THE CONTROL OF STORAGE ROTS OF RASPBERRIES WITH SULFUR DIOXIDE[1]

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Abstract

Fumigating red raspberries with 0.5 per cent SO_2 for 20 minutes controlled storage rots for three days without causing off flavors. Fumigated raspberries were lighter in color and more attractive than untreated ones. The varieties Trent, Canby, Willamette and Carnival were firmer but Viking, Malling Promise and Early Red were usually softer following fumigation. One per cent SO_2 caused excessive bleaching and off flavors.

Introduction

The shelf life of red raspberries is very short and the consumer must receive them within 24 hours after picking to obtain good quality berries free of rots. However, according to Wright et al (4) shelf life can be prolonged by cold storage. They were able to keep raspberries 5 to 7 days at 31 to 32°F and at 85 to 90 per cent relative humidity. In Nova Scotia the low annual production (45,000 quarts) is spread among many growers in widely separated areas and it is usually not feasible to maintain local cold storage facilities. Obviously, other less expensive means of controlling rots are needed. Recently, Capellini et al (1) in New Jersey found that rots of Red Latham raspberries were controlled with SO_2 treatments. Such treatments are inexpensive, safe and present no residue problem.

Materials and Methods

In 1963 both field run and selected raspberries were fumigated immediately after picking with SO_2 in a 36 cu. ft. wooden chamber equipped with an air circulating fan, described by Sanford (3). Varieties treated were: Trent, Willamette, Carnival, Viking, Early Red, Canby and Malling Promise. The raspberries had received a dormant Bordeaux 5-10-100 spray on May 6 and a spray of ferbam at 2 lb. per 100 gallons on June 17, 1963. Pint boxes of field run berries or boxes containing 50 selected berries were placed on the floor of the fumigation chamber. Prior to each fumigation, the temperature and relative humidity of the treatment chamber was recorded. A weighed amount of SO_2 was released into the fumigation chamber through a flowmeter to give a concentration of 0.5 or 1.0 per cent. The berries were exposed to SO_2 for 20 minutes with the circulation fan operating in the chamber and, before opening the chamber, a sample of its atmosphere was withdrawn and analysed by Ruck's (2) method to verify the SO_2 concentration. Treated and untreated raspberries were stored in crates at 32, 52 or 72°F

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for two and three days and then examined for appearance and rots. Isolations from unknown rots and discolored drupelets were made on potato dextrose agar. Four boxes of berries were usually used for each treatment but for some varieties it was necessary to treat a lesser number due to lack of fruit.

Results and Discussion

Fumigation with 0.5 per cent SO_2 for 20 minutes gave good control of storage rots of carefully selected berries stored at 72°F for three days and of field run berries stored for two days at 72°F. The latter showed considerable breakdown when stored for three days (Table 1 and 2). Lesser amounts of raspberries of other varieties gave similar results. Selected raspberries which had and had not been treated with SO_2 showed no evidence of breakdown after three days storage at 32°F. The importance of selecting good berries for storage or shipment to market is obvious.

Raspberries fumigated with 0.5 per cent SO_2 had no off flavor and were lighter in color and more attractive than untreated ones. Treated raspberries of the varieties Trent, Canby, Willamette and Carnival were firmer, and Viking, Malling Promise and Early Red were usually softer than the controls. Capellini *et al* (1) found softening and bleaching of Red Latham raspberries treated with 0.5 per cent SO_2. Both treated and untreated Early Red berries crumbled quite readily. All varieties showed considerable bleaching and off flavor when fumigated with 1.0 per cent SO_2. Tests were carried out at temperatures ranging from 70 to 85°F and at relative humidities ranging from 53 to 69 per cent, but these factors had no noticeable influence on the results.

Table 1. Per cent rots on field run Trent raspberries after exposure to 0.5 per cent SO_2 for 20 minutes (Mean values for 4 boxes).

Days in storage	Temp. °F	Total rots		Botrytis		Others ***	
		T*	C**	T	C	T	C
2	32	1.9	8.6	1.9	7.3	0	1.3
2	52	4.0	16.4	2.6	12.5	1.4	3.9
2	72	23.6	88.3	23.3	88.3	0.3	0
3	32	18.3	31.5	17.1	30.1	1.2	1.4
3	52	23.5	25.4	23.3	24.2	0.2	1.2
3	72	89.9	97.9	78.0	93.4	12.0	4.5

* Treated with SO_2

** Untreated

*** Includes *Cladosporium* sp, *Penicillium* spp and *Rhizopus* sp.

Table 2. Per cent rots on selected raspberries stored at 72°F after exposure to 0.5 per cent SO_2 for 20 minutes (Mean values for 4 boxes).

Variety	Days in storage	Total rots		Botrytis		Penicillium		Cladosporium		Rhizopus	
		T*	C**	T	C	T	C	T	C	T	C
Trent	2	2.5	54.0	0.5	2.0	0	5.5	2.0	5.5	0	41.0
Willamette	2	1.5	59.0	0.5	2.5	0	1.0	1.0	15.5	0	30.0
Carnival	2	3.5	38.5	0	2.5	1.0	1.0	2.0	28.0	0.5	7.0
Carnival	3	0	22.5	0	5.0	0	5.5	0	11.5	0	0.5
Willamette	3	3.5	39.5	0.5	4.5	0.5	5.5	2.5	27.0	0	2.5
Viking	3	0	31.0	0	5.0	0	6.5	0	17.0	0	2.5

* Treated with SO_2

** Untreated

Table 3. Occurrence of microorganisms in per cent from discolored drupelets of raspberries

Isolates	Varieties			
	Trent	Early Red	Carnival	Willamette
Botrytis cinerea	0	16.6	14.2	39.3
Cladosporium herbarum	4.2	0	25.0	11.6
Penicillium spp	0	4.2	0	4.5
Rhizopus sp	0	0	25.0	3.6
Undetermined fungi	8.2	4.1	0	0
Bacteria	0	0	3.5	10.7
Yeast	4.2	16.6	0	0.9
Sterile	83.4	58.5	32.3	29.4

Discolored drupelets, light red to whitish in color and often slightly shrunken, were found on both untreated and treated raspberries. In a first series of isolations these were all sterile. In later isolations from untreated berries, a high percentage of Trent and Early Red were sterile but a large number of discolored drupelets of Carnival and Willamette contained organisms (Table 3). Fumigation with SO_2 or storage temperature had little effect on the incidence of discolored drupelets. The drupelet injury was thought to be caused by an insect puncture that occurred prior to picking. The higher incidence of microorganisms isolated from Carnival and Willamette may have been due to periods of wet weather prior to the picking date of these varieties.

It is concluded that first grade red raspberries fumigated 20 minutes with 0.5 per cent SO_2 can be safely handled for three days at 72°F without a significant loss of berries from decay.

Literature Cited

1. CAPELLINI, R.A., A. W. STRETCH and G.S. WALTON. 1961. Effects of sulfur-dioxide on the reduction of post-harvest decay of Latham red raspberries. Plant Disease Reptr. 45: 301-303.
2. RUCK, J.A. 1956. Chemical methods for analysis of fruit and vegetable products. Contribution 350, Chemistry Division, Canada Dept. of Agriculture, Summerland, B.C.
3. SANFORD, K.H. 1962. Fumigation of apples to control the apple maggot, Rhagoletis pomonella. J. Econ. Ent. 55: 724-727.
4. WRIGHT, R.C., D.H. ROSE, and T.M. WHITEMAN. 1963. The commercial storage of fruits, vegetables and florist and nursery stock. U.S. Dept. of Agric. Agric. Handb. 66: 29.

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