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Effect of different types of coating on quality and shelf Life of Kinnow

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Abstract
An investigation was conducted at Agriculture Lab, Department of Agriculture, D.A.V College, Abohar, Punjab during the academic year 2018 to study the effect of different types of coating on quality and shelf life of kinnow. The different coatings were Waxing, Polythene, Oil Coating, Waxing + Polythene and open air as a control were used for experimentation. The fruits were then kept at ambient temperature. The effect of different coatings on change in fruit length, change in fruit breadth, change in fruit weight, change in fruit volume and physiological loss in weight was observed. The different treatments showed variation in physiological and physical characters. Out of these five treatments, the treatment Polythene showed best result as compared to other treatments. The obtained results indicated that less decrease in fruit length, fruit breadth, fruit weight and fruit volume were recorded in fruits covering with polythene and maximum decrease in fruit length, fruit breadth and fruit volume were recorded in oil coated fruits after 28 days of storage. But in fruit weight maximum decrease was observed in wax coated fruits. Minimum physiological loss in weight was recorded in fruits covering with polythene and maximum physiological loss in weight was recorded in oil coated fruits after 28 days of storage.

Keywords: Different coating, kinnow, physical characters, shelf life, polythene

Introduction
Kinnow mandarin (*Citrus reticulata cv.* Blanco), the first generation hybrid of "King" (*Citrus nobilis*) x "Willow leaf" (*Citrus deliciosa*), is the most common citrus fruit grown commercially in north India, particularly in Punjab, and the adjoining areas of Rajasthan and Himachal Pradesh. It was distributed by H.B. Frost at the California Experiment Station, U.S.A, in 1935 (Singh, [1]). It was introduced into Punjab from United states, where it is performing well and is gaining commercial importance. The name "tangerine" could be applied as an alternate name to the whole group, but in the trade, it is usually confined to the types with red-orange skin. Mandarins include a diverse group of citrus fruits that are characterized by bright coloured peel and pulp, excellent flavour, easy-to-peel rind and segments that separate easily. The principal edible portion of a citrus fruit is the juice present in the juice vesicles. Mandarin tree is more erect than other kinds of citrus tress and exhibits a drooping habit because of rather long, willowy branches. The leaves are broadly lanceolate and medium in size. The base of the tree is somewhat rounded rather than obtuse in shape. The fruit colour resembles with that of 'King' (Citrus nobilis) i.e deep yellowish orange. The fruit has smooth surface with gloosy look (Rajput and Haribabu,) [2]. In Kinnow, improper post-harvest handling practices lead to quality deterioration and fetch poor market price. The shelf life extention and quality after harvesting can be maintained with the application of skin coating materials and modified atmosphere packaging (Din *et al.*) [3]. The research being done here takes into account the effect of different types of coating on physical changes that occur during the storage period to determine the best coating material which is suitable for preserving quality and shelf life of kinnow.

Materials and Methods

The study was carried out on fruits of Kinnow (*Citrus reticulata* Blanco) taken from 10 years old tress. Fruits were harvested from a private kinnow orchard at Rampura Village, Abohar Tehsil, Fazilka (Punjab) from Sh. Jagdish Parshad's farm. On 20th January, 60 fruits were harvested and out of which 24 fruits were brought to Anil Kinnow Waxing plant for waxing Nipro Fresh SS40T at fruits. Then all fruits were brought to Agriculture Lab, D.A.V College, Abohar. The objective of the study was to calculate physical characteristics such as change in fruit length, change in fruit breadth, change in fruit weight, change in fruit volume, physiological loss in weight of each fruit from different treatments at 4 days interval. The layout of the trial contains 60 Kinnow fruits with 5 treatments each having 4 replications. The length and breadth of each fruit were measured using vernier's calliper and was expressed in millimetres, fruit weight was evaluated with the help of digital weighing balance and expressed in grams, fruit volume was determined by using water displacement method with graduated cylinder and expressed in millilitres and physiological loss in weight after each interval of storage was calculated on initial weight of the fruits and expressed in per cent.

Treatments

T_1 - Waxing
T_2 - Polythene
T_3 - Oil Coating
T_4 - Waxing + Polythene
T_5 - Control

Results and Discussions

Change in Fruit Length

From the experiment, it has been observed that minimum change in fruit length was under T_2 after 28 days and it was significantly differ than all other treatments. Maximum change was in T_3 followed by T_1, T_5 and T_4. T_3 was at par with T_1 and T_5 but significantly higher than T_4. So less decrease in fruit length was recorded in fruits covering with polythene and maximum decrease in fruit length is recorded in oil coated fruits. The findings of this research are similar with that of Prasad *et al.* [4] who concluded that brown paper performed significantly better under ambient storage T_5 (AT + Brown paper) as compared to other treatments. The findings of Marpudi *et al.* [5] also showed effect of Aloevera based antimicrobial coating on fruit length of papaya in which maximum reduction in size was seen in control and least reduction in PLEAG coated fruits.

Change in Fruit Breadth

From the experiment, it has been observed that minimum change in fruit breadth was under T_2 after 28 days and it was par with T_4 and significantly differ from T_5, T_1 and T_3. Maximum change was in T_3 followed by T_1, T_5 and T_4. T_3 was at par with T_1 and T_5 but significantly higher than T_4. So less decrease in fruit breadth was recorded in fruits covering with polythene and maximum decrease in fruit breadth was recorded in oil coated fruits. Similarly, Pratap *et al.* [6] who concluded that maximum fruit width was observed in Cling film (15µ) and minimum in Control. Dutta *et al.* [7] studied the effect of edible coatings on ber in which the fruit breadth was found highest in fruits treated with guar gum 2% where as it was minimum in the fruits under control.

Change in Fruit Weight

From the experiment, it has been observed that minimum change in fruit weight was under T_2 after 28 days and it was par with T_4 and was significantly differ from T_5, T_3 and T_1. Maximum change was in T_1 followed by T_3, T_5 and T_4. T_1 was at par with T_3 but significantly higher than T_5 and T_4. So less decrease in fruit weight was recorded in fruits covering with polythene and maximum decrease in fruit weight was recorded in wax coated fruits. Khan *et al.* [8] found the similar results in jujube varieties in which minimum decrease in fruit weight was observed in plastic bag while maximum decrease in wooden crate. Kanth *et al.* [9] who concluded that highest fruit weight was recorded in fruits treated with Oxalic acid 10% as compared to control fruits.

Change in Fruit Volume

From the experiment, it has been observed that minimum change in fruit volume was under T_2 after 28 days and it was par with T_4 and was significantly differ from T_5, T_1 and T_3. Maximum change was in T_3 followed by T_1, T_5 and T_4. T_3 was at par with T_1 and T_5 but significantly higher than T_4. So less decrease in fruit volume was recorded in fruits covering with polythene and maximum decrease in fruit volume was recorded in oil coated fruits. Similarly, Raj Kumar and Mitali [10] who concluded that sealed polythene markedly reduce the percentage of volume loss per day followed by 2% wax emulsion as compared to control. Genanew [11] indicated that least loss in volume was registered in fruits treated with 8% $CaCl_2$ and packed with polythene cover whereas the maximum loss in control fruit.

Physiological Loss in Weight

From the experiment, it has been observed that minimum physiological loss in weight was under T_2 after 28 days and it was significantly differ than all other treatments. Maximum physiological loss in weight was in T_3 followed by T_1, T_5 and T_4. T_3 was at par with T_1 and T_5 but significantly higher than T_4. So minimum physiological loss in weight was recorded in fruits covering with polythene and maximum physiological loss in weight was recorded in oil coated fruits. Similarly, Anyasi *et al* [12] who concluded that packaged and chemically treated tomato samples showed reduced PWL compared to the unpacked samples. Mahajan and Singh [13] studied the effect of packaging films on quality of Kinnow fruits in which Shrink film packed fruits registered the lowest mean PLW followed by cling film where highest PLW in the control fruits.

Observations and Tables

Table 1: Effect of Different Types of Coating on Change in Fruit Length (mm)

Days interval of observation	0	4	8	12	16	20	24	28
T_1	0	2.72	4.93	10.50	11.06	10.52	13.02	14.06
T_2	0	-2.42	-1.59	2.43	-0.65	-0.38	-1.18	1.22
T_3	0	2.49	5.86	10.54	8.61	12.64	14.14	14.39
T_4	0	1.61	3.3	6.23	1.16	3.69	3.26	5.25
T_5	0	2.51	3.76	9.17	8.19	12.40	11.93	13.34
CD	0	2.07	3.28	3.71	4.55	3.46	4.51	3.55

Table 2: Effect of Different Types of Coating on Change in Fruit Breadth (mm)

Days interval of observation	0	4	8	12	16	20	24	28
T_1	0	3.37	5.04	10.80	8.59	10.13	12.77	14.50
T_2	0	-0.20	0.51	3.27	1.45	0.91	2.78	4.24
T_3	0	4.05	6.75	11.86	10.13	11.44	15.24	15.61
T_4	0	0.80	0.36	4.69	2.50	2.36	2.52	4.36
T_5	0	3.65	3.22	10.32	9.26	10.49	13.20	13.55
CD	0	2.39	2.14	2.79	3.02	1.73	2.64	2.20

Table 3: Effect of Different Types of Coating on Change in Fruit Weight (gm)

Days interval of observation	0	4	8	12	16	20	24	28
T_1	0	13.82	22.87	28.9	39.82	51.4	60.07	69.07
T_2	0	-0.26	-0.80	-1.50	-1.67	-1.72	-2.00	3.07
T_3	0	10.15	18.02	23.27	33.27	44.57	53.35	62.55
T_4	0	0.6	0.17	-0.3	-0.3	-0.25	-0.2	7.4
T_5	0	10.52	17.87	22.87	32.47	42.75	50.65	59
CD	0	1.90	3.05	3.77	5.05	6.29	7.12	8.22

Table 4: Effect of Different Types of Coating on Change in Fruit Volume (ml)

Days interval of observation	0	4	8	12	16	20	24	28
T_1	0	8.75	28.75	30	46.25	52.5	73.75	88.75
T_2	0	-11.25	-10	-15	-10	-26.25	-12.5	1.25
T_3	0	11.25	28.75	37.5	54.5	68.75	73.75	95
T_4	0	-5	-18.75	-20	-13.75	-30	-27.5	2.5
T_5	0	13.75	23.75	30	49.5	60	65	86.25
CD	0	5.14	15.68	14.16	12.51	12.97	13.40	21.24

Table 5: Effect of Different Types of Coating on Physiological loss in weight (%)

Days Interval of Observation	0	4	8	12	16	20	24	28
T_1	0	4.72	3.24	2.23	4.14	4.57	3.6	3.87
T_2	0	-0.08	-0.18	-0.25	-0.05	-0.01	-0.09	1.84
T_3	0	3.49	2.81	1.92	3.74	4.39	3.57	3.88
T_4	0	0.21	-0.15	-0.16	0.00	0.01	0.01	2.72
T_5	0	3.74	2.71	1.89	3.72	4.14	3.32	3.63
CD	0	0.55	0.34	0.22	0.39	0.39	0.31	0.85

Conclusion

The results concluded from the present investigation are that the kinnow fruit when treated with different types of coating showed significant effect on physical characters. All the treatments also showed significant differences among each other. Loss in quality and physical characters of Kinnow fruit was observed as the storage time increases.

So, we concluded from the research that fruits covering with polythene showed best results among all the treatments. Polythene have a significant effect on preserving the quality and shelf life of Kinnow. Minimum decrease in fruit length, fruit breadth, fruit weight, fruit volume and physiological loss in weight was observed in fruits covering with polythene whereas maximum decrease was noted in oil coated fruits. This research being done on physical characteristics which would help to avoid the deterioration of fruits and increasing the shelf life of fruits.

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