

Fumigation for Cyclamen Mite

methyl bromide fumigation can give good control of pest on strawberries when treatment is properly timed and applied

William W. Allen

Fumigation of strawberry beds with methyl bromide can give better control—99% and higher—of the cyclamen mite than any other method, however, the treatment costs approximately \$150.00 an acre. At the maximum, two applications are needed per year, and with perfected techniques a single fumigation probably will suffice. However, fumigation must be carried out carefully to obtain maximum control and must be done precisely to avoid damage to the plants because the dosage that will give good control is rather close to that which will give plant injury and the proper dosage varies with the temperature surrounding the plants. At any one dosage better control is obtained at higher temperatures, but at the same time there is an increase in the amount of injury.

Fumigation is carried out by covering the beds with a white plastic—polyethylene—tarpaulin, introducing methyl bromide gas, and letting it remain for several hours.

The white color is essential to help reduce temperatures under the tarp when the sun is shining. Tarps wide enough to cover eight rows—32'—and long

enough to extend the length of the beds—100'–200'—are most satisfactory. After the tarp is in place, it must be sealed by placing the edges in the furrows and either weighing them down with dirt or running water over them. Small holes in the tarp or improperly sealed margins will result in almost complete lack of control.

In addition to a completely sealed tarp it is essential to introduce the gas evenly to all areas which can be done by introducing the gas through plastic soil soakers or with a blower which completely re-circulates the air under the tarp.

When soakers are used, four of them should run the entire length of the tarp. One line of soakers should be placed on top of each of the two outer beds and the remaining two should be distributed down the center. As an added precaution it would be wise to introduce the gas into two of the soakers at one end of the tarp and two at the other end. To help disperse the gas as it passes out of the soakers, the methyl bromide must be heated as it is released. Heating can be done easily by passing the methyl bromide through a 25' coil of one-half inch

Fumigation Dosages and Temperatures for Control of Cyclamen Mite on Strawberries

Winter—When Plants are Dormant		
Temperature* °F	Lbs./1,000 cu. ft.	Hours
80–85	2	2
70–80	2½	2
60–70	2½	2½
50–60	2½	3
Summer—Between Crops		
Temperature* °F	Lbs./1,000 cu. ft.	Hours
75	1½	2
70	2	2
60	2½	2
55	3	2

* Air temperature under tarp covering strawberry beds.

copper tubing immersed in hot water. Although methyl bromide becomes a gas at 40°F, the hot water should be held above 120°F because of the large cooling effect methyl bromide has as it changes from a liquid to a gas.

When a re-circulating blower is used, the discharge and intake hoses should be arranged so that the air is blown in at one end of the tarp and removed at the other. The blower should have sufficient capacity to completely re-circulate all of the air under the tarp in a short period of time.

The tolerance of strawberry plants to fumigation varies from summer to winter; thus a considerably higher dosage can be used when the plants are dormant. Also, weak or damaged plants can not withstand fumigation as well as healthy plants. Caution must be used when varieties other than Shastas and Larsens are fumigated, because strawberry varieties vary greatly in their ability to withstand methyl bromide fumigation.

Winter dosages should only be used when the plants are fully dormant. Summer dosages should be increased one half pound per 1,000 square feet when the plants are more than 12" tall because of the increased volume under the tarp. Fumigation during the summer can be carried out at undertarp temperatures between 80°F–90°F without killing the plants, but considerable leaf injury will result even when the dosage is cut to one and one half pounds for one and one half hours. During the summer it is usually necessary to fumigate during the

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Portion of a strawberry field covered with a plastic tarpaulin and the edge being sealed, prior to fumigation with methyl bromide.



chemically treated plots where weed control was good and the flower stand was not reduced excessively.

The soil fumigants—methyl bromide and Vapam—increased growth and seed yields beyond that attributed to lack of competition from weeds. Apparently these materials control other pests—such as insects and fungi—and prevent those pests from feeding on the flower plants and reducing plant vigor.

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SUGAR PINE

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after seven days. When the seed coats were removed germination was the same as if the seeds had been stratified.

After two-year storage at 36°F germination of the intact unstratified seeds began later and fewer germinated than when the seeds were fresh. However, after stratification seeds germinated as if they were fresh. When the seed coats were removed, germination was improved but not to the same extent as with fresh seeds. Thus, unlike fresh seeds, the germination of stored seeds was differentially affected by stratification and removal of the seed coats.

The effect of the storage temperature on germination was not apparent when the seeds were stratified, but was apparent when the seeds were unstratified, and the seed coats removed. Germination of fresh seeds—with seed coats removed—was complete in seven days, with 96% germinated; stored at 0°F germination was 91% and complete in 18 days; stored at 36°F germination was complete in 20 days, with 85% germinated; and stored at 77°F germination was complete in 20 days, with 55% germinated.

Two-year storage at 36°F had a pronounced effect upon root elongation, following germination. Of the embryos from the fresh seed that germinated, 98% developed roots 3" or longer in 30 days while only 38% of the embryos from stored seeds did so. Furthermore, unlike germination, root elongation was unaffected by stratification.

Storage temperatures had a pronounced effect upon subsequent root elongation, which was not altered by stratification. Roots 3" or longer were developed in 13 days by 98% of the

fresh seeds while 82% of the seeds stored at 0°F, 38% of the seeds stored at 36°F, and 25% of the seeds stored at 77°F developed roots of 3" or more in 30 days.

Thus the number of seeds that germinated was unaffected by two years of dry storage—provided the seeds had been stratified—but the number of seeds capable of subsequent root elongation was drastically reduced.

To measure potential field survival, fresh seeds and seeds that had been stored at 36°F for two years were planted—after stratification—in soil-filled flats in the greenhouse. Ten rows of 20 fresh seeds and 10 rows of 20 stored seeds were planted 1/2" deep in each of six flats. The flats were watered until the entire soil mass was saturated. Three of the flats were not watered again but the soil in the other three was brought to field capacity, three times each week, by watering with a sprinkling can.

After two months, approximately 90% of the seedlings from fresh seeds were alive in both the watered and nonwatered flats.

In sharp contrast, survival of seedlings from stored seeds in the flats watered three times each week was approximately 70% after two months and approximately 20% in the flats watered only once.

It is apparent—from these studies—that seed storage conditions can affect seedling survival subsequent to germination.

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The above progress report is based on Research Project No. 1577.

FUMIGATION

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evening or early in the morning in order to avoid temperatures that are injuriously high.

At night or on cloudy days the undertarp temperatures approximate the outside air temperatures, but on sunny days they are considerably higher. With clear tarps this increase is so pronounced that they are too dangerous to use for fumigation. Fortunately, temperatures under white opaque tarps are much lower, even though they are still somewhat higher than outside air temperatures.

Temperatures under the tarp are so important it is essential that they be known. Electrical equipment such as thermocouples could be used but the initial expense and care in handling make them undesirable. Temperatures inside a small airtight box—about 8" square—covered with a piece of the tarp plastic, approach temperatures under the tarp.

A thermometer inserted through a hole in the side of the box makes it possible to determine undertarp temperatures rather closely. Temperatures in a box will drop a little more rapidly in the evening than those under the tarp because of the heat given off by the ground.

Overdosage or overexposure to methyl bromide will cause plant injury, as will high temperatures.

Mild damage merely burns the mature leaves, and the plants soon recover, but in more serious cases the young leaves and fruit buds are burned, and in severe cases the plants are completely killed.

If unexpected high temperatures are encountered during fumigation the tarp should be removed before serious injury can be done. When not being used to actually fumigate, the tarp should be removed or extensive damage to the plants will result.

Methyl bromide—like ethylene dibromide—generally stimulates the growth of strawberry plants even when the cyclamen mite has not been present. This stimulation is, at times, attributed to the control of microorganisms in the soil, but it seems more likely that it is caused by a direct effect on the plants themselves. The stimulating effect—coupled with mite control—usually brings about a striking plant response soon after fields are fumigated. However, fumigation should not be undertaken when the cyclamen mite is not a problem, because stimulation—at certain times—may merely result in small leaves, flowers and fruit. This is least likely to happen when fumigation is done between crops.

Early spring—about January and February—seems to be the most suitable time for fumigation and should give cyclamen mite control well into the summer if not for the entire season. Early spring fumigation should also control the two-spotted mite and strawberry aphid for a reasonable length of time. As the plants are dormant and the weather cool at that time, it is generally possible to fumigate throughout the day. The exact time of fumigation will be determined by the distribution of the spring rains, because it is impractical to fumigate in the rain. The tarp soon fills with water and becomes unmanageable, and—probably—fumigation is less effective when the plants are thoroughly soaked, because water forms an impenetrable barrier against methyl bromide.

When fumigation is necessary during the growing season, an attempt should be made to fumigate between crops; however, if severe damage is encountered control should not be delayed.

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The above progress report is based on Research Project No. 1119.