Pest Control and Herbs

By Raymond Cloyd
and Nina Cycholl

Herbs are used throughout the United States for culinary and medicinal purposes. Total sales of culinary herbs were $30.9 million in 1998. The annual retail sales of medicinal herbs in the United States in 1994 was $1.6 billion and nearly $4.0 billion in 1998. Popular herbs grown in greenhouses include basil (*Ocimum basilicum*), chives (*Allium schoenoprasum*), dill (*Anethum graveolens*), lavender (*Lavandula angustifolia*), mint (*Mentha sp.*), parsley (*Petroselinum crispum*), rosemary (*Rosmarinus officinalis*), sage (*Salvia officinalis*), scented geraniums (*Pelargonium sp.*) and thyme (*Thymus vulgaris*). Similar to other greenhouse-grown crops, herbs are susceptible to a diversity of insect and mite pests, including aphids, whiteflies, thrips, fungus gnats and spider mites. The number of pest control materials registered for herbs, however, is limited because of liability and the fact that herbs are considered a minor or specialty crop.

Pest control materials registered for use on herbs are generally considered "biorational" because these materials are less toxic to workers, have short residual properties and have minimal environmental contamination. These materials also have a narrow spectrum of pest activity and generally take longer to kill pests. Although some "biorational" insecticides are registered for use on herbs, these materials may not have been tested on all herb species or on plants at different maturities. Currently, only a minimal amount of information is available on the phytotoxicity of these insecticides to herbs.

Greenhouse managers need information on which insecticides are safe to apply to herbs because any phytotoxic effects may limit the use of these registered materials, thus making it difficult to manage insect and mite pests. Furthermore, these materials cannot leave unsightly residues or cause tissue discoloration, which would reduce the market value of herbs. The objective of this study was to determine if certain pest control materials are phytotoxic to a select group of commonly grown herb species at two different growth stages.

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MATERIALS AND METHODS

A greenhouse study, divided into two experiments and replicated over two growing seasons, was conducted at H. M. Buckley and Sons, Inc., Springfield, Ill. The first experiment was conducted from October 1999 through February 2000. The second experiment was conducted from March 2001 through April 2001. Within each experiment, there were two treatment groups with four treatments and an untreated check for all herb species. In experiment one, both groups were done consecutively because of space restrictions at the greenhouse facility. As a result, the first experiment was conducted over a longer time period (five months). In experiment two, both treatment groups were conducted simultaneously. Herbs used for the studies were five- and nine-week-old plants of Spanish lavender (*Lavandula stoechas*), oregano (*Origanum vulgare* 'Santa Cruz'), rosemary (*Rosmarinus offici-*

Successful herb production requires diligent scouting, as well as judicious chemical usage. (Photos courtesy of Raymond Cloyd) *nalis*), St.-John's-wort (*Hypericum perforatum* 'Topaz'), wolly thyme (*Thymus vulgaris* 'Wolly') and nutmeg thyme (*Thymus vulgaris* 'Nutmeg'). These herbs were selected for the study because they are widely grown by greenhouse operations and they are popular with customers.

For each experiment, five- and nine-week-old plants were started from cuttings taken from stock plants. After rooting, cuttings were potted into 4-inch, plastic containers. The growing medium used for the study consisted of 30 percent bark, 30 percent peat, 20 percent medium vermiculite and 20 percent perlite. Plants were fertilized using a constant liquid feed program with 20-8.3-8.8 (N:P:K) at 200 ppm. Plants were placed in a glass greenhouse (52½ x 17 feet) on four raised benches (12 x 5 feet) in a completely randomized design. There were five treatments each with five replications for each herb species and age class, for a total of 600 plants (100 plants for each species). Plants were grown under natural daylight conditions with temperatures between 68 and 82° F.

The insecticide treatments and rates for the first group were *Beauveria bassiana* Strain GHA (Botanigard) at 32 fl.oz. per 100 gal., Pyrenone at 25 oz. per 100 gal., Azatin at 16 fl.oz. per 100 gal., or insecticidal soap at 2 gal. per 100 gal. The insecticide treatments and rates for the second group were Cinnamite at 85 fl.oz. per 100 gal. or 64 fl.oz. per 100 gal., Ultrafine spray oil at 8 gal. per 100 gal., or hot pepper wax at 50 gal. per 100 gal. Both groups had an untreated check that received no treatment. The insecticides used in this study were selected because they are or were registered for herbs in greenhouse production systems. The rates used were based on manufacturer label recommendations for herbs. All insecticides were sprayed to run-off with a 9.5-L capacity hand pump sprayer.

Three applications of each treatment were made at seven-day intervals, with temperatures during the applications ranging from 64-82° F for the first experiment and 73-77° F for the second experiment. The outdoor weather conditions during insecticide applications were generally overcast. Plants were watered regularly to minimize plant stress, as environmental conditions, such as low air speed or high relative humidity, and cultural stresses may predispose plants to phytotoxicity. In addition, all spray applications were performed in the morning so that any phytotoxic effects were due directly to the insecticides. A numerical phytotoxicity rating scale from 0-3 (0 = no visible injury; 1 = light injury, 25 percent foliar injury, no influence on marketability; 2 = moderate injury, 50 percent foliar injury, reduced market quality; and 3 = complete foliar injury, more than 75 percent foliar injury, not marketable) was used to describe the extent of phytotoxicity from the insecticide treatments. This numerical rating scale is similar to the one used for evaluating phytotoxicity on chrysanthemums. Typical phytotoxic plant injury on herbs was a marginal leaf burn (necrosis). Visual evaluations were conducted seven days after the final insecticide treatment. Plants were individually evaluated for phytotoxicity.

Tables 1 and 2. Mean phytotoxicity rating for all insecticide treatments in experiment two (group one and two) with five replications per treatment per herb species (n=6) and age class (five- and nine-week-old plants). Greenhouse temperatures were between 64 and 82° F and plants were grown under natural daylight conditions.

Group One Treatment	Product Label Rate (ml per liter)	Mean Phytotoxicity Rating	Group Two Treatment	Product Label Rate (ml per liter)	Mean Phytotoxicity Rating
Pyrenone	1.94	0.22 a[z]	Cinnamite	6.61	0.67 a[z]
Insecticidal soap	19.40	0.11 b	Cinnamite	4.98	0.22 b
Botanigard	2.50	0.00 c	Hot pepper wax	62.25	0.00 c
Azatin	1.25	0.00 c	UltraFine spray oil	9.96	0.00 c
Untreated check	—	0.00 c	Untreated check	—	0.05 c

[z] *Numbers not followed by a common letter are significantly different.*

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Untreated check	—	0.00 b	Untreated check	—	0.00 b

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RESULTS AND DISCUSSION

In experiment one, Pyrenone, insecticidal soap and both rates of Cinnamite were significantly more phytotoxic than the other treatments and the untreated check (See Table 1, above). The high rate of Cinnamite (85 fl.oz. per 100 gal.) had a significantly higher phytotoxicity rating than the lower rate (64 fl.oz. per 100 gal.). Botanigard, Azatin, hot pepper wax and UltraFine spray oil were not phytotoxic to any of the herb species tested.

Sticky cards are one of the most important tools herb growers have for controlling pests.

Results from experiment two were similar to experiment one, with the same four treatments causing significantly more phytotoxicity than the other treatments and the control. Although plants treated with hot pepper wax and UltraFine spray oil exhibited minor phytotoxic symptoms, they were not significantly different from the control (See Table 2, page 23).

Despite the phytotoxic effects from some of these pest control materials, new growth that emerged following the treatments appeared to overcome the initial injury. As a result, plants at the conclusion of the study were still saleable, as determined subjectively by the herb production manager. This type of response has occurred with other pesticides such as acaricides / miticides where reductions in stomatal openings caused by the phytotoxic effects were temporary. No significant effect could be attributed to the age of the plants when they were treated.

A possible reason why the tested insecticides did not harm most of the herb types is because the plants possess a waxy or thick leaf cuticle, which may have protected them. This may be due to the physiological nature of the leaf surface. Of all the herb types, St.-John's-wort demonstrated the highest sensitivity to the insecticides, especially to both rates of Cinnamite. This may be because St.-John's-wort has a thinner leaf cuticle compared to the other herb types.

This set-up was used to determine if selected pest control materials are phytotoxic to herbs.

Initial research with Cinnamite has shown that it was phytotoxic to poinsettia, *Euphorbia pulcherrima*. However, it was noted that this might be due to a formulation problem and not a direct effect of the active ingredient. In those studies, no phytotoxicity was demonstrated on rosemary and thyme at 0.25 percent Cinnamite; however, 0.50 percent Cinnamite was phytotoxic to thyme. As a result, the rate of Cinnamite for use on herbs has been lowered.

Although oils generally have a higher probability of causing phytotoxicity, this was not the case in this study. For example, UltraFine spray oil, which was one of the treatments in this study, has demonstrated safety to flowers and fruit.

This study demonstrated that several registered insecticides were phytotoxic to certain herbs. However, the overall effects were not significant enough to reduce market quality and salability. Furthermore, most tested insecticides showed no chronic phytotoxic effects. These insecticides are useful for controlling pests on herbs because they have short residual activity, which minimizes any potential effects from spray residues. The information produced from this study will help greenhouse managers when selecting pest control materials to manage insects and mites on herbs. GPN

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