

Effect of washing on persistence of residues of mancozeb in cardamom (*Elettaria cardamomum* Maton) capsules

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Abstract

Experiments on degradation of the fungicide mancozeb on cardamom (*Elettaria cardamomum*) capsules by processing techniques indicated that thorough washing had a profound influence on the removal of surface residues. A waiting period of 8 to 14 days in the case of fresh capsules could be brought down to 3 to 4 days by washing.

Key words: cardamom, decontamination, *Elettaria cardamomum*, mancozeb, residues.

Mancozeb is widely used in cardamom (*Elettaria cardamomum* Maton) plantations for the management of leaf blotch disease. This may lead to residues of the fungicide and its carcinogenic metabolite, ethylene thiourea (ETU) in the capsules. Hence a field experiment was conducted at Cardamom Research Station, Pampadumpara (Idukki District, Kerala) to study the persistence and degradation of mancozeb in cardamom and to assess the effect of processing on the removal of residues.

A well maintained cardamom field planted with Malabar variety was selected for the experiment. The experiment was conducted in a RBD with three replications. Plots of 4 m x 10 m size comprising of 3 rows and 6 clumps

in each row were demarcated. Dithane M45 manufactured by M/s Indofil Chemicals (now marketed as Indofil M45) containing 75% active ingredient (a mixture of 2.5% Zinc and 20% Manganese) was sprayed three times on the plants at two doses namely, 0.2% and 0.4%, on proprietary product basis. The first spray was given in July, second spray in August and the third spray was staggered so as to harvest capsules corresponding to different intervals after treatment on the same day. A quantity of 750 g fresh capsules was collected from each plot out of which three sub samples of 200 g each were drawn. One set was subjected to rigorous washing with water before analysis and another set was subjected directly to analysis of fresh capsules.

The third set was subjected to normal curing process which consisted of washing in water, drying under hot air (45 to 60°C for 36 to 42 h) and polishing on a wire gauze to remove floral parts. For residue analysis, 50 g fresh capsule and 20 g cured capsule were drawn by quartering method. The samples were digested with boiling 10 N sulphuric acid in a decomposition absorption apparatus as per the method of Keppel (1991). Mancozeb residues were determined as equivalent to CS₂ evolved and the concentration was worked out from standard curves. The residue data were subjected to regression analysis to calculate the residual half life (RL₅₀) and waiting period (T_{tol}) based on maximum residue limit.

For the purpose of comparison between fresh and cured capsules, the residues on moisture-free basis was calculated from the values for fresh capsules. Then the corresponding percentage reduction of residues as a result of curing process was worked out considering all on dry (moisture-free) basis. This was essential since the number of capsules in a unit weight of cured sample was more than double the number in corresponding fresh sample thereby increasing the total surface area of sample and the fungicide deposit on them.

In fresh cardamom, the initial residues of 7.07 mg/kg at the lower dose and 14.76 mg/kg at the higher dose found on the first day after application dissipated to 0.27 and 0.49 mg/kg respectively, on the 28th day after application. A waiting period of 8 and 14 days could be fixed for the lower and higher doses respectively, in the fresh capsules. When fresh cardamom was washed rigorously with water, the initial deposit (2.83 mg/kg) on capsules treated at the normal

Table 1. Residues of mancozeb (mg/kg) in fresh and cured cardamom capsules

Sampling interval (days)	Mancozeb 0.2%			Mancozeb 0.4%		
	Fresh	Fresh after washing	Cured	Fresh	Fresh after washing	Cured
1	7.06	2.83	15.79	14.76	3.31	22.12
3	4.69	2.29	12.51	10.58	2.76	15.59
7	3.16	1.02	5.36	8.05	2.40	9.34
14	1.51	0.78	4.24	2.99	1.17	2.78
21	0.67	0.12	2.92	1.33	0.35	2.33
28	0.27	0.00	1.58	0.49	0.12	1.49
Reg. equation	$y=2.87-0.05t$	$y=2.68-0.085t$	$y=3.14-0.034t$	$y=3.23-0.054t$	$y=2.66-0.053t$	$y=3.29-0.044t$
RL ₅₀	5.95	3.56	8.75	5.48	5.64	6.85
T _{tol}	7.69	2.35	19.37	13.96	3.5	18.52

dose reached below maximum residue limit of 3 mg/kg (FAO/WHO 1991) on the third day while in the higher dose it took 4 days. The waiting period of 8 to 14 days worked out for fresh cardamom could be brought down to 3 to 4 days by washing alone. The percentage removal of residues by washing of fresh capsules was 60 to 100 at the lower and higher doses. This indicated that mancozeb residues are easily dislodgable by thorough washing immediately after harvest (Table 1).

The residue levels observed in cured cardamom was almost double the level observed in fresh capsules because of higher (more than double) number of capsules in unit weight of dry capsules

and corresponding increase in the treated surface area of dry sample. The extent of reduction of residues due to curing process was worked out based on the calculated residues in fresh capsules on moisture-free basis and the actual residues left in the samples after curing. The extent of residue removal by curing thus worked out ranged from 37.3 to 80.6% (Table 2).

The study indicated that curing had no significant advantage over washing in removing mancozeb residues from cardamom capsules. Even though washing of capsules before curing is recommended to remove dirt and soil particles, many planters do not adopt this step. However in the light of present

Table 2. Effect of washing and curing on reduction of mancozeb residues in cardamom capsules

Sampling interval (days)	Residues (mg/kg) on moisture- free basis		Residues (mg/kg) in cured sample	Per cent removal of residues	
	Fresh	Washed		Washing	Curing
Recommended dose (0.2%)					
1	41.35	16.55	15.84	60.0	61.7
3	27.32	13.34	12.53	51.2	54.1
7	18.43	5.95	5.52	67.7	70.0
14	8.69	4.49	4.28	48.3	50.7
21	3.94	0.71	2.47	81.9	37.3
28	1.54	0.00	0.44	100.0	71.4
Higher dose (0.4%)					
1	91.68	20.56	22.12	77.6	75.9
3	56.96	14.86	15.59	73.9	72.6
7	48.25	14.44	9.34	70.1	80.6
14	17.00	6.65	2.78	60.9	83.6
21	7.82	2.06	2.33	73.7	70.2
28	2.78	0.68	1.49	75.5	46.4

findings a rigorous and at the same time careful (without breaking the pod cover) washing of capsules may be recommended with a view to remove surface residues of contact pesticides if any.

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