

Surface and Wall Sprays of Malathion for Controlling Insect Populations in Stored Shelled Corn^{1,2}

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ABSTRACT

Corn stored in 16 circular metal bins 114.53 m³ (3250 bu) was observed for a period of 15 mo. Four of the lots of corn were sprayed with malathion on the surface, 4 were surface sprayed and a spray applied to the outside wall of the bin, and 4 sprayed only on the outside wall of the bin. The remaining 4 bins served as controls.

Samples were drawn to assess the numbers and species of live insect at monthly intervals. The surface spray application reduced the insect populations whether it was used alone or in combination with the wall spray. The wall spray alone did little to reduce populations.

Quinlan (1972) demonstrated the effectiveness of a surface spray of malathion in preventing insect infestations in shelled corn stored in metal bins; however, that corn was aerated. Since aeration could have influenced the effectiveness of the application, studies were conducted to determine whether the surface spray was effective in protecting unaerated corn. Also, the possible effectiveness of a spray applied to the outside of the bins had not been studied. Since the malathion spray is easy to apply to both the surface of the grain and to the outside bin walls, and since it is an inexpensive insecticide, the dual treatments might be worthwhile even if they resulted in only a slight reduction in insect populations within the grain mass.

MATERIALS AND METHODS.—The study was conducted at Watseka, IL, and involved sixteen 114.53-m³ (3250 bu) circular metal bins filled with shelled yellow corn. Each bin was 5.47 m (18 ft) in diam and 4.57 m (15 ft) high and contained ca. 105.72 m³ (3000 bu) of corn. After being stored on the farm as ear corn for one yr, it was shelled on the farm in Sept. and immediately trucked to the bin site where it was augered into the bins. Moisture content ranged from 12–13.5% and averaged ca. 13%. An even and low infestation was assured by immediately fumigating each lot of corn with 56.8 liters (15 gal) of liquid grain fumigant containing 4 parts CCl₄ and one part CS₂ (the “80-20” mix, Storey et al. 1970).

In Sept. and again in Oct. of the 1st yr of the test, the corn in 4 bins received a surface spray of malathion, and the outside wall of these bins received a spray; 4 bins received the surface spray only; 4 bins received the wall spray only; and 4 bins served as checks and received no insecticidal treatment. The treatments were repeated during June and July of the 2nd yr.

For the spray, 59.15 ml (2 fl oz) of premium-grade 57% malathion EC was diluted in 1.9 liters (2 qt) of water. The resulting emulsion was applied as uniformly as possible over the grain surface area with a 11.36-liter (3 gal) conventional garden-type sprayer, and the same amount of formulation and the same equipment were used to spray the outside bin walls from the ground level to 1.2 m (4 ft) up the wall:

Each month, for 15 mo, 9 samples were taken from each bin with a standard 1.5-m (5 ft) bin trier that held 500 g (1.1 lb) of corn. (The trier was equipped with extensions and handles.) One sample was taken vertically from the center of the bin, one from 1.2 m (4 ft) from the center towards the bin roof door, and one from 30.5 cm (1 ft) from the bin wall beneath the roof bin door, from the top, middle, and bottom 1.2 m (4 ft) of corn. The samples were stored in plastic bags and taken to the laboratory for examination the following day. There they were screened with a standard 0.48-cm (12/64 in) grain dockage screen, and the numbers of living insects found were recorded.

RESULTS.—Table 1 reports live insects/1,000 g (2.2 lb) shelled corn through the observation period. Corn that received the surface spray and corn that received the surface spray plus the wall spray had lower populations of insects than untreated corn or corn treated with the wall spray only. However, differences in insect populations were slight between corn that was untreated or that received the wall spray only. Thus, from Table 1, wall spraying is plainly of little value. The same judgement also was clearly demonstrated when the number of insects/1,000 g (2.2 lb) of corn was averaged over the 15-mo observation period: the surface plus wall spray averaged 0.46; the surface sprayed averaged 0.62; the wall spray alone averaged 2.76; and the untreated series averaged 3.48 insects.

Table 2 shows results of analysis of variance. Highly significant F values resulted from differences

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Table 1.—Insect populations in bins of shelled corn treated with malathion spray on the grain surface and outside wall (Means of 4 bins in each treatment).

Live insects/1,000 g (2.2 lb) shelled corn*														
1st yr ^b				2nd yr ^c										
Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
<i>Surface and walls sprayed</i>														
0	0	0.1	1.2	0.9	0.1	0.1	0	0.1	0.2	0.2	0.3	1.1	2.9	2.4
<i>Surface sprayed</i>														
0.1	0	0.7	0.4	0.4	0.2	0	0.1	0	0	0.1	0.2	1.0	1.3	2.6
<i>Walls sprayed</i>														
0	0	1.8	2.0	3.2	1.6	0.8	0.4	0.2	0.1	0.7	3.5	3.1	9.4	14.6
<i>Untreated</i>														
0	0.1	2.4	4.4	3.9	4.9	1.9	1.1	0.3	0.4	2.8	2.3	6.6	8.2	15.2

* Each value is avg of 9 samples of 500 g (1.1 lb) of shelled corn.

^b First yr, September thru December.

^c Second yr, January thru November.

due to the nature of treatments and to changes during intervals (months). Replications caused no significant differences, and none were caused by the interactions listed.

Duncan's multiple range test was applied to test mean differences for treatments and months of storage. Insect populations were least when both surface and wall sprays were applied, but the dual treatment was not significantly better than the surface spray alone; both were significantly different at a high level from the wall spray only and from the control. These latter 2 treatments also differed significantly from each other.

Table 2.—Analysis of variance of insect population in shelled corn (mean values).

Source	df	ss	ms	F
Treatments (T)	3	411.49	137.16	12.79 **
Months (M)	14	1133.45	80.96	7.54 **
Replications (R)	3	26.72	8.90	0.82 NS
Interactions:				
T × M	42	105.04	2.50	0.23 NS
T × R	9	97.36	10.81	1.071 NS
M × R	42	166.20	3.96	0.37 NS
T × M × R (error)	126	1352.08	10.73	
Total	239	3292.34		

The foreign grain beetle, *Ahasverus advena* (Waltl), comprised ca. 56% of the total insect population found; the rusty grain beetle, *Cryptolestes ferrugineus* (Stephens), comprised ca. 29%; and the rice weevil, *Sitophilus oryzae* (L.), red flour beetle, *Tribolium castaneum* (Herbst), and sawtoothed grain beetle, *Oryzaephilus surinamensis* (L.) each comprised ca. 5%.

The results confirm the value of the malathion surface spray treatment reported by Quinlan (1972) and demonstrate that it reduces insect populations in unaerated corn as well as in aerated corn. The outside wall spray reduced insect populations within the grain mass so slightly that it should not be used when corn is stored in metal bins. However, spray treatment of the inside walls of metal bins may be of value.

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