The Pharma Innovation Journal 2022; 11(3): 1352-1356

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(3): 1352-1356

www.thepharmajournal.com
Received: 10-01-2022
Accepted: 17-02-2022

Sukrampal
Department of Horticulture, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

GS Rana
Department of Horticulture, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Satpal Baloda
Department of Horticulture, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Mohan Lal Jat
Department of Horticulture, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Rajesh Mor
Department of Horticulture, College of Horticulture, Maharana Pratap Horticultural University, Karnal, Haryana, India

Corresponding Author:
Mohan Lal Jat
Department of Horticulture, College of Agriculture, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

Effect of different fungicides and calcium nitrate on shelf life and quality of kinnow mandarin

Sukrampal, GS Rana, Satpal Baloda, Mohan Lal Jat and Rajesh Mor

Abstract
An experiment was conducted to study the effect of different fungicides and calcium nitrate on shelf life and quality of Kinnow mandarin" was carried out at CCS Haryana Agricultural University, Hisar during the year 2019-20. Spray of carbendazim, copper oxychloride, mancozeb, propiconazole, nimbecidine, calcium nitrate and their combinations was done ten days prior to harvesting on ten years old Kinnow plants in the experimental orchard of the Department of Horticulture, CCS HAU, Hisar. The minimum loss (4.82%) in weight was also observed in carbendazim 0.05% + calcium nitrate 1% and propiconazole 0.05% + calcium nitrate 1% compare to other treatments. The physical and quality parameters *viz*., juice content, rag content, organoleptic rating, were found non-significant with various pre- harvest treatments as compared to control. Among all the treatments, the maximum rind weight was observed in carbendazim 0.05% + calcium nitrate 1% (26.10%).

Keywords: Kinnow, fungicides, calcium nitrate, physical parameters, shelf life

Introduction
Citrus group belongs to the family rutaceae. It consists of sweet orange, lime, lemon, mandarin and grapefruit. Kinnow (*Citrus nobilis* Lour. x *Citrus deliciosa* Tenora.) is a hybrid variety of mandarin group in citrus. Kinnow has become exceedingly popular with the growers and consumers because of its superb fruit quality coupled with good tree vigour, higher cropping potential and better performance than other citrus fruits. Citrus occupies an important place in horticultural wealth of India by covering 10.03 lakh hectare area with an annual production of 125.46 lakh MT (Anonymous, 2018) [1]. In Haryana total area under citrus fruits is 20.78 thousand hectares with an annual production of 549.33 thousand MT (Anonymous, 2019) [2]. Kinnow mandarin is cherished around the globe due to their nutritional value, pleasant flavor and refreshing taste. Citrus fruits are non-climacteric, having low rate of respiration and they are comparatively poorer in post-harvest life as compared to climacteric fruits. It is essential to store the Kinnow fruits for a considerable period to avoid glut in the market after harvesting season. Storage impact a great influence on fruit texture, colour, aroma and other various physical and biochemical parameters. Various factors have been reported to be associated with post-harvest losses of Kinnow mandarin. There are 20-30% post-harvest losses in Kinnow mandarin happened during the storage due to bacterial and fungal contamination on the fruit, mismanagement of diseases, poor quality fruit, inappropriate weather condition, delay in harvesting, lack of proper roads and improper cold storage facilities, surplus supply in the market (Singh *et al*., 2004) [14]. Post-harvest impairment caused by green mould rot, blue mould rot, stem end rot and core rot are the most economically significant post-harvest diseases of Kinnow mandarin. Various physiological activities like respiration, ethylene liberation and enzyme were also responsible for limiting the shelf life of Kinnow (Singh and Mandal, 2006) [13]. Fruit infected with pathogen cannot be stored for a longer period. The disease spreading inoculum load, already established at pre-harvest stages of fruit is difficult to eradicate by mere post-harvest application of fungicides. So to achieve higher yield of quality fruits with better shelf life, different pre-harvest treatments were used. It is also noted that government regulations allow only pre-harvest application of specific chemicals for decay control. The best approach to control the post-harvest fruit rotting is pre-harvest field application of fungicides (Sharma, 1990) [12]. Pre-harvest application of fungicides has been used to reduce pre-harvest inoculum load and subsequent post-harvest decay in various citrus fruits (Blackarski *et al*., 2001) [3]. The application of mineral nutrients like calcium nitrate and different fungicides at pre-harvest stages was known to play a crucial role in growth, development and quality with longer shelf life of fruits.

The role of calcium in stabilizing cell membrane, enzymatic activity and slowing senescence of horticultural and agronomic crops were widely recognized. The use of pre and post-harvest calcium application may additionally slowdown senescence in fruits without harmful impact on consumer attractiveness (Lester and Grusak, 1999) [8]. The present study will contribute in understanding the physical and biochemical status of Kinnow mandarin fruits at harvest as influenced by pre-harvest spray of fungicides and calcium nitrates, which may help in increasing the shelf life and quality of Kinnow mandarin.

Material and Methods

The present investigation was conducted during the year 2019-20 in the experimental orchard, Department of Horticulture, CCS Haryana Agricultural University, Hisar. The objective determing suitable treatments for better shelf life and quality of kinnow mandarin. The experiment was laid out in 6×6 Randomized block design comprising 12 treatments *i.e*. Carbendazim 0.05% + calcium nitrate 1% (T_1), Carbendazim 0.1% (T_2), Copper oxy chloride 0.2% + calcium nitrate 1% (T_3), Copper oxy chloride 0.3% (T_4), Mancozeb 0.2% + calcium nitrate 1% (T_5), Mancozeb 0.3% (T_6), Propiconazole 0.05% + calcium nitrate 1% (T_7), Propiconazole 0.1% (T_8): Nimbecidine 0.0009% + calcium nitrate 1% (T_9), Nimbecidine 0.0015% (T_{10}), Calcium nitrate 1% (T_{11}), Control (T_{12}) with three application. Application of above treatments was done on 5th December 2019 and fruits were harvested on 16th December 2019 with the help of secateurs. Harvested fruits were stored in CFB boxes at room temperature. Observations was recorded Loss in weight (%), Rind weight (%), Juice content (%), Rag content (%) and Organoleptic evaluation.

Results and Discussion

Loss in weight (%)

The data presented in table no. 1 clearly indicates that loss in weight was increased with the advancement of storage period. On 7th day of storage, the minimum loss in weight (4.82%) was recorded, whereas the maximum loss in weight (15.13%) was observed on 49th day of storage when considered on the mean basis irrespective of treatments. Application of fungicides, nimbecidine, calcium nitrate and their combinations reduced the loss in weight significantly during storage period. Among the treatments, application of carbendazim 0.05% + calcium nitrate 1% and propiconazole 0.05% + calcium nitrate 1% showed maximum reduction in loss in weight of fruits as compared to control during storage. This reduction in loss in weight was observed from the first day of observation after storage and this trend was maintained throughout the storage period. On 7th, 14t^{h}, 21st, 28th, 35th, 42nd and 49th days of storage the minimum loss in weight (4.40%), (7.19%), (10.54%), (12.81%), (13.98%), (14.25%), and (14.79%) was observed with carbendazim 0.05% + calcium nitrate 1% respectively followed by propiconazole 0.05% + calcium nitrate 1% (4.47%), (7.17%), (10.56%), (12.82%), (14.03%), (14.28%) and (14.82%) on 7th, 14t^{h}, 21st, 28th, 35th, 42nd and 49th days of storage respectively. Both the treatments were statistically at par with respect to loss in weight of fruits and the maximum loss in weight was observed in control during the storage period. The loss in weight of Kinnow fruits during storage period varied with different preharvest sprays of fungicides, nimbecidine, calcium nitrate and their combinations. In this experiment data presented in table 1 reveals that treatments carbendazim 0.05% + calcium nitrate 1% and propiconazole 0.05% + calcium nitrate 1% were found very effective in reducing the loss in weight of Kinnow fruits. Both the treatments were statistically at par in respect to reduction of loss in weight at different intervals of storage. With advancement of storage period, loss in weight of Kinnow fruits increased in all the treatments. The increase in loss in weight during storage period is obvious because the fruits were stored at ambient conditions. The loss in weight was mostly due to loss in moisture from fruit surface in the form of evapotranspiration and respiration. In treated fruits, loss in weight was observed less as compared to control. This might be due to calcium nitrate because calcium was known to retard the rate of respiration and prevent the cellular disintegration by maintaining protein and nucleic acid synthesis there by reduced the weight loss. These results are in close conformity with the earlier findings of Gupta and Singh (2016) [6] who found that loss in weight increased with the advancement of storage period and the minimum loss in weight was recorded in calcium chloride 1.0% + Bavistin 0.1 percent. Similar results were obtained by Kaur and Kumar (2014) [7] in Kinnow, Sinha *et al*. (2019) [15] in plum and Meena *et al*. (2017) [9] in Nagpur mandarin.

Table 1: Effect of pre-harvest spray of fungicides, nimbecidine, calcium nitrate and their combinations on loss in weight (%) in Kinnow mandarin during storage at room temperature

Treatments	Days in storage						
	7	14	21	28	35	42	49
Control	5.29	7.79	10.93	13.24	14.50	14.90	15.54
Carbendazim 0.05% + calcium nitrate 1%	4.40	7.19	10.54	12.81	13.98	14.25	14.79
Carbendazim 0.1%	4.93	7.54	10.76	13.01	14.21	14.59	15.18
COC 0.2% + calcium nitrate 1%	4.71	7.38	10.63	12.92	14.15	14.54	15.08
COC 0.3%	4.83	7.50	10.72	12.97	14.21	14.58	15.17
Mancozeb 0.2% + calcium nitrate 1%	4.76	7.44	10.70	12.93	14.17	14.53	15.11
Mancozeb 0.3%	4.85	7.53	10.75	13.00	14.22	14.58	15.16
Propiconazole 0.05% + calcium nitrate 1%	4.47	7.17	10.56	12.82	14.03	14.28	14.82
Propiconazole 0.1%	4.87	7.53	10.73	12.99	14.22	14.58	15.16
Nimbecidine 0.0009% + calcium nitrate 1%	4.80	7.52	10.75	12.97	14.19	14.58	15.13
Nimbecidine 0.0015%	4.93	7.61	10.76	13.02	14.23	14.59	15.18
Calcium nitrate 1%	5.03	7.66	10.78	13.06	14.27	14.61	15.22
Mean A	4.82	7.49	10.72	12.98	14.20	14.55	15.13
C.D. at 5%	0.12	0.16	0.18	0.16	0.18	0.19	0.20

Rind weight (%)

The data presented in table no. 2 reveals that the rind weight of fruits decreased with increasing storage period in all the treatments. The maximum rind weight (28.96%) was observed on initial day of storage which decreased to 23.67% on 49th day of storage when considered on mean basis irrespective of treatments. Among the treatments, the maximum rind weight was observed in carbendazim 0.05% + calcium nitrate 1% (26.10%) followed by propiconazole 0.05% + calcium nitrate 1% (26.08%), mancozeb 0.2% + calcium nitrate 1% (26.01%), Copper oxychloride 0.2% + calcium nitrate 1% (26.00%) and nimbecidine 0.0009% + calcium nitrate 1% (25.99%) which were statistically at par with carbendazim 0.05% + calcium nitrate 1%. While the minimum rind weight (25.59%) was observed in control, followed by carbendazim 0.1% (25.65%), propiconazole 0.1% (25.66%), mancozeb 0.3% (25.66%), copper oxychloride 0.3% (25.66%), and nimbecidine 0.0015% (0.68%), these treatments were statistically at par with carbendazim 0.1% in respect of rind weight of fruits. The interaction between treatments and storage period was found non-significant. The rind weight of Kinnow fruits was significantly affected by the pre-harvest treatments and the different storage period. The data presented in table no. 2 reveals that rind weight of Kinnow fruits decreased with advancement of storage period. The maximum rind weight (26.10%) was reported in fruits treated with carbendazim 0.05% + calcium nitrate 1% while the minimum rind weight was observed in control. Decreasing of rind weight with advancement of storage might be due to moisture loss from the surface of fruits peel in the form 37 of respiration and evaporation. Similar results were obtained by Devi *et al*. (2016) [4] in Kinnow mandarin who reported that rind weight was decreased with advancement of storage period.

Table 2: Effect of pre-harvest spray of fungicides, nimbecidine, calcium nitrate and their combinations on Rind weight (%) in Kinnow mandarin during storage at room temperature

Treatments	Days in storage								
	0	7	14	21	28	35	42	49	Mean
Control	28.69	28.04	26.98	25.16	24.34	24.11	23.95	23.41	25.59
Carbendazim 0.05% + calcium nitrate 1%	29.29	28.63	27.40	25.79	25.01	24.49	24.30	23.91	26.10
Carbendazim 0.1%	28.70	28.13	26.84	25.24	24.40	24.22	24.07	23.58	25.65
COC 0.2% + calcium nitrate 1%	29.23	28.58	27.23	25.90	24.79	24.50	24.11	23.68	26.00
COC 0.3%	28.71	28.13	26.85	25.28	24.42	24.23	24.05	23.59	25.66
Mancozeb 0.2% + calcium nitrate 1%	29.22	28.59	27.26	25.83	24.83	24.45	24.11	23.80	26.01
Mancozeb 0.3%	28.72	28.14	26.84	25.30	24.43	24.21	24.06	23.61	25.66
Propiconazole 0.05% + calcium nitrate 1%	29.26	28.64	27.37	25.84	24.94	24.49	24.23	23.84	26.08
Propiconazole 0.1%	28.71	28.12	26.85	25.29	24.44	24.19	24.06	23.59	25.66
Nimbecidine 0.0009% + calcium nitrate 1%	29.22	28.55	27.20	25.82	24.80	24.41	24.14	23.80	25.99
Nimbecidine 0.0015%	28.73	28.12	26.83	25.27	24.43	24.20	24.06	23.60	25.66
Calcium nitrate 1%	29.05	28.37	27.05	25.54	24.57	24.24	24.06	23.65	25.82
Mean	28.96	28.34	27.06	25.52	24.62	24.31	24.10	23.67	
C.D. at 5%	Treatments(T)=0.19, Storage(S)=0.16, T×S=NS								

Juice content (%)

The data pertaining to juice content as affected by pre harvest treatments are presented in table no. 3 the data reveals that the juice content was non significantly affected by the treatments. The fruit juice content was reduced with the advancement of storage period in all the treatments. The maximum juice content (45.79%) was found at initial day of storage while the minimum (38.13%) was observed at 49th day of storage when considered on the mean basis irrespective of treatments. The interaction between treatments and period of storage was found non-significant. In this experiment the sprays of different fungicides, nimbecidine, calcium nitrate and their combinations had non-significant difference on juice content of Kinnow fruits. The juice content of Kinnow fruits was decreased with the advanced of storage period in all the treatments. The decrease in juice content of fruits during storage wass due to loss of moisture from fruit surface. Similar results were obtained by Kaur and Kumar (2014) [7] in Kinnow who reported that juice content decreased with advancement of storage period and effect of various treatments found non-significant on juice content. Similar results were obtained by Meena *et al*. (2017) [9] in Nagpur mandarin

Table 3: Effect of pre-harvest spray of fungicides, nimbecidine, calcium nitrate and their combinations on Juice content (%) in Kinnow mandarin during storage at room temperature

Treatments	Days in storage								
	0	7	14	21	28	35	42	49	Mean
Control	45.67	44.47	42.69	41.31	39.97	38.86	38.45	38.10	41.19
Carbendazim 0.05% + calcium nitrate 1%	45.84	44.81	43.15	41.36	40.09	39.10	38.63	38.16	41.39
Carbendazim 0.1%	45.78	44.87	43.20	41.36	40.09	39.10	38.63	38.22	41.41
COC 0.2% + calcium nitrate 1%	45.84	44.75	42.76	41.42	40.15	39.10	38.51	38.10	41.33
COC 0.3%	45.90	44.81	43.15	41.36	40.09	39.04	38.51	38.10	41.37
Mancozeb 0.2% + calcium nitrate 1%	45.79	44.70	43.15	41.36	40.09	39.04	38.51	38.10	41.34
Mancozeb 0.3%	45.90	44.87	43.15	41.31	40.03	38.98	38.45	38.10	41.35
Propiconazole 0.05% + calcium nitrate 1%	45.73	44.70	42.76	41.36	40.09	39.04	38.51	38.10	41.29
Propiconazole 0.1%	45.84	44.81	43.15	41.36	40.09	39.04	38.51	38.16	41.37
Nimbecidine 0.0009% + calcium nitrate 1%	45.78	44.75	43.15	41.31	40.09	38.98	38.51	38.16	41.34

Nimbecidine 0.0015%	45.73	44.75	43.15	41.31	40.09	38.98	38.45	38.16	41.33
Calcium nitrate 1%	45.73	44.70	43.15	41.42	40.15	39.10	38.63	38.16	41.38
Mean	45.79	44.75	43.05	41.35	40.08	39.03	38.53	38.13	
C.D. at 5%	Treatments(T)=NS, Storage(S)=0.31, T×S=NS								

Rag content (%): The data presented in table no. 4 reveals that rag content increased with advancement of storage period, whereas the effect of various treatments was found non-significant on rag content throughout the storage period. The maximum rag content (25.65%) was observed on 49th day of storage while the minimum (23.37%) was observed on initial day of storage, when considered on the mean basis irrespective of treatments. The interaction between treatments and period of storage was also found to be non-significant. he data presented in table no. 4 reveals that rag content increased with the advancement of storage period, whereas the various treatments had non-significant effective on rag content throughout the storage period. The maximum rag content (25.65%) was observed on 49th day of storage while the minimum (23.37%) was observed on initial day of storage. The increased rag content during storage might be due to decrease rind and juice percentage as it is inversely proportion to both rind and juice percentage. The results of present study are in line with Dhakad *et al*. (2020) [5] who reported that rag percent of acid lime fruits increased with the storage period. Similar results were obtained by Sangwan *et al*. (2008) [11] in Kinnow mandarin.

Table 4: Effect of pre-harvest spray of fungicides, nimbecidine, calcium nitrate and their combinations on Rag content (%) in Kinnow mandarin during storage at room temperature

Treatments	Days in storage								
	0	**7**	**14**	**21**	**28**	**35**	**42**	**49**	**Mean**
Control	23.52	23.76	24.22	24.35	24.59	24.96	25.31	25.79	24.56
Carbendazim 0.05% + calcium nitrate 1%	23.30	23.65	24.03	24.26	24.43	24.80	25.18	25.59	24.41
Carbendazim 0.1%	23.39	23.67	24.05	24.30	24.47	24.84	25.21	25.70	24.45
COC 0.2% + calcium nitrate 1%	23.25	23.61	23.99	24.22	24.37	24.76	25.13	25.52	24.36
Coc 0.3%	23.41	23.68	24.06	24.29	24.46	24.83	25.20	25.70	24.45
Mancozeb 0.2% + calcium nitrate 1%	23.31	23.66	24.05	24.28	24.43	24.79	25.17	25.59	24.41
Mancozeb 0.3%	23.41	23.66	24.06	24.26	24.46	24.83	25.20	25.70	24.45
Propiconazole 0.05% + calcium nitrate 1%	23.25	23.66	24.04	24.26	24.41	24.79	25.15	25.54	24.39
Propiconazole 0.1%	23.41	23.65	24.06	24.27	24.46	24.82	25.20	25.70	24.45
Nimbecidine 0.0009% + calcium nitrate 1%	23.30	23.65	24.04	24.26	24.43	24.79	25.17	25.58	24.40
Nimbecidine 0.0015%	23.40	23.65	24.05	24.27	24.45	24.83	25.19	25.69	24.44
Calcium nitrate 1%	23.45	23.69	24.07	24.76	24.48	24.86	25.22	25.71	24.53
Mean	23.37	23.67	24.06	24.32	24.45	24.83	25.19	25.65	
C.D. at 5%	Treatments(T)=NS, Storage(S)=0.15, T×S=NS								

Organoleptic evaluation

The data presented in table no. 5 indicates that the organoleptic rating decreased with advancement of storage period. The various treatments were found non-significantly affecting the organoleptic rating. The maximum organoleptic rating (9.48) was observed on initial day of storage while the minimum (4.66) was recorded at 49th day of storage period when considered on the mean basis irrespective of treatments. The interaction between treatments and period of storage was also found to be non-significant. The present study reveals that pre-harvest sprays of different fungicides, nimbecidine, and their combinations had non-significant effect on organoleptic rating of Kinnow fruits. The organoleptic rating of Kinnow fruits declined with the advancement of storage period. This might be due to decreased firmness and overall appearance of fruits during storage period. The above findings are in accordance with the finding of Sinha *et al.* (2019) [15] who reported that organoleptic rating decreased with advancement of storage period in plum. Similar results were obtained by Meena *et al.* (2017) [9] in Nagpur mandarin.

Table 5: Effect of pre-harvest spray of fungicides, nimbecidine, calcium nitrate and their combinations on Organoleptic evaluation in Kinnow mandarin during storage at room temperature

Treatments	Days in storage								
	0	**7**	**14**	**21**	**28**	**35**	**42**	**49**	**Mean**
Control	9.30	8.50	8.00	7.40	6.80	6.10	5.20	4.20	6.94
Carbendazim 0.05% + calcium nitrate 1%	9.40	8.70	8.30	7.80	7.20	6.60	5.90	4.70	7.32
Carbendazim 0.1%	9.40	8.70	8.20	7.70	7.20	6.60	5.80	4.60	7.28
COC0.2% + calcium nitrate 1%	9.60	8.90	8.40	7.90	7.40	6.80	6.00	4.90	7.49
COC 0.3%	9.50	8.80	8.30	7.80	7.30	6.70	5.90	4.80	7.39
Mancozeb 0.2% + calcium nitrate 1%	9.50	8.70	8.20	7.80	7.30	6.70	5.80	4.80	7.35
Mancozeb 0.3%	9.50	8.70	8.20	7.80	7.30	6.70	5.80	4.80	7.35
Propiconazole 0.05% + calcium nitrate 1%	9.50	8.80	8.30	7.70	7.20	6.60	5.70	4.70	7.31
Propiconazole 0.1%	9.40	8.70	8.30	7.70	7.20	6.62	5.70	4.70	7.29
Nimbecidine 0.0009% + calcium nitrate 1%	9.60	8.80	8.30	7.80	7.30	6.70	5.70	4.70	7.36
Nimbecidine 0.0015%	9.50	8.70	8.20	7.70	7.20	6.60	5.60	4.60	7.26
Calcium nitrate 1%	9.50	8.60	8.20	7.60	7.20	6.50	5.50	4.40	7.19
Mean	9.48	8.72	8.24	7.72	7.22	6.60	5.72	4.66	
C.D. at 5%	Treatments(T)=NS, Storage(S)=0.28, T×S=NS								

References

1. Anonymous. Horticultural Statistics at a Glance 2018 2018, 9p. http://www.nhb.gov.in
2. Anonymous. http://www.hortharyana.gov.in. Final area and production of fruits crops for the year, 2018-19, 2019.
3. Blacharski RW, Bartz JA, Xiao CL, Legard DE. Control of post-harvest Botrytis fruit rot with pre-harvest fungicide applications in annual strawberry. Plant disease. 2001;85(6):597-602.
4. Devi A, Sharma N, Wali VK, Bakshi P, Jamwal M, Kumar R. Effects of preharvest bioregulator application on shelf-life and disease incidence during storage of Kinnow mandarin. Bangladesh Journal of Botany, 2016;45(5):1091-1099.
5. Dhakad A, Sonkar P, Bepari A, Kumar U. Effect of pre-harvest application of plant growth regulators and calcium salts on biochemical and shelf life of acid lime *(Citrus aurantifolia* Swingle.). Journal of Pharmacognosy and Phytochemistry. 2020;9(4):1983-1985.
6. Gupta N, Singh VB. Pre-harvest foliar application of calcium chloride, Bavistin and Bayleton on post-harvest life of *Emblica officinalis* Gaertn. fruits. Bangladesh Journal of Botany. 2016;45(1):211-219
7. Kaur N, Kumar A. Impact of post-harvest treatments on shelf life of Kinnow mandarin. International Journal of Advance Research. 2014;2(5):290-295.
8. Lester GE, Grusak MA. Post-harvest application of calcium and magnesium to honeydew and netted muskmelons: effects on tissue ion concentrations, quality, and senescence. Journal of the American Society for Horticultural Science. 1999;124(5):545-552.
9. Meena MK, Jain MC, Singh P. Effect of pre-harvest spray of calcium nitrate, boric acid and zinc sulphate on storability of Nagpur mandarin (*Citrus reticulata* Blanco). Journal of Applied and Natural Science. 2017;9(3):1297-1301.
10. Meena MK, Jain MC, Singh J, Sharma M, Shing B, Maurya IB. Effect of preharvest spray of calcium nitrate, boric acid and zinc sulphate on yield and quality of Nagpur mandarin (*Citrus reticulata* Blanco). International Journal of Horticultural Science. 2016;22(1-2):23-28.
11. Sangwan AK, Rattanpal HS, Arora NK, Dalal RS. Effect of foliar application of potassium on fruit yield and quality of Kinnow mandarin. Environmental Ecology. 2008;26(4C):2315-2318.
12. Sharma RL. Efficacy of pre-harvest fungicidal sprays in controlling post-harvest diseases of China pear. Plant Disease Research. 1990;5(1):109-111.
13. Singh D, Mandal G. Improved control of Rhizopus stolonifer induced storage rot of peach with hot water and antagonistic yeast, *Debaryomyces hansenii*. Indian Phytopathology. 2006;59(2):168-173.
14. Singh IP, Srivastava AK, Shivankar VJ, Singh S. Storage of citrus fruits. In: M.S. Ladaniya (ed.), Advances in Citriculture. Jagmander Book Agency, Delhi, 2004, 608-645.
15. Sinha A, Jawandha SK, Gill PPS, Singh H. Influence of pre-harvest sprays of calcium nitrate on storability and quality attributes of plum fruits. Journal of food science and technology. 2019;56(3):1427-1437.