ppm, T_8 Cocopeat +Vermicompost +Cinder (2:1:1) +GA3 200ppm, T_2 Soil+Vermicompost +Cinder (1:2:1) +GA3 200ppm and T_1 Soil+Vermicompost +Cinder (1:1:1)+GA3 200ppm. While the minimum Survival (%) 58.64 respectively were recorded in T_0 (Soil). This could be because

GA3 caused the seed coat to weaken, which allowed radicals and plumules to emerge and have a favorable impact on the initiation of roots and shoots. In addition to this, GA3 promotes cell elongation and expansion, which improves root and shoot growth and increases seedling survival **(Rahangdale, 2015).**

Table 1: Effect of different levels of cinder, vermicompost and GA_3 on germination and seedling growth of Papaya.

Treatments No.	Germination (%)	Days taken for completion of germination	Seedling height (cm)			Number of leaves per seedling			Diameter of seedling (cm)			Leaf area (cm2)		
			30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
T_0	47.05	22.94	6.71	12.18	18.77	4.03	6.08	9.22	0.15	0.27	0.50	15.33	28.77	56.51
T_1	74.08	16.40	9.88	16.34	22.84	6.13	9.19	12.39	0.26	0.53	0.97	36.33	46.45	81.77
T_2	75.72	16.63	9.31	16.80	22.73	6.38	9.49	12.52	0.28	0.53	0.79	32.67	48.54	82.47
T_3	68.00	17.52	9.95	15.69	21.67	6.07	8.75	12.28	0.24	0.50	0.77	31.38	51.56	85.00
T_4	58.00	18.23	7.67	13.77	19.81	4.96	7.49	10.71	0.18	0.35	0.57	28.39	51.79	85.43
T_5	54.51	19.51	8.01	13.84	19.83	5.24	7.33	10.73	0.18	0.33	0.57	28.53	52.15	80.07
T_6	51.33	19.21	7.45	14.00	20.36	5.18	7.19	10.53	0.17	0.32	0.54	33.97	54.08	83.44
T_7	61.17	17.89	9.65	15.54	21.76	5.18	8.20	11.87	0.23	0.45	0.62	31.64	51.15	83.82
T_8	71.38	16.41	9.91	17.10	22.04	6.39	9.77	13.15	0.31	0.56	1.00	33.53	55.74	96.82
T_9	77.37	15.27	10.66	17.74	25.00	6.58	9.87	13.53	0.33	0.60	1.03	35.05	59.17	97.64
F-Test	S	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
S.Ed.(±)	2.16	**0.65**	**0.21**	**0.61**	**0.60**	**0.14**	**0.19**	**0.27**	**0.01**	**0.01**	**0.03**	**0.80**	**1.79**	**1.43**
C.D. at 0.5%	4.54	**1.38**	**0.44**	**1.28**	**1.27**	**0.29**	**0.40**	**0.57**	**0.02**	**0.03**	**0.07**	**1.69**	**3.78**	**3.00**
CV	4.15	**4.49**	**2.92**	**4.89**	**3.45**	**3.06**	**2.80**	**2.84**	**6.97**	**4.47**	**5.69**	**3.22**	**4.41**	**2.10**

Table 2: Effect of different levels of cinder, vermicompost and GA_3 on germination and seedling growth of papaya.

Treatments No.	Chlorophyll content (SPAD Value)	Length of longest tap root (cm)	Survival (%)
T_0	44.71	4.52	58.64
T_1	48.02	5.49	80.69
T_2	48.44	5.38	86.15
T_3	50.62	5.26	75.64
T_4	51.65	5.16	66.30
T_5	47.67	5.48	61.19
T_6	47.63	5.51	59.54
T_7	49.87	6.14	71.60
T_8	53.85	6.16	82.36
T_9	54.97	6.50	83.27
F-Test	**S**	**S**	S
S.Ed.(±)	**0.80**	**0.19**	0.99
C.D. at 0.5%	**1.69**	**0.41**	2.09
CV	**1.98**	**4.32**	1.68

CONCLUSION

Based on the above finding, it is concluded that treatment T_9 Soil+Cocopeat +Vermicompost +Cinder (1:1:1:1) + GA3 200ppm performed best in terms of germination percentage (77.37%), days taken for completion of germination (15.27), and growth parameters were seedling height (25.00 cm), number of leaves per seedling (13.53), diameter of seedling (1.03cm), Leaf area (97.64cm^2), Chlorophyll content (SPAD Value) (54.97), Length of longest tap root (4.52cm) and Survival percentage (83.27%) under Prayagraj agro-climatic condition.

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