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POSTHARVEST TREATMENTS FOR CONTROLLING PERSIMMON FRUIT ROTS IN COLD STORAGE

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ABSTRACT

Dipping persimmon fruits in certain salts solutions decreased the severity of infection by either *Alternaria alternata* or *Botrytis cinerea*. Zinc sulphate at 500, 1000 and 1500 ppm was the most effective followed by potassium sorbate and salicylic acid. Calcium chloride at 4 % for 5 mins. gave good results in reducing fruit decay. Oil of majoram at the rate of 1.5 ml/L significantly decreased disease severity caused by the tested pathogenic fungi, followed by oil of cinnamon and camphor. Prestorage forced hot air at 50°C for 5 hrs was effective in controlling fruit rots with good fruit quality and without heat injuries. Exposure with low dose of UV light reduced the development of fruit rot disease during storage period. UV irradiation at 365 nm for 1, 3 and 5 mins. reduced the percentage of disease severity compared with 254 nm at the same exposure time.

INTRODUCTION

Persimmon fruits are subjected to the attack of several pathogenic fungi during storage. *Alternaria alternata* and *Botrytis cinerea* were reported to cause considerable damages to persimmon fruits (Kechakmadze and Kikvadze, 1974; Prusky *et al.*, 1978; Prusky and Ben-Arie, 1981; Kitagawa and Glucina, 1984; Snowdon, 1990; Perez *et al.*, 1995 and Baraka *et al.*, 2002). Prusky *et al.* (1997) mentioned that *A. alternata* caused black spots and rotting on persimmon fruits during storage as well as severe postharvest losses. In this respect, postharvest treatments were applied to reduce fruit decay during storage period. Prestorage treatments with different salts solutions were effective in reducing storage fruit rots (Parida *et al.*, 1991; El-Sheikh, 1998 and Soltan, 1998). Persimmon fruits treated with calcium chloride gave good results in decreasing fruit rots (Treglazova and Fataliev, 1989). Fruit treatments with calcium chloride have been previously studied by Conway *et al.* (1991), Biggs *et al.* (1993) and Abbass (1999). Essential oils and volatiles produced by plants possess fungicidal activity and may have a potential for control of postharvest diseases (Dikshit *et al.*, 1983 and Singh & Gupta, 1992). Prestorage forced heating shows potential as a nonchemical method for protecting persimmon fruits against rot pathogens in storage (Woolf *et al.*, 1997). However, Prusky *et al.* (1981) found that treated persimmon fruits with hot air decreased the infection by *A. alternata* during storage period. Postharvest treatment with hot air has been used to reduce fruit decay of several crops (Fallik *et al.*, 1993; Klein *et al.*, 1997; El-Sheikh, 1998 and Abbass, 1999). Exposure of persimmon fruits to low dose of ultraviolet radiation reduced the development of postharvest diseases (Ogata,

1973). Treatment of different fruits with hermetic low doses of UV reduced disease incidence and delayed ripening (Stevens *et al.*, 1991). Application of UV light reduced the infection with either *A. alternata* or *B. cinerea* on stored fruits (Lu *et al.*, 1993; Stevens *et al.*, 1996; Franco *et al.*, 1998 and Abbass, 1999).

The aim of this study is to determine the effect of some postharvest treatments such as certain salts, essential oils, hot air and ultraviolet radiation on persimmon fruit rot disease severity in cold storage.

MATERIALS AND METHODS

The tested pathogenic fungi *A. alternata* and *B. cinerea* were previously isolated from infected persimmon fruits by Baraka *et al.* (2002). Spore suspension (10^6 spores/ml) for each tested fungus was prepared for the artificial inoculation. Persimmon fruits, cv. Costata, were harvesting from commercial orchards at Dakahlia Governorate. Apparently healthy fruits uniformed in size and maturity were washed thoroughly with tap water, sterilized by ethanol 90 %, then left to dry at room temperature. Twenty-four hours after inoculation, the fruits were treated with different treatments. Three replicates were used for each treatment and fifteen fruits per replicate. Treated persimmon fruits were packed in polyethylene bags, then stored for 30 days at 0°C and 90-95 % R.H. Disease severity was calculated as a percentage of symptom area in proportion to the total area of the fruit according to Fallik *et al.* (1993).

I- Effect of certain salts on persimmon fruit rot severity:

Six salts namely boric acid, calcium carbonate, copper sulfate, potassium sorbate, salicylic acid and zinc sulfate were tested at three concentrations, *i.e.* 500, 1000 and 1500 ppm. Persimmon fruits were inoculated as mentioned before. Inoculated fruits were dipped for 5 minutes in different concentrations of the tested salts. Similarly inoculated fruits were immersed in sterile water to serve as control. Treated and untreated fruits were stored and severity of infection was determined after 30 days.

II-Effect of calcium chloride on persimmon fruit rot development:

Artificially inoculated fruits were immersed in 1, 2, 3 and 4 % solutions of calcium chloride for 3-5 minutes. Treated fruits were allowed to dry in the air and stored. Disease severity was recorded after 30 days as previously mentioned.

III- Effect of essential oils on persimmon disease severity:

Five oils, *i.e.* camphor, carnation, cinnamon, majoram and thyme at 0.5, 1.0 and 1.5 ml/L plus 0.5 ml/L Triton B, were used in this experiment. Inoculated fruits were dipped for five minutes in oils concentrations tested. The control fruits were immersed in sterile water. The fruits were stored and severity of infection was calculated after 30 days.

IV- Effect of forced hot air on persimmon fruit rots development:

Artificially inoculated fruits were treated with forced hot air in a chamber with fan for continuous forced hot air at different temperatures, *i.e.* 30, 40 and 50°C for 5, 10 and 15 hrs. Non - treated fruits with forced air were served as control. Treated and untreated fruits were stored and disease severity was recorded.

V-Effect of ultraviolet light on reducing postharvest diseases of persimmon fruits:

Inoculated fruits were exposed to UV irradiation at two doses (254 and 365 nm) and three exposures times (1, 3 and 5 mins.). Inoculated fruits without irradiation were used as control. The fruits were stored and severity of infection was determined as mentioned before.

RESULTS AND DISCUSSION

Data in Table (1) indicate that, zinc sulfate was the most effective treatment in controlling fruit rots caused by both *A. alternata* and *B. cinerea,* followed by potassium sorbate, salicylic acid and copper sulphate, respectively. While, calcium carbonate at 500 ppm was not effective against both fungi. Generally, increasing the concentrations of all salts tested resulted in decreasing in disease severity in infected persimmon fruits after storage period. These results are in agreement with those findings reported by Parida *et al.* (1991), and Soltan (1998).

Table (1): Effect of different salts solutions on persimmon fruit disease severity, 30 days after storage at 0° C and 90 - 95 % R.H.

Treatments	Conc. (ppm)	%Severity of infection by :		
		A.alternata	*B.cinerea*	Mean
Boric acid	500	18.15	15.20	16.68
	1000	16.25	12.50	14.38
	1500	15.15	13.30	14.28
Calcium carbonate	500	18.20	20.15	19.18
	1000	12.45	14.50	13.48
	1500	9.20	10.45	9.83
Copper sulfate	500	17.90	19.85	18.86
	1000	10.40	12.45	11.43
	1500	7.30	9 35	8.39
Potassium sorbate	500	15.20	19.20	17.20
	1000	12.50	14.20	13.35
	1500	5.60	5.20	5.40
Salicylic acid	500	17.25	20.10	18.68
	1000	13.15	15.45	14.30
	1500	7.10	8.80	7.95
Zinc sulfate	500	15.30	18.65	16.98
	1000	7.60	9.15	18.38
	1500	4.15	7.30	5.73
Control	0	18.65	21.30	19.98
L.S.D. at 5 % for: Treatments (T)		**1.20**	**0.53**	
Concentrations (C)		**0.98**	**0.75**	
T x C		**2.18**	**1.68**	

The effect of dipping persimmon fruits in calcium chloride solutions on disease severity was shown in Fig. (1), indicate that calcium chloride at 4 % for 5 min. was the most effective treatment in decreasing fruit rot disease caused by both *A. alternata* and *B. cinerea*, while it was not effective at 1% in controlling the disease. It was noticed that all calcium chloride concentrations tested reduced the percentage of severity of infection and the reduction of infection was increased by increasing the concentration compared with untreated fruits. Similar results were obtained by Treglazova and Fataliev (1989) who reported that persimmon fruits treatment with 4 % calcium chloride, generally gave better results in reducing storage rots. However, calcium from calcium chloride postharvest treatments delays ripening or senescence and reducing softening of the fruit (Poovaiah *et al.*, 1988). On the other hand, calcium in calcium chloride treated apples induced resistance to gray rot caused by *B. cinerea* by decreasing the maceration of cell wall by fungal polygalacturonase (Conway *et al.*, 1991). Also, calcium reduces both respiratory rate and ethylene production in stored apple and pear fruits (Sams & Conway, 1984 and Dimitrios & Daryl, 1996). Prestorage treatments with calcium chloride had been previously reported (Conway *et al.*, 1987 and 1988 ; Conway *et al* ., 1991; Parida *et al* ., 1991; Biggs *et al* ., 1993 and Abbass , 1999).

Data presented in Table (2) indicated that the essential oils tested significantly reduced the development of fruit rots of persimmon after cold storage, compared with untreated ones. Also, increasing essential oils concentrations decreased the percentage of infection in inoculated fruits by both pathogens. However, majoram at the rate of 1.5 ml/L was the most effective treatment in controlling fruit rots followed by cinnamon and camphor. These data are in agreement with those of Singh & Gupta (1992) and Soltan (1998). Essential oils have been recognized as having good fungitoxic. A number of essential oils and volatiles produced by plants possess fungicidal activity and may have a potential for the control of postharvest diseases (Prasad & Stadelbacker, 1974 and Singh *et al.*, 1980).

Data in Fig. (2) show that the severity of infection was decreased by increasing air temperature and exposure period. Forced hot air treatment for persimmon fruits at 50°C for 15 hrs., was the most effective in controlling fruit decay, followed by 50°C for 10 hrs., but both treatments causes external and internal heat damage symptoms after one month in cold storage. Clear damage was evident in response to hot air with high temperature and longer duration. However, forced hot air at 50°C for 5 hrs. was the best treatment in controlling persimmon fruit decay with good fruit quality, and without heat injuries. Similar results were obtained by Couey (1989) and Woolf *et al.* (1997). Prusky *et al.* (1981) mentioned that persimmon fruit decay caused by *A. alternata* can be controlled by treating persimmon fruits with hot air at 55°C for 2 days, and stored at 0°C. Prestorage treatment with hot air was used to reduce fruit decay of different crops (Fallik *et al.*, 1993; El- Sheikh, 1998 and Abbass, 1999). The mode of action of hot air treatment effect attributed to either by inhibiting directly the growth of the pathogen (Couey, 1989) or by inducing natural resistance of the fruit (Spotts and Chen, 1987).

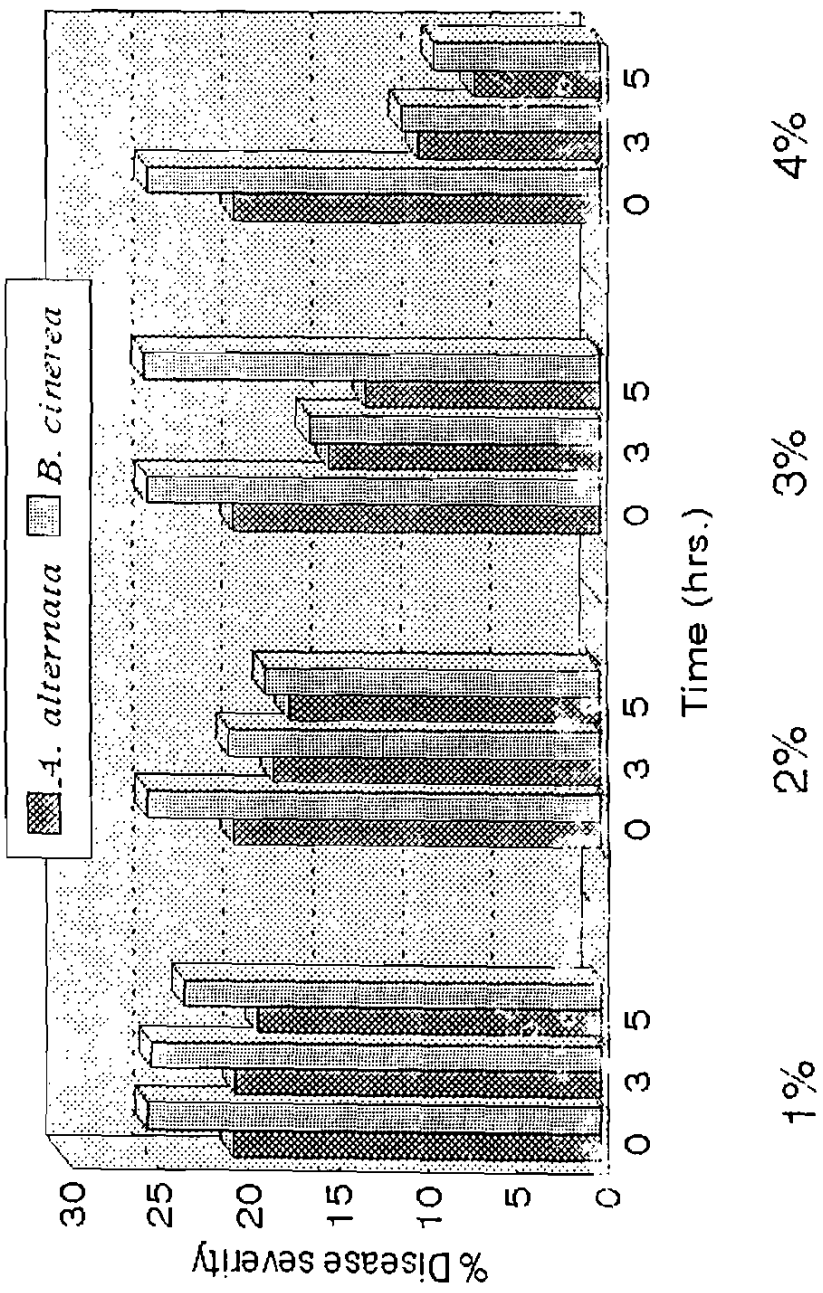

Fig. (1). Effect of calcium chloride solutions on persimmon fruit disease severity, 30 days after storage at 0°C and 90-95 % R.H.

Table (2): Effect of five essential oils on the severity of fruit rot disease of persimmon , 30 days after storage at 0°C and 90-95 % R.H.

Oil	Conc. (ml/L)	% Severity of infection by :		
		A. alternata	*B. cinerea*	Mean
Camphor	0.5	17.50	15.50	16.50
	1.0	13.60	9.20	11.40
	1.5	9.50	5.10	7.30
Carnation	0.5	17.35	15.20	16.28
	1.0	15.50	12.15	13.83
	1.5	12.40	10.30	11.35
Cinnamon	0.5	14.25	16.33	15.29
	1.0	10.15	11.20	10.68
	1.5	6.25	6.50	6.38
Majoram	0.5	12.30	10.20	11.25
	1.0	6.85	4.50	5.68
	1.5	4.70	2.90	3.80
Thyme	0.5	18.25	19.90	18.08
	1.0	17.65	17.33	17.49
	1.5	14.10	16.80	15.45
Control	0.0	18.85	23.40	21.13
L.S.D. at 5 % for : Treatments (T)		1.20	0.53	
Concentrations (C)		0.98	0.75	
T x C		2.18	1.68	

The effect of ultraviolet light on rot development of persimmon fruits inoculated with *A. alternata* and *B. cinerea* in cold storage is shown in Fig. (3). Data indicate that UV irradiation at 365 nm for 1, 3 and 5 min. clearly reduced the severity of infection caused by both fungi compared with 254 nm at the same exposure time or untreated fruits. This result confirms those reported by Ogata (1973), Lu *et al.* (1993), Stevens *et al.* (1996), Franco *et al.* (1998) and Abbass (1999). Stevens *et al.* (1991) mentioned that treatment of onions, sweet potatoes, tomatoes, peaches and citrus fruits with hormetic low doses of UV reduced disease incidence and delayed ripening. In this respect, the possible explanations by which postharvest decay could reduced by UV light are germicidal effect on the pathogen propagules on the fruit surface and induced resistance of treated fruits (Stevens *et al.*, 1996). Increasing biosynthesis of phenolic compounds are believed to be an important part on disease resistance of plants (Frylinck *et al.*, 1987). On the other hand, the possibility of noticeable or unnoticeable injuries to fruits by higher UV doses probably caused an increase in the susceptibility of fruit to postharvest decay at higher UV doses (Stevens *et al.*, 1990).

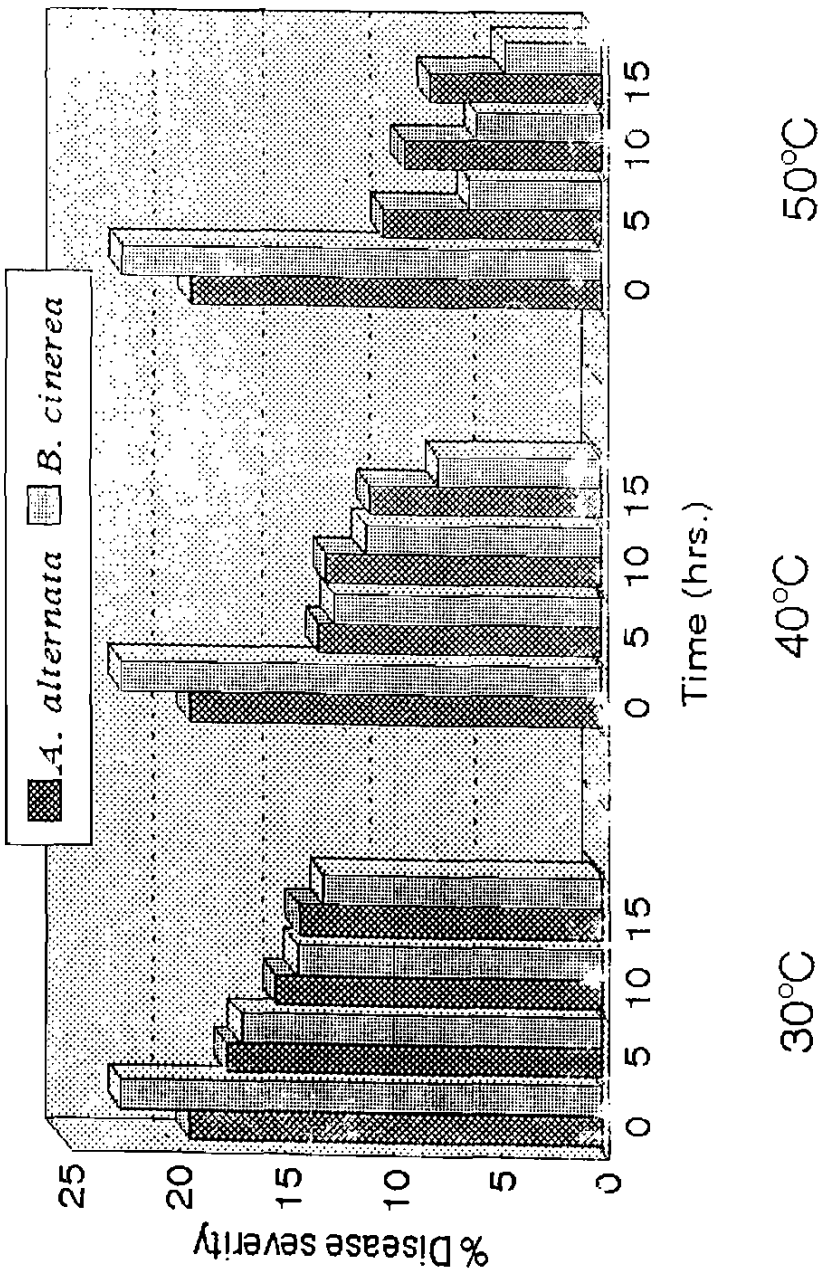

Fig. (2). Effect of forced hot air treatment on disease severity of persimmon fruits, 30 days after storage at 0°C and 90-95 % R.H.

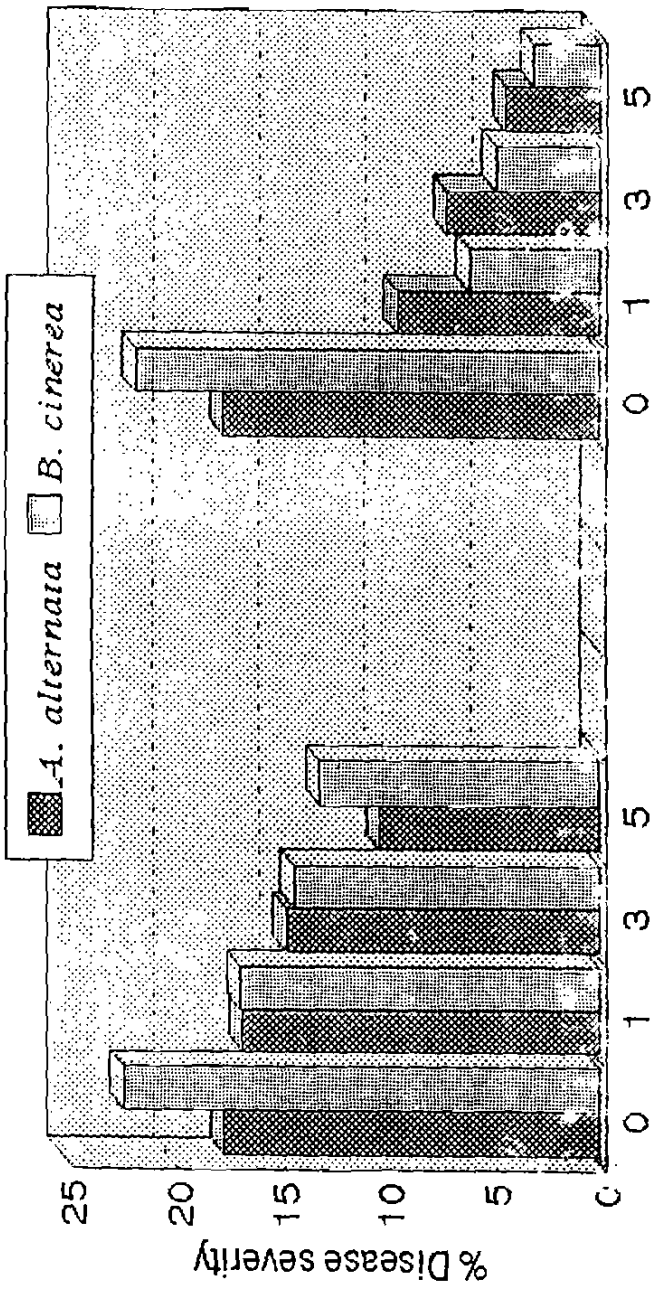

Fig. (3). Effect of UV light on disease severity of persimmon fruits, 30 days after storage at 0°C and 90-95 % R.H.

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معاملات ما بعد الحصاد وتأثيرها على أعفان ثمار الكاكى فى المخزن

متولى على بركة * ، فاطمة مهدى رضوان**، حمادة حماد سلطان** ، خالد حسين عرفات**

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أدى غمر ثمار الكاكى فى بعض محاليل بعض الأملاح الى نقص فى شدة الاصابة بكل من الفطر الترناريا الترناتا وبوتريتس سينماريا كما كانت سلفات الزنك فى تركيزات ٥٠٠ ، ١٠٠٠ ، ١٥٠٠ جزء فى المليون أكثر كفاءة فى مقاومة أعفان ثمار الكاكى.

أدت المعاملة بكلوريد الكالسيوم بتركيز ٤ % لمدة ٤ دقائق الى نتائج جيدة فى خفض النسبة المئوية لشدة الأصابة بأعفان الثمار.

وجد أن غمر الثمار فى زيت العتر بمعدل ١،٥ مل/لتر الى نقص معنوى فى شدة المرض يليه زيت القرفة والكافور ، كما وجد أن معاملة الثمار قبل التخزين بالهواء الساخن على درجة ٥٠ درجة مئوية لمدة ٥ ساعات، كانت فعالة فى مقاومة المرض وبدون أن تؤثر على جودة الثمار أو تحدث أضرارا ناتجة عن المعاملة الحرارية.

لوحظ أن تعريض الثمار لجرعات منخفضة من الأشعة الفوق البنفسجية تؤدى الى خفض شدة مرض عفن الثمار خلال فترة التخزين ، كما وجد أن أفضل طول موجى للأشعة لتعريض الثمار لها هو ٣٦٥ نانوميتر لمدة ٥،٣،١ دقائق لخفض شدة الأصابة للفطرين الممرضين بالمقارنة بالتعريض بالطول الموجى ٢٤٥ نانوميتر لنفس زمن التعريض.