concentrations of FeEDDHA, 10^{-9} to 10^{-4} M, delayed the plants from death for several days, after which the protective effect was lost. At 10^{-3} and 10^{-2} M, FeEDDHA completely protected the plants from death. Low concentrations may be effective only for several days due possibly to metabolism or breakdown of the FeEDDHA due to light. The breakdown products may not be effective as protectants against 2,4-D injury. A like effect has been reported with versenol. An injection of versenol prevented epinasty (leaf curl) due to 2,4-D in tomato plants for only a few hours, after which epinasty occurred.

Mechanism

The mechanism involved in the ability of an Fe additive to either protect from, or add to, the lethality of 2,4-D is probably quite complicated. Earlier work had shown that an Fe additive can behave as a protective agent whether applied 24 hours before, simultaneously with, or 24 hours after the 2,4-D. This strongly indicated that the Fe additive primarily influenced the action of 2,4-D within the plant rather than affecting the absorption of 2,4-D through the leaf surface. FeEDDHA did not seem to cause any breakdown of 2,4-D since the 2,4-D was active again after the protective effects of low concentrations of FeEDDHA disappeared.

Applications of 2,4-D to barley and wheat have resulted in increased yields of grain. Data from these tests showed that wheat and barley can withstand higher concentrations of 2,4-D when an Fe additive is included in the spray solution. Since barley and wheat are much less sensitive to 2,4-D than broad-leaved weeds, it is possible that the presence of an Fe chelate can increase the stimulatory range of 2,4-D concentrations for barley and wheat and bring about increased efficiency of broad-leaved weed control.

Application of modifying agents in the chelated form could become important in future field applications of growth regulators since formation of copious precipitates is prevented when commercial water, usually high in salt content, must be used for sprays.

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HEAT CONTROLS NEMATODES IN SWEET POTATO ROOTS

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Studies in San Bernardino County showed that 95 to 100% of slips grown from sweet potato roots that were heavily infested with root-knot nematodes also became contaminated. A simple, effective treatment consisting of dry heat—first, at 60° to 100°F for six to eight hours, then at 108° to 110°F for 24 hours—successfully killed nematodes and nematode eggs inside infested roots.

SWEET POTATO GROWERS have periodically experienced what they call "fumigation failures," even though the soil was fumigated under ideal moisture and temperature conditions with recommended rates of nematocides. Studies in San Bernardino County proved that, instead, these "failures" were caused by contaminated slips brought into the field.

Contamination was coming from two sources; the first being sand—brought in from dry washes and used in the sweet potato slip-producing beds—which growers had formerly thought to be free of nematodes. However, fall rains encouraged the growth of susceptible weeds in this sand, which carried populations of root-knot nematode. This problem was easily overcome by treating the sand with DD or Telone.

The second and major source of contamination was from nematode-infested roots used for slip production. Sweet potato propagation depends on vegetative shoots from the mother roots, which offer an ideal route for the transfer of diseases and nematodes to the succeeding crop. Once seed lots of potatoes become infested, the only known way to overcome this problem is by vine cuttings. Vine cuttings, however, require more labor, considerable land preparation, and extra irrigations. The cuttings are also difficult to establish and usually yield poorly, because they are started late in the season.

Sweet potatoes known to be infested with root-knot nematode were embedded in sand and held at a temperature of 85°F in a greenhouse. Slips from each of three successive pullings were examined for nematode infestations. Some were planted in steamed soil and grown for six weeks—then examined for galls. Only 7% of the 171 slips first pulled were infested. The second pulling of 312 slips showed 90% infestation, and the third pulling of 75 slips, five weeks after the test was started, was 98% infested.

Dry heat treatment

Three experiments were conducted over several seasons to determine if dry heat could be used as a rapid and safe method for eliminating certain fungi and nematodes. All sweet potato roots used were dug from the field before they became chilled, and then were properly cured and stored. Half of the roots infested with root-knot nematode were placed in boxes in a small, well-insulated heating room, and half were unheated and served as checks.

The temperature was slowly brought up to 110°F for an eight-hour period and held for 24 hours. Thermal probes placed inside some of the sweet potato roots indicated that about 1¼ hours were required to bring the inside temperature of the roots up to the outside room temperature of 110°F. Thermographs were used in the heating room to keep a continuous record of external temperatures during the heat-treating period.

Tomato roots infested

The infested, heat-treated roots and checks were then sliced, and egg masses were removed. These egg masses were used to inoculate soil in which tomato seedlings were transplanted. Tomatoes were grown for approximately six weeks; roots were then examined for galls. Heat treatment killed all the nematodes, and eggs taken from the untreated roots produced galls on all tomato roots.

The experiment was repeated, except that the temperature was held between 107°F and 110°F, which was one degree lower than in the previous experiment. After the roots were treated, they were sliced into sections and the egg masses were removed. Egg masses within 1/4 inch of the surface (shallow) were kept separate from those found at greater depths in the root tissue (deep), as shown in the table. Egg masses from both heat-treated and untreated roots were again mixed with soil in which tomato seedlings were planted. Six weeks later, the tomato roots were examined for root-knot galls. Results from this experiment are presented in the table:

OCCURRENCE OF GALLS IN HEATED AND UNHEATED TOMATO ROOTS

Root number	Unheated		Heated	
	Shallow	Deep	Shallow	Deep
1	+++	+++	0	0
2	++	++	+	0
3	+++	+	0	0
4	+++	+++	0	0
5	+++	+++	0	0
6	+++	+++	0	0
7	++	+++	0	0
8	+	+++	+	+
9	++	++	0	0

0 = no galls
+ = few galls (1 to 10)
++ = moderate number of galls (10 to 50)
+++ = numerous galls (50 to 500)

Data presented in the table again confirmed the results obtained by heat treatment. In an earlier heating experiment conducted in cooperation with this grower, all nematodes were killed. In tests reported here, temperatures between 108°F and 110°F killed eggs and larvae within the sweet potato roots. Temperatures above 112°F resulted in a high percentage of rotted roots before slips were produced. In one experiment where a 114°F-temperature was maintained for 26 hours, 60% of the roots rotted.

Summary

Dry heat treatment is a simple, effective, and reasonably safe procedure, provided that the prescribed temperature for treatment is held above 108°F and below 111°F. These experiments demonstrate that the heat treatment will control nematodes inside sweet potato roots, and furnish the grower with a convenient tool to help prevent reinfestation of fumigated soil. In addition, these heat-treating experiments helped to increase the slip production in both the whole and cut roots.

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California CANNED FRUITS IN INTERNATIONAL

BEATRICE M. BAIN • SIDNEY HOOS

THE UNITED STATES is world leader in both production and consumption of canned fruits, in total and per capita. U.S. exports of canned fruit have increased sharply both in quantity and dollar value during the past decade. More than 12% of total U.S. canned deciduous fruit sales now occur in the export markets (table 1). Furthermore, U.S. exports of canned fruit are "dollar sales"—moving without direct government price support or subsidy.

California, the leading producer and exporter of canned deciduous fruits in the nation, also accounts for most exports from the country. Of the 200 farm crops and products produced commercially in California, over 100 have export markets. Canned fruits as a group rank third in the State's total value of farm exports. Canned peaches, the top canned fruit in international trade, is one of the largest-value individual farm products exported from California. In the marketing year just closed, almost 5 million cases of California cling peaches alone were exported (table 2).

Canned peaches have constituted 40% of the export of all U.S. canned deciduous fruits for the last five years. During this time, West Germany has replaced the United Kingdom as the leading single export market for U.S. canned peaches. The annual increases in shipments going to the European Economic Community (EEC) were spectacular in volume, and nearly 80% of the EEC imports of canned peaches from the U.S. went to West Germany (table 3).

Leading export markets

The United Kingdom had been traditionally the most important single export market for canned fruits, with U.S. products taking a large share of that market after the lowering of import restrictions in the mid-1950's. Since 1958, 23% of all U.S. canned peaches and nearly 23% of all fruit cocktail exported have been shipped to the U. K. (table 4).

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