

PMR Report # SECTION J: FRUIT - Diseases.

STUDY DATA BASE:

CROP: Apples (*Malus domestica* Borkh.) cv. Empire

PEST: Blue mold (*Penicillium expansum*)

NAME AND AGENCY

ERRAMPALLI D

Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Centre

P.O. Box 6000, 4902 Victoria Ave. N. Vineland Station, ON, L0R 2E0

Office: (905) 562-4113 ext. 234 Fax: (905) 562-4335 Email: errampallid @em.agr.ca

TITLE: Evaluation of postharvest fungicide treatment for control of blue mold of apples cv. Empire, 2001-2002.

MATERIALS: Biosave 10 LP (*Pseudomonas syringae* strain ESC-10), Mertect 500SC (thiabendazole 45%).

METHODS: BioSave, a biological control agent was compared with the thiabendazole (TBZ) for efficacy against blue mold of apple caused by *Penicillium expansum*. Commercially ripe apple cv. Empire were obtained from a research orchard at Jordan Station, Ontario and from a local commercial cold storage facility. All fruits were stored at 1 - 4 °C until used in experimental treatments. Apples were disinfested in 10% household bleach (5% sodium hypochlorite) and 0.01% Tween 20 (Fisher Scientific) for 4 min and rinsed in reverse osmosis water for 4 min. After disinfestation, 24 apples were placed on a plastic packing insert (24 fruit master) contained in a plastic box. Each box represented a treatment replication and three replicate trays were prepared for each treatment. The apples were punctured once with a nail-like probe (5 mm diam.) to a depth of 4 mm. Within 45 minutes of wounding, apples were drenched for 20 seconds in fungicide and TBZ-resistant *Penicillium expansum* at a concentration of 1×10^4 conidia/ml. Untreated check had no fungicides. In experiment 1 and 2, TBZ-resistant (TBZ-R) *Penicillium expansum* was used while in experiments 3 and 4 TBZ-R and TBZ-sensitive (TBZ-S) *Penicillium expansum* were compared. The treatments were completely randomized. Treated apples were incubated at 4°C for 30 days in experiments 1 and 2; at 4°C for 33 days; in experiment 3, and ; in controlled atmosphere (CA) storage (1.5 °C , 2.5% oxygen and 2.5% carbon dioxide) in experiment 4. Apples in each of the experiments were evaluated for decay after the respective incubation periods. To determine the efficacy of fungicides on the shelflife of the fruit, after first fruit decay evaluations after incubation at 4°C or CA, the fruits were moved to 20 °C, 85% RH and incubated for 6 days. The fruit was again evaluated for blue mold incidence (percent infected apples). Fruits were considered decayed when a lesion is developed on the fruit. The data obtained was analyzed by analysis of variance using appropriate transformations and significance between means were separated by LSD comparative tests.

RESULTS: Percent reduction of blue mold in different experiments is outlined in Tables 1 and 2.

CONCLUSIONS: Table 1: In experiment 1, at 4 °C for 30 days, BioSave at a lower concentration (1.06 g/L) and at recommended concentration (1.59g/L) controlled blue mold of apple at 89% and 92 %, respectively. Two higher concentrations gave 100 control. However, when the experiment (Experiment 2) was repeated the results varied. The BioSave gave only 83 to 43 % control. In both experiments

BioSave was not effective at 20 °C for 6 days as it gave 12.5 to 0.0 control of blue mold. The TBZ was ineffective (19 to 0% control) against the blue mold caused by TBZ-resistant *Penicillium expansum*.

Table 2. BioSave at the recommended concentration was evaluated for the control of blue mold caused by TBZ-sensitive and -resistant *P. expansum* in cold (4 °C) and CA storage conditions. In experiment 3, BioSave gave 79% control of TBZ-S and 67% control of TBZ-R at 4 °C. However only 2% of blue mold was controlled at 20 °C. TBZ gave (100%) control of TBZ-S at 4 °C and 20C but only 40% at 4 °C and 4 % at 20C control of blue mold caused by TBZ-R.

In CA storage (experiment 4) overall disease incidence was lower than that was observed in cold storage at 4 °C. BioSave gave 78% and 89% of disease control cor TBZ-s and TBZ-R, respectively. TBZ gave 86 % of control of blue mold at 4 °C and 36% control at 20 °C blue mold caused by TBZ-R. TBZ was effective at both temperatures on TBZ-S. Biosave was ineffective against blue mold at 20C.

In summary, In CA storage Biosave and TBZ gave similar controls on TBZ resistant isolates. In cold storage 4 °C BioSave gave controls ranging from 67 to 79%.

Table 1. Percent reduction* of blue mold following the protective treatment of *Pseudomonas syringae* (TBZ-resistant isolates) following drench inoculation with *Penicillium expansum*. 2001 to 2002.

		Reduction (%) of blue mold ^a			
		Experiment 1 ^b		Experiment 2 ^c	
Fungicide		at 4°C for 30 days	Shelflife at 20 °C for 1 week	at 4°C for 30 days	Shelflife at 20 °C for 1 week
		TBZ-R	TBZ-R	TBZ-R	TBZ-R
water only		100.0	100.0	100.0	100.0
Inoculum only		1.4	0.0	3.4	0.0
BioSave 1.06 g/L		88.9	12.5	43.4	0.0
BioSave 1.59 g/L		91.7	0.0	63.3	0.0
BioSave 2.38 g/L		100.0	7.6	80.0	0.0
BioSave 3.57 g/L		100.0	6.1	83.4	0.0
TBZ		19.5	4.2	1.7	0.0
Observations recorded on		April 9	April 15	May 10,	May 16

* based on an average of 3 replicates and 20 fruit/replicate

^a The apples were treated fungicides and *Penicillium expansum*. Disease incidence (percentage of inoculation sites with disease) was assessed after incubation for 7 days at 22 - 24 °C and was used for calculating the disease reductions.

^b Expt 1. Treated with fungicides and inoculum on March 7, 2002 and stored at 4 °C until April 8, 2002. Recorded observations of blue mold incidence and area affected on April 8, 2002, and moved to 20C on the same day. Shelflife study of 1a (April 8-15) at 20 °C for 6 days.

^c Expt 2. (Treated with fungicides and inoculum on April 4, 2002 and stored at 4 °C until May 10 , 2002. Recorded observations of blue mold incidence and area affected on May 12, 2002, and moved to 20 °C on the same day. Shelflife study of 2a (May 10-16) at 20 °C for 6 days.

Table 2. Efficacy of BioSave at recommended dose on cotrol of blue mold of apple at 4°C for 33 days and at CA for 105 days, 2001 to 2002.

Fungicide	Reduction (%) of blue mold ^a							
	Experiment 3 ^b				experiment 4 ^c			
	Storage at 4°C for 33 days		Shelflife at 20 °C for 6 days		CA storage for 100 days		Shelflife at 20 °C for 6 days	
	TBZ-S	TBZ-R	TBZ-S	TBZ-R	TBZ-S	TBZ-R	TBZ-S	TBZ-R
water only	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Inoculum only	2.8	1.4	1.4	1.4	47.3	55.6	2.8	8.3
BioSave 1.59 g/L	79.2	66.7	1.4	0.0	77.8	88.9	13.9	11.1
TBZ	100.0	39.7	100.0	3.5	100.0	86.1	100.0	36.2
Observations recorded on	April 8	April 9	April 15	April 15	May 10	May 10,	May16	May 16

* based on an average of 3 replicates and 20 fruit/replicate

^a The apples were treated fungicides and *Penicillium expansum*. Disease incidence (percentage of inoculation sites with disease) was assessed after incubation for 7 days at 22 - 24 °C and was used for calculating the disease reductions.

^b Expt 3. Treated with fungicides and inoculum on March 7, 2002 and stored at 4 °C until April 8 and 9, 2002. Recorded observations of blue mold incidence and area affected on April 8, and 9, 2002, and moved to 20 °C on the same day. Shelflife study of 1a (April 8-15) at 20 °C for 6 days.

^c Expt 4. Treated with fungicides and inoculum on April 4, 2002 and stored at 4 °C until May 10, 2002. Recorded observations of blue mold incidence and area affected on May 12, 2002, and moved to 20 °C on the same day. Shelflife study of 2a (May 10-16) at 20 °C for 6 days.