CONTROL OF STORAGE DISEASES OF CARROTS WITH POSTHARVEST FUNGICIDE TREATMENTS

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Abstract

Postharvest treatment of washed carrots with benomyl or thiabendazole type fungicides gave significantly better control of storage decay than did Dowicide A. Gray mold and crater rots were the dominant types of decay.

Résumé

Le traiternent d'après-récolte des carottes lavées, avec des fongicides de type benomyl ou thiabendazole a donne des résultats significativement rneilleurs qu'avec le Dowicide A contre la pourriture d'entrepôt. La rnoisissure grise et les pourritures en cratère étaient les principaux types de pourriture.

Previously it was shown that decay of carrots stored for 15 or 16 weeks was significantly reduced by washing, grading, and treating them with fungicides prior to storage (2). One of the fungicides, Dowicide A, was adopted for commercial use but has not been consistently effective in controlling rots of carrots for long storage periods, and it became evident that better control measures were needed. Recently, Derbyshire and Crisp (1) found that benomyl postharvest dips were effective in controlling decay of carrots stored for 7 months. One year's test with thiabendazole (2) indicated that it was effective.

This paper presents further tests on postharvest fungicide treatments for the control of decay of carrots stored in a commsrcial jacketed cold storage.

Materials and methods

In 1972 and 1973 carrots (Daucus carota L. var. sativa D.C. cv. Nantes) machine harvested in late September were washed, spray rinsed and graded as previously described (2), except that excess soil was washed off prior to the entry of the carrots into the washer, and a final rinse of clean well water replaced the pond water used previously. The prestorage fungicide treatments and rate of formulation/100 gal of water were as follows:

1. washed control - carrots from conveyer following grading.
2. Dowicide A (97% sodium orthophenyl phenate, Dow Chemicals of Canada Ltd., Sarnia, Ontario), 0.5 lb.
3. Benlate 50 W (50% benomyl, DuPont of Canada Ltd., Montreal, Quebec), 0.5 and 1.0 lb.
4. Benlate T-20 (30% benomyl and 30% thiram, E. I. DuPont de Nemours and Company (Inc.) Wilmington, Delaware, U. S. A.), 0.5 lb.
5. MPXP-37 (experimental liquid formula of thiabendazole of unknown concentration in hypophosphate. Merck Chemical Division, Merck and Co., Inc., Rahway, New Jersey U. S. A.), 10 fl oz.
6. Mertect 460 (60% thiabendazole, Merck Sharp and Dohme Canada Ltd., Kirkland, Quebec), 0.56 and 1.12 lb in 1972.
7. Mertect Flowable (41.8% thiabendazole, Merck Sharp and Dohme International, Division of Merck and Co. Inc., Rahway, New Jersey, U. S. A.), 6 and 12 fl oz in 1973.

The fungicides were applied to the carrots on the conveyor belt following final water rinse. Dowicide A was drenched onto the carrots while the other fungicide treatments were sprayed on at 200 p.s.i. Each treatment was applied to four 18-bushel bulk bins of carrots. The carrots were held for 17 weeks (1972-73) and 14 weeks (1973-74) in a jacketed cold storage at 0 C and 97-100% R.H. and then graded into healthy or rots and weighed,

The rots were identified visually and the causal organisms verified by isolations onto potato dextrose agar from a 10-lb sample of rotted carrots from each treatment.

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For statistical analyses data on rots were transformed to angles.

Results and discussion

No field rots were found in 1972 or 1973 when the carrots were graded. This was attributed to growing carrots in fields known to be free of Botrytis problems, and to favorable weather during the growing season. Growers had experienced severe losses from Botrytis cinerea Pers. when carrots were grown in fields previously vacated by pea and bean qrowers because of gray mold rot problems. Better growing practices and changing the final prestorage rinse from pond water to well water may have accounted for most of the decrease in decay of the washed and graded control to 2% or less (Table 1) compared to losses of 6.1% to 10.3% reported previously *(2)*.

There was significantly less storage decay in carrots that had received postharvest treatment with benomyl and the thiabendazole type fungicides than in those treated with Dowicide A or that were washed and graded only (Table 1). In 1972–73 Benlate 50W gave better control at 1.0 lb/100 gal than at 0.5 lb/100 gal but in 1973–74 there was no significant difference in % decay between the two rates. Control with Benlate T20 was not significantly different from that with Benlate 50W. The various formulations of thiabendazole were equally effective and control was comparable to that obtained with the two benomyl compounds.

Table 1. Percentage rots in carrots stored at 0 C and 97–100% relative humidity for 14–17 weeks

Postharvest treatment	Rate per 100 Imp gal	% decay 1972–73 *	% decay 1973–74
Washed and graded		2.1 a	1.8 b
Dowicide A	0.5 lb	1.3 ab	3.2 a
Benlate 50W	1.0 lb	0.1 d	0.3 c
Benlate 50W	0.5 lb	0.8 b	0.4 c
Benlate T20	0.5 lb	**	0.6 c
Mertect 460	1.12 lb	0.4 cd	
Mertect 460	0.56 lb	0.3 cd	
MPXP-37	10 fl oz	0.3 cd	0.3 c
Mertect Flowable	12 fl oz		0.6 c
Mertect Flowable	6 fl oz		0.4 c

* Letters indicate treatments which do not differ significantly in Duncan's Multiple Range groupings at the 5% level.

** Blank spaces indicate no evaluation.

Table 2. Types of rots and loss in pounds of carrots stored at 0 C and 97–100% relative humidity for 14–17 weeks (avg of 4 replicates each averaging 800 lb)

Postharvest treatment	Rate per 100 Imp gal	1972–73 *Botrytis*	1972–73 Crater	1972–73 Total *	1973–74 *Botrytis*	1973–74 Crater	1973–74 Others ***	1973–74 Total *
Washed and graded		9.9	5.6	16.5 a	9.4	3.8	1.3	14.5 b
Dowicide A	0.5 lb	8.5	1.9	10.4 ab	20.6	3.1	1.8	25.5 a
Benlate 50W	1.0 lb	0.45	0.45	0.9 d	0.4	1.2	0.7	2.3 c
Benlate 50W	0.5 lb	2.3	4.3	6.6 b	0.5	0.5	2.2	3.2 c
Benlate T20	0.5 lb	**			0.8	1.7	1.5	4.0 c
Mertect 460	1.12 lb	1.3	0.1	1.4 cd				
Mertect 460	0.56 lb	2.5	1.1	3.8 cd				
MPXP-37	10 fl oz	0.9	0.9	1.8 cd	0.5	1.1	0.5	2.1 c
Mertect Flowable	12 fl oz				1.0	2.1	2.1	5.2 c
Mertect Flowable	6 fl oz				0.3	0.9	1.5	2.7 c

* Letters indicate treatments which do not differ significantly in Duncan's Multiple Range groupings at the 5% level.

** Blank spaces indicate no evaluation.

*** Indicates rots caused by *Alternaria* spp., Fusariumspp., *Penicillium* spp. and bacteria.

Gray mold (B. cinerea) rot was the most prominent type of decay of stored carrots followed by crater rot (Rhizoctonia), and miscellaneous rots caused by Alternaria spp., Fusarium spp., Penicillium spp. and bacteria (Table 2).

The results obtained in this study confirm those of Derbyshire and Crisp (1) and of Wells and Merworth (3) that benomyl is an effective postharvest fungicide treatment for control of decay on stored carrots. Thiabendazole in various formulations is also effective.

Literature cited

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