

Effect of Ethrel on Ripening of Mango

BY

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ABSTRACT

Fruits of Baneshan, KO 8 and Mulgoa were exposed to ethylene gas released by Ethrel (2-chloroethyl phosphonic acid) with Na OH pellets to hasten ripening. Ethrel at 10,000 ppm hastened the ripening of Baneshan fruits in 48 hours, in 60 hours in KO 8 at 2500-10000 ppm as against 108 hours under normal conditions. For ripening Mulgoa, 60 hours at 5000 and 10000 ppm was required as against 120 hours in control. Due to increase in carotenoids, the pulp and skin colouration was markedly improved at ripening. There was reduction in phenolics, pectin, sugars and ascorbic acid. Invariably the skin had more ascorbic acid than the pulp.

INTRODUCTION

Under tropical conditions, mango fruits normally ripe within five to six days after picking. They are generally ripened by keeping them in alternate layers of straw or gunny. Recently Ethrel has been successfully employed to hasten the ripening of pears, apples (Edgerton and Blanpied, 1968), cherries (Anderson, 1969), banana, persimmon and sapota (Madhava Rao *et al.*, 1972). Studies employing Ethrel to hasten ripening in mango has not been fully attempted and hence this study.

MATERIALS AND METHODS

Uniformly matured mango fruits of Baneshan, KO 8 and Mulgoa harvested at 'C' stage of maturity (Srivastava, 1967) from the orchard of the Department of Horticulture were utilised for the study. There were ten fruits in each

treatment. Fruits were kept in cylindrical chambers with 54 cm height and 52 cm diameter. Aqueous preparations of Ethrel at 2500, 5000, and 10000 ppm were made. A beaker containing 200 ml of aqueous solution of Ethrel at each concentration was kept inside each chamber. Five grams of Sodium hydroxide pellets were added to each concentration just before closing the chamber. For comparison, fruits were kept in gunny bags. In another lot, fruits without any treatment served as control. The experiment was carried out at a room temperature of 25°C.

Time taken for complete ripening, texture and colour of fruits were recorded on complete ripening of fruits. Loss of weight of fruits from harvest to ripening was recorded and expressed as per cent. Moisture, titrable acidity, reducing sugars and non-reducing sugars were determined using standard methods

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of AOAC (1960). The percentage of soluble solids was determined by hand refractometer. Total carotenoids were determined calorimetrically by the method of Snell and Snell (1937). The ascorbic acid was estimated by titration method using 2, 6-dichlorophenol indo-phenol following the procedures of Freed (1966). The pectin was estimated as calcium pectate and expressed as per cent as suggested by Ruck (1963).

Phenolics were estimated and expressed in terms of catechol equivalents as per the method of Bray and Thorpe (1952).

RESULTS AND DISCUSSION

Ethrel treatments completed the ripening of the three mango varieties in 48-60 hours as against 96 to 120 hours in the control and gunny wrapped fruits (Table 1). Ethrel at 10,000 ppm accelerated the ripening of fruits of Beneshan in 48 hours as against 108 hours in the

TABLE-1. Effect of Ethrel on ripening, colour and loss in weight of mango fruits

Variety	Concentration in ppm.	Time taken for ripening (Hrs)	% loss in weight	Moisture per cent	Colour of the skin on complete ripening	Total carotenoids in pulp mg/100g
BANESHAN	2500	60	4.43	85.22	Yellow	4642
	5000	60	2.66	86.12	Golden Yellow	4968
	10000	48	3.79	87.04	Golden Yellow	5244
	Gunny	96	12.70	84.64	Light Yellow with green background	4281
	Control	108	16.95	84.72	-do-	4264
KO 8	2500	60	6.31	87.14	Yellow	3248
	5000	60	2.62	87.68	Yellow	3564
	10000	60	2.41	87.94	Yellow	3896
	Gunny	108	7.68	85.94	Light Yellow	2864
	Control	108	10.12	84.11	Greenish Yellow	2831
MULGOA	2500	Not tried	—	—	—	—
	5000	60	4.05	87.18	Light Yellow	2641
	10000	60	2.54	87.92	Light Yellow	2984
	Gunny	108	14.42	85.14	Green with light Yellow patches	2448
	Control	120	17.39	84.02	Green with light Yellow patches	2472

control, whereas in KO 8 and Mulgoa it caused complete ripening in 60 hours while it was 108 and 120 hours in the control. The early ripening is due to the release of ethylene from Ethrel as observed in other fruits by Warner and Leopold (1969) Madhava Rao *et al.*, (1971) and Shanmugavelu *et al.*, (1971) and in mango by Kar and Banerjee (1939) and Burg and Burg (1962).

The loss in weight of fruits after complete ripening was comparatively more in the control and gunny wrapped fruits than the treated ones, while with Ethrel treatments the loss decreased with increase in concentration. The moisture content was more in the Ethrel treated fruits than the respective control. Loss in weight of Ethrel treated fruits was less, due to quick ripening thus averting loss due to transpiration

TABLE 2. Effect of ethrel on the chemical composition of certain varieties of mango (pulp)

Variety	Concentration in ppm	TSS %	Total sugars %	Reducing sugars %	Non-reducing sugars %	Acidity	Ascorbic acid mg/100 g.	Pectin/calcium pectate %	Total phenolics mg/100 g.
BANESHAN	2500	16.6	15.42	5.94	9.48	0.28	12.42	2.31	24
	5000	17.2	14.08	5.94	8.14	0.26	11.31	2.10	24
	10000	16.4	15.14	5.60	9.54	0.26	11.43	1.94	22
	Gunny	20.6	15.44	5.21	10.23	0.34	18.42	3.42	36
	Control	20.4	15.53	5.10	10.43	0.38	18.58	3.46	36
KO 8	2500	18.8	15.85	6.77	9.08	0.34	10.22	2.84	24
	5000	17.2	15.43	6.01	9.42	0.39	10.04	2.64	18
	10000	17.4	14.92	6.46	8.46	0.43	9.62	2.14	15
	Gunny	19.4	15.36	5.88	9.48	0.32	14.14	4.16	26
	Control	19.6	15.21	5.69	9.52	0.34	14.69	4.24	28
MULGOA	2500	Not tried	—	—	—	—	—	—	—
	5000	20.8	14.48	4.80	9.68	0.46	10.18	2.21	28
	10000	21.4	14.41	4.98	9.43	0.39	9.43	1.04	21
	Gunny	22.0	17.56	5.88	11.68	0.38	15.48	2.94	38
	Control	22.6	17.78	6.07	11.71	0.36	16.51	3.08	36

There was a gradual loss in weight of the mango fruits due to increase in the length of storage period as reported by Mukerjee (1971).

The most characteristic changes noticed during ripening due to treatment was the change in colour development. Ethrel treated fruits turned yellow to golden yellow due to high carotenoids while it was greenish yellow or yellow with green background or a mixture of green and yellow in case of controls. Further the increase in the carotenoid corresponds with the increase in concentration. In both the pulp and the skin, the carotenoid content was more in the treated fruits (Tables 1 and 3). The colour changes as noted in the studies are the most characteristic symptoms of fruit ripening and are due to the reduction in chlorophylls and also due to enhanced synthesis of carotenoids (Ulrich, 1958).

Pectin content was reduced both in pulp and peel the maximum reduction being at 10,000 ppm, thus causing the quick softening of the Ethrel treated

fruits. Phenolics in pulp and peel were comparatively low in treated fruits resulting in the considerable reduction in astringency and the maximum reduction being in 10,000 ppm and generally the phenolics reduced with increase in concentration (Table - 2). Similar reduction in pectin and total phenolics as a result of Ethrel treatments have been reported in sapota by Shanmugavelu *et al.*, (1971) and in persimmon by Srinivasan *et al.*, (1973).

Soluble solids of treated fruits was less than the control and gunny covered fruits. Maximum TSS content was found in Mulgoa fruits in the treated and the controls. Both pulp and skin of the treated fruits had less sugar content. Except Mulgoa, Ethrel caused increase in the reducing sugars in other varieties. Acidity in the treated Baneshan variety was less while it was more in KO8 and Mulgoa thus exhibiting varietal variations. Further it was of interest to note that the acidity was more in the skin of the treated fruits than the control.

TABLE 3. Effect of Ethrel on the chemical composition of the skin of certain varieties of mango.

Variety	Total sugars %	Concentration in ppm	Reducing sugars %	Non-reducing sugars %	Acidity %	Ascorbic acid mg/100 g.	Total carotenoids mg/100g.	Pectin (Cal. pectate %)	Total Phenolics mg/100 g	% of moisture.
BANESHAN	10000	7.54	3.42	4.12	1.12	19.46	853	4.39	42	62.49
	Control	9.02	3.86	5.16	0.98	26.14	642	7.48	58	60.58
KO 8	10000	8.42	3.94	4.48	1.14	19.18	988	5.74	52	63.41
	Control	10.01	4.28	5.81	0.86	23.15	743	8.49	64	58.59
MULGOA	10000	9.53	3.92	5.61	1.26	10.43	438	4.93	55	59.61
	Control	9.62	3.81	5.81	0.96	17.51	345	8.56	67	54.31

Ethrel caused a remarkable reduction in ascorbic acid both in pulp and skin. In general, the ascorbic acid content was in the pulp than in the skin. The Ethrel treatments showed a downward trend with the increase in the concentration and such a trend was also noticed in the case of sapota (Shanmugavelu *et al.*, 1971).

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