Improved Pesticide-treated Wooden Spheres for Controlling Apple Maggot Flies

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In recent years, we have been working toward development of pesticide-treated spheres as a substitute for sticky spheres in controlling apple maggot flies. In the Spring 1996 issue of *Fruit Notes*, we reported on progress made through 1995 on development of pesticide-treated wooden spheres. Here, we assessed residual effectiveness against apple maggot flies of the best-performing version of pesticide-treated wooden spheres developed through 1995 versus a new type developed in 1996. We also evaluated the performance of each of these sphere types in controlling apple maggot flies in a small commercial orchard.

Materials and Methods

The 1995-version spheres consisted of three layers of materials: first layer = 76% sugar, 4% wheat flour, and 20% Glidden gloss red paint; second layer = 1% Digon 4E (=0.5% dimethoate), and 99% Glidden gloss red paint, third layer = shellac. The layer of shellac was intended to reduce the loss of fly feeding stimulant (sucrose) from the sphere surface during rainfall. To a significant degree, this loss was prevented. However, following rainfall or a series of heavy dews, spheres coated with shellac sometimes turned whitish in color, rendering them less visually attractive to apple maggot flies than completely red spheres.

The 1996-version spheres featured a new approach to extending the residual activity of sucrose. Rather than rely on application of shellac (or several other applied substances that we evaluated prior to 1995) to extend the residual activity of sucrose, we instead drilled 14 evenly spaced holes (1/4 inch diameter x ½ inch deep) into each sphere and filled each hole with a mixture of 94% sucrose, 6% flour. This was followed by application of 2 layers of paint (same composition as first 2 layers of paint applied to 1995 - version spheres).

To assess toxicity of spheres to apple maggot flies, in early July of 1995, twelve 1995-version spheres were hung from branches of apple trees near Prokopy's small commercial orchard in Conway. Every other week thereafter until apple harvest, two spheres were brought to the laboratory for assays. In early July of 1996, the same procedure was followed for 1996-version spheres. For assays, thirty flies were allowed to stay and feed on each sphere for up to five minutes, following which, flies were placed in cages and examined for mortality 24 hours later. Rainfall was measured by a rain gauge placed near trees.

Comparison of pesticide-treated spheres with sticky spheres for providing direct control of apple maggot flies was made in the Prokopy orchard, which consisted of 50 trees (10 rows x 5 trees per row, primarily Liberty/M.26). In 1995, each tree in the five eastern rows received two 1995-version pesticide-treated spheres, whereas each tree in the five western rows received two sticky (Tangletrap-coated) spheres. In 1996, the arrangement was reversed, with each tree in the five eastern rows receiving two sticky spheres and each tree in the five western rows receiving two 1996-version pesticide-treated spheres. Spheres were deployed in July each year, were unbaited, and were positioned optimally for attracting apple maggot flies. At harvest, every tenth picked apple was

Table 1. Residual effectiveness of dimethoate-treated red spheres (before treatment) against laboratory-tested apple maggot flies.

Spheres*		Weeks of sphere exposure in orchard 2	4	6	8	10	12	Retreated with sucrose
1995 Version	Fly mortality (%)	90	80	60	40	30	--	70
	Cumulative rainfall (in.)	0.4	2.0	4.3	5.1	5.7	--	
1996 Version	Fly mortality (%)	95	90	85	80	70	55	75
	Cumulative rainfall (in.)	1.6	2.0	2.4	3.2	7.2	10.2	

*Spheres in 1995 received two coatings of paint and a third coating of shellac. Spheres in 1996 were drilled with 14 holes subsequently filled with a sucrose/flour mixture and received two coatings of paint.

examined carefully for presence of apple maggot egglaying stings.

Results

Results of laboratory assays of residual effectiveness of pesticide-treated spheres against flies (Table 1) show that after four weeks of exposure and two inches of rainfall, 80% of flies placed on 1995-version spheres died compared with 90% that died when placed on 1996-version spheres. In 1995, after ten weeks of exposure (5.7 inches of rain), 1995-version spheres killed only 30% of tested flies. In 1996, after ten weeks of exposure (7.2 inches of rain), 1996-version spheres killed 70% of tested flies. In fact, for every period when assayed, 1996-version spheres outperformed 1995-version spheres (Table 1). Retreating spheres with 16% sucrose solution (in water) after twelve weeks of exposure restored effectiveness of 1995 spheres to a level of 70% fly kill, demonstrating that loss of sucrose as feeding stimulant and not loss of dimethoate as toxicant was the principal factor responsible for decreasing performance.

Results of tests assessing the capability of pesticide-treated spheres for providing direct

Table 2. Effectiveness of dimethoate-treated red spheres versus sticky-coated red spheres in providing control of apple maggot flies in a small commercial orchard.

Year	Treatment	Number of fruit examined	Fruit with fly egglaying stings (%)
1995	Spheres - 1995 version	1263	1.0
	Sticky spheres	1294	0.9
1996	Spheres - 1996 version	896	0.6
	Sticky spheres	913	0.7

within-orchard control of flies (Table 2) show that 1995-version spheres as well as 1996-version spheres provided a level of control essentially identical to that provided by sticky spheres (1.0% fruit injury or less). In contrast, 96 and 97% of fruit on unmanaged apple trees and about 250 yards away was injured by apple maggot flies in 1995 and 1996, respectively. In 1995, pesticide-treated spheres were dipped in a 16% sucrose solution weekly after the fifth week of exposure to renew feeding stimulant. In 1996, no such dipping was performed.

Conclusions

Our findings show that 1996-version pesticide-treated spheres (each with 14 sugar-filled holes) maintained high season-long residual activity against apple maggot flies and provided excellent control of this pest under commercial orchard conditions. They have a distinct advantage over earlier versions of pesticide-treated spheres in requiring no re-treatment with sucrose solution during the growing season. Their major shortcoming is the need to drill holes in each sphere and then to fill each hole with sucrose/flour mixture annually before painting. In the coming year, we plan to determine the optimum number and size of holes needed to attain season-long sphere effectiveness and to determine if one rather than two coats of paint will suffice.

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