APPLICATION OF VAPORMATE TO IMPORTED BANANA

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MB fumigation is the most common and current treatment for imported and exported plants in Korea. It has been recognized as an ozone-depleting chemical, whose use has been restricted in accordance with international agreement, the Montreal Protocol. The MB amount used for agricultural purposes has been dwindling however the amount used for quarantine and preshipment (QPS) has been kept stationary. There is a great need to cope with international restriction on MB on a national basis.

In Korea, imported bananas infected with the quarantine pest have been fumigated in order to meet National Plant Quarantine Service (NPQS) requirement and the fumigated bananas with MB have been damaged from the chemical, there is an urgent need to develop the substitute for MB.

The study is to fumigate bananas with Vapormate as an alternative to MB. The fumigant Vapormate, developed in Australia and whose main ingredient is ethyl formate(16.7% by weight) is widely used to fumigate dried fruits and cereals. Recently, BOC and DOLE food company conducted trials in the Philippines to test the effectiveness of Vapormate controlling pests such as mites and mealybugs in bananas and pineapples.

Based on the test on mealybugs, *Planococcus citri*, on a small scale (Sung, 2007), this study was to carry out the application test using 15m^3 tarpauline PVC tent(Figure 1). The same concentration of the fumigant and treatment time (210g/ m^3 4hours, 17℃) were applied but other conditions were re-adjusted according to the circumstances.

The concentration of ethyl formate is 16.33g/ m^3 right after treatment and turned out to be 6.50g/ m^3 4 hours after treatment(Figure 2). In the atmosphere at the point where 3m and 5m distant from the tarpaulin, no ethyl formate was detected with a detection limit of 0.05ppm which is 0.05% of the TLV of 100ppm. All the live stages of citrus mealybugs, *P. citri*, proved to be controlled and the fumigated bananas did not show significant changes in discoloration(Table 1). The firmness after 9 days of fumigation was slightly higher in fumigated bananas in comparison with control bananas. This gain in firmness of fumigated bananas might be attributed to the lesser ripening(Table 2). The result of Vapormate residue analysis revealed that when treated in 420g/ m^3, only 0.320 ppm, which is less than the Australian MRL standard (1ppm), was detected, however, not detected(less than detection limit(0.05) when treated in 210g/ m^3(Table 3). This application test result could be an important data to prepare for the related fumigation system.

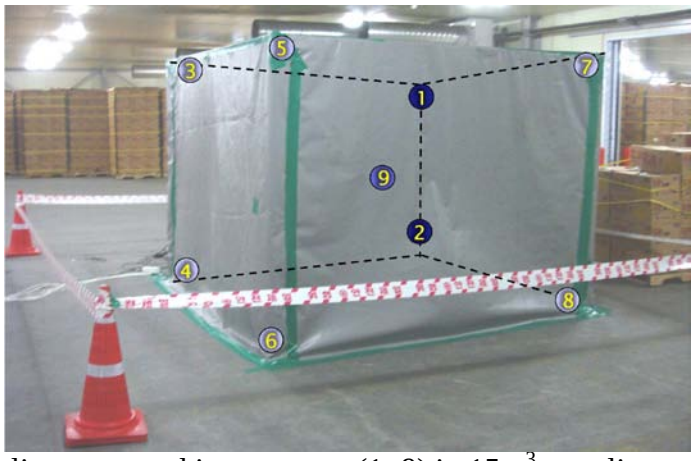

Figure 1. Gas sampling ports and insect cages (1~9) in 15m^3 tarpulin

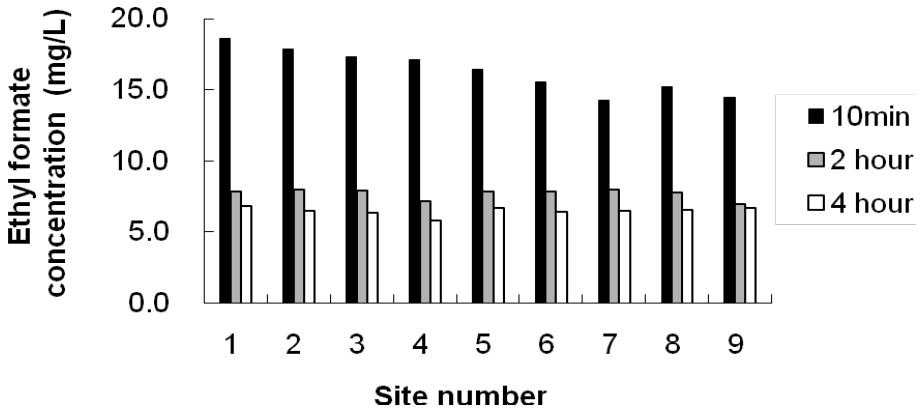

Figure 2. Ethyl formate concentration during fumigation in tarpulin

Table 1. Mortality of citrus mealy bugs

Stage	Treatment	TTL	TLI	M%	MC%
Adults	Control	73	66	7	
	Vapormate 210g/m^3	405	0	100	100
Nymphs	Control	122	106	13.1	
	Vapormate 210g/m^3	933	0	100	100

TTL: total treated insects. TLI: total no. of living insects. M%: percentage of mortality. MC%: percentage of mortality corrected by the Abbot's method.

Table 2. Firmness of control and treated bananas after 9 days of fumigation

	Treatment			
	Site 1	Site 2	Site 9	Control
Firmness(kg)	0.66 ± 0.01^{ab}	0.67 ± 0.03^{a}	0.67 ± 0.03^{a}	0.63 ± 0.02^{b}

Entries with different superscripts letters (a, b) are significantly different ($p < 0.05$).

Table 3. Analysis of ethyl formate residue in bananas

Treatment	Ventilation (hr)	Residue of ethyl formate (ppm)			
		Rep 1	Rep 2	Rep 3	Mean
Control	-	<0.05	<0.05	<0.05	<0.05
Vapormate 210g/m^3	2	<0.05	<0.05	<0.05	<0.05
	4	<0.05	<0.05	<0.05	<0.05
	6	<0.05	<0.05	<0.05	<0.05
	24	<0.05	<0.05	<0.05	<0.05
	48	<0.05	<0.05	<0.05	<0.05
Vapormate 420g/m^3	2	8.22	8.48	9.50	8.73
	4	0.34	0.30	0.31	0.32
	6	<0.05	<0.05	<0.05	<0.05
	24	<0.05	<0.05	<0.05	<0.05
	48	<0.05	<0.05	<0.05	<0.05

Reference :
Sung Bo-Kyung et al. Efficacy of ethyl formate as a quarantine fumigant for the control of pests in fruits. 2007 Annual International Research Conference on Methyl Bromide Alternatives and Emissions Reductions (130)