REGISTRATION STANDARDS PHASE I

QUALITATIVE USE ASSESSMENT

FOR

# FONOFOS

**(041701)**

**Prepared by**

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**U.S. ENVIRONMENTAL PROTECTION AGENCY**

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FONOFOS*



*O-ethyl S-phenyl ethylphosphonodithioate

I. MANUFACTURING USE PRODUCTS

None listed in PRD-1 printout.

II. MULTIPLE ACTIVE INGREDIENT FORMULATIONS

Section 3.

**Fonofos products are marketed which also contain:**

**Tillam (S-Propyl butylethhthiocarbamate)**

Intrastate

**None**

**24(c)'s**

Fonofos products are marketed which also contain:

Thiram (Tetramethylthiuram disulfide) - MI, NY.

III. END USE PRODUCTS

| | Sole AI | Multi AI |
|---|---|---|
| Sec. 3 | 9 | 1 |
| Intrastate | 11 | 0 |
| 24(c) | 19 | 2 (MI, NY) |

**Formulation types:**

**Sec. 3 - Granulars (2, 5, 10, 15 and 20% AI).**
**- Emulsifiable concentrate (4 lb/gal AI)**
**Also mixture of 1 lb-fonofos with 4 lb Tillam/gal.**

**Intrastate - Granulars (5 and 10% AI)**
**- Emulsifiable concentrate (4 lb/gal AI)**
**Also custom mixed fonofos/fertilizer mixtures**
**(0.165 to 2% AI fonofos)**

**24(c)'s - Granular (10% AI)**
**Also mixture of 5% fonofos + 10% Thiram**
**- Emulsifiable concentrate (4 lb/gal AI)**

**NOTE: Emulsifiable concentrates of > 44% fonofos (4 lb/gal) are restricted use pesticides.**

## IV. QUALITATIVE USE ASSESSMENT

Common name: Fonofos Tradename: Dyfonate®

SITE CATEGORY: AGRICULTURAL CROPS

SITE: Corn (field, pop and sweet)

PESTS: Northern corn rootworm, southern corn rootworm, western corn rootworm, lesser cornstalk borer, seedcorn maggot, seedcorn beetle, European corn borer, southwestern corn borer, garden symphylan, wireworms, black cutworm, maize billbugs.

LABEL SUMMARY: See EPA Index to Pesticide Chemicals for Insecticides (attached). Of the pests listed on fonofos labeling corn rootworms, wireworms and European corn borer are considered the most important pest of corn and it is for the control of these pests that most of the dyfonate applied to corn is utilized. In the corn belt the application of fonofos for rootworm control also control seedcorn beetle and seedcorn maggot if present at time of planting.

CHEMICAL APPLICATION:

Method of Application: Ground application and aerial (European corn borer only).

Type of Application: Predominately soil application but for treatment for control of European corn borer is over the row foliar application.

Equipment: Granular soil application - Corn planters are available in 2-, 4-, 6- and eight row units and where conditions permit larger multiple row, flexible units are popular. Granular pesticide applicators are attached to these planters which allow for either band or in-furrow applications at the time of planting. The granules are lightly incorporated into the soil to a maximum depth of 2-inches using press wheels, covering disks, trailing chains or granular pesticide incorporators.

Post emergence soil applications are made by attaching granular applicators to cultivators and applying the fonofos granules on each side of the row or

apply as a 6-8" band over the corn rows. The granules are placed just ahead of the cultivator shovels so that the granules are covered lightly with soil.

Liquid soil application - Applied alone or with liquid fertilizer. May be broadcast or band applied, though in northcentral and midwest corn growing areas a split boot application may be used. Low pressure tractor mounted sprayers are used for applying the liquid insecticide. The insecticide is incorporated into the soil as outlined for granulars.

Granular foliar application - Nearly all of the fonofos applied for European corn borers is applied by fixed winged aircraft.

Applicator Category: EC products of > 44% (4 lb/gal) are restricted use products. Granular products 5-20% fonofos are for Agricultural or Commercial Use and not for House Garden Use.

Timing: Wireworms - At planting in spring.

Corn rootworms - At planting in spring/or a post emergence application in late spring or early summer.

European corn borer - Applied at pre tassel stage when 50 percent of plants show first generation feeding. For second generation, apply when counts show 100 egg masses per 100 plants.

Planting Dates: The early planting dates for the entire U.S. are given in Fig. 1.

Number of Applications: One to two applications are applied to corn fields that have been planted to corn for more than one season.

PEST INFORMATION:

Corn rootworms - Three species of the corn rootworm attack field corn, sweet corn and popcorn in the United States. The species are (1) the northern corn rootworm (Diabrotica longicornis); (2) the western corn rootworm (D. vergifera); and (3) the southern corn rootworm (D. undecimpunctata).

The northern and western corn rootworms are very similar in their seasonal life cycles. Both species have a single generation per year and overwinter as eggs in the soil. Eggs hatch in late spring and the larvae feed on the roots of the developing corn plant. They will also tunnel along and within larger roots. The larvae become full grown in late June and July when they leave the roots and pupate in cells in the soil. The duration of the larval plus pupal stage is approximately one month. Adults emerge in July/August and oviposition occurs during August and September. The northern corn rootworm is more widely distributed than the western corn rootworm (see attached distribution maps, Figures 2 and 3). Where the two species overlap there is a tendency for the western corn rootworm to dominate and the distribution of this species is gradually spreading eastwards.

The southern corn rootworm also known as the spotted cucumber beetle is distributed throughout the United States and has several generations. Unlike the northern and western corn rootworms, this species has a wide host range and rarely causes damage to corn.

Moisture and heat stress during the time of peak root feeding may prevent root regeneration and establishment of brace roots. Winds occurring during this period may cause infested plants to lodge. Lodge plants are those plants that breakover or lean > 30 degrees from the vertical.

European corn borer (Ostrinia nubilalis) - This insect overwinters as a fully grown larva (borer) in the stems of corn and other plants on which it has been feeding. Late in spring or early in summer the larvae pupate and moths begin emerging in approximately two weeks. Egg masses are laid on the underside of leaves. These eggs hatch in from 4 to 9 days, the larvae immediately crawl to protected areas, commence feeding on leaves, immature tassels and finally they bore into the stalks and ears. There are one or more generations

a year, depending on the length of the growing season in the different growing areas. A distribution map is attached (Figure 4).

Wireworms - Are the larvae of click beetles which overwinter in the larval and adult stages in the soil. Several species attack corn. The larval stages last from two to six years. Wireworms may attack the seed or drill into the base of the stem below ground level, damaging or killing the growing point. Later in the season the wireworms feed upon the roots of the corn, grasses and any other plant in the field. Attempts to control wireworms with insecticides once damage has been observed are usually not very successful. Wireworms move only short distances during their long larval development, pupae transform into adult beetles in summer, but the beetles do not emerge until the next spring. The beetles often remain near where they developed so that the level of infestation often varies considerably in fields within a given area. Wireworms are usually more prevalent in bottom lands or in poorly drained areas on upland soils.

CULTURAL PRACTICES:

Planting - Corn is usually planted to a depth of 2-3 inches. For very early plantings this depth may be reduced to between 1 and 1½ inches or increased to between 3 and 4 inches when dry surface soil conditions prevail. Rows are spaced from 12 to 48 inches apart with the individual state average varying from 35 to 39 inches.

Planting Date - In southern Texas corn planting begins around the 1st of February and the planting date is progressively later in more northern latitudes. Planting in the corn belt is at its peak around the middle of May (see Figure 1).

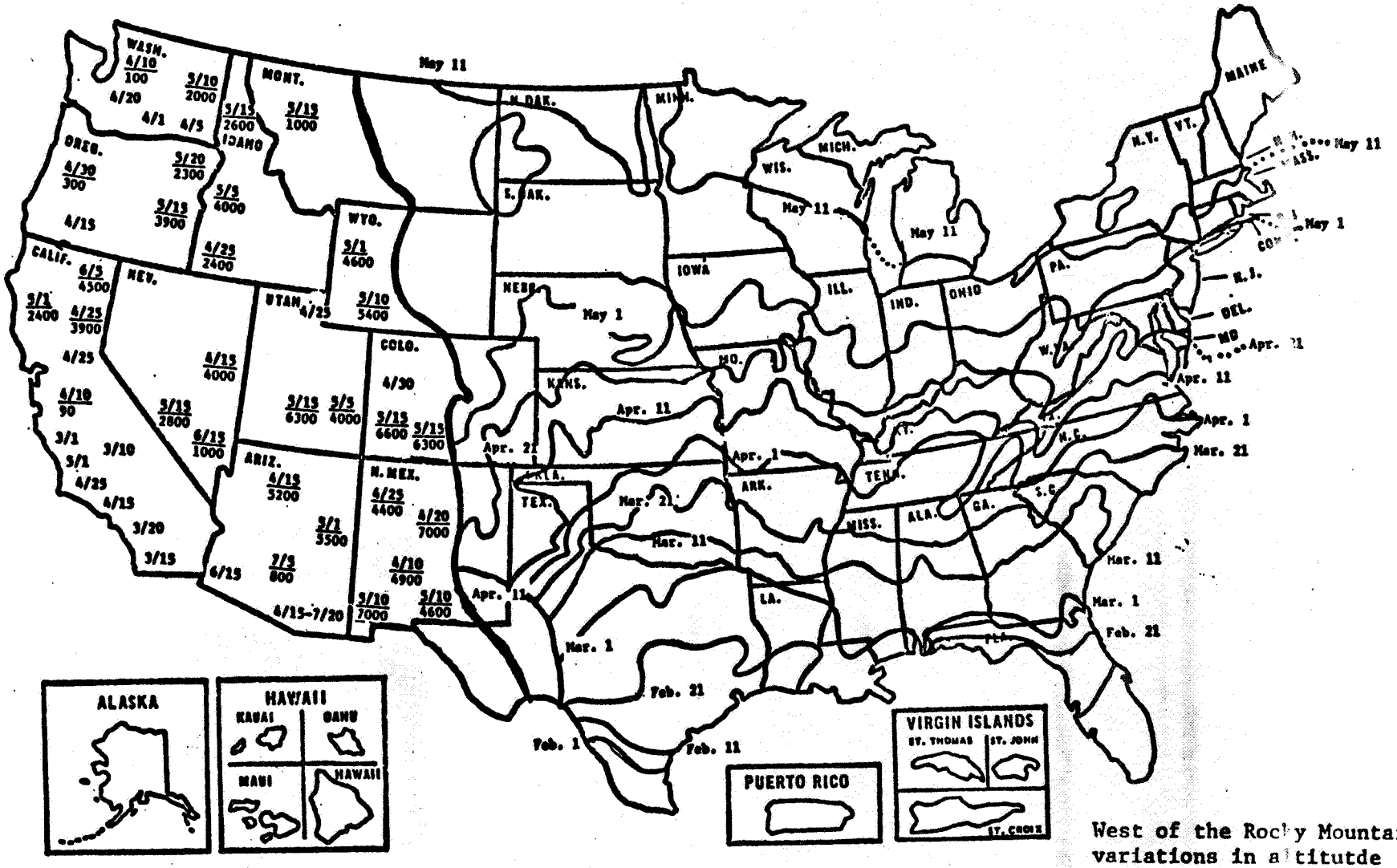
Planting Rate - Plants per acre range from 3,000 to 4,000 on poor soils or under extremely avid conditions to about 24,000 or more under optimum

conditions. The overall average planting rate in 1980 for all corn growing areas in the U.S. was 13.2 lbs per acre (1650 seeds/lbs).

Crop Rotations - Corn Belt - 2 yr., corn and small grains; 3 yr., corn, small grain and clover; 4 yr., corn, oats, wheat and clover or sweet clover or alfalfa or legume grass mixture alternatively corn, corn, small grain and clover or sweet clover or alfalfa or legume grass mixture (soybean often replaces corn or one of the small grains in the rotation). Irrigated western states - corn, sugarbeets or potatoes, alfalfa and small grain. Dryland western states - corn and wheat; corn and barley or oats. South - winter legumes are often grown in a cotton - corn rotation and turned in for green manure.

CORN

DATE WHEN CORN PLANTING BEGINS




West of the Rocky Mountains variations in altitutde prohibit drawing of isochronal lines

Adapted from Principles of Field Crop Production by Martin et al. 1976

Figure 1.

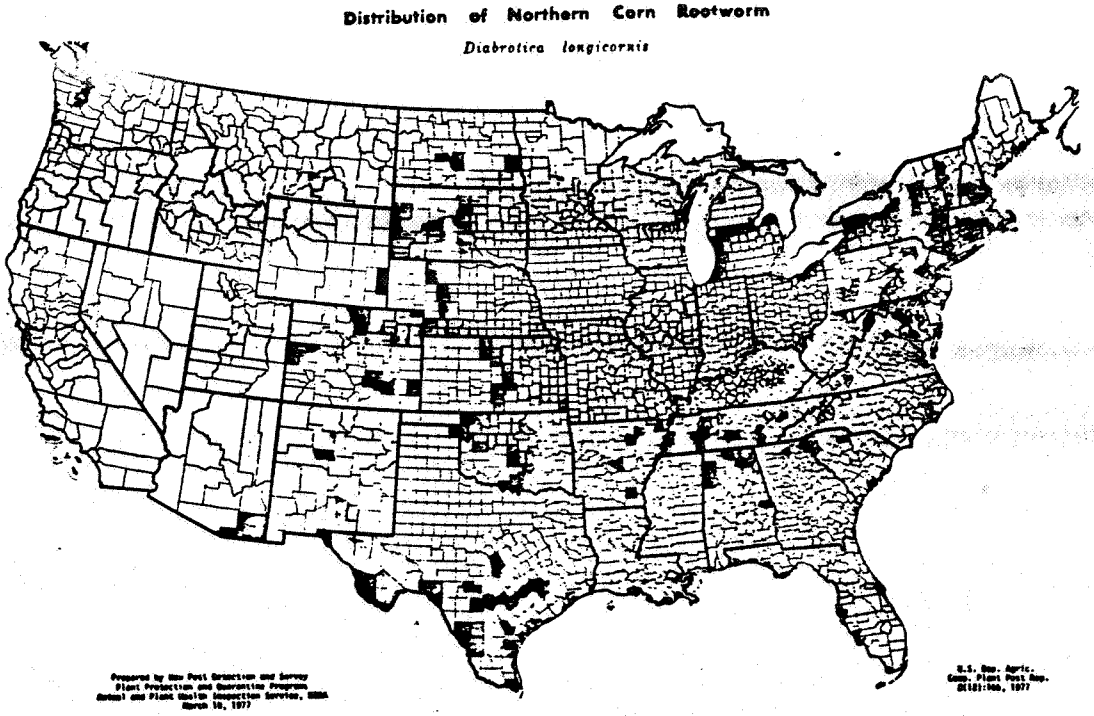



Figure 2.

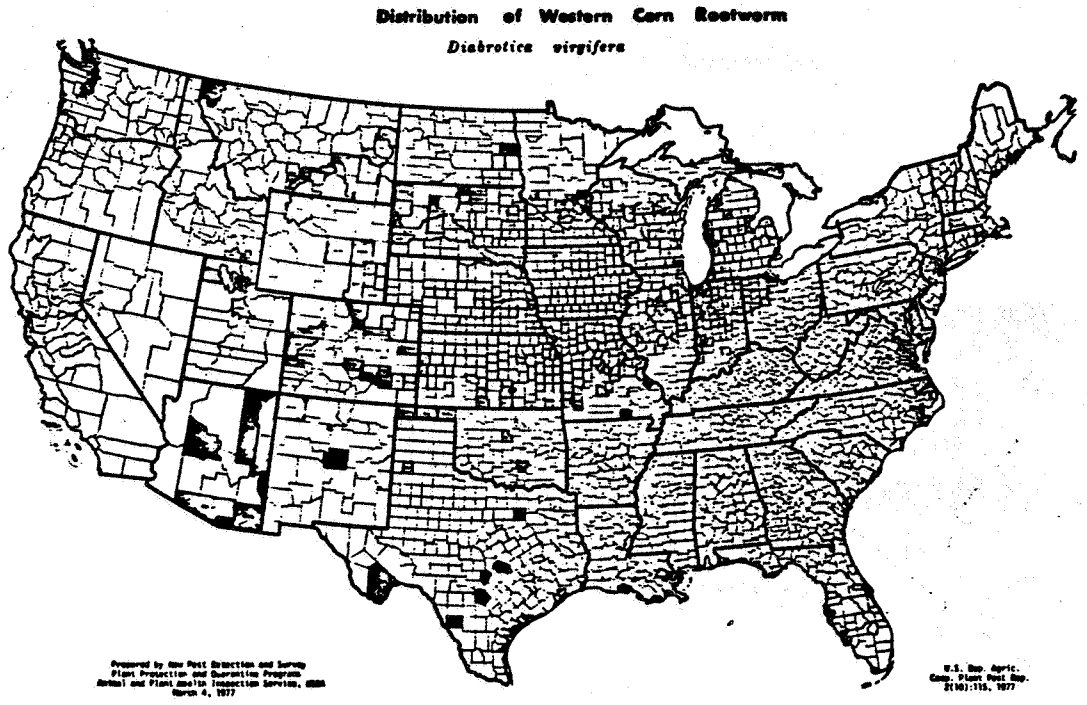



Figure 3.

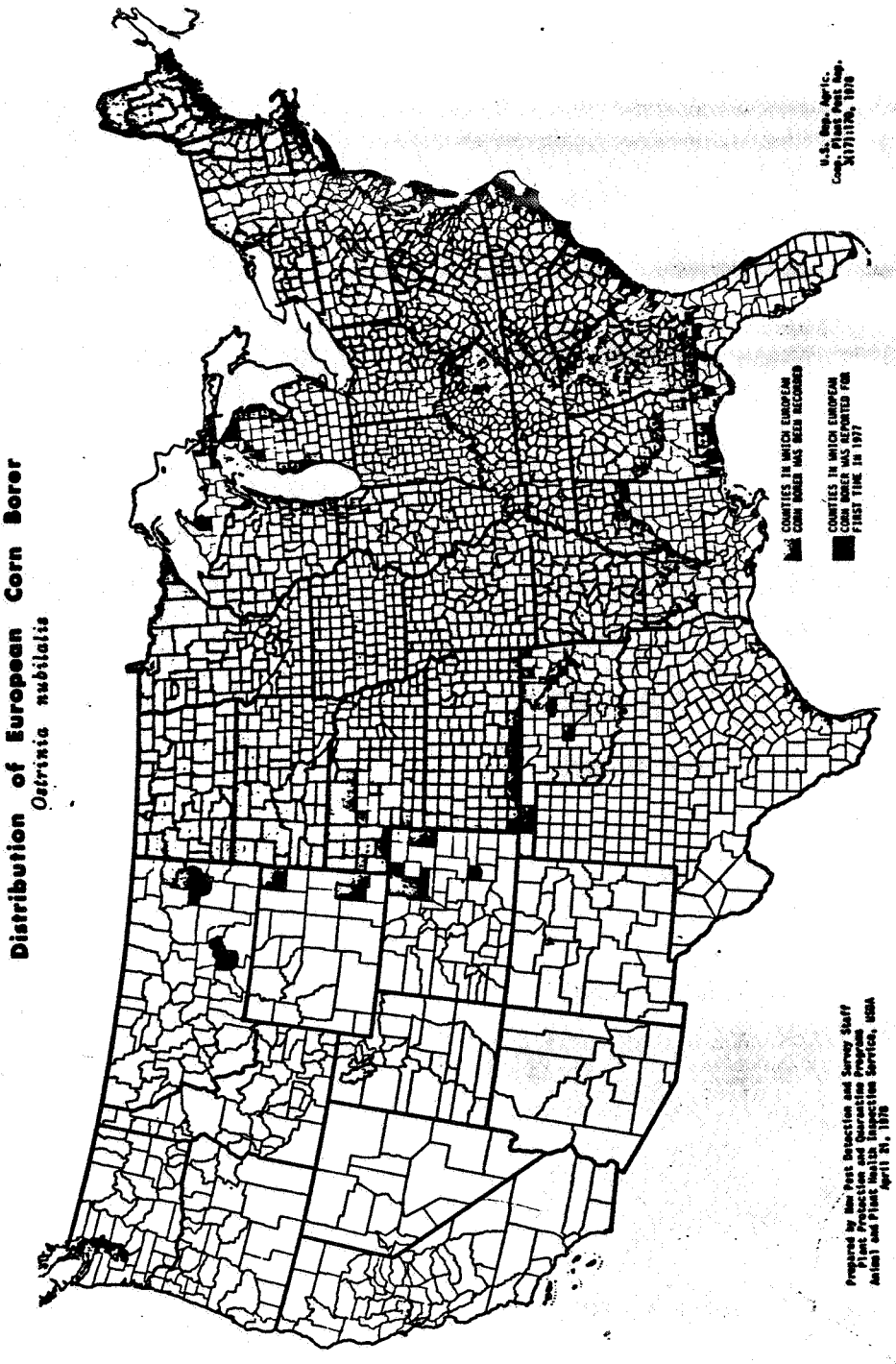

Distribution of European Corn Borer
Ostrinia nubilalis
COUNTIES IN WHICH EUROPEAN CORN BORER HAS BEEN RECORDED
COUNTIES IN WHICH EUROPEAN CORN BORER WAS REPORTED FOR FIRST TIME IN 1977
Prepared by Pest Detection and Survey Staff
Plant Protection and Quarantine Programs
Animal and Plant Health Inspection Service, USDA
April 15, 1978

Figure 4

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SITE: Sugarbeets

PESTS: Sugarbeet root maggots, wireworms and garden symphylans

LABEL SUMMARY: See EPA Index to Pesticide Chemicals for Insecticides - Fonofos.

CHEMICAL APPLICATION:

Method of Application: Fonofos is only applied using ground equipment.

Type of Application: Preplant broadcast for control of wireworms and garden symphylans, and band application at planting for control of the sugarbeet root maggot.

Equipment: Preplant broadcast - Emulsifiable concentrate are applied using tractor operated low-pressure spray equipment delivering 20 to 50 gallons finished spray per acre, and incorporated into the soil by discing. Granulars are broadcast using drop-type or spin spreaders and disced into the soil prior to planting. At planting - granular pesticide applicators fitted with 7" spreaders are attached to planters. These applicators are used in Colorado and northwest sugarbeet growing areas for applying a 7" band over the row. In the Big Horn Basin of Wyoming granular applicators are used to apply a band 2" from the seed furrow and 2" below the soil on the irrigated side of the row.

Applicator Category: EC products of > 44% (4 lb/gal) are restricted use products. Granular products of 5-20% fonofos are for Agricultural and Commercial use.

Timing: Preplant or at planting in spring.

Planting Dates: In the northern sugarbeet growing areas planting occurs during April or early May, and in the milder areas planting occurs in February, March and April. In parts of California and Arizona planting may occur in fall or winter.

Number of Applications: 1

PEST INFORMATION:

Sugarbeet root maggot (Tetanops myopaeformis) - This insect overwinters as a mature larva (maggot) in the soil of beet fields. In spring the maggot move up to within one to two inches of the soil surface and pupate. Adult flies emerge from mid to late spring and deposit eggs around the base of young sugarbeet plants. Eggs hatch in about a week and the maggots commence feeding on the underground portion of developing sugarbeet plants. There is one generation per year.

The presence of wilted plants is often an indication that a field is infested. Young plants are often killed which results in fields with reduced plant stand. Older plants may survive a root maggot infestation but the plants are often severely dwarfed and stunted. Sugarbeet root maggots infestations result in reduced yields. Infestations of sugarbeet root maggot reduce yields of beets over a wide area. The sugarbeet root maggot is considered a serious annual pest in areas of North Dakota, Wyoming, Idaho, and Colorado. In these areas preventive treatments are justified. It is estimated that 38% of the U.S. Acreage is subject to sugarbeet root maggot damage which results in about a 2% yield loss or 550,000 tons per year.

Wireworms - Are the larvae of click beetles which live in the soil and feed on germinating seeds and underground parts of plants. Damage is most severe during cool, moist weather. During hot, dry weather, they migrate into the subsoil. Several species attack sugarbeets. The larval stage last from two to six years. Attempts to control wireworms with insecticides once damage has been observed are not usually very successful. Wireworms tend to move only short distances during their long larval development, pupae transform into adult beetles in summer, but the beetles do not emerge until the next spring. The beetles often remain near where they developed

so that the level of infestation often varies considerably in fields within a given area.

Garden Symphylan (Scutigerella immaculata) - The garden symphylan is sometimes a serious pest of some commercial crops, home gardens and greenhouses. Symphylans feed on germinating seeds, plant roots and above ground parts in contact with the soil. A severe symphylan infestation results in a poor stand of stunted sugarbeet plants which yield poorly. All stages of development can be found at anytime of the year, but in field crops the majority of the egg laying occurs in the spring. Nymphs and adults become active in spring and are to be found in the top 10 to 12" of warm, moist soils, but during hot, dry weather, they migrate into the subsoil. A distribution map is attached (Figure 5).

OTHER INFORMATION:

Seeding practices - Row spacement varies from 18 to 22 inches apart or in 34 cm. double rows spaced at one meter between centers. Special 4- to 12- row planters are used to seed fields. The desired stand is from 21,000 to 36,000 plants per acre. Unprocessed monogerm or processed multigerm, polished to remove some of the cork, is usually planted at a rate of 1.5 to 4 lbs. per acre. The final desired spacing within a row is 8 to 12 inches apart.

Irrigation - Irrigation water is required for successful commercial sugarbeet production in areas where the rainfall is 18" or less.

**DISTRIBUTION OF GARDEN SYMPHYLAN (Scutigerella immaculata (Newport))**

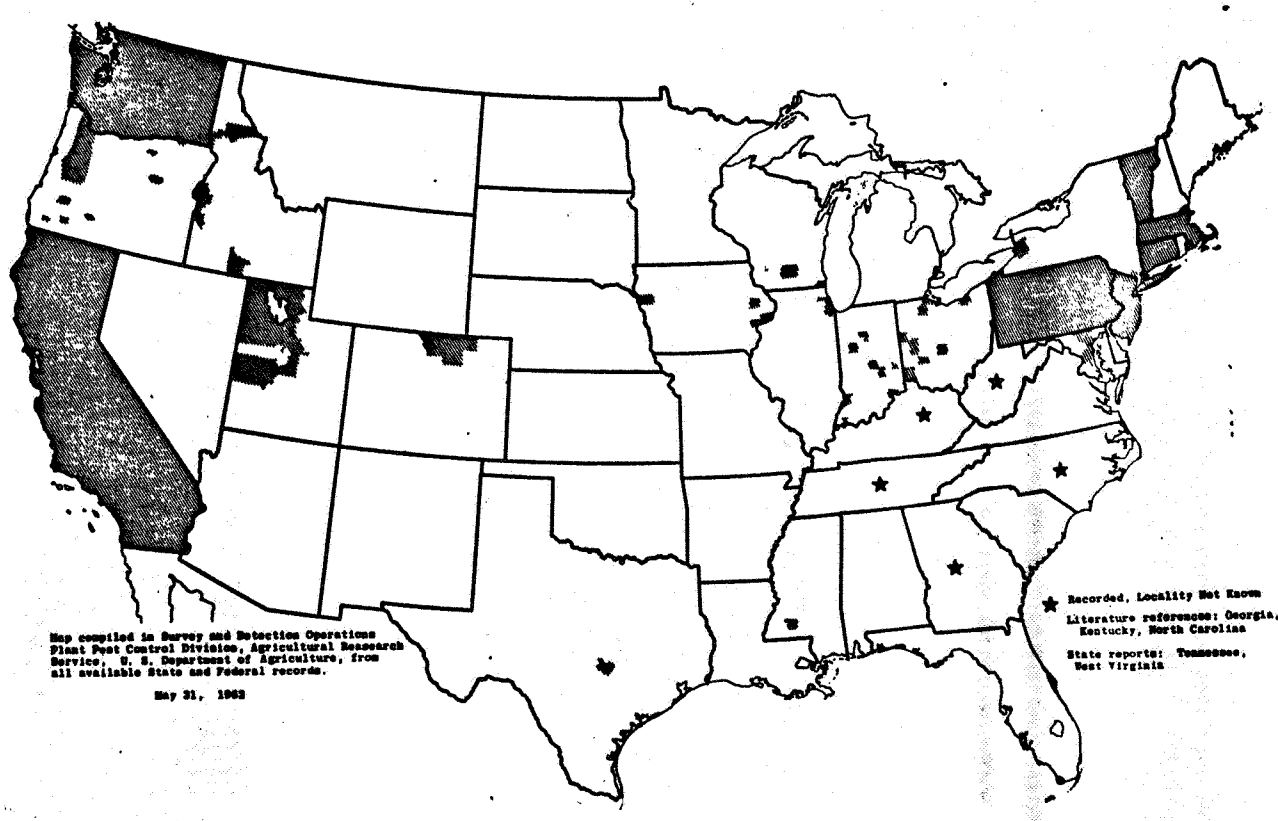


Figure 5.

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## LAWN AND HOME VEGETABLE GARDEN USE

A 2% fonofos granular insecticide is registered for use by homeowners. The product permits the homeowner to apply fonofos to certain vegetable crops and lawns. In addition, there is a registration which permits commercial applicators to treat lawns with a 5% fonofos product. No current usage information is currently available to indicate if these products are marketed and used around the home.

In the absence of any usage data it is impossible to outline all use parameters but an attempt has been made to identify how the 2% home garden product would be used by homeowners if available.

PESTS: Southeast - sod webworms and earwigs.

Southern U.S. - chinch bugs..

LAWNS: (Bahia, Bermudagrass, Bluegrass, St. Augustines and Zoysia).

LABEL SUMMARY: See EPA Index To Pesticide Chemicals for Insecticides - Fonofos (attached).

VEGETABLES AND PESTS: Garden symphylan - Snap beans, lima beans, beets, broccoli, Brussels sprouts, cabbage, cauliflower, corn, white potatoes, radishes, tomatoes and strawberries.

Wireworms - Snap beans, corn, white potatoes and sweet potatoes.

Cabbage maggot - Beets and radishes.

LABEL SUMMARY: Garden symphylan and cabbage maggot - ¼ lb product (0.08 oz AI)/100 sq. ft.

Wireworms - ½ lb product (0.16 oz AI)/100 sq. ft.

Granules are applied just prior to planting or at transplanting and are worked into the top 2-3 inches of soil with rake or power tiller.

CHEMICAL APPLICATION:

Method of Application: Required dosage applied by shaking prepackaged canister or using lawn fertilizer spreader.

Type of Application: Soil application.

Applicator Category: Homeowner

Timing: Lawns - Chinch bugs are controlled by applying the chemical as needed from spring onwards.

- Sod webworms are controlled by applying the chemical as needed from summer onwards (Hot, dry periods are prime webworm conditions).

Vegetables - Garden symphylan/wireworms/cabbage maggot - These pests are controlled by applying the chemical at planting or transplanting.

Number of Applications: Lawn pests - multiple applications (chinch bugs 1-2 applications but more applications may be required in southern areas; sod webworms and earwigs, chemical applied every 4 weeks in hot, dry weather).

Vegetables - one application.

LAWN PEST INFORMATION:

Chinch bugs - There are several species of chinch bugs. The hairy chinch bug (Blissus leucopterus hirtus) infests lawns along the eastern seaboard and midwest, while the chinch bug (B. leucopterus leucopterus) is a pest of Bermudagrass in Oklahoma. Ths southern chinch bug (B. insularis) is a serious pest of St. Augustinegrass in Florida and the Gulf Coast States, it is also a serious pest of lawns in Georgia, North Carolina, and South Carolina. Most chinch bug damage is caused by nymphs sucking the plant juices from the

grass which result in yellowish to brownish areas in the lawn. In southern Florida all stages of the pest may be found throughout the year, in other areas the adult chinch bug hibernates during the winter.

Sod webworms - These pests are the larvae of lawn moths (Crambus spp.) that overwinter in silken tubes which are found in the soil or in heavy thatch. The larvae become active in spring and feed at night on grass blades, though some species feed on crowns at ground level and on the roots. Pupation occurs in late spring and the adults appear about one week later. In summer the entire life-cycle is completed in 5 to 6 weeks. The number of generations that occur annually varies considerably with the species. In the southeast there are usually 2-3 generations per year.

Earwigs - These insects are occasional pests of lawns and sometimes breed in enormous numbers in lawn clippings. Earwigs hide during the day and forage for food at night but do not damage lawns. Some species of earwigs, are very good predators of both chinch bugs and sod webworm larvae.

VEGETABLE PEST INFORMATION:

Garden symphylan - The garden symphylan (Scutigerella immaculata) is sometimes a serious pest of home gardens. Symphylans feed on germinating seeds, plant roots and above ground parts in contact with the soil. A heavy infestation results in a poor stand of stunted plants which yield poorly. All stages of development can be found at anytime of the year though in vegetable gardens the majority of egg laying occurs in the spring. Nymphs and adults become active in spring and are to be found in the 10 to 12" of warm, moist soils, but during hot, dry weather, they migrate into the subsoil. Distributed throughout the humid areas of the U.S.

Cabbage maggot - The cabbage maggot (Delia radicum) is destructive in seed beds and on young transplants. They overwinter as pupae in the garden soil, the adult fly emerges in spring and lays eggs near the stems of the developing

plants. On hatching the maggots feed on roots and may tunnel into roots and stems, causing rot which results in the plant wilting and dying. Cabbage maggots are more prevalent in the northern parts of the U.S.

Wireworms - Are the larvae of click beetles which overwinter in the larval and adult stages in the soil. The larval stages lasts several years and they feed on the underground parts of plants. They feed on seeds, seedlings and injure tubers, roots and bulbs of a wide variety of vegetables. They occur throughout the U.S. but are particularly common in well watered gardens.

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