

The Effect of Vapor Guard¹ and Thiabendazole on Rind Disorders and Decay of Valencia Orange Fruits

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ABSTRACT

Pitting of Valencia (*Citrus sinensis* [L.] Osbeck) orange fruits increased markedly during storage at $5 \pm 1.5^\circ\text{C}$. Thiabendazole (TBZ) at 750 and 1000 ppm, and Vapor Guard (VG) at 1%, reduced pitting. Incorporating TBZ into VG further reduced pitting. VG was more effective in reducing pitting than TBZ alone at any concentration. Decay and stem-end aging were extensive after only 3 months of storage, particularly on control fruits. Incorporating TBZ into VG was more effective in reducing pitting and stem-end aging than either one alone. Valencia fruits were classified unmarketable at the end of 4 months of storage. The extensive decay development after 3 months of storage suggests that storage of Valencia orange fruits should not be extended beyond 3 months.

INTRODUCTION

Pitting and aging results in extensive losses during storage. Pitting is a low-temperature injury characterized by abruptly sunken spots in the rind usually on the shoulder or cheek of the fruit (10,12). The rind around the stem button wilts and shrivels (as a result of loss of water) resulting in aging (1). Both pitting and aging are aggravated by low relative humidity during storage and marketing. Low relative humidity in storage increases the transpiration rate of citrus fruits particularly from the stem-end area. VG at 1% reduced weight loss of Hamlin orange fruits by 45% (4), thus maintaining the turgidity of fruits. Benlate; a fungicide, and Pinolene; a film-forming anti-transpirant, were reported to reduce pitting of grapefruits (12), and decay in apples (5) and citrus (10). The objective of this paper was to study the effect of VG and TBZ on pitting, aging and decay of Valencia orange fruits during storage at $5 \pm 1.5^\circ\text{C}$.

MATERIALS AND METHODS

Valencia orange fruits grown on rough lemon rootstock were harvested from College of Agriculture Research Farm at Tripoli, Libya, on February 2, 1978. The fruits were held at room temperature for 3 days and then sorted to eliminate decayed fruits. Four replicates of 24 fruits each were assigned at random and dipped for 2 minutes in one of the following treatments:

- (1) Control (water)
- (2) VG at 1%

¹Vapor Guard (Poly-1-p-menthen-8-9-diyl) Miller Chemical & Fertilizer Corp. Pen., U.S.A.

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Table 1 The effect of Vapor Guard and Thiabendazole, separating or combined on fruit pitting and decay during storage at $5^{\circ}\text{C} \pm 1.5$.

	11/3/78				11/4/78				11/5/78			
	Pitted fruit %	Average pits/fruit %	Decay fruit %	Sound fruit %	Pitted fruit %	Average pits/fruit %	Decay fruit %	Sound fruit %	Pitted fruit %	Average pits/fruit %	Decay fruit %	Sound fruit %
Control	61.46	2.31	6.25	32.29	67.78	2.57	6.67	32.22	72.22	2.98	6.67	25.56
VG												
1%	40.03	2.31	3.13	56.25	55.56	3.60	3.22	46.24	66.67	3.26	3.23	33.33
TBZ 750 ppm	54.17	1.77	3.13	42.71	63.44	2.25	3.22	36.56	82.80	3.40	4.30	16.13
TBZ 1,000 ppm	48.96	2.23	0	51.04	58.33	2.68	1.04	40.63	84.21	3.10	1.05	15.79
TBZ 750 ppm + VG 1%	51.04	1.76	2.08	46.88	52.13	2.35	2.13	47.87	58.51	2.91	2.13	41.49
TBZ 1,000 ppm + VG 1%	34.38	1.67	0	65.63	64.58	2.31	1.04	34.38	65.26	2.47	2.11	33.68

% Sound fruits, LSD 0.05 for treatments = 6.39, for periods = 5.22

% Decayed fruits, LSD 0.05 for treatments = 3.67, for periods = 4.89

% Pitted fruits, LSD 0.05 for treatments = 8.46, for periods = 5.98

Average pits/fruits, LSD 0.05 for treatments = 0.29, for periods = 0.24

- (3) TBZ at 750 ppm
- (4) TBZ at 1000 ppm
- (5) TBZ at 750 ppm mixed into VG 1%
- (6) TBZ at 1000 ppm mixed into VG 1%

The fruits stored in wooden boxes at $5 \pm 1.5^{\circ}\text{C}$ and relative humidity of 40–60%. Decay and rind disorders (pitting and stem-end aging) were traced periodically. Fruits showing a total sunken area, about the size of a nail-head on peel surface, were classified as pitted. A fruit showing any sign of decay was considered decayed. The data were subjected to statistical analysis.

RESULTS AND DISCUSSION

Pitting in both treated and untreated Valencia orange fruit increased markedly during storage at $5 \pm 1.5^{\circ}\text{C}$. Control lots exhibited more pitted fruits with more pits per fruit than VG and TBZ treated lots. All treatments, except TBZ at 750 ppm, resulted in a significant decrease in percentage pitted fruits (Table 1). Pitting decreased as TBZ concentration increased. Incorporating TBZ into VG further decreased pitting and number of pits per fruit, perhaps a result of reducing fruit transpiration. Anti-transpirants were reported to reduce transpiration by 30–80% (1,2,3,4,6). TBZ at 1000 ppm incorporated into VG 1% resulted in a significantly lower pitted fruits with lowest number of pits per fruit. Fruits with few small pits were still marketable but affected fruits decay readily at higher temperature during marketing. Decay was generally low during the first 2 months of storage, but was significantly higher in control than treated fruits during whole storage period. TBZ at 1000 ppm alone or incorporated into VG 1% completely checked decay during the first month of storage and to a lesser degree during the first 3 months of storage (Table 1).

Pitting and decay were extensive after 3 months of storage. The fruits were either severely pitted or decayed. Invasion of micro-organisms started at pitted areas. At the end of the fourth month of storage, decay overshadowed pitting, thus data was not presented.

Aging was not evident during the first 3 months of storage, except in control fruits (Table 2). Aging increased markedly during the fourth month of storage at $5 \pm 1.5^{\circ}\text{C}$. VG and TBZ (at both concentrations), separately or in combination checked aging development.

Aging in untreated fruits increased from 8.33% to 48.7% during the fourth month of storage. Both TBZ and VG significantly decreased fruit aging. TBZ appeared to be more effective than VG in reducing aging. Incorporating of 1,000 ppm TBZ into VG 1% completely checked aging. (Table 2). The striking effect of TBZ in controlling aging was unexpected. Reduction in pitting and aging was related to low water loss

Table 2 The Effect of VG and TBZ on Aging of 'Valencia' orange fruit after 4 months of storage.

Treatment	% Aged fruits	
	3rd Month	4th Month
Control	8.33 ^a	48.7
VG, 1%	0	13.9
TBZ 750 ppm	0	10.8
TBZ 1,000 ppm	0	7.3
TBZ 750 ppm + VG 1%	0	3.2
TBZ 1,000 ppm + VG 1%	0	0
LSD, 0.05	—	6.72

^aStatistical analysis was not possible due to too many zeros.

from fruits. High humidity in storage reduced chilling injury (7,8). Waxing (12), and VG (3) reduced pitting in orange fruits. TBZ has shown to reduce incidence of chilling injury in grapefruits (10,12). Benomyl (like TBZ, a benzimidazole) reduced chilling injury in orange fruits (3), and exhibited a cytokinin-like activity in inhibiting senescence in broccoli heads (9). Thus it is possible that TBZ possess stomata closing properties which reduced desiccation of the peel, reported to be associated with pitting (7,8), and/or reduced the accumulation of toxic metabolites which may lead to chilling injury (7).

Post-harvest treatments with TBZ alone, or incorporated into VG, could reduce citrus fruit losses attributed to chilling injury.

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تأشير استعمال مركب Vapor Guard المشبط
للنتح والمبيد الفطري Thiabendazole (TBZ)
على الإصابة بالعيوب الفسيولوجية والأمراض الفطرية
أثناء تخزين برتقال صنف فالنسيا

د. محمد إبراهيم الطمزيني ، ضميم منصور نيــــــــــــــازي

المستخلص

يهدف هذا البحث الى محاولة تقليل الإصابة بالعيوب الفسيولوجية
التحفر Pitting والشيخوخة Aging باستعمال مادة Vapor Guard
المشبطة للنتح بتركيز ١/ والمبيد الفطري TBZ بتركيز ٧٥٠ ، ١٠٠٠ جزء
في المليون منفصلين او مخلوطين .

وتفيد الدراسة ان المادتين (منفصلتين او مخلوطتين) ادت
الى تقليل الإصابة بالتحفر والشيخوخة وان مادة TBZ ادت الى تقليل
الإصابة بالأمراض الفطرية وان كفاءة المبيد ازدادت بازدياد التركيز
وبالخلط بمادة Vapor Guard ينصح المعاملة بمادة TBZ لتقليل
الإصابة بالأمراض الفطرية والعيوب الفسيولوجية وخاصة الشيخوخة كما
ينصح عدم تخزين برتقال صنف فالنسيا اكثر من ٣ شهور على درجة حرارة = ١٥م°
لتقليل نسبة الفاقد .