



EFFECT OF SWELL (CPPU) ON FRUIT RETENTION, FRUIT QUALITY AND YIELD OF “ALPHONSO” MANGO

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Abstract

The present investigation was carried out during 2012-13 to 2013-14 seasons on “Alphonso” mango trees (*Mangifera indica* L.). To improve yield and fruit quality the trial was conducted at Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist-Ratnagiri, Maharashtra, India on effect of Swell (CPPU) on fruit retention, fruit quality and yield of “Alphonso” mango, in a three location university orchard at Konkan region. Swell (CPPU) was sprayed @ (1, 2, 3 and 4 ppm) at peanut and marble stage and water as control. The obtained results significantly indicated the superiority of 3 and 4 ppm Swell (CPPU) foliar application at fruit set on the testes parameters. The effects of Swell (CPPU) on the fruit biochemical characteristics such as total soluble solids, titratable acids and sugar contents were not significant.

Key words : Mango, yield, swell, ripening behavior, PLW, fruit quality.

Introduction

Mango (*Mangifera indica* L.), the choicest tropical fruits of the world and is rightly designated as “King” of all fruits. Due to its wide adaptability, high nutritive value, richness in variety, delicious taste, pleasant flavour, attractive appearance, it enjoys the unique popularity among the masses and classes (Anon., 1998). It is especially valuable as a fresh fruit for international markets, processing and for export. India enjoys a monopoly in it's trade being the biggest mango producing country in the world. Mango occupies an important socio-economic position within the religion and culture of India and South East Asian countries, where it is held with high esteem (Singh, 1978 and Sukonthasing *et al.*, 1991).

Mango is a cross pollinated crop, the fruit set in mango occurs toward the end of the winter season, when the condition for cross pollination are favourable. According to one view, the failure of fruit set due to adverse climatic condition might lead to an increase of hermaphrodite flowers, from which fruits grow parthenocarpically up to marble size. However, fruit retention is very intriguing, as it may be affected by the nutrient status of the plant, hormonal regulation, carbohydrate deficiency, water retentions and weather conditions.

Abscission of premature fruits in mango is a natural mechanism (Lam *et al.*, 1985; Singh, 1960), which is particularly high (90% fruit shedding) during the first 3 to 4 weeks after pollination (Nunez-Elisea and Davenport, 1986; Singh, 1960). Fruit drop might be caused by several factors, such as nutrient deficiency, disturbances in embryogenesis and/or embryo abortion, sink competition between fruits and abiotic and biotic stressors (Chadha, 1993).

In spite of profuse flowering and very high fruit set, the ultimate retention and marketable produce of mango is phenomenally low primarily due to heavy fruit drop. Three distinct phases of fruit drop in mango are pin head drop, post setting drop and May drop (Chadha and Singh, 1964). Fruit drop can be significantly controlled by the plant growth regulators (Anila and Radha, 2003). Keeping these views in mind the present investigation was carried out to study entitled, “Effect of swell (CPPU) on fruit retention, fruit quality and yield of Alphonso mango” was undertaken with the objectives :

- To study the effect Swell (CPPU) on fruit retention and yield of mango cv. Alphonso.
- To study the effect of Swell (CPPU) on fruit quality of mango cv. Alphonso.

Materials and Methods

A field experiment was conducted at Alphonso mango orchards of Dr. Balasaheb Sawant Konkan Krishi vidyapeeth, Dapoli, Maharashtra, India for two years from 2012-13 to 2013-14. CPPU (Forchlorfenuron-0.1%) or swell was tried for their effect on fruit retention and post harvest quality of mango Cv. Alphonso. Five treatments comprised of CPPU was done two times when first fruit reaches at pea nut stage and second at marble stage with different concentration as per the treatment details. The observations on number of fruit set were taken at 3 different stages (*i.e.* peanut, marble and harvest stage). The tagged Alphonso mango fruits were harvested at uniform stage of maturity *i.e.* "B" stage of physiological maturity (85% maturity). After harvest, fruits were brought to laboratory in plastic crates. Then stalk of all these fruits were cut at 2.5 cm. All these fruit were cleaned with surfactant and dried with dry muslin cloth and allowed to ripe at ambient temperature. Fruit were sorted according to treatment and kept in 1 dozen CFB boxes for studying ripening pattern, PLW (Physiological loss in weight %), shelf life and quality parameters like TSS (%Brix), acidity (%), total sugar (%) at ripe stage under ambient storage condition.

Experimental details

Experimental Design	: Randomized Block Design (RBD)
Replications	: Four
No. of treatments	: Five
No. of plants per treatment	: Four
No. of fruits per treatment	: One hundred twenty five
Location	: 1. Mango Orchard Plot Number 14 Horticulture Nursery, Dapoli. 2. Mango orchard, Agriculture School, Killa, Roha. 3. Mango research sub centre, Girye, Rameshwar.

Treatments details

The details of experimental treatments were as follows:

S. no.	Treatments	Symbols
1.	Swell 1 ml/lit (CPPU-1ppm)	T ₁
2.	Swell 2 ml/lit (CPPU-2ppm)	T ₂
3.	Swell 3 ml/lit (CPPU-3ppm)	T ₃
4.	Swell 4 ml/lit (CPPU-4ppm)	T ₄
5.	Control (Water spray)	T ₅

Results and Discussion

Effect of CPPU concentration and their interaction on :

Fruit retention at marble stage : Fruit retention at marble stage was also found to be significant CPPU applied in Alphonso as compared to the control (0 ppm). The highest values recorded with concentrations (3 and 4 ppm) at marble stage. In this respect, this might be due to fact that CPPU has a promoting effect of fruit set and retention by reducing ABA content (Guirguis *et al.*, 2010). Similar effects were reported by Yasuyoshi Hayata *et al.* (1995) in watermelon.

Fruit retention at harvest stage : Data indicated that the application of CPPU significantly reduce the fruit drop in mango cv. Alphonso as compare to untreated control. The maximum fruit set per panicle at marble stage and fruit retention at time of harvest were reducing with the foliar application of CPPU. Foliar spray of CPPU twice before peanut stage during second marble stage decreased fruit drop in cv. Alphonso. The beneficial effect on increasing fruit set, fruit retention and decreasing fruit drop may be due to the improving effect of such treatments on nutrition status of the trees which reflected on increasing fruit set fruit retention. Number of fruits per panicle was highest in T₃ (CPPU-3ppm) and T₄ (CPPU - 4ppm) (table 1). Similar enhancements in fruit retention have been reported by Susila *et al.* (2013) on watermelon.

Yield : Generally, the number of fruits per tree at harvest range from 122.40 to 560.50 and 128.75 to 321.5 in the two seasons respectively according to the tested treatment (table 1). The data show significant promotion in number of fruit/tree at harvest and the most significant effect resulted from CPPU at 3 and 4 ppm. The variation in the treatment effect at Roha, Dapoli and Rameshwar may be due to environmental conditions and topography. These finding are in agreement with those obtained by Fathi *et al.* (2011) on monetary value of "Costata" Persimmom and Guirguis *et al.* (2010) on persimmom who reported that, Sitofex (CPPU) application significantly increased the total yield.

Chemical composition : Fruit chemical properties were determined at harvest are shown in table 2. No significant difference was obtained among the mention treatments in both seasons. The above mentioned results are in accordance with those obtained by Patterson *et al.* (1993) on Kiwifruit, Faissal *et al.* (2007) on pear fruits.

Physiological loss in weight (PLW) : The perusal of data observed for CPPU effect on the shelf life of

Table 1 : Effect of Swell (CPPU) concentration, stage of application on fruit retention, number of fruit per tree and yield of Alphonso mango trees in 2012-13 and 2013-14 seasons.

Year	2012-13										2013-14									
	Number of fruits at peanut stage/panicle										Number of fruits at marble stage/panicle									
Location	T ₁	T ₂	T ₃	T ₄	T ₅	S.Em ±	CD at 5%	T ₁	T ₂	T ₃	T ₄	T ₅	S.Em ±	CD at 5%						
Dapoli	5.18	5.98	6.36	6.32	5.90	0.35	NS	10.40	10.05	10.05	9.77	10.65	0.85	NS						
Roha	7.53	7.75	7.62	7.33	7.38	0.36	NS	13.16	13.03	13.06	13.04	13.21	0.33	NS						
Rameshwar	12.13	16.13	15.19	17.56	12.06	1.42	NS	21.38	21.56	23.00	23.44	21.25	0.90	NS						
	Number of fruits at harvest stage/panicle										Yield (Number of fruit per tree)									
Dapoli	1.28	1.37	1.75	1.30	1.27	0.11	0.32	1.21	1.22	2.11	1.30	1.11	0.06	0.18						
Roha	1.25	1.28	1.50	1.36	0.81	0.07	0.21	1.39	1.50	1.87	1.78	1.19	0.07	0.22						
Rameshwar	1.38	1.75	2.25	3.50	1.00	0.12	0.37	2.75	3.19	3.69	4.38	1.63	0.22	0.69						
Dapoli	392.00	441.50	560.50	445.50	364.25	33.41	89.18	180.75	302.50	321.50	276.25	133.00	36.05	111.07						
Roha	130.00	138.25	211.50	187.25	135.50	17.71	54.59	137.75	151.50	216.25	198.50	128.75	7.40	22.81						
Rameshwar	203.00	236.00	273.00	303.40	122.40	17.23	51.68	221.25	237.00	256.25	294.50	170.25	10.33	31.83						

Table 2 : Effect of Swell (CPPU) concentration, stage of application on TSS, Titratable acidity and Total sugar of Alphonso mango trees in 2012-13 and 2013-14 seasons.

Year	2012-13										2013-14									
	Total soluble solids										Titratable acidity									
Location	T ₁	T ₂	T ₃	T ₄	T ₅	S.Em ±	CD at 5%	T ₁	T ₂	T ₃	T ₄	T ₅	S.Em ±	CD at 5%						
Dapoli	18.66	18.08	20.48	19.70	19.30	0.55	1.60	22.12	24.97	22.12	21.52	24.15	1.07	NS						
Roha	16.80	17.40	16.42	17.15	16.62	0.94	NS	17.30	17.90	16.42	17.40	17.17	0.69	NS						
Rameshwar	20.42	19.72	19.55	20.02	19.52	0.80	NS	19.60	19.70	19.90	20.00	19.50	0.17	NS						
Dapoli	0.24	0.22	0.18	0.17	0.20	0.01	NS	0.30	0.22	0.21	0.19	0.18	0.02	NS						
Roha	0.27	0.25	0.25	0.25	0.25	0.03	NS	0.31	0.23	0.22	0.25	0.26	0.02	NS						
Rameshwar	0.36	0.36	0.29	0.37	0.37	0.05	NS	0.19	0.21	0.23	0.20	0.22	0.01	NS						
	Total sugar																			
Dapoli	9.18	11.80	11.50	12.27	11.26	1.21	NS	9.35	9.60	11.82	9.52	9.90	0.56	1.72						
Roha	10.97	11.08	9.44	10.36	10.76	1.75	NS	12.37	13.19	10.79	11.09	12.57	2.00	NS						
Rameshwar	15.60	14.95	14.98	16.32	13.60	1.57	NS	14.10	15.63	16.44	16.66	14.26	0.95	NS						

Table 3 : Physiological loss in weight (days) influenced by the CPPU of mango as during ripening at ambient condition. (22-31°C, 85 percent R.H.) in 2012-13 and 2013-14 seasons.

		Year – 2012-13																	
Location	Treatments	Dapoli						Roha						Rameshwar					
		Days			Days			Days			Days			Days			Days		
		4	8	12	16	20	Mean	4	8	12	16	20	Mean	4	8	12	16	20	Mean
	T ₁	6.99	10.31	14.39	18.22	26.41	15.26	5.22	10.93	13.25	21.09	28.54	15.80	5.22	9.62	13.86	19.40	29.20	15.46
	T ₂	7.30	10.78	15.02	18.93	27.32	15.87	5.31	10.33	13.32	19.01	29.02	15.39	5.48	10.76	14.28	20.28	30.86	16.33
	T ₃	7.20	10.62	14.55	18.66	25.47	15.30	5.44	10.91	14.47	21.65	30.01	16.49	5.27	10.65	14.59	22.13	30.57	16.64
	T ₄	7.61	11.22	14.37	18.73	26.09	15.60	5.15	10.42	13.09	21.61	28.02	15.65	5.77	11.63	14.11	23.37	31.45	17.26
	T ₅	7.61	11.21	14.61	18.19	25.09	15.34	5.52	11.39	14.43	22.61	31.18	17.02	5.61	11.81	14.56	23.30	31.71	17.39
	Mean	7.34	10.83	14.59	18.55	26.07		5.32	10.79	13.71	21.19	29.35		5.47	10.89	14.28	21.69	30.75	
	Treatment (A)	0.58						0.61						0.42					
	Days (B)	0.64						0.61						0.42					
	Interaction (A×B)	1.29						1.38						0.95					
		Year – 2013-14																	
Location	Treatments	Dapoli						Roha						Rameshwar					
		Days			Days			Days			Days			Days			Days		
		4	8	12	16	20	Mean	4	8	12	16	20	Mean	4	8	12	16	20	Mean
	T ₁	2.80	6.62	10.93	14.05	18.44	10.56	7.50	11.14	14.55	18.36	25.34	15.37	6.85	10.36	14.64	18.11	25.38	15.06
	T ₂	2.94	6.44	10.57	14.54	18.12	10.52	7.62	11.48	14.32	18.23	26.16	15.56	7.28	10.70	13.55	17.67	25.65	14.97
	T ₃	3.36	6.17	10.38	14.59	18.74	10.64	7.31	10.71	14.73	18.52	25.84	15.42	7.29	10.74	14.69	18.56	25.58	15.37
	T ₄	2.83	6.35	10.74	15.13	19.51	10.91	7.22	10.60	15.75	19.45	27.85	16.17	7.56	11.25	14.39	18.50	26.32	15.60
	T ₅	4.99	7.30	11.63	15.71	19.56	11.83	7.67	10.41	14.68	19.19	26.65	15.72	7.22	10.74	14.65	18.36	24.79	15.15
	Mean	3.38	6.57	10.85	14.80	18.87		7.46	10.86	14.80	18.75	26.36		7.24	10.75	14.38	18.24	25.54	
	Treatment (A)	0.66						0.65						0.68					
	Days (B)	0.94						0.92						0.96					
	Interaction (A×B)	1.36						1.29						1.50					

mango reveals that physiological loss in weight (PLW) of the fruit increased with an increase in storage period. This decrease in moisture content during storage might be due to either evaporation losses or utilization of water in various senescence processes. The observations similar to this finding were also reported by Kalra and Tandon (1984) and Rangavalli *et al.* (1993). The interaction effect between treatments and storage was also found to be statistically non significant.

Conclusion

The results showed that CPPU at 3 and 4 ppm gave the best result in increasing fruit retention, number of fruit per cluster and per plant. Whereas, the quality of fruit harvested is not different among the treatments and the control. Using CPPU showed an indication of giving higher monetary return to the growers.

References

- Anila, R. and T. Radha (2003). Studies on fruit drop in mango varieties. *J. Trop. Agric.*, **41** : 30-32.
- Anonymous (1998). *The mango*. Bulletin of Central Institute for Sub-tropical Horticulture. Lucknow, p. 1.
- Chadha, K. L. and K. K. Singh (1964). Fruit drop in mango: Intensity, periodicity and nature of shedding of immature fruits. *Indian J. Hort.*, **20** : 30-33.
- Chadha, K. L. (1993). Fruit drop in mango. *Advanc. Horti.*, **3** : 1131-1166.
- Faissal, F. Ahmed and Ahmed M. K. Abdel AAI (2007). Effect of concentration and date of spraying Sitofex (CPPU) on yield and quality of Le-Conte pear fruits. *African Crops Science Conference Proceedings*, **8** : 523-527.
- Fati, M. A., Azza J. Mohamed and A. Abd El- Bary (2011). Effect of sitofex (CPPU) and GA₃ spray on fruit set, fruit quality, yield and monetary value of “Costata” Persimmon. *Nature and Science*, **9** (8).
- Guirguis, N. S., Eman, S. Attala, G. B. Mikhael and M. A. Gabr (2010). Effect of Sitofex (CPPU) on fruit set, yield and fruit quality of “Costata” persimmon trees. *J. Agric. Res. Kafer El-Shiekh Univ.*, **36**(2) : 206-216.
- Kalra, S. K. and D. K. Tondon (1984). Ripening behaviour of Dashehari mangoes at different temperature. *Indian J. Hort.*, **41**(3/4) : 177-181.
- Lam, P. F., K. H. Ng, D. Omar and Talib (1985). Fruit-drop and growth, respiration and chemical changes in ‘Golek’ mango. *Bul. Penyel. Mardi*, **13** : 8-14.
- Nunez-Elisea, R. and T. L. Davenport (1986). Abscission of mango fruitlets as influenced by enhanced ethylene biosynthesis. *Plant Physiol.*, **82** : 991-994.
- Patterson, K. J., K. A. Mason and K. S. Gould (1993). Effect of CPPU (N-(2-chloro-4-pyridyl)-N’-phenylurea on fruit growth, maturity, and storage quality of kiwifruit. *New Zealand Journal of crop and Horticultural science*, **21** : 253-261.
- Rangavalli, K., C. Ravisagar and M. Hariprasad (1993). Post harvest changes in mango cv. Baneshan. *South Indian Hort.*, **41**(3) : 169-170.
- Singh, U. R. (1960). Studies in the fruit drop of mango (*Mangifera indica* L.). II. Nature and extent of fruit drop. *Hortic. Adv.*, **4** : 142-154.
- Singh, R. N. (1978). *Mango*, Published by Indian Council of Agricultural Research, New Delhi.
- Sukonthasing, S. M., Wangrakpanich and Verheij (1991). Mango (*Mangifera indica* L.) in plant resources of South East Asia. Eds. Edible burits, Nute, E.W.M., Verhij and Coronel, R.E., Pudoc-DLO Wageningen. *The Netherlands*, p. 221.
- Susila, T., S. Amarender Reddy, M. Rajkumar, G. Padmaja and P. V. Rao (2013). Studies on Exogenous application of CPPU and GA₃ on yield, fruit quality characters and seedlessness in watermelon. *World Journal of Agricultural Science*, **9**(2) : 132-136.
- Yasuyoshi Hayata and Yoshiyuki Niimi (1995). Synthetic Cytokinin-1-(2=chloro=4=pyridyl) -3- phenylurea (CPPU)- Promotes fruit set and induces parthenocarp in watermelon, *J. Amer. Soc. Hort. Sci.*, **120** (6) : 197-100.