Fumigation of Walnuts

southern California packing house tests show control of navel orangeworm and Mediterranean flour moth larvae

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Methyl bromide fumigation applied to walnuts under packing-house conditions killed navel orangeworm and Mediterranean flour moth larvae without leaving harmful residues in the fumigated walnut meat.

The navel orangeworm, *Myelois venipars* Dyar, and the Mediterranean flour moth, *Ephestia kuhniella* Zeller, are serious pests of walnuts in southern California.

The navel orangeworm infests the nuts in the field and is brought into the packing house at harvest time, but it has not been shown that this insect will continue to reproduce and maintain itself in the packing house.

The Mediterranean flour moth is chiefly a pest of the stored nuts in the packing house.

Navel Orangeworm Tests

Since fumigation for navel orangeworm larvae in walnut packing houses are conducted under atmospheric pressure in practically all instances, experiments were made under similar conditions in the laboratory at Riverside.

Larvae in the fourth and fifth instar were placed in cylindrical wire screen cages.

In one series of tests, two pounds of whole walnuts were placed in loosely woven cloth sacks, with caged larvae in the center of each sack.

The sacks were exposed to various dosages of methyl bromide fumigation for two, four, six, and eight hours.

A 100% mortality was obtained at all dosages and exposures, so the lowest will suffice for control—a two-hour exposure to two pounds of fumigant per 1,000 cubic feet.

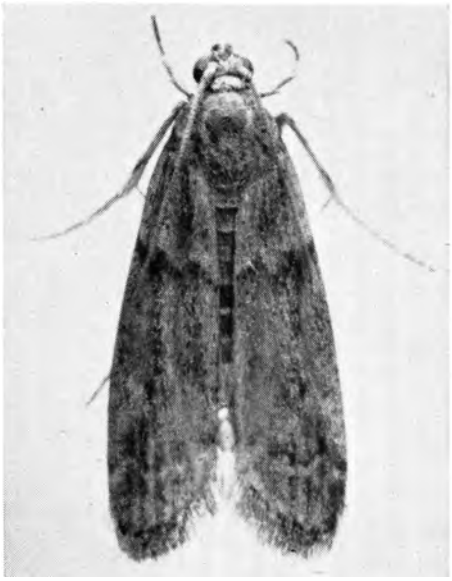
Because there was the possibility that nuts might require fumigation in cellophane bags, tests were made to determine whether the larvae could be killed in such bags.

Whole walnuts were sealed into double-walled cellophane bags, each containing one pound of nuts and caged navel orangeworm larvae. The bags were exposed for two to eight hours to fumigation dosages of two, three, and four pounds per 1,000 cubic feet.

A 100% mortality was not obtained at any dosage or any exposure period. A dosage of two pounds of methyl bromide per 1,000 cubic feet in general gave poor kill regardless of the length of the exposure period. Dosages of three and four pounds of methyl bromide per 1,000 cubic feet gave a very inadequate mortality. This indicates that at atmospheric pressure and exposures of two to six hours, insufficient quantities of fumigants penetrated the cellophane bags to give satisfactory control. An exposure of more than eight hours might give satisfactory control.

Adult navel orangeworm. Photo greatly enlarged.

Adult Mediterranean flour moth. Photo greatly enlarged.



Mediterranean Flour Moth

For laboratory fumigation tests with the Mediterranean flour moth, larvae were caged and placed in sealed, double-walled cellophane bags containing one pound of whole walnuts.

Exposed to methyl bromide fumigation under atmospheric pressure, results were so poor that this method would not be acceptable to the industry.

Two types of vacuum fumigation were tested. In the first, a vacuum of 25″ was produced, the methyl bromide introduced, then the vacuum released slowly over a period of five minutes.

In the second type of vacuum fumigation, a vacuum of 25″ was produced, the fumigant introduced, and a slightly decreased vacuum maintained for the remainder of the fumigation period—one to three hours.

No larvae survived with either type of vacuum when exposed for one hour to two pounds of methyl bromide per 1,000 cubic feet.

Other vacuum fumigation tests were conducted in a Los Angeles packing house. A cage with Mediterranean flour moth larvae was placed in one-pound cellophane bags of walnuts. The bags were sealed by the standard packaging machinery. Three bags were held as controls.

The bags under test were fumigated according to commercial procedure of the plant, at a dosage of 2.86 pounds of methyl bromide per 1,000 cubic feet for 90 minutes under vacuum.

Under this procedure, a vacuum of 15″ is first produced in the chamber, held for 10 minutes, then increased to 28″. The fumigant is introduced, the slightly reduced vacuum is maintained for 90 minutes, and then released slowly over a period of 10 minutes.

Continued on page 14

RANGE

Continued from page 12

Burnet is a perennial herb, as palatable and nutritious as filaree. It can withstand heavy grazing and is a strong competitor against weedy annuals.

Certain perennials are less desirable because of low production or unpalatability. Among those are saltgrass, beardless wild-rye, squirreltail, velvetgrass, foxtail barley, spreading three-awn, and sweet vernalgrass.

Steps to Improve Range

Annuals and perennials have their advantages and disadvantages, and a good range will have a mixture of both.

The chief advantage of the annuals is the flush of feed they supply in the rainy season. The chief advantage of the perennials is the stability they give to the forage supply. Under proper seasonal use they will last longer than many of the annuals, including ryegrass.

Improvement of the range should be based on the types present. Winter annual legumes should be encouraged by proper season of use, by fertilizers or soil amendments, and by seeding. If desirable grasses are present, they will gradually increase in density. After the population of weedy annuals is decreased and soil fertility is improved, the better type grasses may be seeded.

The control of the grazing season or management is the most important single factor in range improvement.

Time of use has a large influence upon the composition of a range in relation to weedy annuals, desirable annuals, and perennials. Early heavy grazing while the weedy species are palatable, reduces their capacity to produce seed. If the animals are removed from the area early and before the soil moisture is depleted, the desirable annuals, short-lived perennials, and perennials will recover and produce a considerable amount of seed. After the seed has shattered the animals can be brought back to the area to utilize this feed and trample the seed into the ground. This type of management results in suppressing the weedy types and encourages the better forage species on the range.

This type of management can also be used in seasonal rotation. The land is divided into three fields, and livestock is allowed to graze heavily in the spring in field one. If removed before all soil moisture is exhausted the undesirable annuals will not recover as well as the desirable annuals and perennials, and their seed supplies are reduced. Field two is treated in this manner the second, field three the third year.

This rotation of seasonal use will gradually increase the desirable annuals and perennials—if present—and decrease the undesirable annuals.

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WALNUTS

Continued from page 5

A 100% mortality was obtained in all instances, regardless of the location of the larvae in the chamber during the fumigation.

Natural mortality in the three controls ranged 12.5% to 32%, and averaged 21.8%.

Bromine Residue

Walnut meats contain considerable amounts of oil, and methyl bromide is readily absorbed by fats and oils. Analyses were run to determine the amount of bromine absorbed by the nuts.

Whole walnuts in sealed double-walled cellophane bags were vaccum-fumigated with two pounds methyl bromide per 1,000 cubic feet. They were exposed to fumigation for 30 minutes.

One hour after fumigation the nut meats had taken up an average of 0.41 milligram—mg—of bromine per 100 grams fresh weight. After 21 days in the cellophane bag the nuts had taken up, on the average, as much as 4.84 mg of bromine per 100 grams fresh weight. This indicates that walnuts sealed in cellophane bags and subjected to fumigation with methyl bromide continue to absorb bromine for at least three weeks after fumigation.

Shelled walnuts of different sizes were packed in five-pound cardboard cartons sealed only by staples. They were subjected to vacuum fumigation with 2.86 pounds of methyl bromide per 1,000 cubic feet.

Residue was high at first but became almost constant after the first 24 hours of fumigation. This was true regardless of the size of the shelled walnut meat, for halves as well as for pieces—quarters and broken halves—and pills—eighths or smaller.

Analyses carried out as much as nine weeks after fumigation found the bromine residue at about the same level.

The residue experiments showed that whole or shelled walnuts which are subjected to vacuum fumigation with methyl bromide may be expected to show bromine residues.

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Navel orangeworm larvae, showing webbing and frass caused by larvae feeding. Photo greatly enlarged.