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COMPARING THE EFFECT OF NATURAL AND CHEMICAL TREATMENTS ON POSTHARVEST DECAY DISEASES CONTROL OF ALPHONSO MANGO FRUITS DURING COLD STORAGE

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ABSTRACT

The present study was done during 2004 and 2005 seasons to evaluate the effect of postharvest treatments of seven oils extracted from the following plants. peppermint, onion bulbs, parsley, cinnamon, garden rocket, radish roots and leaves. blue gum leaves, as well as TBZ solution as dipping treatments at the concentration of 1000 ppm and forced hot air treatment at 48°C and RH 90–95% on physical and chemical properties of Alphonso mango fruits and calculated the percentage of decayed fruits during cold storage at 13°C and RH at 90–95% for one month. The obtained results showed that total soluble solids, ascorbic acid., soluble pectien and pigments were not affected by all dipping treatments. Heat treatment increased the percentage of fruit weight loss, firmness, carotene and reduced V.C., acidity, soluble pectien and peel chlorophyll content in treated fruits. Meanwhile, TBZ fruit treatment increased fruit weight loss percentage. Cinnamon, peppermint, blue gum and TBZ dipping treatments and air heated fruits reduced respectively decay fruit percentage. In meanwhile, baresly, radish root, leaves, and onion bulbs had no significant effect on fruit decay percentage..

Key words: Mango fruits, decay, forced hot air, plant oil extraction and TBZ

INTRODUCTION

Mango trees are widely grown in tropical and mild subtropical climates and their fruits are very important in many countries including Egypt. Mango fruits are of high export potential in Egypt. Governmental strategies in the agricultural sector include the gradual extension of mango plant ages specifically in the newly reclaimed soil. In addition, more efforts are exerts to raise the export potential of the existing markets, beside opening new international markets for export of the local mango fruits production. In order to realize these goals, more attention should be directed to solve problems facing production, handling and marketing processes.

Mango fruits are commonly exposed to unfavourable environmental conditions in addition to infection with many diseases during the growing season and storage. Common diseases and disorders that are predominantly related to harvesting and handling include mold rot Mold diseases in mango are controlled primarily by applications of chemical fungicides in commercial handling. The most fungicides used are orthophenyl-phenate, imazolil and thiabendazole (D'Hallewin *et al.*. 1996)

New methods of control are needed because pathogen resistance to these chemicals has developed, and regulatory tissues and public concerns about health risks of ingesting fungicide residues threaten the continued use of fungicides in the future. In order to minimize such problems, many investigators in the postharvest field of fresh fruit production (Schirra and Mulas, 1995 and Schirra *et al.*, 1995) are trying to develop nonchemical means to treat fruits to improve their postharvest shelf life and to protect them from decay.

Hot air treatment controls organisms that have already penetrated the fruit as well as on the surface. The treatment also leaves no residue of chemicals on the product. However, the absence of residues also leaves the fruits vulnerable to spoilage, if it later becomes contaminated with pathogens. Consequently, for maximum efficacy, heat treatment must be combined with sanitation procedures during subsequent handling and storage. The antagonistic effect of some plant extracts and essential oils against fruit-decaying pathogens was also investigated (Hussein *et al.*, 1996).

However, the application of these substances has not been used yet in practice. Bearing in mind all the above points, the present study was conducted to: (1) Determine the optimal heat thipendazole and some plant extraction treatments of mango fruits to control mold disease, (2) Comparing the effect of above treatments on the incidence of rot decay and their effect on some chemical and physical fruit properties in Alphonso mango fruits during cold storage.

MATERIALS AND METHODS

The present investigation was conducted during the second week of August of the two successive seasons 2004 and 2005, on healthy, sound mature and completely injury – free green mango Alphonso fruits.

Sixty mango Alphonso trees as uniform as possible, were chosen for this study. The selected trees were grown in a private orchard at Daraneet-orchard, Kafr El-Dawar Behira Governorate. At the harvest time, of both experimental seasons, medium sized fruits were randomly selected from the yield of 54 trees out of the 60 chosen ones.

Extraction of tested plants oils

The leaves of peppermint, onion bulbs, parsley leaves, cinnamon leaves, garden rocket leaves radish roots and leaves were collected from the farm of medicinal and aromatic plants at El-Tarh-Alex oils of the tested plants were extracted by steam distillation as mentioned by Cleavenger (1982). The essential oils were collected in cold trap, then separated to its components and finally dried over anhydrous sodium sulphate. The oils were filtrated then kept quickly in a dark bottle at 7°C according to Guenther (1961).

Identification and determination of the chemical constituents of different plant oils extracts (Table 1).

Table (1): Chemical components of the tested plants oil extracts

Components (%)	Peppe -rmint leaves	Onion bulbs	Parsley leaves	Cinnamo n leaves	Garde n rocket leaves	Radish roots and leaves	Blue gum leaves
Thujene	---	1.68	---	0.50	0.11	---	15.60
Tricyclene	1.40	---	---	---	---	0.16	---
α-Pinene	---	12.18	11.2	14.11	6.40	---	---
Camphene	23.11	---	0.3	---	---	10.10	11.20
Sabinene	---	---	13.5	---	---	---	20.13
α-Terpinoi	---	22.06	---	28.10	10.2	---	---
Limonen	---	---	---	---	2.10	1.40	---
Linalool	50.1	---	---	---	---	1.40	17.01
Cineole	1.10	---	---	32.10	19.11	---	6.51
Linalyl acetate	---	15.11	20.21	---	14.26	---	---
Eguenol acetate	10.01	---	---	---	---	18.40	15.11
Borneol	---	---	1304	2.01	---	34.01	---
Myrcene	0.51	---	---	---	---	10.60	2.02
γ-Carene	---	---	20.12	11.00	16.89	0.50	---
Citronellol	0.31	28.14	---	12.00	0.22	---	---
Nerol	---	---	11.11	---	17.40	---	1.12
β-Citral	---	---	---	---	12.6	---	0.53
α-Citral	---	---	10.01	---	---	---	---
Geranyl acetate	13.21	20.01	---	---	---	23.01	10.07

The GLC analysis was carried out in the central laboratory of Faculty of Agriculture, Alexandria University. The conditions are described in :

PRO – Gcpye Unicom
Colume : PEGA 10%
Tem. Programming:

Initial temp.	70°C
Rate	4°C/min
Final temp.	190°C
Final time	20 min
Detector temp.	300°C
Injection temp.	250°C
Char speed	2 min/cm
Flow rate of grasses	
N2	30 ml / min
H2	33 ml / min
Air	330 ml / min

The harvest yield of every two trees was used as a single replicate. Fruits selected from each replicate (two trees) were divided into 3 groups, 20 fruits of each and then every 3 groups (60 fruits) were dipped for 3 minutes in one of the following solutions and then dried in both experimental seasons :

T_1 (water "control").

T_2 (Oil extract of peppermint leaves "*Menth apiperita*") at 10 % in water emulsion with 0.2% tween 80 surfactant.

T_3 (Oil extract of onion bulbs "*Allium cepa*") at 10% in water emulsion with 0.2% tween 80 surfactant.

T_4 (Oil extract of parsley leaves " *Petroselinum sativus* ") at 10% in water emulsion with 0.2% tween 80 surfactant.

T_5 (Oil extract of cinnamon *Cinnamomum sp.* bark) at 10% in water emulsion with 0.2% tween 80 surfactant..

T_6 (Oil extract of garden rocket leaves "*Eruca sativa*") at 10% in water emulsion with 0.2% tween 80 surfactant.

T_7 (Oil extract of radish roots and leaves "*Raphanus sativus*") at 10% water emulsion with 0.2% tween surfactant.

T_8 (Oil extract of blue gum leaves "*Eucalyptus globules*") at 10% water emulsion with 0.2% tween 80 surfactant.

T_9 (Thiabenzadole "TBZ" solution at 1000 ppm, with 0.2 % tween 80 surfactant

T_{10} (fruits were exposed to forced hot air at 48°C and 90-95% RH for (2 hours) .Sound medium sized fruits were randomly select from the yield of remained selected trees (two trees were used as a single replicate).

The fruits from each replicate were weighed washed and dried . then divided into 3 groups, 20 fruits of each were then placed in plastic rings inside plastic pans containing 75 ml water and covered with polyethylene sheet to maintain relative humidity (RH). Forced hot air was carried out by using a small unit with a heater and air motor, which forced hot air through the fruits and air temperature at 48°C (RH from 90–95%). This temperature was monitored in the cores of 10 fruits every 60 sec. Using type T copper constant thermocouples (Sharp *et al.*, 1991).

All treated fruits were placed in plastic boxes (60 x 40 x 18 cm) cold storage at 13°C and 90–95% (RH) in the exporters union refrigerator in Abis, Alexandria for one month and fruit samples were taken at 10 days intervals from cold storage for physical and chemical determinations. Firmness was determined using the Effegi firmness tester with an eight mm plunger (Effegi 48011 Alfonsine Italy). The average flesh firmness of each sample of fruits was estimated. Fruit firmness was expressed as pounds/ square inch. Total soluble solids (TSS) percentages were estimated by a hand refractometer while acidity was determined by titration against 0.1 N NaoH. Acid percentage was estimated as citric acid. Ascorbic acid (V.C.%) was determined according to the (A.O.A.C., 1980).

Peel pigments were extracted by direct immersion of 0.9 gram of peel into solvent N, N dimethyl formamide using Moran and Porath (1980) method. However, the determination of peel pigments contents were determined according to the method of Grodzinsky and Grodzinsky (1973). The total chlorophyll and carotene content were expressed as mg per 100 gm fresh weight.

The percentage of soluble pectin was determined according to Care and Haynes (1922) through extraction with HCL 0.020, 0.050 N and followed by precipiation as the calcium salt by using calcium chloride solution. The precipitate was washed with boiled distilled water until it becomes free from chloride, dried and weighted as calcium pectate. For calculating the percentage of physiological fruit weight loss, 15 fruits from each replicate were labeled and periodically weighted and the loss in weight was calculated. In addition on each sampling date, fruit showing decay were counted and discarded. Then the percentage of decayed fruits was estimated on total fruit number basis.

The data collected throughout the course of this study were statistically analyzed using analysis of variance method and using the randomized complete blocks design with 10 treatments 3 replicates as described by Snedecor and Cochran (1971). The L.S.D. method at (0.05 level) was used to compare the effects of treatments (T), storage period by days (D) and their interaction (TxD)

RESULTS AND DISCUSSION

A- Effect of different treatments on physical changes during storage Alphonso mango fruits at 13°C±1

1- Fruit weight loss percentage

During storage period the data in Table (2) indicated that fruits treated by different plant extracts (peppermint, onion bulbs, parsley, cinnamon, garden rocket, blue gum and radish root) showed significantly lower physiological weight loss than control treatment and there was no significant differences between different plant extraction treatments during both storage seasons. However, weight loss % was significantly increased by increasing storage period and reached to the highest percentage when stored to the largest period (30 days). Meanwhile, using storage for % days in combination with onion bulbs treatment encouraged the lowest significant water loss % compared with the other interactions.

Such observation could be due to that plant extractions and vegetable oil, formed a layer that restricted transpiration of fruits. Although fruit coatings plug lenticals and create a barrier of O_2 and Co_2 exchanges (Banks, 1984). Water loss occurs via the cuticle, coating material improved water retention capability of fruit during storage and marketing period (Elson, *et al.*, 1985). On the other hand, heated fruits and fruit treated with thiabendazole (TBZ), showed the highest significant weight loss percentage respectively, comparing with control. In line with these results those reported by D' Hallewin *et al.* (1996). They found that fruit weight loss was highest in the thiabendazole treated fruits, as well as, Attia (2003), they pointed out that heat treatment caused increased water weight loss percentage in peach fruits. They added that heat treatment causing stress condition on peach fruits resulted in more water loss like was observed in the present work.

Table (2): The effect of dipping treatments and forced hot air on Alphonso mango fruits weight loss % for different storage periods (days) during 2004 and 2005 storage seasons

Treatments		Storage period (days)				
		Season 2004				
		0	10	20	30	Means
		Fruit weight loss %				
Control	T_1	0.00	1.89	2.52	5.20	2.40
Peppermint	T_2	0.00	1.65	2.11	4.22	2.00
Onion bulbs	T_3	0.00	1.62	2.12	4.12	1.97
Parsley	T_4	0.00	1.65	2.10	4.16	1.98
Cinnamon	T_5	0.00	1.66	2.13	3.99	1.95
Garden rocket	T_6	0.00	1.65	2.00	3.97	1.91
Radish root	T_7	0.00	1.66	2.14	4.11	1.98
Blue gum	T_8	0.00	1.67	2.11	4.21	2.00
TBZ	T_9	0.00	2.00	2.79	5.91	2.68
Forced hot air	T_{10}	0.00	2.28	3.98	6.46	3.18
Means		0.00	1.77	2.31	4.65	
L.S.D. 0.05		T = 0.26		D= 0.10		T×D= 0.35
		Season 2005				
Control	T_1	0.00	1.93	2.51	6.11	2.64
Peppermint	T_2	0.00	1.61	2.00	3.96	1.89
Onion bulbs	T_3	0.00	1.59	2.00	3.99	1.90
Parsley	T_4	0.00	1.70	1.98	4.11	1.95
Cinnamon	T_5	0.00	1.63	1.96	4.02	1.90
Garden rocket	T_6	0.00	1.72	2.11	4.07	1.98
Radish root	T_7	0.00	1.60	2.00	4.00	1.90
Blue gum	T_8	0.00	1.67	1.99	3.96	1.91
TBZ	T_9	0.00	2.16	2.75	7.10	3.00
Forced hot air	T_{10}	0.00	2.38	3.00	7.66	3.26
Means		0.00	1.80	2.23	4.90	
L.S.D. 0.05		T = 0.20		D= 0.08		T×D= 0.27

T = Treatments D = Storage period (days) T × D = Interaction

2- Firmness (lb/inch^2)

The data in Table (3) generally indicated that fruit flesh firmness was significantly higher in heated fruits during both seasons comparing with control and other treatments (peppermint, onion bulbs, parsley, cinnamon, garden rocket, radish roots, blue gum and thiobendazol "TBZ") which has no significant effect on fruit firmness. However, fruit firmness showed a significant decrease by increase of storage period to reach the lowest significant level at the end of storage period in both experimental seasons.

Table (3): Effect of dipping treatments and forced hot air on fruit firmness (Ib/in) of Alphonso mango fruits for different storage period (days) of during 2004 and 2005 storage seasons

Treatments		Storage period (days)				
		Season 2004				
		0	10	20	30	Means
		Fruit firmness (Ib/in^2)				
Control	T_1	10.60	8.90	5.90	4.20	7.40
Peppermint	T_2	10.60	8.92	5.91	4.30	7.43
Onion bulbs	T_3	10.60	8.98	5.93	4.43	7.49
Parsley	T_4	10.60	8.99	5.81	4.55	7.46
Cinnamon	T_5	10.60	9.14	5.77	4.53	7.51
Garden rocket	T_6	10.60	8.99	5.73	4.22	7.39
Radish root	T_7	10.60	8.96	5.99	4.28	7.46
Blue gum	T_8	10.60	8.96	5.80	4.40	7.44
TBZ	T_9	10.60	8.99	5.80	4.30	7.44
Forced hot air	T_{10}	10.60	9.91	7.01	5.00	8.13
Means		10.60	9.07	5.97	4.42	
L.S.D. 0.05		T = 0.50		D= 0.20		T×D= 0.67
		Season 2005				
Control	T_1	10.10	8.76	6.02	3.94	7.21
Peppermint	T_2	10.10	8.77	6.00	4.00	7.22
Onion bulbs	T_3	10.10	8.66	5.92	3.96	7.16
Parsley	T_4	10.10	8.75	5.96	3.92	7.19
Cinnamon	T_5	10.10	8.74	6.00	3.01	6.96
Garden rocket	T_6	10.10	9.00	5.99	3.95	7.26
Radish root	T_7	10.10	8.71	5.89	3.97	7.17
Blue gum	T_8	10.10	8.75	5.86	3.96	7.17
TBZ	T_9	10.10	8.74	5.76	4.00	7.15
Forced hot air	T_{10}	10.10	9.61	6.89	4.99	7.90
Means		10.10	8.85	6.03	3.97	
L.S.D. 0.05		T = 0. 45		D= 0.18		T×D= 0.60

T = Treatments D = Storage period (days) T × D = Interaction

The increment in flesh firmness values due to heat treatments in the present study go in line with the results of Paull (1990) who found that heat treatments for insect disinfestations or to control disease could sometimes disrupt fruit ripening. The fruit softening enzymes are sometimes not produced following heating, while the other processes associated with ripening are not apparently influenced to the same extent or soon recover. The sensitivity is modified by differences in response to seasons, cultivars and rates of heating. The sensitivity can be related to the heat shock response and the presence of heat shock proteins. Also, Huang-Wanrong *et al.* (1993) and El-Zayat (1996) investigated the effect of heat treatment on storage behaviour of Okuba peach fruits. They showed that fruits heat treatments maintained significantly the flesh hardness during storage comparing with control. Hassanein and Desheesh (1997) found that plant extracts or oils may exhibit no effect on fruit metabolism mechanism.

B- Chemical fruit composition

1- Total soluble solids

The data in Table (4a) showed that no consistent trend was observed in TSS percentages as a result of the all treatments in this study. However, TSS percentage was significant increased by increasing storage periods in both seasons. The results of the present investigation were in line with those found by El-Zayat (1996) who worked on peach and plum varieties and pointed out that fruits heat treatment did not showed clear effective total soluble solids percentage as compared with control. Also, Paull (1990) found that heat treatments for insect disinfestations or to control disease can sometimes disrupt fruit ripening. As well as, Hassanein and Desheesh (1997) found that fruit dipping treatments for control postharvest decay in plant extracts or oils may exhibit no effect on fruit metabolism mechanism.

2- Titratable acidity (TA) percentage

The data of Table (4b) showed that the lowest significant percentages of malic acid were detected with heated fruit treatment compared with the other treatments. Meanwhile, there was an indirect relationship between an increase of storage period and titratable acidity content. On the other hand, using of heated treatment during the end of storage period induced the lowest titratable acidity comparing with control and other treatments, in both experimental seasons. The results of the present study were in a complete agreement with those previously reported by Klein *et al.* (1990) who reported that heated fruits of Anna apple cultivars Golden Delicious and Granny Smith resulted in a decrease in titratable acidity of apple flesh and increase in respiration of whole apple. There may be connection between the enhanced respiration and decrease in the titratable acidity. Acidity reflects the level of organic acid in fruit tissues particularly malic acid. These acids are the substrate for respiratory cycle and enhanced respiration would lead to decrease their level. The results also indicated that all dipping treatments (peppermint, onion bulbs, parsley, cinnamon, garden rocket, blue gum, radish root and thiabendazole "TBZ") had no significant effects on fruit acid content and there is no significant differences between all dipping treatments during and the end of storage period in both experimental season of study. In line with these results those reported by Hassanein and Desheesh (1997) found that fruit dipping treatments for control postharvest decay in plant extracts or plant oils extracts may exhibit no effect on fruit metabolism mechanism

.3- Ascorbic acid (V.C.)

Present data (Table 4) of both storage seasons showed significant reduction in ascorbic acid content in heat treatment of mango fruits comparing with the control However. reduction of ascorbic acid due to the effect of heat treatment on the activation of the degradation effect of enzymes, particularly ascorbic acid due to the effect of heat treatment on the activation of the degradation effect of enzymes. particularly ascorbic acid oxidase (Gosh *et al.*, 1964). On the other hand. negative results were obtained with all dipping treatments (peppermint, onion bulbs, parsley. cinnamon, garden rocket, blue gum, radish root and thiobendazol "TBZ") In line with these results those reported by Airas *et al* (1996), they pointed out that the thiabendazole (TBZ) dipping treatments as 1000 ppm concentration had no effect on V.C. content in Avana mandarin fruits. In the main time Qamar and Chaudhary (1994) and Jiratko (1995). They reported that many plant extracts and essential oils where shown to have high antifungal activity against a wide range of fungi had no significant effect on ascorbic acid content in treated citrus fruits Meanwhile, there was an indirect relationship between an increase of storage period and titratable acidity content.

4- Water soluble pectin percentage

The present data in Table (5) generally indicated that the average percentages of water soluble pectin of the heated fruit were lower than that of all other treatments and control where as the differences between dipping treatments, were not significant during and the end of storage period in both experimental seasons. These results were in agreement with those obtained by Attia (2003) who heated three varieties of peaches. He found that the insoluble pectin contents of cortical tissues were higher in hot treated fruits than in the control while soluble pectin levels were lower. Also, Han Tao *et al.*, (1996) they worked on peaches concluded that heat shock treatment inhibits some physiological changes maintaining fruit quality there by increasing storability. However, water soluble pectin % were significantly increased by increasing storage period in both seasons.

5- Fruit pigments

The data in Table (6) generally indicated that the effect of the various dipping treatments (peppermint, onion bulbs, parsley, cinnamon, garden rocket, blue gum, radish root and leaves and thiabendazole "TBZ") on peel total chlorophyll and carotene content of Alphonso mango fruits had no significant effect and there were no significant differences between the effect of different dipping treatments during and the end of storage period in both experimental seasons of study. In line with these results those recorded by many authors using different antagonistic plant extracts such as Davidson and Parish (1989), Siveropoulou *et al.* (1995) and Hassanein and Desheesh (1997). As well as, D'Hallewin *et al.* (1996) dipped mandarin fruits in 1000 ppm TBZ solution. They found no significantly differ between treatment and control on peel pigments content. On the other hand, under the prevailing conditions of this study, heated treatment resulted in significantly lower peel total chlorophyll and higher peel carotene content than control and other various dipping treatments during and the end of the storage period in both experimental season in line with these result those reported by Williams *et al.* (1994). They worked on Valencia oranges, they found that heated treatment enhanced color development and little effect on structure of surface. However, peel total chlorophyll content slowed significantly decrease while carotene content significantly period.

C- Fruit decay percentage

Obtained data (Table 7) showed that the tested plant materials (cinnamon, peppermint and blue gum oil plant materials extractions exhibited a variable degree of antimicrobial activity, they significantly had highly reduction in the incidence of decayed fruits percentage comparing with control and other treatments and there were no significant differences between three mentioned treatments during and at the end of the storage period in both experimental seasons. Successful control of fruit decay was also recorded by many others using different antagonistic plant extracts and essential oils were shown to have antifungal activity against wide range of fungi (Davidson and Parish, 1989). In addition, other plants extracts and essential oils proved to be effective in controlling many phytopathogenic bacteria i.e. cinnamon, clove and eucalyptus oils against Erwinia Emylovora (Hassanein and Deshéesh, 1997). Mint essential oils against pseudomonas spp. And many other phytopathogenic bacteria (Siveropoulou *et al.*, 1995) and monoterpene, carvone and caraway, chenopodium and peppermint extracts against Agrobacterium tumefaciens. Plant extracts oils may exhibit its effect throughout a positive effect on the metabolism mechanism, an effect know from extracts of Reynoutria sacchalinenis on host plants succeptible to powdery mildew (Herger *et al.*, 1988) Hussein *et al* (1996) investigated that alleochemical(s) from some plant extracts may have a potential to develop natural products that may act as bactericides and fungicides. Our results also (Table 7) indicated that heat or chemical (TBZ) treatments of the tested mangos had a significant reduction effects on the incidence of fruit decay comparing with control. At the end of the storage periods chemical and heat treatments reduced the percentage of decayed fruits as much as by 65.6 and 63.9% in 2004 season and 61.3 and 58.0% in 2005 season respectively, however, numerous investigators such as Ben-Yehoshua *et al* (1990), Barkai-Golan and Philips (1991); Lanza *et al* (1994), Williams *et al* (1994) and Mulas *et al* (1995) reported that different heat treatments gave a good control for mold decay in different fruits species. Mild heat treatment at high atmospheric relative humidity may develop resistance to infection by some fungi in fruits (Baudoin and Ecket, 1985) This treatment increase the activity of phenyl-ammonium lyase and thus elicit the biosynthesis of lignin and its phenolic precursor in the outer pericarp of the fruit reducing the growth of fungi. These phenolic materials may prevent penetrations of germinating spores into peel tissue or interfere with the action of pectolytic enzymes of the pathogen (Baudoin and Eckert, 1985). Moreover, Kim *et al* (1991) found that scoparone phytoalexin plays an important role in the increased resistance of heat treated lemon fruit to infection by *P. digitatum*. It was also suggested that the effect of post harvest heat treatment on fruit decay might be related to the modulation of endogenous disease resistance of fruit via influence on the changes of performed antifungal materials such as citral (Ben-Yehoshua *et al.*, 1996). Successful chemical control of fruits mold decay were achieved using thiabendazol (TBZ) (D'Hallewin *et al* 1996) On the other hand, reduction in infection % due to TBZ may not significantly differ from that of heat treatment of mandarin fruit (D'Hallewin *et al.*, 1996). In the meantime, the application of other plant extracts (Parsley, Radish and Onion bulbs) did not result in any significant appreciable reduction comparing with control during and at the end of the storage period. However fruit decay percentage, generally increase by increase of storage period in both experimental seasons (Table 7).

Table (4): **The effect of dipping treatments and forced hot air on chemical composition of Alphonso mango fruits for different storage period (days) during 2004 and 2005 storage seasons**

Treatments		Storage period (days)									
		Season 2004					Season 2005				
		0	10	20	30	Means	0	10	20	30	Means
		(4a) Effect on TSS % in fruit juice									
Control	T_1	9.10	11.12	14.10	17.11	12..86	9.60	12.00	15.00	16.96	13.39
Peppermint	T_2	9.10	11.10	14.15	17.20	12.89	9.60	11.87	14.96	17.00	13.36
Onion bulbs	T_3	9.10	10.99	14.01	16.82	12.73	9.60	12.01	14.90	17.00	13.38
Parsley	T_4	9.10	11.13	14.00	17.30	12.88	9.60	12.00	14.98	16.87	13.34
Cinnamon	T_5	9.10	11.20	13.93	16.95	12.80	9.60	11.85	15.01	16.89	13.34
Garden rocket	T_6	9.10	11.15	13.95	17.00	12.80	9.60	11.92	14.92	17.01	13.36
Radish root	T_7	9.10	11.23	14.20	17.05	12.89	9.60	11.88	15.06	17.02	13.39
Blue gum	T_8	9.10	11.13	14.15	16.88	12.82	9.60	12.02	14.79	17.03	13.41
TBZ	T_9	9.10	11.20	14.10	16.90	12.83	9.60	11.90	15.03	16.95	13.37
Forced hot air	T_{10}	9.10	11.30	14.06	17.01	12.87	9.60	12.03	15.00	17.18	13.45
Means		9.10	11.16	14.07	17.02		9.60	11.95	14.97	17.01	
L.S.D. 0.05		T = N.S.		D= 0.31		T×D= 1.0	T = N.S.		D= 0.35		T×D= 1.17
		(4b) Effect on titratable acidity									
Control	T_1	2.62	1.90	0.90	0.24	1.42	2.90	2.10	1.32	0.27	1.65
Peppermint	T_2	2.62	1.91	0.93	0.22	1.42	2.90	2.11	1.33	0.25	1.65
Onion bulbs	T_3	2.62	1.98	0.95	0.24	1.43	2.99	2.11	1.32	0.28	1.65
Parsley	T_4	2.62	1.89	0.93	0.25	1.43	2.90	2.10	1.31	0.26	1.64
Cinnamon	T_5	2.62	1.90	0.92	0.24	1.42	2.90	2.10	1.30	0.27	1.64
Garden rocket	T_6	2.62	1.92	0.93	0.22	1.42	2.90	2.11	1.29	0.28	1.65
Radish root	T_7	2.62	1.90	0.92	0.23	1.42	2.90	2.09	1.32	0.26	1.64
Blue gum	T_8	2.62	1.90	0.90	0.22	1.42	2.90	2.11	1.33	0.28	1.66
TBZ	T_9	2.62	1.90	0.90	0.24	1.42	2.90	2.11	1.28	0.27	1.64
Forced hot air	T_{10}	2.62	1.37	0.50	0.13	1.16	2.90	1.62	0.66	0.16	1.34
Means		2.62	1.85	0.88	0.23		2.90	2.06	1.25	0.26	
L.S.D. 0.05		T = 0.04		D= 0.016		T×D= 0.16	T = 0. 06		D= 0.024		T×D= 0.24
		(4c) Effect on V. C. content (mg/ 100 ml juice)									
Control	T_1	0.40	0.28	0.19	0.11	0.25	0.46	0.30	0.22	0.12	0.29
Peppermint	T_2	0.40	0.26	0.17	0.11	0.24	0.46	0.32	0.21	0.13	0.28
Onion bulbs	T_3	0.40	0.27	0.16	0.09	0.23	0.46	0.33	0.19	0.14	0.28
Parsley	T_4	0.40	0.26	0.19	0.09	0.24	0.46	0.30	0.18	0.11	0.26
Cinnamon	T_5	0.40	0.25	0.18	0.10	0.23	0.46	0.32	0.20	0.12	0.28
Garden rocket	T_6	0.40	0.26	0.19	0.11	0.24	0.46	0.29	0.21	0.11	0.27
Radish root	T_7	0.40	0.29	0.17	0.10	0.24	0.46	0.29	0.22	0.13	0.27
Blue gum	T_8	0.40	0.28	0.16	0.12	0.24	0.46	0.31	0.19	0.10	0.27
TBZ	T_9	0.40	0.26	0.16	0.09	0.23	0.46	0.32	0.20	0.11	0.27
Forced hot air	T_{10}	0.40	0.19	0.12	0.05	0.19	0.46	0.20	0.13	0.06	0.21
Means		0.40	0.26	0.17	0.10		0.46	0.30	0.20	0.11	
L.S.D. 0.05		T = 0.05.		D= 0.02		T×D=0.070	T = 0.06		D= 0.024		T×D=0.080

T = Treatments   D = Storage period (days)   T × D = Interaction

Table (5): The effect of dipping treatments and forced hot air on water soluble pectin % of Alphonso mango fruits for different storage periods (days) during 2004 and 2005 storage seasons

Treatments		Storage period (days)				
		Season 2004				
		0	10	20	30	Means
		Water soluble pectin (%)				
Control	T_1	0.400	0.483	0.492	0.850	0.556
Peppermint	T_2	0.400	0.484	0.483	0.862	0.557
Onion bulbs	T_3	0.400	0.482	0.494	0.851	0.557
Parsley	T_4	0.400	0.481	0.496	0.860	0.559
Cinnamon	T_5	0.400	0.483	0.492	0.850	0.556
Garden rocket	T_6	0.400	0.473	0.493	0.841	0.552
Radish root	T_7	0.400	0.482	0.492	0.843	0.554
Blue gum	T_8	0.400	0.471	0.481	0.852	0.551
TBZ	T_9	0.400	0.472	0.486	0.851	0.553
Forced hot air	T_{10}	0.400	0.406	0.436	0.517	0.440
Means		0.400	0.471	0.485	0.818	
L.S.D. 0.05		T = 0.32		D= 0.013		T×D=0.043
		Season 2005				
Control	T_1	0.380	0.441	0.569	0.829	0.555
Peppermint	T_2	0.380	0.442	0.579	0.845	0.562
Onion bulbs	T_3	0.380	0.439	0.576	0.842	0.559
Parsley	T_4	0.380	0.436	0.581	0.833	0.558
Cinnamon	T_5	0.380	0.440	0.581	0.843	0.561
Garden rocket	T_6	0.380	0.429	0.590	0.825	0.556
Radish root	T_7	0.380	0.437	0.588	0.827	0.558
Blue gum	T_8	0.380	0.436	0.571	0.840	0.557
TBZ	T_9	0.380	0.432	0.561	0.842	0.554
Forced hot air	T_{10}	0.380	0.383	0.436	0.536	0.434
Means		0.380	0.432	0.563	0.806	
L.S.D. 0.05		T = 0.035		D= 0.014		T×D= 0.047

T = Treatments D = Storage period (days) T × D = Interaction

During cold storage in general the data in Tables (2, 3, 5, 6 and 7) showed that in 2004 and 2005, TSS%, weight loss %, decay % fruit, peel carotene content and water soluble pectin were increased. In the meantime the acid %, V.C. %, fruit firmness and fruit peel chlorophyll content were decreased by increase of storage period (Tables 3, 4 and 6). In line with these results those reported by Mitra (1997) working on mango fruits, Ismail (1998) working on apples and Atiaa (2003) working on peaches.

Table (6): The effect of dipping treatments and forced hot air on Alphonso mango fruits peel pigments content during 2004 and 2005 storage seasons

Treatments		Storage period (days)									
		Season 2004					Season 2005				
		0	10	20	30	Means	0	10	20	30	Means
		Chlorophyll (mg/100 g fresh weight)									
Control	T_1	10.0	7.10	3.10	1.90	5.53	9.90	6.16	3.03	1.56	5.16
Peppermint	T_2	10.0	7.11	3.20	1.92	5.56	9.90	6.16	2.98	1.55	5.15
Onion bulbs	T_3	10.0	7.13	3.14	1.88	5.54	9.90	6.30	2.99	1.50	5.17
Parsley	T_4	10.0	7.22	3.09	1.79	5.53	9.90	6.22	3.01	1.64	5.19
Cinnamon	T_5	10.0	6.98	2.99	1.89	5.47	9.90	6.33	3.00	1.56	5.20
Garden rocket	T_6	10.0	6.96	2.98	1.78	5.43	9.90	6.11	2.90	1.50	5.10
Radish root	T_7	10.0	7.11	3.14	1.76	5.50	9.90	6.15	2.89	1.52	5.12
Blue gum	T_8	10.0	7.00	305	1.77	5.46	9.90	6.17	3.00	1.50	5.14
TBZ	T_9	10.0	7.01	3.00	1.87	5.47	9.90	6.18	2.98	1.51	5.14
Forced hot air	T_{10}	10.0	5.00	2.01	0.79	4.45	9.90	3.46	1.82	0.63	3.95
Means		10.0	6.86	2.97	1.74		9.90	5.92	2.86	1.45	
L.S.D. 0.05		T = 0.30		D= 0.12		T×D= 0.4	T = 0.27		D= 0.11		T×D= 0.36
		Carotene									
Control	T_1	2.10	6.06	10.11	13.60	7.97	2.26	6.36	11.11	14.08	8.45
Peppermint	T_2	2.10	6.07	10.20	13.75	8.03	2.26	6.40	11.22	14.05	8.48
Onion bulbs	T_3	2.10	6.11	10.12	13.77	8.03	2.26	6.45	11.25	14.06	8.51
Parsley	T_4	2.10	6.15	10.16	13.63	8.01	2.26	6.38	11.20	14.11	8.49
Cinnamon	T_5	2.10	5.99	10.11	13.73	7.98	2.26	6.41	11.13	14.17	8.49
Garden rocket	T_6	2.10	5.98	10.01	13.55	7.91	2.26	6.44	11.21	14.00	8.48
Radish root	T_7	2.10	6.00	9.99	13.61	7.93	2.26	6.47	11.23	14.15	8.53
Blue gum	T_8	2.10	6.01	10.00	13.60	7.93	2.26	6.38	11.16	14.13	8.48
TBZ	T_9	2.10	5.96	10.14	13.76	7.99	2.26	6.41	10.98	13.98	8.41
Forced hot air	T_{10}	2.10	8.12	15.60	17.00	10.71	2.26	8.20	17.11	19.01	11.65
Means		2.10	6.25	10.64	14.00		2.26	6.59	11.76	14.57	
L.S.D. 0.05		T = 0.40		D= 0.16		T×D=0.53	T = 0.44		D= 0.18		T×D= 0.31

T = Treatments D = Storage period (days) T × D = Interaction

Table (7): The effect of dipping treatments and forced hot air on fruits decay percentage of Alphonso mango fruits for different storage periods (days) during 2004 and 2005 storage seasons

Treatments		Storage period (days)				
		2004				
		0	10	20	30	Means
		Fruits decay (%)				
Control	T_1	0.0	3.86	9.11	15.00	6.99
Peppermint	T_2	0.0	0.00	0.00	0.00	0.00
Onion bulbs	T_3	0.0	3.60	8.95	14.96	6.88
Parsley	T_4	0.0	3.81	9.03	15.01	6.96
Cinnamon	T_5	0.0	0.00	0.00	0.00	0.00
Garden rocket	T_6	0.0	3.90	8.88	14.82	6.90
Radish root	T_7	0.0	3.66	8.90	15.11	6.92
Blue gum	T_8	0.0	0.00	0.00	0.00	0.00
TBZ	T_9	0.0	1.28	3.35	5.16	2.45
Forced hot air	T_{10}	0.0	1.44	4.14	5.80	2.85
Means		0.0	2.16	5.24	8.60	4.00
L.S.D. 0.05		T = 0.43		D= 0.17		T×D=0.57
		2005				
Control	T_1	0.0	4.15	9.80	16.66	7.65
Peppermint	T_2	0.0	0.0	0.0	0.10	0.00
Onion bulbs	T_3	0.0	3.96	9.71	16.90	7.64
Parsley	T_4	0.0	4.02	9.99	16.60	7.65
Cinnamon	T_5	0.0	0.0	0.0	0.00	0.00
Garden rocket	T_6	0.0	4.11	9.86	17.63	7.60
Radish root	T_7	0.0	4.20	9.60	16.76	7.64
Blue gum	T_8	0.0	0.0	0.02	0.20	0.06
TBZ	T_9	0.0	1.91	4.60	6.00	3.13
Forced hot air	T_{10}	0.0	2.11	5.11	7.00	3.56
Means		0.0	2.45	5.85	9.76	4.50
L.S.D. 0.05		T = 0.54		D= 0.22		T×D= 0.73

T = Treatments D = Storage period (days) T × D = Interaction

We can conclude that from above results it can be recommended to treated mango fruits by each of the cinnamon, peppermint and blue gum oil plant materials extractions and forced hot air to reduced the incidence of fruit decay. Heat treatment improve fruit quality and firmness during cold storage but it is not advisable to store the fruits treated with parsley, Radish and onion bulb oil plant materials extractions because it did not result in any significant appreciable reduction in the incidence of fruit decay. As well as we can not adviser by using TBZ as a chemical production for keeping healthy, if we can use natural production.

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مقارنة تأثير بعض المعاملات الطبيعية والكيماوية علي السيطرة علي أمراض ما بعد الحصاد الفطرية لثمار المانجو الفونس خلال التخزين المبرد

إقبال زكريا علي أحمد
محطة بحوث البساتين بالصبحية – الإسكندرية – مركز البحوث الزراعية – مصر.

أجريت هذه الدراسة خلال موسمي ٢٠٠٤ و٢٠٠٥ لمقارنة تأثير معاملات ما بعد الحصاد باستخدام الزيوت النباتية المستخلصة من أوراق الفلفل والبصل والبقدونس والقرفة والنعناع والفجل والكافور بتركيز ١٠% وكذلك المبيد الفطري TBZ لمعاملات غمر الثمار بتركيز ١٠٠٠ جزء في المليون وكذلك استخدام هواء ساخن مدفوع علي درجة حرارة ٤٨°م (لمدة ساعتين) ورطوبة نسبية ٩٠ – ٩٥% علي خواص المانجو الكيميائية والطبيعية والحسية وكذلك حساب النسبة المئوية للثمار المصابة بالأمراض الفطرية خلال تخزين الثمار لمدة شهر علي درجة حرارة ١٣°م ورطوبة نسبية ٩٠% ٩٥% أظهرت النتائج المتحصل عليها خلال عامي ٢٠٠٤ – ٢٠٠٥ أن محتوى الثمار من الــ .T.S.S وفيتامين جـ والبكتين الذائب والصبغات لم تتأثر بجميع معاملات الغمر (زيوت النباتات المستخلصة). بينما معاملة الحرارة أدت إلي زيادة نسبة الفقد في الوزن والصلابة ونسبة الكاروتين وقللت فيتامين جـ ونسبة الحموضة ومحتوى جلد الثمار من الكلوروفيل. بينما معاملة الثمار بالــ TBZ أدت إلى زيادة نسبة الفقد في الوزن. وكذلك أدت معاملة الثمار بكل من زيت الفلفل أوالقرفة أوالكافور والــ TBZ والحرارة بالتتابع إلى تقليل نسبة الإصابة بالأمراض الفطرية وفي نفس الوقت معاملة الثمار بالزيوت المستخلصة من البصل أوالبقدونس أوالنعناع أوالفجل لم يكن لها أى تأثير معنوى على نسبة الإصابة بالأمراض الفطرية.