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ENZYME ACTIVITIES AS INFLUENCED BY CHEMICALS AND GROWTH REGULATORS IN MANGO CV. ALPHONSO

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ABSTRACT

A study was conducted to investigate the effect of soil drenching with paclobutrazol and foliar sprays of certain chemicals and growth regulators on the activities of certain enzymes viz., catalase, peroxidase, nitrate reductase (Nrase) and IAA oxidase on the yield of alphonso mango.The result revealed that the increase in the peroxidase and catalase activity has led to the increased chlorophyll metabolism thereby enhancing the yield in off seasons. The increase in Nrase had brought about better growth and development while the decrease in the IAA oxidase had led to high auxin content at the time of flowering resulting in high flowering and fruit set during off-years in alphonso mango.

KEY WORDS: Chemicals, Growth regulators, Enzyme activities, Yield, Alphonso mango.

Enzymes speed up the rate of reactions in plant system without affecting the equilibrium. In general, they participate in all metabolic reactions, enhancing and controlling the course of these processes. Application of chemicals and growth regulators significantly triggered the activities of enzymes. Application of paclobutrazol stimulated an overall increase in antioxidant enzyme activities in winter wheat (Kraus *et al.*, 1995). Hence the present study was conducted with certain chemicals and growth regulators on off-year alphonso mango to understand the role of these enzyme activities in manipulating certain physiological processes thereby bringing out yield during off-years.

MATERIALS AND METHODS

The present investigation was carried out in ten year old mango trees, located at the College Orchard, Tamil Nadu Agricultural University, Coimbatore. The experiment was laid out in a randomised block design with seven treatments replicated three times. The experiment was initiated during September 1995 (i.e.,) after the harvest of on-year bearing mangoes and when the tree had entered into off-year. A single soil drenching of paclobutrazol at 10ml/tree at the root zone was given during the second fortnight of September and simultaneously the foliar sprays of chemicals and growth regulators viz., KNO_3 (1 per cent), urea (1 per cent), ethrel (22 ppm), NAA (20ppm) and Mepiquat chloride (5000ppm) were given at monthly intervals commencing from September to January, 1996. The leaf samples were taken for evaluation at different stages namely Stage 1 (Before spray). Stage II (New flush formation), State III (Bud initiation). Stage IV (Flowering) and stage V (Fruiting). The catalase activity of the leaf was evaluated as per the method suggested by Gopalachari (1963). The peroxidase activity was determined by adopting the method of Nicholas *et al.*, (1976) while, IAA oxidase activity was estimated by the method of Parthasarathy *et al.* (1970).

RESULTS AND DISCUSSION

(i) Catalase and Peroxidase

Between the stage of sampling, the enzyme activities registered its peak value at the fourth stage with a gradual decline in the activity at the time of harvest. The mean catalase activity was favoured to a greater extent by the soil application of paclobutrazol (12.57 U moles H_2O_2) (Table 1) and peroxidase activity to the level of 2.94 µg g^{-1} hr^{-1}

Table 1. Effect of chemicals and growth regulators on catalase activity (moles H_2O_2 utilized 100 g^{-1} min^{-1})

Treatments	Stage I	Stage II	Stage III	Stage IV	Stage V	Mean
T_1 Paclobutrazol - 10 ml/tree	9.12	10.82	12.56	16.25	14.13	12.57
T_2 KNO_3 - 1%	6.17	7.10	9.89	10.55	10.07	8.75
T_3 Urea - 1%	5.23	6.62	8.03	9.95	9.03	7.77
T_4 Ethrel - 200 ppm	3.94	4.49	6.39	7.60	6.44	5.77
T_5 NAA - 20 ppm	5.41	5.62	7.23	8.80	6.90	6.79
T_6 Mepiquat chloride -5000 ppm	4.24	5.12	7.10	8.23	7.02	6.34
T_7 Control	1.10	2.20	4.06	5.31	4.19	3.37
Mean	5.03	6.00	7.89	9.53	8.25	7.34

	SED	CD (P=0.05)
T - Treatment	0.024	0.049**
S - Stage	0.021	0.041**
T x S	0.054	0.109**

(Table 2). The mean enzyme activities were very low in the untreated trees. They were of the view that paclobutrazol was able to cause an overall stimulation of antioxidant enzyme activities. Moreover, a highly significant positive association was established between catalse and peroxidase activity and yield of fruit. Since these enzymes were associated with chlorophyll metabolism, they

Table 2. Effect of chemicals and growth regulators on peroxidase activity (g^{-1} hr^{-1})

Treatments	Stage I	Stage II	Stage III	Stage IV	Stage V	Mean
T_1 Paclobutrazol -10 ml/tree	1.94	2.32	2.52	4.76	3.17	2.94
T_2 KNO_3 - 1%	1.52	2.00	2.03	4.46	2.91	2.58
T_3 Urea - 1%	1.29	1.85	1.97	4.30	2.50	2.38
T_4 Ethrel - 200 ppm	1.78	1.93	2.33	4.65	3.04	2.75
T_5 NAA - 20 ppm	1.64	1.71	2.25	4.58	2.98	2.63
T_6 Mepiquat chloride -5000 ppm	1.52	1.63	2.02	4.32	2.85	2.47
T_7 Control	1.25	1.19	1.33	2.33	1.71	1.56
Mean	1.56	1.81	2.06	4.20	2.74	2.47

	SED	CD (P=0.05)
T	0.015	0.030**
S	0.013	0.025**
T x S	0.034	0.067**

Table 3. Effect of chemicals and growth regulators on IAA oxidase activity (g IAA oxidised g^{-1} hr^{-1})

Treatments	Stage I	Stage II	Stage III	Stage IV	Stage V	Mean
T_1 Paclobutrazol -10 ml/tree	537.90	425.93	301.67	263.53	304.33	366.67
T_2 KNO_3 - 1%	754.63	564.27	358.60	298.17	349.93	465.12
T_3 Urea - 1%	776.10	652.83	386.80	361.70	385.50	512.59
T_4 Ethrel - 200 ppm	642.10	664.97	349.70	346.37	360.27	472.68
T_5 NAA - 20 ppm	586.30	476.10	322.57	269.37	379.23	406.71
T_6 Mepiquat chloride -5000 ppm	715.13	719.03	386.97	375.50	424.87	524.30
T_7 Control	901.30	821.63	426.07	421.97	425.20	599.23
Mean	701.92	617.82	617.82	333.80	375.62	478.19

	SEd	CD (P=0.05)
T	4.348	8.676**
S	3.675	7.333**
T x S	9.722	19.400**

were able to bring about high photosynthesis thereby affecting the yield positively.

(ii) Nrase activity

The nitrate reductase activity varied significantly between the treatments and stages of sampling. A significant increase was evident due to the foliar application of 1 per cent urea (1.35Ug NO_2 g^{-1} hr^{-1}) and least activity was recorded in the control trees. However, all the foliar sprays triggered the enzyme activity. It also exhibited a significant association with yield of fruits. The increase in the enzymes activity has led to the growth and development of the crop thereby remaining as a crucial factor to bring about yield of off-years.

(iii) IAA oxidase

A high decline in the enzyme activity was observed in the treatment of soil application of paclobutrazol (366.67 µg IAA oxidised g^{-1} hr^{-1}) in control, the enzymes activity was maximum (599.23µg IAA oxidised g^{-1} hr^{-1}) (Table 3) A high significant negative association was established between the IAA oxidase activity and yield of fruits.

The data indicated that the enzyme activity was significantly reduced as the growth of the crop advanced.At the time of flowering, the enzymes activity was decreased and the available auxin content was accelerated to an optium level for flowering process.

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