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EFFECT OF PLANT GROWTH REGULATORS AND GROWTH MEDIA ON SEED GERMINATION AND GROWTH VIGOUR OF PAPAYA

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ABSTRACT

An experiment was conducted during 2009-10 at College of Horticulture, Mandsaur (M.P.) to study the effect of plant growth regulators and growth media on seed germination and growth vigour of papaya (Carica papaya L.) seedling cv. Barwani red. Maximum seed germination (65.4%) was found under the application of 100ppm GA_3 along with FYM : soil: sand (1:1:1) (G_1M_3) followed by G_1M_1 and G_2M_3 treatments , while rest of parameters i.e completion of germination (23.75), first appearance of plumule(12.69), appearance of first true leaves(18.25), plant height(17.41cm), stem diameter(0.441cm), number of leaves per plant(10.42), average leaf area(41.28sq.cm), fresh weight of stem and leaves(13.45g), dry weight of stem and leaves(1.036g), number of primary roots per plant (8.83), number of lateral roots per primary root (76.32), length of the longest root(25.36cm), diameter of the thickest root(0.343cm),were found superior with application of 200ppm GA_3(G_2) followed byG_3 and G_4 treatments. The fresh weight and dry weight of papaya roots (2.88g and 0.353g respectively) were found significantly higher with the growth media of FYM : soil: sand (1:1:1) in combination of GA_3 200ppm(G_2M_3) and G_2M_1.

Keywords: Growth regulators, media, germination, growth, papaya

INTRODUCTION

Papaya (*Carica papaya* L.) is grown in all tropical and sub tropical countries. It belongs to the family Caricaceae .Papaya is the second rich in vitamin A after mango. Both ripe and raw fruits of papaya are used in the preparation of various products. Papaya fruits are used for the treatment of piles, dyspepsia of spleen and liver, digestive disorders, diphtheria and skin blemishes. Proper seed germination and seedling growth are most important considerations in successful seedling production under nursery technique of papaya cultivation. As the germination rate and seedling growth are affected by pre-sowing seed treatment of papaya with growth regulators and growth media, an experiment was carried out to identify a suitable treatment for getting better seed germination and seedling growth vigour.

MATERIALS AND METHODS

The experiment was conducted at the Horticultural farm, K.N.K. College of Horticulture, Mandsaur (M.P.). The poly bags experiment was laid out in factorial completely randomized design with three replications. The experiment comprised of twenty eight treatment combinations of three plant growth regulators, namely, Gibberellic acid (GA_3), Naphthalene acetic acid (NAA) and Benzyl adenine (BA) with two concentrations of each plant growth regulators were used i.e. GA_3 at 100ppm and 200ppm NAA at 50ppm and 100 PPM and BA at 50ppm and 100ppm and different growth media used in different ratio i.e. FYM.:soil (2:1), soil:sand (2:1) and FYM.:soil:sand (1:1:1) in control water soaking seeds were sown in polythene bags (6'x3'). The seeds of papaya cv. "Barwani red" were collected from the farmer of the Barwani district of Madhya Pradesh and sown in the prefilled poly bags. The required quantities of plant growth regulators were prepared through stock solution with their different concentrations. The seeds were soaked before sowing in the aqueous solution of every plant growth regulators of the desired concentrations for 6 hours in beaker. The seeds were dried for 10 minutes in shade after soaking. The dried seeds were immediately sown in the polythene bags. Seeds were slightly covered with thin layer of grass or straw. The polythene bags were watered by water cane.

RESULTS AND DISCUSSION

Growth regulators

The results (Table1) revealed that the maximum (60.4%) seed germination of papaya was obtained under G_1 (100ppm GA_3) followed by G_2 (200ppm GA_3), G_3 (50ppm NAA) and G_5 (50ppm BA).The promising effect of GA_3 on seed

germination might be due to its participation in the activity of alpha-amylase, which catalyzes the starch conversion into simple carbohydrates and chemical energy is liberated which is used in the activation of embryo. The results are in conformity with the findings of several workers, (Babu *et al*. 2010) in papaya. The observations noted on days required for the completion of germination, appearance of plumule and appearance of first true leaves were also found significantly higher under G_2 (200ppm GA_3) followed by G_1 (100ppm GA_3) and G_3(50ppm NAA). The endogenous Gibberellic acid synthesized by the seed embryo might not be sufficient and as such the external application might have boosted the growth by increasing cell multiplication and cell elongation, resulting in rapid plant growth. The rapid and early germination might have helped in producing vigorous growth of seedlings during subsequent period of growth. The results are in conformity with the finding of Zhao *et al.* (2004) in papaya and Maiti *et al.* (2003) in jackfruit. Similarly, plant height, diameter of the stem and primary roots per plant were also noticed significantly more with G_2 (200ppm GA_3) over the other treatments and control (Table 1). Maximum plant height in GA might have occurred due to cell division and cell elongation, which in turn would have increased the internodal length. The observations are in agreement with the findings of Deb *et al.* (2010) in papaya seeds. Number of leaves per plant was found significantly higher over the control and other treatments under G_2 (200 ppm GA_3). Increase in number of leaves might be due to that GA helps in invigoration of physiological process of plant and stimulatory effect of chemicals to form new leaves faster rate. The results are in conformity of Sen *et al.* (1990) in papaya seeds and Kalalbandi *et al.* (2003) in kagzi lime.

Table 1: Effect of plant growth regulators and growth media on seed germination and growth vigour of papaya seedling

	Seed germi-nation (%)	Days required for the completion of germination	Days required for the first appearance of plumule.	Days required for the appearance of first true leaves	Height of the plant (cm) at fifty days	Diameter of the stem (cm) at fifty days	Leaves per plant at fifty days	Avg. leaf area (sq.cm)	Fresh weight of stem and leaves (g)	Dry weight of stem and leaves (g)	Primary roots per plant.	Lateral roots per primary root.	Length of the longest root (cm)	Diameter of the thickest root (cm)	Fresh weight of the roots (g)	Dry weight of the roots (g).
Plant Growth Regulators																
Control (water soaking) (G_0)	39.29	27.75	16.64	22.75	10.01	0.264	6.32	24.59	7.79	0.66	3.29	31.85	15.02	0.205	0.44	0.121
100PPM GA3 (G_1)	60.46	25.75	13.48	18.50	17.29	0.422	10.25	38.33	13.41	1.028	8.75	76.21	24.92	0.338	1.88	0.271
00 PPM GA3 G_2)	50.39	23.75	12.69	18.25	17.41	0.441	10.42	41.28	13.45	1.036	8.83	76.32	25.36	0.343	2.43	0.324
50 PPM NAA (G_3)	49.83	26.25	14.10	18.75	15.18	0.350	9.10	33.68	10.47	1.01	8.22	62.10	21.86	0.292	1.28	0.210
100 PPM NAA (G_4)	46.27	26.75	14.98	19.25	14.70	0.349	8.31	29.78	10.39	0.95	8.17	61.09	21.51	0.272	0.89	0.142
50 PPM BA (G_5)	39.29	27.25	16.77	21.50	10.23	0.273	6.97	26.52	8.91	0.85	4.75	48.02	17.31	0.229	0.75	0.127
100 PPM BA (G_6)	39.29	28.50	17.02	22.75	10.11	0.264	6.31	26.63	7.02	0.68	4.15	34.37	15.68	0.210	0.53	0.118
S.Em+	1.34	0.46	0.39	0.55	0.17	0.005	0.06	0.34	0.13	0.01	0.02	0.33	0.13	0.007	0.03	0.005
C.D. at 5%level	3.81	1.32	1.13	1.58	0.48	0.015	0.19	0.96	0.39	0.04	0.06	0.94	0.38	0.02	0.09	0.01
Growth Media																
Control (soil) (M_0)	40.13	27.57	15.71	21.14	13.01	0.323	8.18	30.83	10.00	0.85	6.51	54.62	19.23	0.259	0.87	0.174
FYM: soil (2:1) (M_2)	49.25	26.14	14.86	19.85	13.74	0.336	8.21	31.73	10.30	0.9	6.62	55.9	20.53	0.274	1.28	0.192
Soil: sand (2: 1) (M_3)	43.56	27.00	15.32	20.85	13.52	0.33	8.18	31.29	10.13	0.88	6.58	55.17	20.15	0.265	1.05	0.179
FY M: soil: sand (1:1:1) (M_4)	52.71	25.57	14.50	19.14	13.98	0.343	8.38	32.32	10.39	0.92	6.66	57.16	21.04	0.281	1.48	0.205
S.Em+	1.01	0.35	0.39	0.42	0.13	0.004	0.05	0.25	0.10	0.01	0.01	0.25	0.10	0.005	0.02	0.003
C.D. at 5% level	2.88	0.99	0.85	1.19	0.37	0.01	0.14	0.73	0.29	0.03	0.05	0.71	0.28	0.015	0.07	0.01

The fresh weight and dry weight of stem and leaves were found significantly maximum under G_2 (200 ppm GA_3) in comparison to other treatments and as well as control. This seems to be the effect of

mobilization of water and nutrients transported at higher rate which might have promoted more production of photosynthetic product and translocated them to various plant parts which might have resulted in better growth of the seedlings and hence, more fresh and dry weight. The results are in conformity with the findings of Dhankhar and Singh (1996) in Aonla. It is revealed that (Table 1) stem diameter of papaya significantly increased under G_2 (200ppm GA_3) followed by G_1 and G_4. Increase in girth of stem may be possible due to stimulation of cambium and its immediate cell progeny, as observed. Dhankhar and Singh (1996) and Gholap *et al.* (2000) in Anola (*Phyllantus emblica* L.) and Deb *et al.* (2010) in papaya.

The observations noted on all the parameters were significantly influenced by different growth media but highest seed germination, shoot growth and root growth parameters were noted under M_3 (FYM: soil: sand: 1:1:1) over the other treatments and control (Table 1).The promising effect of M_3 on seed germination might be due to its appropriate cation exchange capacity for retention of nutrients and having the properties of good water holding capacity as well as sufficient porous, so that permitting adequate moisture and exchange of gasses between the germination growth media and the embryo. It is essential for rapid and uniform germination of seeds. Narayan *et al.* (2008) and Bihari *et al.* (2009) reported in Aonla (*Emblica officinalis* L.).

Growth media

Table 2: Interaction effect of plant growth regulators and growth media on seed germination, fresh and dry weight of roots of papaya seedling

Plant growth regulators	Growth media			
	Control (soil) (M_0)	FYM: soil (2:1) (M_1)	Soil: sand (2: 1) (M_2)	FYM: soil: sand (1:1:1) (M_3)
	Seed Germination (%)			
Control (G_0)	35.44	40.22	38.16	43.36
100PPM GA_3 (G_1)	52.00	63.56	60.85	65.44
200PPM GA_3(G_2)	40.11	57.36	42.88	61.24
50 PPM NAA(G_3)	46.28	50.22	48.44	54.38
100PPM NAA(G_4)	36.16	52.89	38.26	57.77
50 PPM BA(G_5)	35.55	40.22	38.16	43.36
100 PPM BA(G_6)	35.44	40.22	38.16	43.36
CD(P=0.05)	7.62			
	Fresh weight of roots (g)			
Control(G_0)	0.35	0.47	0.39	0.56
100PPM GA_3(G_1)	1.42	2.04	1.73	2.33
200PPM GA_3(G_2)	1.99	2.58	2.29	2.88
50 PPM NAA(G_3)	0.78	1.52	1.02	1.81
100PPM NAA(G_4)	0.48	1.04	0.75	1.32
50 PPM BA(G_5)	0.65	0.77	0.70	0.89
100 PPM BA(G_6)	0.48	0.56	0.50	0.61
CD(P=0.05)	0.19			
	Dry weight of roots (g)			
Control(G_0)	0.112	0.116	0.140	0.119
100PPM GA_3(G_1)	0.262	0.280	0.243	0.299
200PPM GA_3(G_2)	0.296	0.334	0.316	0.353
50 PPM NAA(G_3)	0.201	0.218	0.182	0.239
100PPM NAA(G_4)	0.115	0.153	0.134	0.169
50 PPM BA(G_5)	0.123	0.129	0.126	0.132
100 PPM BA(G_6)	0.114	0.120	0.117	0.124
CD(P=0.05)	0.02			

Interaction

Perusal of data (Table 2) revealed that the seed germination and fresh and dry weight of roots increased under the interaction of G_1M_3 (100ppm GA_3 x FYM: soil: sand: 1:1:1) and G_2M_3 (200ppm GA_3 X FYM: soil: sand 1:1:1) over the other

treatments and control. This may be due to the promising effect of GA on seed germination might be due to its participation in the activity of alpha-amylase, which catalyzes the starch conversion into simple carbohydrates and chemical energy is liberated which is used in the activation of embryo. Growth media, has appropriate cation exchange capacity for retention of nutrients and having the properties of good water holding capacity as well as sufficient porous, so that permitting adequate moisture and exchange of gasses between the germination growth media and the embryo. It is essential for rapid and uniform germination of seeds. The activities of GA are more effective with the growth media, i.e. FYM: soil: sand: 1:1:1 and vice versa.

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