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Effect of Paclobutrazol on Mango Seedling Quality

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ABSTRACT

Seeds from control trees produced only one main stem during germination and subsequent growth upto 60 days. However, mango seeds obtained from paclobutrazol (PBZ) treated trees produced more than 1 (2-5) shoots on each main stem. Multi-branching as a result of PBZ treatment was due to the death of apical shoot apices. Therefore, seedling deformed with increased number of primary and secondary branches.

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INTRODUCTION

Paclobutrazol is a triazole growth retardant not only regularized alternate bearing (Burondkar and Gunjate 1989; Kurian and Iyer, 1993) but it also affects on seedling quality. Paclobutrazol treated tree show reduced stem height, internodal length and leaf size with increased main stem thickness. Multibranching as a result of PBZ treatment was due to the death of apical shoot apices. The objective of these studies, therefore, was to determine the residue effect of PBZ in seed germination and seedling growth.

MATERIALS AND METHODS

The experiment was carried out during 1993-95 on 16-17 year old bearing mango tree of the cvs. Dasheri, Langra, Chausa and Fazri at H. R. C., Patherchatta of G.B.P. U.A. & T. Pantnagar, U.P. Paclobutrazol was applied on two different dates namely 15 September and 15 October 1993 and 1994 and 2.3 g PBZ per meter tree canopy radius in soil at the drip and mixed with 7 litre of water. One tree was taken under each treatment and each treatment was replicated thrice.

Seeds extracted from ripe fruits of each treatment were sown in seed bed soon after their extraction. Data on germinated seeds (stone) for their number of primary and secondary branches, number of dead or alive shoot-tips, height, internodal length, thickness of main stem, number and size of leaves on each seedling were recorded 60 days after seed sowing. The observations were subjected to statistical analysis by using Randomized Block Design.

RESULTS AND DISCUSSION

Data in Table 1 (ABC) show that out of 10 seeds sown in each treatment, 6-8 seeds germinated in all the cultivars in both the years

TABLE 1 (A)

Effects of time of paclobutrazol treatment on seed germination and seedling growth in mango.

Treatment	No. of germinated stones out of 10		% germination		No. of seedling having > 1 primary branches		% seedlings having > 1 prl. branches		No. of primary branches		No. of died main shoot tips		% of died main shoot tips	
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
Dashehari-Control	7.0	7.0	70.00 (56.99)	70.00 (56.99)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00
Dashehari-15 Sept.	8.66	8.33	86.66 (68.85)	83.33 (66.14)	4.00	5.00	49.46 (44.69)	68.51 (56.57)	5.33	4.66	2.33	2.33	45.71 (42.52)	58.88 (50.16)
Dashehari-15 Oct.	7.66	7.33	76.66 (61.21)	73.33 (59.00)	3.33	3.33	43.45 (41.21)	58.92 (50.14)	4.00	4.33	1.66	2.00	46.66 (43.07)	61.10 (51.48)
Langra-Control	5.66	5.66	56.66 (48.84)	56.66 (48.84)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Langra-15 Sept.	7.66	7.66	76.66 (61.21)	76.66 (61.71)	3.66	4.00	47.61 (43.62)	68.45 (56.37)	5.33	6.00	1.33	1.66	46.66 (43.07)	43.33 (41.75)
Langra-15 Oct.	6.66	6.66	66.66 (54.78)	66.66 (54.78)	2.66	3.33	39.67 (39.01)	61.10 (51.96)	4.00	4.33	2.00	1.66	67.21 (55.16)	61.10 (51.48)
Chausa-Control	6.66	6.33	66.66 (54.78)	63.33 (52.85)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chausa-15 Sept.	7.66	8.00	76.66 (61.21)	80.00 (63.92)	3.33	4.66	43.45 (41.21)	66.85 (54.88)	4.66	4.66	2.00	1.33	62.22 (52.08)	38.88 (38.50)
Chausa-15 Oct.	6.66	6.66	66.66 (54.78)	66.66 (54.78)	2.66	3.66	39.67 (39.01)	65.87 (54.70)	3.66	3.66	2.00	1.00	70.00 (56.92)	38.88 (38.50)
Fazri-Control	5.66	5.33	56.66 (48.84)	53.33 (46.92)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fazri-15 Sept.	7.33	7.33	73.33 (59.00)	73.33 (59.00)	2.33	4.33	31.54 (34.12)	72.61 (58.45)	5.33	5.66	1.66	1.00	50.00 (44.99)	44.44 (41.75)
Fazri-15 Oct.	6.66	6.33	66.66 (54.78)	63.33 (52.77)	2.00	4.00	30.15 (33.29)	63.48 (53.33)	4.66	4.33	2.66	1.00	67.21 (55.16)	50.00 (44.91)
Treatment	0.578	0.720	3.400	4.740	0.464	0.570	2.543	6.755	0.603	0.623	0.396	0.309	3.142	3.141
C.D. at 5% cultivar	0.668	NS	3.926	5.473	0.535	NS	2.937	NS	NS	NS	NS	0.357	3.628	3.628
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	6.285	6.283

TABLE 1(B)

Effects of time of paclobutrazol treatment on seedling growth in mango.

Treatment	Main stem height (cm)		Height of seedling (cm) Healthy		Height of seedling (cm) Deformed		Internode length of main stem (cm)		Internode length of seedling (cm) Healthy		Internode length of seedling (cm) Deformed		Thickness of main stem (cm)	
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
Dashehari-Control	30.70	30.43	35.65	36.00	0.00	0.00	4.76	4.43	5.76	5.76	0.00	0.00	5.23	5.23
Dashehari-15 Sept.	25.20	25.13	27.66	27.33	16.66	15.33	3.90	3.26	4.16	4.13	3.16	3.33	6.26	6.86
Dashehari-15 Oct.	29.86	27.10	30.66	30.66	20.00	19.33	4.10	3.80	4.66	4.76	3.50	3.26	5.33	5.40
Langra-Control	33.20	33.00	36.33	36.00	0.00	0.00	5.00	4.90	5.69	5.66	0.00	0.00	5.46	5.50
Langra-15 Sept.	24.36	24.06	27.33	28.00	17.00	15.66	3.83	3.13	4.23	4.33	3.50	3.26	6.36	6.46
Langra-15 Oct.	28.26	27.70	23.66	31.66	21.00	20.00	4.36	3.70	4.90	4.80	3.76	3.83	6.23	6.30
Chausa-Control	32.33	31.66	33.33	35.66	0.00	0.00	4.76	4.93	5.23	5.16	0.00	0.00	5.96	6.00
Chausa-15 Sept.	25.73	24.63	26.66	26.00	16.33	15.33	3.33	3.46	4.46	4.40	3.76	3.43	6.50	6.73
Chausa-15 Oct.	28.83	28.86	30.00	29.33	19.00	19.00	4.06	3.80	4.70	4.83	4.06	3.90	6.40	6.60
Fazri-Control	31.63	31.96	32.66	37.66	0.00	0.00	4.83	4.90	5.06	5.10	0.00	0.00	5.76	5.70
Fazri-15 Sept.	22.16	22.06	25.66	24.66	16.33	17.00	3.36	3.26	4.26	4.26	3.70	3.56	7.13	7.30
Fazri-15 Oct.	26.10	25.40	29.66	30.66	21.00	18.33	3.80	3.70	4.70	4.80	4.36	4.23	6.93	7.03
Treatment	1.181	1.720	1.140	1.545	1.006	1.464	0.270	0.239	0.114	0.161	0.147	0.150	0.278	0.266
C.D. at 5% cultivar	1.364	1.353	1.317	NS	NS	NS	NS	NS	0.132	NS	0.170	0.174	0.321	0.308
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	0.228	0.322	NS	NS	NS	0.533

TABLE 1 (C)

Effects of time paclobutrazol treatment on seedling growth in mango.

Treatment	Number of leaves		No. of leaves in seedlings: Healthy		Deformed		Length of leaves (cm)		Length of leaves in seedling (cm): healthy		deformed		Width of leaves (cm)		Width of leaves in seedling (cm)			
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
Dashehari-Control	20.33	21.00	18.00	18.00	0.00	0.00	19.66	19.66	23.66	24.00	0.00	0.00	7.23	7.20	8.33	8.33	0.00	0.00
Dashehari-15 Sept.	27.66	28.66	21.66	23.33	31.00	31.00	14.66	15.00	17.00	16.33	7.19	7.19	5.60	5.46	4.36	7.46	4.36	4.30
Dashehari-15 Oct.	24.00	25.00	20.66	22.33	29.00	30.33	17.33	16.66	21.33	21.00	7.33	7.46	6.90	6.23	8.13	7.76	4.63	4.80
Langra-Control	22.33	22.00	20.33	20.66	0.00	0.00	23.00	23.33	26.33	26.00	0.00	0.00	7.10	7.13	8.79	8.80	0.00	0.00
Langra-15 Sept.	28.33	28.66	23.66	24.66	31.33	32.66	12.66	11.66	19.66	19.00	7.76	7.63	5.56	5.53	7.79	7.76	4.60	4.43
Langra-15 Oct.	26.33	24.66	22.00	24.00	28.66	31.33	15.66	15.00	24.00	22.00	8.26	7.90	6.06	6.10	8.43	8.13	5.26	4.80
Chausa-Control	19.66	20.33	17.33	18.00	0.00	0.00	21.33	21.66	26.33	26.33	0.00	0.00	7.80	7.53	8.76	8.76	0.00	0.00
Chausa-15 Sept.	27.66	27.66	24.00	24.33	31.00	31.66	13.66	13.33	19.33	19.00	7.40	7.30	6.80	5.96	8.09	7.93	4.86	4.66
Chausa-15 Oct.	24.33	24.33	20.33	21.33	27.33	29.00	17.33	16.66	23.66	22.00	7.76	7.63	6.66	6.56	8.53	8.20	5.40	5.13
Fazri-Control	20.66	20.33	17.66	17.66	0.00	0.00	21.66	20.66	29.33	30.00	0.00	0.00	8.03	8.00	9.23	9.10	0.00	0.00
Fazri-15 Sept.	28.66	28.66	23.33	24.33	31.66	35.00	16.00	16.33	24.33	23.00	8.06	7.86	6.40	6.10	8.53	7.83	5.16	5.26
Dazro-15 Oct.	25.66	24.33	21.33	21.66	29.00	31.66	17.33	17.00	25.66	24.33	8.43	8.13	7.13	6.80	8.76	8.30	5.09	5.60
Treatment	1.740	1.666	0.839	1.385	1.411	1.487	1.258	1.812	1.33	1.398	0.124	0.560	0.340	0.328	0.135	0.177	0.195	0.175
C. D. at 5% cultivar	NS	NS	0.968	1.600	NS	1.718	NS	NS	1.537	1.614	0.143	0.180	0.392	0.378	0.156	0.204	0.225	0.202
Interaction	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

and parcentage of germination in cultivars was different. The time of PBZ application also affected germination. Seeds from control tree produced only one main stem during germination and subsequent growth whereas seeds obtained from PBZ treated trees produced more than 1 (2-5) shoot on each main stem. The effect of cultivars and time of application of PBZ affected branching of the main stem in 1994. However, in 1995 effect of cultivar was negligible and interaction between cultivars and time of application were non-significant in both the years. Similar was the result of PBZ on percentage of seeds having more than one branch on each main stem and as high as 50% seedling in 1994 and 73% seedling in 1995 possessed more than one secondary branches on each seedling. The number of primary branches on each main stem was also more than one and as high as 5.33 and 6.00 in 1994 and 1995, respectively. Multibranching as a result of PBZ treatment was due to death of 28-70% apical shoot apices in 1994 and 1995 respectively. The effect of time of PBZ application, cultivar and their interactions were significant in both the years. Therefore, seedling deformed with increased number primary and secondary branches which gave the appearance of malformation. Thus PBZ was capable of creating abnormal seedling having multibranching, restricted shoot growth, rusetting and smaller leaf size similar to that of malformation (Tripathi and Ram, 1994).

The height of seedling in different PBZ treatments varied depending upon the cultivar and date of application. Treatments of 15th September was most effective in reducing the height than 15 October. When data of healthy and deformed seedling under different treatment were analysed, cultivars effects were generally negligible and effects were similar in all the cultivars. However PBZ affected the height of healthy and deformed seedling significantly without any significant effect on cultivar and time of PBZ application suggesting major height reduction due to application of PBZ and similar effect of PBZ were seen on internodal length, thickless of seedling main stem and number of leaves on each seedling under different treatment. Paclobutrazol is also reported to reduce 11-80% tree height, 53-90% internodal length and 20-70% leaf area in mango (Kulkarni, 1988; Burondkar and Gunjate, 1989; Goguey, 1990; Khader, 1991; Kurian and Iyer, 1993).

Number of leaves in different PBZ treatments were increased but its length and width where reduced. Treatments of 15 September was most effective in increase the number of leaves with reduced leaf size than 15 October in both healthy and deformed seedling. Increase number of leaves were due to multibranching of seedling.

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