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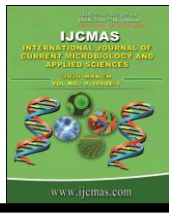

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Effect of Pre-harvest Foliar Spray of Chemicals and Mulching on Fruit Yield, Quality and Marketability of Mango cv. Langra

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A B S T R A C T

Pre-harvest foliar spray of chemicals and mulching is an important technique to extend the self-life, marketability as well as fruit quality of mango. Keeping in view the experiment was conducted under the experimental area of BAU, Sabour, Bhagalpur, Bihar, India during the two successive seasons of 2012 and 2013. Thirty-year-old mango cv. Langra trees were used with eight treatments along with polythene mulching (during October) and per-harvest chemicals were sprayed at 30 days before harvesting of fruits of $CaCl_2$ $6H_2O$ @ 2, 4 and 6%,Ca $(No_3)_2$@ 4%, K_2SO_4@ 1.0% and borax @ 1.0% in combination with polythene mulching and control. On the basis of pooled analysis of two years data. The treatment borax @ 1 % with mulching was performed better in respect of increasing the fruit weight (306.38g) and yield (132.13 kg tree-^{1}). This treatment was also found effective for increasing the TSS (13.83 & 20.96 ^{0}Brix) and for decreasing the acidity (0.818 & 0.326%) at the time of harvest and end of storage period respectively. Whereas, the end of storage period minimum softness percentage (11.88%), minimum physiological loss in weight (15.40%) and maximum fruit marketability (87.50%) were observed with the treatment of $CaCl_2$ $6H_2O$@ 2% in combination with mulching. Thus, the observations indicated that per-harvest application of $CaCl_2$ $6H_2O$ @ 2% is effective for improving the fruit shelf-life and decreasing the physiological loss in weight (PLW) whereas; the borax @1.0% with mulching proved effective for improving the fruit quality of mango cv. Langra.

Introduction

Mango (*Mangifera indica* L.) is a very popular fruit crop of family Anacardiaceae in India as well as tropical and subtropical countries of the world. India is the largest mango producing country in the world. It is known as "King of fruits" due to its delicious taste, attractive colour and nutritional value. A fully matured fruit contains a high level of sugars (16-18 % w/v) with blending of acidity and antioxidants medicinal value like carotene. In respect to big demand of the larger population the availability of mangoes

is restricted due to lack of adequate knowledge of post-harvest technique and inadequate storage and poor transport facilities resulting in poor fruit quality with short shelf-life. Mango fruits are also highly perishable, sometimes due to over-ripening; they increase susceptibility on viral and fungus diseases that results into un-marketable fruits (Nagarag *et al.,* 1995).

Low fruit calcium levels have been associated with reduced post-harvest life and physiological disorders (Prabu, 2011). So, to solve the problem of short shelf-life of mango fruits, different chemicals are used (Suhardi, 1992). Calcium, potassium and boron are known to play very important role in improvement of fruit quality and shelf life of various fruits. The previous workers have also demonstrated that calcium play a very important role in improvement of shelf- life of fruits (Mika, 1983; Jones *et al.,* 1970). Calcium has been extensively reviewed as both an essential element and it has a potential role in maintaining post-harvest quality of fruit (Chadha, 2000).

However, some other calcium salts especially calcium chloride has been reported in literature to delay the ripening and senescence in fruits by lowering the respiration rate (Singh *et al.,* 1993). Spraying with foliar nutrients like calcium nitrate also increase the number of fruits/tree, fruit set, yield/tree and improved the quality as well as physiological and chemical properties of fruits (Ramzi *et al.,* 2011). Calcium spraying increased the productivity of mango due to the reduction of abscission (Kumar *et al.,* 2006).

It enhances the mango quality by increasing the fruit firmness and by maintaining the middle lamella cells. Boron and potassium are responsible for increased fruit quality of various tropical and subtropical fruits. Therefore, present studies were carried out with the objective of evaluating the effect of pre-harvest foliar spray of chemicals and mulching on fruit yield, quality and marketability of mango cv. Langra.

Materials and Methods

The present investigation on effect of pre-harvest spray of chemicals for extending the shelf-life and quality of mango was carried out on thirty years old mango tree cultivar 'Langra'. All the plants were selected uniform in growth and size, which were planted at the distance of 10 m × 12 m in experimental area under Department of Horticulture (Fruit and Fruit Technology), Bihar Agricultural University, Sabour, Bhagalpur, Bihar during the two successive seasons 2012 and 2013.

The experiment was conducted in Randomized Block Design with four replications with total eight treatments. The treatments were comprised of T_1-black polythene mulching, T_2- black polythene mulching + $CaCl_26H_2O$ @ 2 %, T_3- black polythene mulching + $CaCl_26H_2O$ @4%, T_4-black polythene mulching+ $CaCl_26H_2O$ @ 6%, T_5- black polythene mulching+ $Ca(NO_3)_2$ @ 4%, T_6- black polythene mulching+ K_2SO_4 @ 1%, T_7- black polythene mulching+ borax @ 1% and T_8-control (water spray).

The pre-harvest foliar spray was given as chemicals and mulching to find the effect on physiological loss in weight (PLW), fruit marketability (shelf-life) and fruit quality of mango cv. Langra. The mulching was done during the month of October, and pre-harvest chemical spray was done 30 days before anticipated harvest date during the years 2012 and 2013.

Observations recorded

Twenty fruits were sampled from each tree and assessed the different characteristics of

fruits at harvest and at the end of storage period. Immediately after the harvest of the fruits stalk was removed and fruits were washed with clean water and liquid soap and following observations were recorded.

Physical parameters of fruit

Fruit length

The length of the fruit from base of fruit to apex of fruit was determined at harvest stage with the help of vernier caliper and expressed in centimeters.

Fruit breadth

The breadth of fruit was determined as the maximum linear distance between two shoulders of the fruit with the help of vernier caliper and expressed in centimeters.

Fruit weight

Immediately after the harvest of the fruit, stalk was removed and the weight of the raw fruit was recorded in grams.

Peel weight

The ripened fruits were peeled off using a knife and weight of the peel was recorded in grams. The percentage weight of peel to that of total weight of fruit was also computed.

Stone weight

The stones of ripe mango fruits were separated from the pulp and their weight was recorded in grams. The percentage weight of stone to that of total weight of fruit was also computed.

Pulp weight

The mango pulp from the ripe fruits was separated from the peel and the stone and the weight was expressed in grams. The percentage weight of pulp to that of total weight of fruit was also computed.

Chemical composition of fruit

The fruits harvested from each tree were randomly selected to estimate the chemical composition of fruit.

TSS

Total soluble solids content of a solution was determined by the index of refraction. This was measured using a refractometer and was referred to as the degrees Brix.

Titratable acidity

Titratable acidity was estimated from the pulp of ripe mango fruits. One gram of pulp from each replication in each treatment was homogenized using a pestle and mortar and the volume was made up to 20 ml with distilled water.

It was then titrated against 0.1N sodium hydroxide solution to a phenol phatalein end point. The acidity was expressed in per cent.

Shelf-life of fruit

The shelf-life of fruit was accounted from the date of harvesting to the shelf- life expiration date.

Physiological loss in weight (PLW)

Twenty fruit were sampled from each tree and stored under ambient condition ($30+2^{0}C$) over muslin cloth in single layer. The percent physiological loss in weight (PLW) was calculated on initial weight basis at two days interval from harvest.

Softness of fruit

The softening status was assessed on the basis of firmness of fruit at alternate day during storage period and finally it was calculated in percentage.

Fruit marketability

The fruit marketability was assessed on the basis of surface colour, extended of shrinkage, firmness and fungal spot and was expressed in terms of percentage.

Results and Discussion

Fruit weight (g), Fruit yield (kg per tree)

The data presented in Fig.- 1 & 2 indicates that the foliar spray $CaCl_2$ $6H_2O$ @ 2, 4 and 6 %, $Ca(NO_3)_2$ @ 4%, , K_2SO_4 @1% , borax @ 1% significantly increased the fruit weight and fruit yield as compared to the control in both the years 2012 and 2013.The treatment borax @ 1% + black polythene mulching proved to be most effective for increasing the fruit weight in both the years (320.25g and 292.50g respectively) and pooled result of both the years (306.38 g) has also been found higher than remaining treatments including control (231.13g).

The result of the treatment $CaCI_2$ @ 2.0% + black polythene mulching was found statistically at par with the treatment borax @ 1% + black polythene mulching during the year 2013. While the effect of the treatment borax @ 1% + black polythene mulching was observed significantly superior to rest of treatment including control in the year 2012 and pooled result of the both years 2012 and 2013.

In regards to fruit yield (kg per tree) of both the years 2012 and 2013 was also found significantly maximum of 63.89 kg/tree and 200.36 kg per tree respectively and pooled yield (132.13 kg per tree) also by the effect of treatment borax @1% + black polythene mulching, which was showed at par with the treatment $CaCI_2$ @ 2.0%+ black polythene mulching with having value 123.04 kg per tree, whereas; the minimum yield was recorded in control (69.96 kg per tree). The increase in fruit weight with the spray of borax was might be due to the involvement in hormonal metabolism, increased cell division and expansion of cell. Boron is also known to stimulate rapid mobilization of water and sugar in the fruit. Appreciable improvement in fruit weight by borax application has been also reported by Dutta (2004) in mango cv. Himsagar, Brahmachari *et al.,* (1997) in litchi. The significant increase in yield by boron application may be accredited to black polythene mulching the positive effect of boron for increasing the rates of carbohydrate and RNA metabolism with increased rate of transportation of photosynthetic from the leaves during the fruits development (Dugger, 1968).

Physical parameters of fruits

It is evident from Fig.-3 that the trees sprayed with $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching at 30 days before harvest for the year 2012 and 2013 the fruit length (9.85cm and9.12cm respectively), fruit breadth (7.37cm and 6.85 cm respectively) and pooled result (9.48cm and 7.11cm respectively) were more in respect of other treatment including control but result of the year the year 2013 was found statistically non-significant.

The effect of chemicals on peel (%), stone (%) and pulp (%) were observed significantly positive response as compared to remaining treatments including control in Table-1. The application of $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching increased the peel and pulp percentage of 11.72% and 79.16%

during year 2012 respectively and the year 2013 it was 12.00% and 78.21% respectively and pooled result of both years was 11.86 % and 78.69% respectively of fruit was recorded significantly superior than the other treatments including control (7.45% and 72.80% respectively). While lower stone percentage of 13.55% and 14.29% for the year 2012 and 2013 and pooled data of both years of 13.92 % was also noticed with effect of treatment $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching and maximum in control (15.35%).

The effect of chemicals on lower stone percentage was found statistically at par with the other treatments except control. That could be to the fact that pre-harvest applications are more successful early in the development of fruits rather than when they are applied late just before harvest. Probably the improvement observed in the fruit peel and pulp percentage due to calcium chloride could be attributed to its effects in influencing formation and changes of carbohydrates and carbohydrate enzymes, others reasons might be the reduction of abscission and the calcium influence in maintaining the middle lamella cells. Singh *et al.,* (1993) showed that the calcium (0.6%) treated 'Dashehari' mango fruits contained higher calcium level in the peel and flesh and lower cumulative physiological loss in weight and reduced respiration rate. The findings obtained in the present investigation were also supported by Wahdan *et al.,* (2011).

Chemical parameters of fruits

The pooled data of two years 2012 and 2013 showed the effect of different treatments of chemical properties of fruits. Total soluble solids (TSS) determine the quality of fruits. The TSS content was increased during the advancement of fruits ripening. The data presented in Table-2 indicated that the result of the year 2012 and 2013 at harvest (0 day) and end of storage period (10 day) were showed maximum (12.88 and 14.79 ^{0}Brix respectively) and (20.96^{0}Brix and 20.97 ^{0}Brix respectively), when the trees were treated with borax (1%) + black polythene mulching followed by $CaCl_2$ $6H_2O$ (2%) + black polythene mulching (12.66^{0}Brix and 14.68 ^{0}Brix respectively) and (20.94 ^{0}Brix and 20.96 ^{0}Brix respectively).

The pooled data of both the years 2012 and 2013 with the effect of treatment foliar spray of borax (1%) + black polythene mulching at the time of harvest (0 day) and end of storage period (10 day) also proved significantly superior result (13.83 ^{0}Brix and 20.96^{0}Brix respectively) than the remaining treatments including control (13.13^{0}Brix and 20.13^{0}Brix). The increase in TSS during storage period may be due to conversion of complex polymers into simple substances. This findings was supported by the result of Meena *et al.,* (2006), Nehete *et al.,* (2011), Sankar *et al.,* (2013) and Kumari *et al., (*2017).The similar results have been also obtained by Dutta (2004) in mango Brahmachari *et al.,* (1997) in litchi.

It is evident from Table- 2 that the foliar spray of borax (1%) + black polythene mulching before one month of harvest for the year 2012 and 2013 significantly listed lower titratable acidity percentage (0.861% and 0.776% respectively) at the time of harvest (0 day) and end of storage period (10 day) was also found minimum (0.344 % and 0.308% respectively) in the treatment of. borax (1%) + black polythene mulching. When the data for both the years 2012 and 2013 were pooled the minimum titratable acidity content (0.818% and 0.326% respectively) was estimated at the time of harvest (0 day) and end of storage period (10 day) with the same treatment i.e. spray of borax (1%) + black polythene mulching. The pooled data of both

years showed that the minimum acidity was observed by the effect of the treatment borax (1%) + black polythene mulching at the time of harvest (0 day) and for end of storage (10 day) was significantly lower than the rest of the treatments including control. The lowest acidity by boron might be due to the role of boron in conversion of acid into sugar and their derivatives by the reaction involving reversal of glycolytic pathway (Sankar *et al.,* 2013). This observation was also supported with the finding of Ahmed *et al.,* (2017) in peach. The similar findings were reported by Hoggag *et al.,* (1995) and Banik *et al.,* (1997) in mango.

Softness of fruit (Firmness)

The combined effects of mulching and foliar spray of chemicals proved positive response in maintaining of firmness in mango cv. Langra during storage. By observing the Fig.-4, it is clear that minimum softness of 11.25% and12.50% were noticed during the year 2012 and 2013 respectively after ten days of storage period with the effect of treatment $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching. The pooled data of both years 2012 and 2013 was also exhibited significantly minimum softness of 11.88% by the effect of treatment $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching than the remaining treatments including control (29.38%), whereas; treatment $CaCl_2$ $6H_2O$ @ 4%+ black polythene mulching, $CaCl_2$ $6H_2O$ @ %+ black polythene mulching and K_2SO_4 @1%+ black polythene mulching were showed at par result. This might be due to cause of mechanism by which Ca reduces decay may be related to Ca ions in cell wall (Conway *et al.,* 1984). Calcium compounds extend the storage of many fruits by maintaining their firmness and minimizing the rate of respiration, protein break down and disease incidence (Gupta *et al.,* 1980). Conway (1982) reported that post-harvest application of Calcium reduces the softness losses of fruits during storage.

Physiological loss in fruit weight (%)

The physiological loss in fruit weight of mango cv. Langra was significantly affected by the pre-harvest application of nutrients before harvest on 6^{th}, 8^{th} and 10^{th} days during storage of the fruits. The pooled data of the years 2012 and 2013 (Table-3) indicates that on 10^{th} day of storage proved minimum physiological loss in weight (15.40%) by the effect of the treatment of $CaCl_2$ $6H_2O$ @ 2 % + black polythene mulching and maximum (21.92%) in the control.

Similar results have been obtained by Siddiqui *et al.,* (1989) in Ber and Saha *et al.,* (1998) in litchi. The decrease in weight during storage of fruits by the application of calcium may be due to its role in the maintenance of fruit firmness, reduced respiration rate and delayed senescence (Mika, 1983; Jones *et al.,* 1970).

Singh *et al.,* (1987) studied the effect of pre and post-harvest treatment of $CaCl_2$ on the storage life of 'Amrapali' mango and reported application of $CaCl_2$@ 1% performed better in respect of extending the storage life of mango fruits. Mahajan and Sharma (1996) in an experiment used different concentration of $CaCl_2$ (2 %, 4 %, 6 % and 8%) for post-harvest treatments of Dashehari mango fruits, packed in wooden boxes and stored at room temperature. He found $CaCl_2$ 6% showed better result in reducing the weight loss with improving peel colour and quality of fruits.

It prolonged the shelf -life by 5-6 days. Waskar and Gaikwad (2005) studied the various post-harvest treatments for extension of shelf-life of Kesar mango fruits. They observed treatment $CaCl_2$ (2%) + Wax (6%) + Bavistin (0.1 %) were stored up to 24 days at

room temperature in CFB boxes with lower physiological losses in weight and high organoleptic score.

Effect of chemical on marketability (%)

By observing the Table-4 it is clear that fruit marketability was also affected by the effect of mulching and pre-harvest spray of chemicals on mango fruits. The treatment of $CaCI_2$ along with mulching proved very effective for maintaining higher marketability of mango fruits.

The pooled data of the years 2012 and 2013 clearly indicated that marketable fruit of 87.50 per cent at the end of storage period on 10^{th} day was accounted significantly higher by effect of the treatment $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching.

The treatment $CaCl_2 6H_2O$ @ 4%+ black polythene mulching was found statistically at par with the marketability value percentage of 85.00 per cent. The lower fruit marketability of 67.50 per cent was observed under the control .Therefore, it may be concluded that the use of $CaCl_2$ $6H_2O$ @ 2% + black polythene mulching showed more economical for improving the fruit marketability (shelf-life).

The lower value of 67.50 per cent marketable fruit was observed under the control. The increase in fruit marketability might be due to increase in concentration of calcium of middle lamella of cell wall which provided physical strength to cell wall and improved fruit colour development and appearance (Cheour *et al.*, 1990).

Kader (1966) reported that Calcium compound extended the storage life of many fruits by maintaining their firmness and minimizing the rate of respiration, protein breakdown and rotting incidence. Similar findings were observed by Suntharalingam (1996) that the mangoes treated with 4% to 6% $CaCl_2$, extend their shelf-life by 5-7 days. This type of conformity was also reported by Ahmed *et al.*, (2017).

Table.1 Effect of pre-harvest spray of chemicals on fruit peel (%), stone (%) and pulp (%) of mango cv. Langra

Treat.	Peel (%)			Stone (%)			Pulp (%)		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
T1	7.58	8.56	8.07	14.64	14.70	14.67	75.49	75.07	75.28
T2	11.72	12.00	11.86	13.55	14.29	13.92	79.16	78.21	78.69
T3	9.87	10.23	10.05	14.09	14.40	14.25	78.88	77.05	77.96
T4	9.61	9.76	9.69	14.11	14.53	14.32	78.41	76.67	77.54
T5	9.33	9.62	9.47	13.60	14.49	14.05	77.52	76.58	77.05
T6	8.88	8.89	8.89	13.58	14.55	14.07	76.58	75.84	76.21
T7	8.01	8.84	8.42	13.45	14.62	14.03	76.28	75.62	75.95
T8	7.40	7.50	7.45	14.88	15.81	15.35	73.40	72.19	72.80
SEm±	0.22	0.21	0.15	0.19	0.12	0.11	0.29	0.24	0.19
CD (P=0.05)	0.65	0.63	0.44	0.56	0.34	0.32	0.85	0.70	0.54
CV %	4.86	4.56	4.12	2.74	1.58	1.93	0.75	0.63	0.61

T1-Mulching, T2-$CaCl_2$ $6H_2O$ (2%) + T1, T3-$CaCl_2$ $6H_2O$ (4%)+ T1, T4-$CaCl_2$ $6H_2O$ (6%)+ T1, T5-Ca $(NO_3)_2$ (4%)+ T1, T6-K_2SO_4 (1%)+ T1, T7-Borax (1%)+ T1, T8-Control (without mulching & treatment)

Table.2 Effect of preharvest spray of chemicals on TSS and acidity (%) of mango cv.Langra

Treat.	TSS (0Brix)- 0 day			TSS (0Brix)-10 day			Acidity (%) – 0 day			Acidity (%) –10 day		
	2012	2013	Pooled	2012	2012	2013	2012	2013	Pooled	2012	2013	Pooled
T1	12.23	14.24	13.24	20.51	20.78	20.65	0.886	0.786	0.836	0.357	0.314	0.335
T2	12.66	14.68	13.67	20.94	20.96	20.95	0.883	0.785	0.834	0.355	0.310	0.332
T3	12.39	14.40	13.39	20.87	20.91	20.89	0.888	0.787	0.838	0.356	0.313	0.334
T4	12.33	14.40	13.36	20.75	20.89	20.82	0.887	0.786	0.836	0.357	0.318	0.337
T5	12.41	14.44	13.43	20.89	19.92	20.40	0.884	0.786	0.835	0.353	0.310	0.332
T6	12.58	14.56	13.57	20.93	20.96	20.95	0.885	0.784	0.834	0.355	0.311	0.333
T7	12.88	14.79	13.83	20.96	20.97	20.96	0.861	0.776	0.818	0.344	0.308	0.326
T8	12.11	14.15	13.13	19.71	20.55	20.13	0.918	0.812	0.865	0.362	0.312	0.337
SEm±	0.01	0.06	0.03	0.02	0.06	0.03	0.009	0.004	0.005	0.001	0.000	0.001
CD (P=0.05)	0.03	0.17	0.09	0.05	0.16	0.08	0.025	0.010	0.013	0.003	0.001	0.002
CV %	0.18	0.81	0.55	0.17	0.53	0.35	1.933	0.900	1.371	0.618	0.235	0.429

T1-Mulching, T2-$CaCl_2$ $6H_2O$ (2%) + T1, T3-$CaCl_2$ $6H_2O$ (4%)+ T1, T4-$CaCl_2$ $6H_2O$ (6%)+ T1, T5-Ca $(NO_3)_2$ (4%)+ T1, T6-K_2SO_4 (1%)+ T1, T7-Borax (1%)+ T1, T8-Control (without mulching & treatment).

Table.3 Effect of pre harvest spray of chemicals on physiological loss in weight (%) of mango cv. Langra

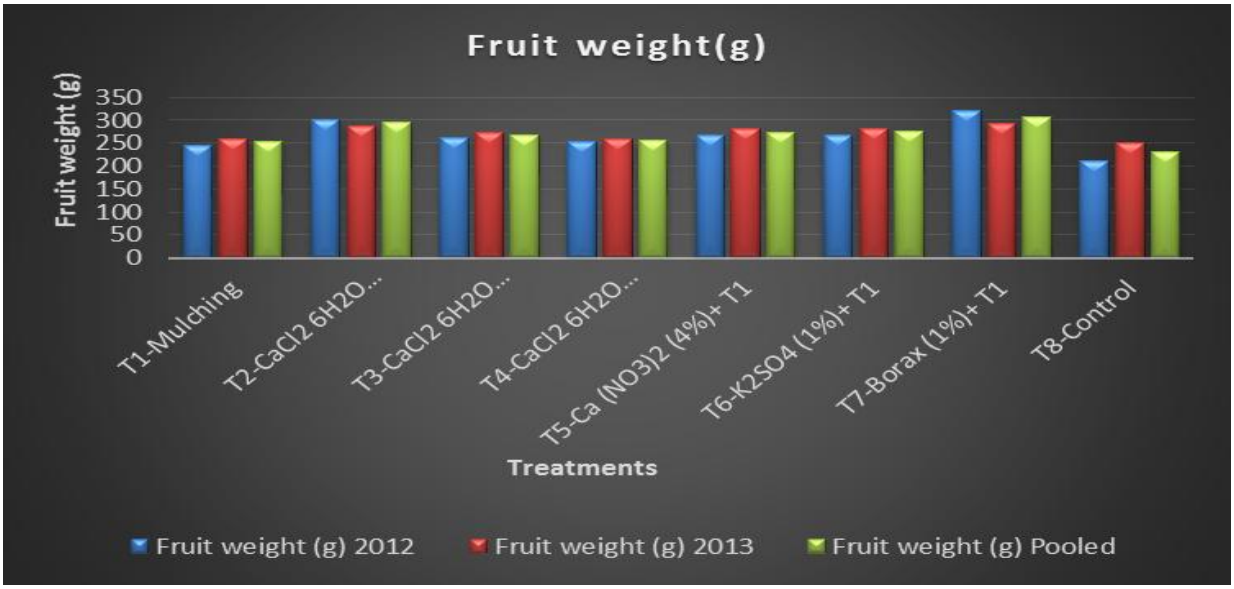
Treat.	Physiological loss in weight at 2 days intervals (%)								
	6 days			8 days			10 days		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
T1	9.90	13.41	11.66	13.31	19.12	16.21	16.28	21.45	18.86
T2	7.91	11.96	9.93	10.62	16.52	13.57	12.89	17.92	15.40
T3	8.49	12.04	10.27	11.46	16.92	14.19	13.79	18.35	16.07
T4	8.95	12.25	10.60	11.97	17.35	14.66	14.83	18.90	16.87
T5	9.77	14.07	11.92	13.13	20.04	16.58	16.08	22.06	19.07
T6	9.47	12.72	11.10	12.72	18.02	15.37	15.61	19.89	17.75
T7	9.39	13.02	11.20	12.68	18.69	15.68	15.59	20.68	18.13
T8	11.73	14.57	13.15	15.79	21.55	18.67	19.68	24.16	21.92
SEm±	0.28	0.34	0.22	0.16	0.32	0.18	0.20	0.34	0.20
CD 5%	0.83	0.99	0.63	0.47	0.94	0.51	0.59	0.99	0.56
CV %	5.95	5.20	4.85	2.50	3.44	2.82	2.59	3.30	2.70

T1-Mulching, T2-$CaCl_2$ $6H_2O$ (2%) + T1, T3-$CaCl_2$ $6H_2O$ (4%)+ T1, T4-$CaCl_2$ $6H_2O$ (6%)+ T1, T5-Ca $(NO_3)_2$ (4%)+ T1, T6-K_2SO_4 (1%)+ T1, T7-Borax (1%)+ T1, T8-Control (without mulching & treatment).

Table.4 Effect of pre harvest spray of chemicals on percentage of marketability of mango cv.Langra

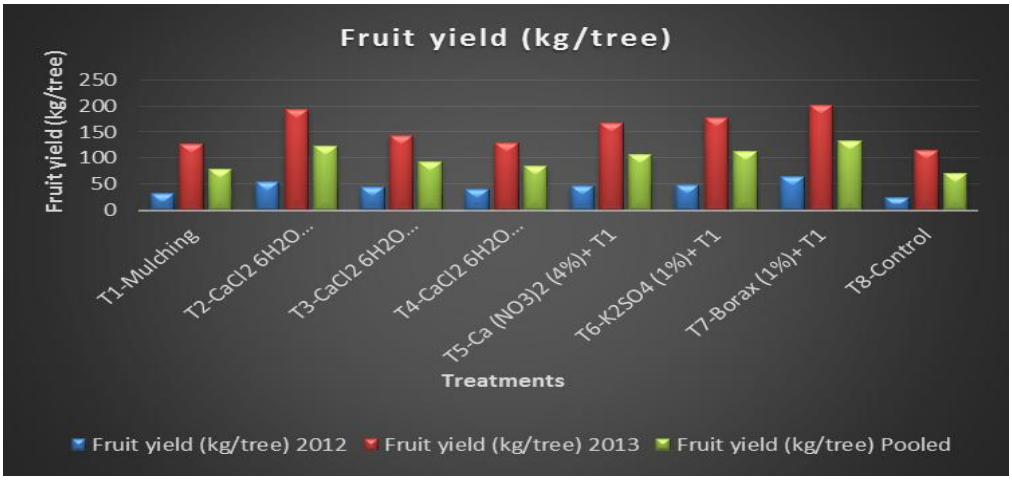
Treatment	Marketability percentage of fruits at 2 days interval								
	6 days			8 days			10 days		
	2012	2013	Pooled	2012	2013	Pooled	2012	2013	Pooled
T1	100.00	90.00	95.00	85.50	82.50	84.00	80.00	67.50	73.75
T2	100.00	100.00	100.00	95.00	90.00	92.50	90.00	85.00	87.50
T3	100.00	100.00	100.00	91.00	90.00	90.50	87.50	82.50	85.00
T4	100.00	100.00	100.00	90.50	88.75	89.63	86.25	78.75	82.50
T5	100.00	100.00	100.00	87.00	82.50	84.75	85.00	78.75	81.88
T6	100.00	95.00	97.50	87.50	87.50	87.50	83.75	73.75	78.75
T7	100.00	100.00	100.00	87.50	85.00	86.25	85.00	75.00	80.00
T8	95.00	90.00	92.50	80.00	77.50	78.75	70.00	65.00	67.50
SEm±	0.00	0.00	0.00	0.37	3.22	1.62	2.14	2.52	1.65
CD 5%	NS	NS	NS	1.09	NS	4.63	6.29	7.42	4.72
CV %	0.00	0.00	0.00	0.84	7.54	4.63	5.13	6.66	5.14

T1-Mulching, T2-$CaCl_2$ $6H_2O$ (2%) + T1, T3-$CaCl_2$ $6H_2O$ (4%)+ T1, T4-$CaCl_2$ $6H_2O$ (6%)+ T1, T5-Ca $(NO_3)_2$ (4%)+ T1, T6-K_2SO_4 (1%)+ T1, T7-Borax (1%)+ T1, T8-Control (without mulching & treatment)



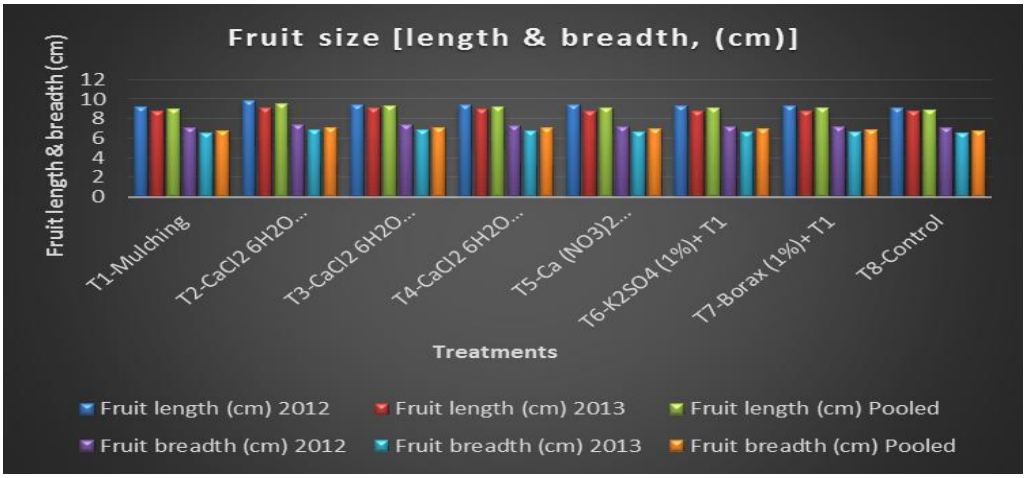
CD (P=0.05): Fruit weight (g): 2012(16.43):2013(13.33): Pooled (10.27)

Fig.1 Effect of pre-harvest spray of chemicals on fruit weight (g)of mango cv. Langra



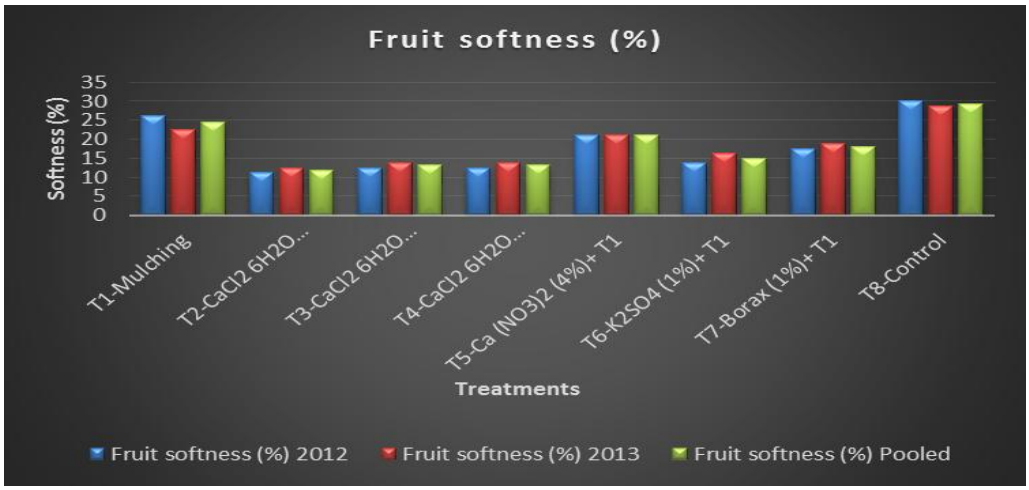
CD (P=0.05): Fruit weight (kg/tree): 2012(7.24):2013(20.50): Pooled (10.55)

Fig.2 Effect of pre-harvest spray of chemicals on yield (kg/tree) of mango cv. Langra



CD (P=0.05): Length (cm): 2012 (0.34): 2013 (NS): Pooled (0.23): Breadth (cm): 2012 (NS): 2013(0.23): Pooled (0.21)

Fig.3 Effect of pre-harvest spray of chemicals on fruit length and breadth (cm)



CD (P=0.05): Softness of fruit (%):2012(4.75): 2013(4.64): Pooled (3.22)

Fig.4 Effect of pre-harvest spray of chemicals on softness of fruit (%) of mango cv. Langra

The findings indicated that pre-harvest foliar application of $CaCI_2$@ 2.0% with polythene mulching is effective for improving the fruit marketability and decreasing the physiological loss in weight (PLW), whereas, the borax @ 1.0% with mulching proved effective for improving fruit quality of mango cv. Langra.

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