International Journal of Research and Development in Pharmacy and Life Sciences

Available online at http//www.ijrdpl.com

December - Januaryr, 2013, Vol. 3, No.1, pp 797-807

ISSN: 2278-0238

Research Article

EFFECT OF FUNGICIDES, HEAT THERAPY, POLYETHYLENE PACKAGING, TEMPERATURE AND STORAGE PERIOD ON QUALITATIVE CHARACTERISTICS OF JIROFT TANGERINE

Sepideh Khorasani[1] , Mohammad Hossain Azizi[2]

1. Department of Food Science & Technology of Shahid Bahonar University, Kerman, Iran.
2. Department of Food Science & Technology of Tarbiat Modares University, Tehran, Iran.

***Corresponding Author: Email** khorasany_mak@yahoo.com, azizit_m@modares.ac.ir

(**Received:** May 14, 2012; **Accepted:** July 19, 2012)

ABSTRACT

In this research, the effect of heat therapy (3 days at 36°C), non-phenyl fungicide (immersion in 4% biphenyl solution for 2 minute), polyethylene coating, and combination of these treatments on the quality and storage life of Kino Tangerines cultivated in Jiroft was studies. The specimens were stored in two media (plain storage and fridge) for 3 months. The total amount of the soluble solid substances in juice (TSS), TA, and TSS/TA ratio, tissue firmness and flesh color in all treatments were measured 60 and 90 days after removing the fruits from fridge and plain storage. Results suggest that in the plain storage, the best treatment after 60 days is the use of fungicide and polyethylene coating. The highest TSS/TA ratio is related to the polyethylene coating stored in fridge for 90 days. The highest color quality is related to heat therapy along with the polyethylene coating stored in fridge for 60 days. Cold storage has been more effective in flesh firmness than in its plain counterpart, and the 60-day period has been more influential than 90-day period with heat therapy and polyethylene coating than other treatments. Therefore, considering the above mentioned results for plain storage, use of fungicide along with polyethylene coating, and for cold storage, heat therapy along with polyethylene coating can be recommended for storing Kino tangerine.

Keywords: Polyethylene coating, Fungicide, Heat therapy, Jiroft Kino tangerine.

.

INTRODUCTION

Producing 3.5 percent of the world citrus, Iran ranks the seventh top producer of these crops. Tangerine is part of citrus production of which in Jiroft region (Southeast Iran) reached about 620 thousands of tons in 2005. Due to different reasons, particularly inappropriate harvest time, incorrect transportation conditions, and improper storage, 10-20 percent of the tangerines produced in the area perish. [1] Fungi such as Penicillium and fungi of the genus Geotrichome and Trichoderma lead to fruit spoilage.

The losses are controlled using fungicide after harvest. This treatment aims at preventing the initial contamination and dispersion of pathogenic fungi spores around the healthy fruits. Biphenyl (1, 1-biphenyl (IUPAS) (prevents formation of spores which are used to prevent citrus spoilage. This combination is soluble in water and no side effect has been reported on the citrus. In one hand, the citrus produced in the south of the country including Jiroft, Jahrom and Bandar Abbas have thick peels which prevent fungicide from penetrating into the fruit flesh.

Mahmood Abadi et al. (1995) reported the influence of heat therapy on decay after exposing the harvested citrus exposed to *Penicillium italicum*. Therefore, heat therapy is in fact a physical treatment and use of fungicide is a chemical treatment with the same objective, and positive results have been achieved through replacement of physical treatment with chemical treatment. [9]

Many researches have been conducted on choosing appropriate post-harvest processes to reduce the wastage to increase storage durability, and to save the primary quality of citrus, and many methods have been considered such as use of fungicides, curing, and packaging with polyethylene coating before storage. Hill et al. recommended the use of gradual heat therapy at 1°C for 16 days at storage period for removing the corrupt microbes in citrus [8]. Mc Glasson (1989) recommends the use of polyethylene coatings along with heat therapy in increasing the storage time [*10*].

As reported by Muoz-Delgado (1987), lemon and lime are more sensitive to cold treatment than orange and tangerine. Research indicates that biphenyl fungicides are appropriate for removing decay-generating fungi in packaging fruits such as tangerine and orange [*11*].

Echot (1990) reports that wrapping the fruit with thin plastic sheets affects the preservation of taste and freshness, decrease of fruit breath severity, and consequently delay in fruit aging and prevents from the dispersion of contamination among the fruits. He also reports the effect of various heat therapy treatments along with polyethylene coating on the decrease of wastage after the Valencia and Washington Novel orange harvest and reports that polyethylene coating and heat therapy are effective in controlling fungal diseases including *Penicillium italicum* and *Penicillium digitatum* as well as preventing from fruit weight loss[*5*].

Obenland et al. (1996), assume that the combined treatment of wax and fungicide is effective in preventing the weight loss and improving in the appearance of orange and grape [*14*].

Predeben & Wards (1992) studied the influence of heat therapy and fungicide on the quality of two types of lemons during storage and recommended the use of ThiabendAzol fungicide for controlling the decay and fungal infections. They believed that heat therapy for 4 days increases the essence percent and the flesh yellow color in 16 and 32 days and prevents from chilling injury [*15*].

Researchers studied the effect of Thiabendazol warm fungicide solution before storage on the reduction of chilling injury and lemon decay in fridge with 3°C and reported that these fungicides control the fruit decay. Applying polyethylene coating and wax has a significant effect on decrease of the lemon tissue firmness.

Some authors have studied the influence of traditional storage, cold storage, fungicide, polyethylene coating, and heat therapy on the storage time of the mandarin tangerine. Their studies suggest that wrapping the fruits with thin polyethylene alone or along with the heat therapy treatments or fungicide in both types of storages, in comparison with other treatments prevents significantly from weight loss.

Golshan (2002) in a study on controlling the decay of local orange in Jiroft, found the same results as Ganji Moghaddam et al. (1995) has reported. Mostofipur et al. (1993) recommend biphenyl and benomyl fungicides and wax paper to reduce fungi decay after harvest and propose fungicide treatment along with polyethylene has the highest effect on decay decrease [*6, 7, 13*].

MATERIALS AND METHODS

The present research studies the effect of fungicide treatments, curing, and polyethylene coating on the loss decrease after harvesting Kino tangerine in Jiroft region in plain and cold warehouse as well as on the increase of the useful age and preserving the desirable quality of this valuable product in Jiroft region.

Kino tangerine of Jiroft has been considered for this purpose. After harvesting the tangerine in conventional temperature in garden, the preliminary testes including the determination of soluble solid substances, tissue firmness, etc. were conducted.

Specimens were immediately taken to the technical research and agriculture engineering laboratory of Kerman. They were first weighed and classified based on their size and color; then the following treatments were conducted:

1- Control group: fruits (almost 2 kg) were put inside the cardboard boxes without any treatment.

2- Polyethylene coating (P): (2kg) they were packed individually without any other treatments inside the 19 microns polyethylene coatings and using thermocouple thermal gun models, HG1100CS/Q and Swiss 662

3- Heat therapy: in this treatment, two kg of fruits were kept in incubator for three days at 36°C.

4- Fungicide: two kg of fruits was disinfected using fungicide (biphenyl, using immersion method for 2 minutes in solution 4%.

5- Fungicide and heat therapy: two kg of fruits were kept in the incubator for 3 days and at 36°C with disinfecting fungicide.

6- Fungicide and polyethylene coating: two kg of fruits were packed in polyethylene coatings without air and after fungicide disinfecting.

7- Heat therapy and polyethylene: first the fruits were put in incubator for 3 days at 36°C and then packed in PE coatings.

8- Fungicide with heat therapy and coating: the fruits were put in incubator for 3 days at 36°C after disinfection with fungicide, and packed in PE coatings.

All treatments were classified in 4 groups and stored with three repetitions in plain storage or ambience temperature of 10°C and relative moisture of 40% and fridge at temperature of 0°C and relative moisture of 90% for 60 and 90 days. After the end of storage period, the total amount of the solid soluble materials of the each treated and replication were measured with refractor model IT, Shonchit Tangliang Company. Also the free acidity of each specimen with pseudo 0.1 was measured based on citric acid. In the further tests, the tissue firmness was measured with tissue-meter model The Houns Field, made in England, and the force exercised was measured with a12mm thick bar to create shear and compression tension reported in terms of Newton. Factors a, b, and also Hue angle of each specimen's color were measured and recorded with colorimeter model DP9000. The color is reported in terms of light parameters (L), Croma © and (h) angle.

The following equations illustrate the food's color quality of with indices c*, h*, ΔE.

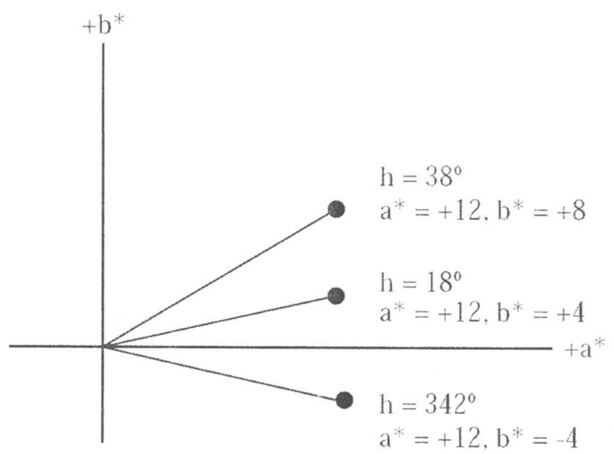
(1) $hue = \tan^{-1}(b^*/a^*)$

(2) $C^* = \left(a^{*2} + b^{*2}\right)^{1/2}$

(3) $E\Delta^* ab = \left(\Delta L^{*2} + \Delta a^{*2} + \Delta b^{*2}\right)^{1/2}$

H angle in three solutions with different colors of orange, red to violet

Positive or negative number a*determined by the device indicates the redness or greenness of the color.



Data collected within completely randomized blocks were compared to double split plots. The type of storage (plain, cold) was compared in the main plot, the storage period was compared in the secondary plot (60, 90 days), and the eight treatments were compared in the secondary plots. In the treatments with significant differences concerning the variance analysis test, the averages were compared with those of Dunken multi-range test. The statistical test was conducted using the software MSTATC and the diagrams were prepared using software Excel.

RESULTS AND DISCUSSION

The following tables show the variance and the comparison of average test factors on the features measured in -Kino Jiroft tangerine.

The variance analysis (mean squares) in table 1 indicates that storage time and post-harvest processes (use of fungicide, curing, and package type) have significant effects on the measured features including TA, TSS, TSS/TA, color and final firmness of the fruit. However, the effect of the storage type on TSS, TSS/TA is not significant.

Due to the higher storage temperatures the amounts of tangerine TSS and TA change. Table 2 indicates that the higher the storage temperature, the lower the TSS and TA.

As the storage temperature decreases, the moisture evaporation slows down and consequently the production of insoluble solid material will be lower and the measurable acidity increases due to transformation of carbohydrates and pectin to the acidic materials. Storage type has a significant effect on TSS/TA in fruit and the increase of storage period from 60 to 90 days, results in acceleration of

Table 1- The result of Data Variance Analysis Test (Mean Squares)

Feature / Change source	Degree of freedom	TSS	TA	TSS/TA	Color degree	Fruit firmness Newton
Storage Type (A)	1	12/01*	9/54*	236/7ns	4622**	28206*
Storage Type (B)	1	1/05**	3/53**	552/6**	4656**	36571**
Fruit treatment (C)	7	5/03**	0/21**	57/45**	1398**	696**
B×A Interaction	1	7/07**	0/005ns	4/02ns	5704**	25460**
C×A Interaction	7	1/35**	0/11**	28/58**	1068**	4716**
C×B Interaction	7	1/48**	0/23**	50/27**	1220**	3530**
C×B×A Interaction	7	0/91**	0/16**	41/79**	1076**	3173**
Change index (%)	–	2/14	8/88	19/48	5/31	10/88

Table 2- The main effects of type of storage type, storage period, and fruit treatment on the measured features

Feature / Treatment	TSS	TA	TSS/TA	Color degree	Fruit hardness Newton
Storage Type	14/2a	1/04b	15/1	63/9b	86/2b
Plain storage	13/5b	1/20a	12/0	77/8a	120/5a
Fridge					
Storage period	13/9a	1/31a	11/1b	77/8a	122/9a
60 days	13/7b	0/93b	15/9a	63/9b	83/9b
90 days					
Control group	14/6a	1/23a	13/1bc	58/7c	103/8ab
Polyethylene coating	14/3ab	0/97c	17/0a	79/8ab	108/3ab
Heat therapy	14/2b	1/25a	11/5c	57/3c	87/2c
Fungicide	13/7c	1/28a	11/5c	57/7c	101/8b
Heat therapy & fungicide	13/3d	1/20a	12/2c	76/8b	104/9ab
Fungicide & coating	14/4 ab	1/00bc	14/7b	77/8b	101/5b

Heat therapy & coating	13/5c	0/98bc	14/7b	81/2a	113/6a
Heat therapy, Fungicide , polyethylene coating	12/6e	1/06b	12/5bc	77/3b	105/9ab

soluble solid material production and this ratio reaches to 15.9 from 11.1.

The highest value of this ratio (17.0) has been achieved in fruit coating with polyethylene and the lowest (11.5) in curing and fungicide.

H angle of the tangerine stored in fridge equals 77.8 which is significantly higher than 63.9 degrees associated with the same fruits stored in plain storage. Increase of the storage period from 60 to 90, decreases the angle significantly.

Separate heat therapy, fungicide application, and polyethylene coating do not create a significant change in H angle, but the combined treatment of heat therapy and polyethylene coating leads to highest H angle at about81.2°.

Tangerine storage temperature has a significant effect on preserving its primary firmness and for the same reason; the fruits stored in fridge have significantly firmer tissue (120.5) than those stored in plain storage (86.2). Heat therapy along with polyethylene coating (113.6 Newton) and curing without coating (87.2 Newton) have the lowest firmness of fruit tissue. Polyethylene coating prevents form removing the fruit moisture and consequently helps preserve the firmness of the fruit.

Table 2 and diagram 10 show that the increase of storage period time from 60 to 90 days significantly decreases the tissue firmness from 122.9 to 83.9 Newton.

Wrapping the tangerine with polyethylene plastic does not affect TSS and does not create a significant difference with the control group. The lowest TSS is achieved when the control group fruits are wrapped with polyethylene plastic after using fungicide and curing. The TA amount of the specimens wrapped with polyethylene is significantly lower than those of the control group fruits.

Tangerine storage period has a significant effect on TSS and TA. TSS and TA are significantly higher in the tangerines stored for 60 days in storage or fridge in comparison with the similar specimens in 90 days, because of the slow production of saccharine in the storage period. Because the interaction of storage type and storage period does not have a significant effect on TA, Dunken test was not used for these two variables. It is necessary to state that witness treatment TSS reached the highest possible amount, 14.5 during the 60-day storage period in plain storage because of the evaporation and removal of moisture. Time and temperature of the tangerine storage have a high effect on decreasing this feature.

Table 3- Interaction of storage type and storage period on the measured

Feature / Treatment	TSS	TA	TSS/TA	Color degree	Fruit firmness Newton
Plain storage					
60 days	14/5a	1/23	12/5	78/6a	122/1a
90 days	13/8b	0/86	17/7	49/2b	50/4b
Fridge					
60 days	13/3d	1/39	9/7	77/0a	123/8a
90 days	13/6c	1/00	14/2	78/5a	117/3a

Table 4- Interaction of storage type and fruit treatment on the measured features

Feature / Treatment	TSS	TA	TSS/TA	Color degree	Fruit hardness Newton
Plain storage					
Control group	15/2a	1/28ab	14/0cde	41/3c	63/0ef
Polyethylene coating	14/6b	0/88ef	22/2a	80/9ab	107/4cd
Heat therapy	14/7b	1/19bc	12/4def	38/9c	55/8f
Fungicide	14/2cd	1/24ab	11/8def	38/7c	70/5e
Heat therapy, Fungicide	14/2d	1/23ab	11/8def	77/2b	67/6ef
Fungicide, coating	14/5bc	0/92e	16/0bc	77/6b	103/2d
Heat therapy, coating	13/6fg	0/78f	17/8b	79/7ab	120/0bc
Heat therapy, Fungicide, polyethylene coating	12/5hi	0/85ef	14/7cd	76/9b	101/5d
Cold Storage					
Control group	13/9def	1/18bcd	12/2def	76/1b	144/7a
Polyethylene coating	14/0de	1/06d	13/8cdef	78/7ab	109/2cd
Heat therapy	13/7 e f	1/30ab	10/6ef	75/7b	118/6c
Fungicide	13/2g	1/33a	11/3def	76/8b	113/2ab
Heat therapy, fungicide	12/4i	1/18bcd	12/7cdef	76/4b	142/2a
Fungicide, coating	14/2cd	1/08cd	13/4cdef	78/0ab	99/9d
Heat therapy, coating	13/5fg	1/18bcd	11/6def	82/7a	106/3cd
Heat therapy, Fungicide, polyethylene coating	12/8h	1/27ab	10/2f	77/7b	110/4cd

The average treatments with similar alphabetical characters in the columns do not have significant difference based on Dunken multi-range test.

TSS and TA of the fruits cured and disinfected just by fungicide, were significantly lower than those of the control group specimens. The highest TA (1.33) was achieved when the fruits were disinfected with fungicide and stored in the storage.

Table 5- interaction of storage period and fruit treatment on the measured features

Feature / Treatment	TSS	TA	TSS/TA	Color degree	Fruit hardness Newton
60 Days					
Control group	14/9a	1/58a	9/49d	80/0b	133b
Polyethylene coating	14/7a	1/28b	11/48cd	80/1b	120c
Heat therapy	14/7a	1/30b	11/32cd	77/0b	107cde
Fungicide	13/8bc	1/58a	8/97d	76/9b	139b
Heat therapy, fungicide	13/3def	1/51a	9/10d	75/7b	152a
Fungicide, coating	14/6a	1/08cde	13/38bc	77/5b	111cd
Heat therapy, coating	13/3ef	1/04def	13/95bc	78/0b	109cde
Heat therapy, Fungicide, polyethylene coating	12/rg	1/12cd	11/34cd	77/4b	113c
90 days					
Control group	14/2b	0/87h	16/72b	37/4c	74g
Polyethylene coating	13/9bc	0/66i	24/48a	79/6b	97ef
Heat therapy	13/7 cd	1/19bc	11/68cd	37/7c	68gh
Fungicide	13/6cde	0/98efgh	14/13bc	38/6c	65gh
Heat therapy, fungicide	13/2f	0/89gh	15/38b	77/9b	58h
Fungicide, coating	14/2b	0/91gh	16/00b	78/1b	92f
Heat therapy, coating	13/8bc	0/92fgh	15/45b	84/4a	119c
Heat therapy, Fungicide, polyethylene coating	13/2f	1/00defg	13/59bc	77/2b	99def

The combination of packaging processes with polyethylene coating, heat therapy and disinfection with fungicide has an intensifying effect and TSS and TA in the specimens of this treatment decreases significantly.

The combination of curing and polyethylene coating and storage in plain storage decreases TA from 1.23 to 0.78.

In terms of tissue firmness, the control group and the fungicide with curing, both stored in fridge, with 144.7 and 142.2 Newton respectively, have the highest fruit firmness because of storage temperature reduction, prevention from breakage of pectin substances in the fruit and preserving the fruit tissue firmness.

Also, fungicide and curing are effective in reducing citrus decay and preventing from loss of citrus juice in cold storage due to high relative moisture, so that the citrus have good appearance and better innate quality.

The highest TSS/TA ratio 22.2 is associated with the treatment of polyethylene coating stored in plain storage.

In each column, the average treatments with similar alphabetical characters do not have significant difference based on Dunken multi-range test.

The lowest TA with 0.66 in coated fruits was measured after 90-day storage.

Durability and packaging have a considerable effect on TSS/TA and this ratio has reached the highest amount 24.5 in the fruits stored for 90 days with polyethylene coating. On the other hand, TSS/TA ratio is not affected by separate fungicide use and curing or both of them and the ratio does not change after 60 days and even 90 days. In terms of color amount, the best treatment is heat therapy along with polyethylene coating after 90 days storage and concerning the fruit tissue firmness, fungicide use and curing provide the best result after 60 days storage due to the decrease in fruit decade.

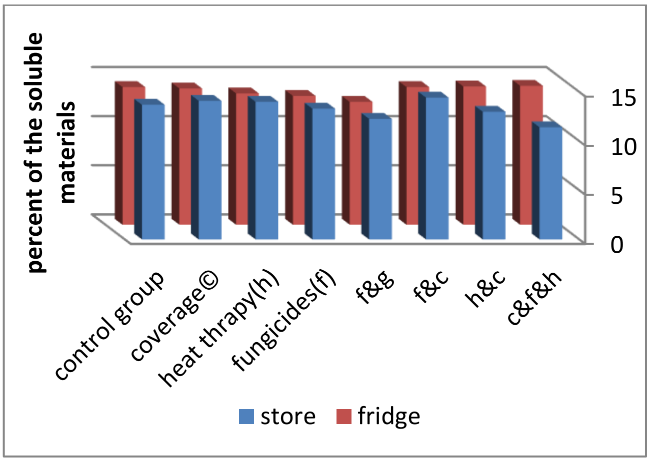


Diagram 1-the effect of preparing methods and fruit storage and fruit storage and their the effect of on the percentage of the solid soluble substances

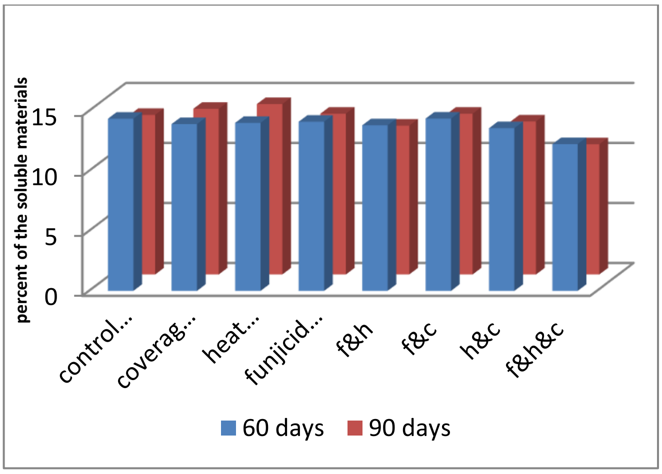


Diagram 2- the effect of storage period and fruit treatment on TSS

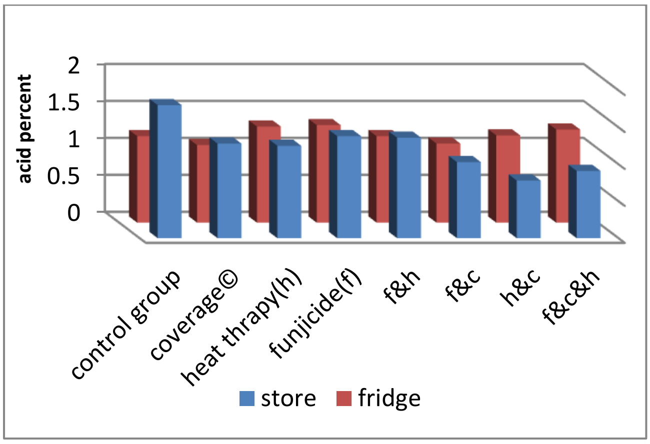


Diagram 3- the effect of storage type and fruit treatment on TA

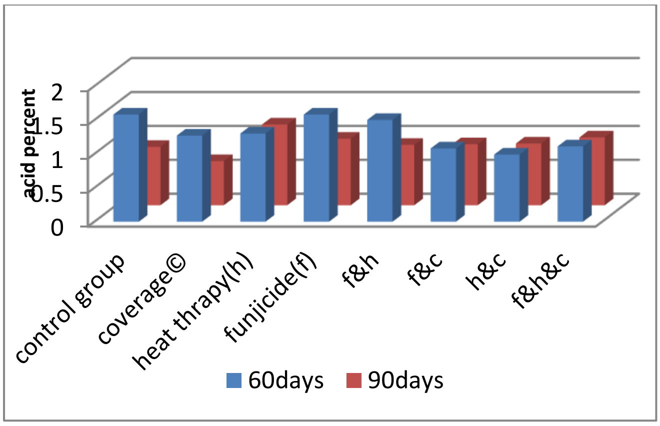


Diagram 4- the effect of storage period and fruit treatment on TA

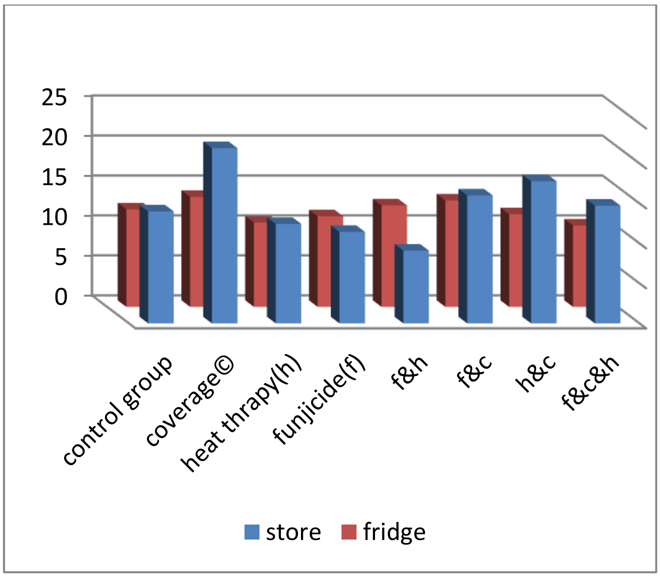


Diagram 5- the effect of storage type and fruit treatment on TSS/TA

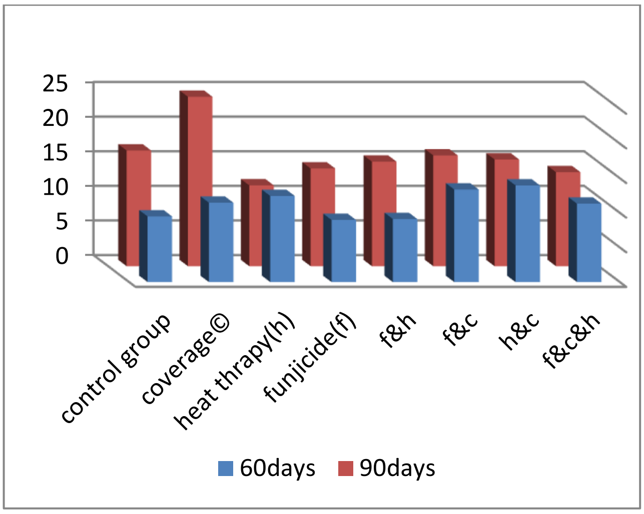


Diagram 6- the effect of storage period and fruit treatment on TSS/TA

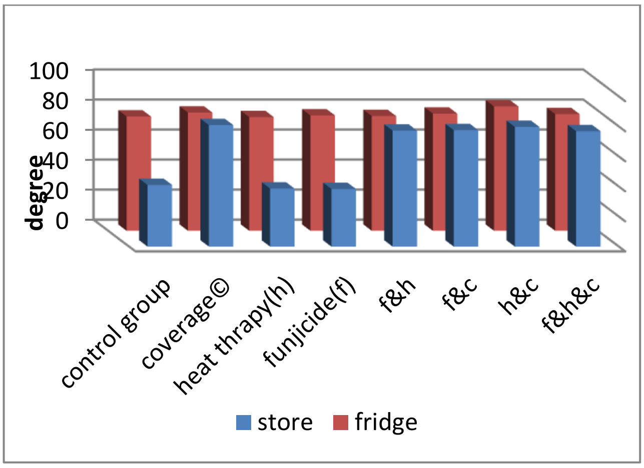


Diagram 7- the effect of storage type and fruit treatment on fruit color (Hue angle)

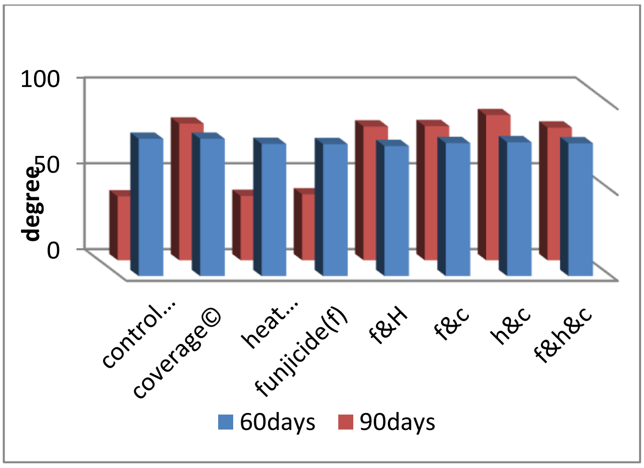


Diagram 8- the effect of storage period and fruit treatment on fruit color (Hue angle)

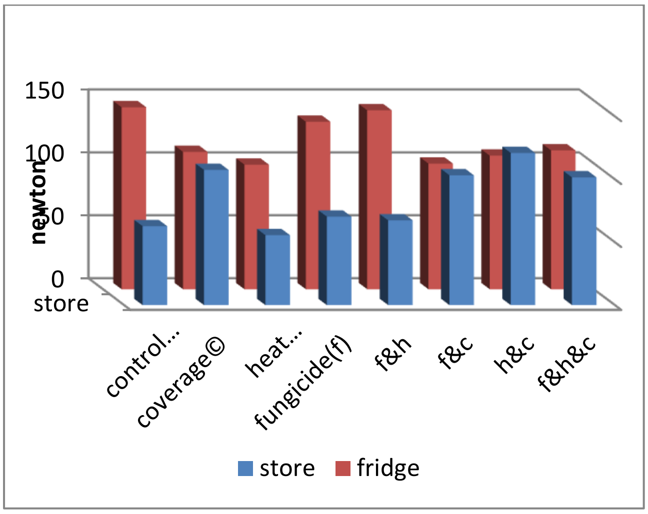


Diagram 9- the effect of storage type and fruit treatment on fruit firmness amount

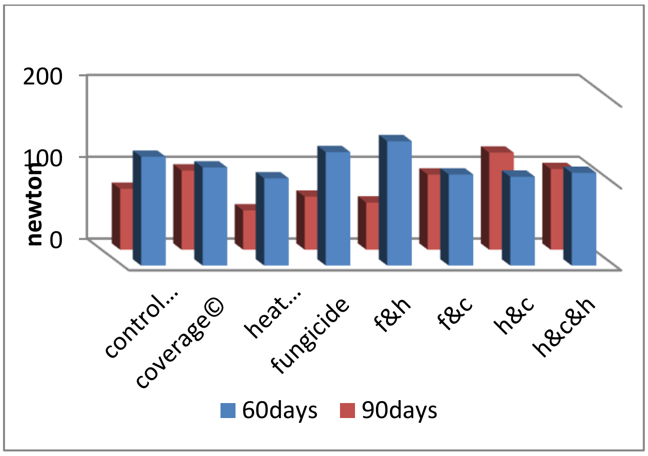


Diagram 10- the effect of storage period and fruit treatment on fruit firmness amount

Studies suggest that it is not only the interaction of storage type and storage period which affects the *TA and* TSS/TA significantly, but the rest modes, the main and mutual effect of the factors on all measurement features at one level are so significant. The use of fungicide and polyethylene coating in plain storage at a 60-day period affects the TSS and increases it. Davis et al. have reported the same result too [4].

The use of polyethylene coating in fridge and after 90 days gives the highest TSS/TA. The same result was reported by Sams et al [16].

Regarding the fruit color, the fridge with 60-day period and curing with polyethylene coating, creates the highest color quality. Storage in the fridge after 90 days with curing and polyethylene coating is more effective in fruit tissue firmness than other treatments. Golshan, Shahbeik, and Ben Yehoshua have reported the same result [*2, 3, 7, 17*].

The use of polyethylene coating in cold storage and after 90 days gives the highest TSS/TA. Sams et al. have reported the same results [*16*].

Regarding the fruit color, the cold storage with a period of 60 days and curing with polyethylene coating creates the highest color quality. Storage in fridge after 90 days with curing along with the polyethylene coating is more effective treatment for the fruit tissue firmness than others. Golshan, Shahbeik and Ben Yehousha also reported the same results [*2, 3, 7, 17, 18*].

Biphenyl fungicide application is effective in preventing the formation of fungi spores and consequently the fruit decay. Ben Yehousha et al. also recommended the use of fungicide for reducing fruit decay [2, 3]. The most important and common disease in tangerines is the *Penicillium* corruption especially green and blue molds and *Aspergillus* caries; specifically caries resulted from *A.nigerandA.alternaria,* to control them, the chemical pesticides such as fungicides may be applied and for some citrus, it is possible to use curing. In this study it was found that curing decreases *Penicillium and Aspergillus* contamination significantly in tangerine. Golshan and ShahBeik have also achieved the same findings [*7, 17, 19*].

The firmness of cured fruit tissue, without polyethylene coating decreases significantly, as the result of which the product is not fresh anymore. Miller et al. and Ben Yehoshua got the same results [*2, 12*]. The control and fungicide groups together with heat therapy in cold storage resulted in the highest firmness the reasons are moisture save, fruit breath reduction, and prevention from decay during the storage. Miller et al. and Ben Yehashoa et al. results confirm the findings [*2, 12*].

Combined fungicide treatment, heat therapy, and polyethylene coating, in addition to preservation of the qualitative features, play significant role in preserving the fruit freshness, prevention from fruit secondary contamination, delay in product aging, and prevention from dispersion of contamination.

For the easy storage, combined treatment of the fungicide and polyethylene coating and for the cold storage, curing along with the polyethylene coating is recommended to farmers in order to achieve better preservation of Kino Tangerine.

REFERENCES

1. Anon. (2002) Estimate Design. Statistical Book of statistics office and computer crevices. Ministry of Jihad-e-Agriculture.
2. Ben-Yehoshua S. (1988) Individual seal-packing of fruit and vegetables in plastic film-a new postharvest technology .Hort. Science. 20: 32-37.
3. Ben-Yehoua S, Kim JJ, and Shapiro B. (1989) Curing of citrus fruit, applications and mode of action. International Controlled Atmosphere Research Conference, Proceedings. 2: 179-196.
4. Davis P L, Roe B, and Bruemmer BH. (1973) Biochemical changes in citrus fruits during controlled-atmosphere storage. J. of Food Science. 38: 225-229.
5. Echot J W. (1990) Resistance of citrus fruit pathogens to postharvest fungicides. Proceedings of the International Citrus Symposium. International Academic Pub.
6. Ganji Moghadam E, Rahemi M. (1995) Prestorage warm solution Treatments of Fungicide in reducing chilling injury and decay of sweet lime Fruits during cold storage. Proceedings of the 12th Iranian plant protections Congress. Karaj, Iran.
7. Golshan A. (2002) Effects of wax, wring, shrink wrapping and Fungicide on storage life of Mares early, Valencia and local oranges Final. Research Report. Agricultural engineering Research institutes, Iran.
8. Hill A R, Rigney J and Sproul AN. (1988) Cold storage of oranges as a disinfestations treatment against the fruit fies *Dacustryoni (Froggau)* and *Ceratitis capiata (Wiedemann) (Diptera: Tephritidae*). J. of Economic Entomology. 81: 257-260.
9. Mahmood Abadi K, Rahemi M and Banihashemi Z.(1995) Determination of infection source and effect of heat treatment on sweet lime postharvest decay by *Penicillium and Italicum*. Proceeding of the 12th Iranian plant protection congress. Karaj. Iran.
10. Mac Glasson W B. (1989) Modified atmosphere packaging. Commercial Horticulture. 30-32.
11. Miller WR, Chum D, Rissel A, Hatton TT, and Hinsch T. (1988) Influence of selected Fungicide treatments to control the development of decay in waxed of film wrapped Florida grape fruit. Agricultural Research service.2: 42-50.

12. MostofipurP, Zakii Z and Mirhosseini A. (1993) Control of citrus fruit Decay by Benomyl, Thiabendazole and no chemical fruit wrap. Proceeding of the 11th Plant Protection Congress. Gillan University. Iran.
13. Munoz-Delgado J A. (1987)Problem in cold storage on citrus fruit. Rev. Int. Florida. 10: 229-233.
14. Obenland O, Fouse D C , Aung L H and Houck L G. (1996) Release of the limonene from cured lemons treated with hot water and low temperature. J. Hort. Sci. 71: 389-394.
15. Predeben S, Wards M. (1992) Curing to prevent chilling injury during cold disinfestations and to improve the external and internal quality of lemon. Australian J. Experiment Agric.
16. Sams C E, Conwas W S, Abbott J, Lewis R J and Shalom N B. (1993) Firmness and decay of Fruits Following postharvest pressure in filtration of heat Treatment. Amer. Soc. Hort. Sci. 5: 623-627.
17. Shahbake M A, Moameni J, Hasanpour M and Shadparvar A. (2002). Effects of fungicide Curing and shrink wrapping life of Thomson Navel orange. J. Agric. Eng. Res.
18. Will R B H, Mac Glasson W B, Gragam D, Lee T H and Gall E G. (1996) Postharvest an introduction to the physiology and handling of fruit and Vegetables. C.B.S. Publishers/Distributers. India.
19. Yang Z, Han Y, Gu Z, and Fan G. (2008) Thermal degradation kinetics of aqueous antocyanins and visual color of purple corn (Zea mays L.) cob. Innovative Food Science and Emerging Technologies. 9: 341-347.