INSECTICIDE USE IN U.S. CROP PRODUCTION
– 100 Information Sheets –

L. P. Gianessi

April 1999

National Center for Food and Agricultural Policy
1616 P Street, NW, First Floor
Washington, DC 20036
Tel: 202-328-5048
Fax: 202-328-5133
E-mail: ncfap@ncfap.org

Assembly of these information sheets was supported financially by the Alliance for Responsible Regulation of Insecticides (ARRI)

100 Crop/State Insecticide Use Information Sheets

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97. Wisconsin/Cranberries

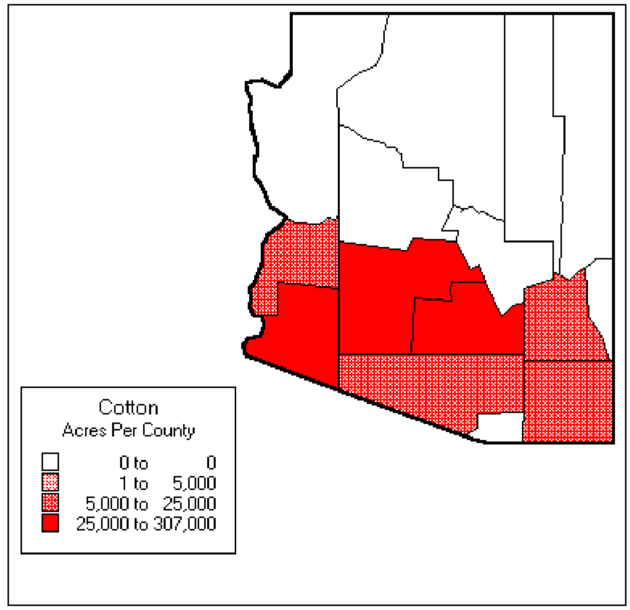
98. Wisconsin/Green Beans

99. Wisconsin/Mint

100. Wisconsin/Onions

INSECTICIDE USE ON ARIZONA COTTON

ACRES: 319,000
PRODUCTION:
VALUE ($/YR): $269,000,000
VOLUME (LBS/YR): 394,000,000



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In 1996, Congress passed the Food Quality Protection Act (FQPA), that significantly amended the laws governing the registration of pesticides. Congress included sections in FQPA that broadened the consideration of health risk factors while reducing the role that pesticide benefits play in granting tolerances. EPA has set August 1999 as a Phase 1 deadline for re-assessing the registrations of pesticides belonging to the organophosphate and carbamate classes of chemistry. Although the results of the risk analyses are unknown at this time, EPA may propose canceling many organophosphate and carbamate insecticide uses in order to reduce the calculated risk to human health to below the acceptable safety standard. The information on this page was compiled in order to describe the current usage and importance of organophosphate and carbamate insecticides.

INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	52	165,880
ALDICARB**	16	51,040
CHLORPYRIFOS**	41	130,790
DIMETHOATE**	17	54,230
ENDOSULFAN	27	86,130
FENPROPATHRIN	18	57,420
LAMBDACYHALOTHRIN	22	70,180
METHOMYL**	14	44,660
OXAMYL**	14	44,660

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Thrips attack seedling cotton plants. They rupture cells with their rasping sucking mouthparts and suck up the sap. Thrips feeding results in stunted plant growth.

Beet armyworm eggs are laid on cotton leaves in clusters. Young larvae feed and quickly disperse as they grow. They skeletonize leaves. Armyworm damage to small bolls can reduce yield if it occurs late enough that plants cannot compensate for it. Lygus bugs are estimated to infest all cotton acres in Arizona on an annual basis. Lygus bugs move into Arizona cotton fields at the time local vegetation is drying out, when alfalfa is cut or when safflower matures. Young nymphs feed on tender vegetative tissue and larger instars begin to attack the small squares. Feeding by lygus can reduce cotton yields significantly as a result of the shedding of immature squares and damaged bolls. Symptoms of lygus damage to squares include puncture holes, yellowish spots of excrement and internal discoloration. Whiteflies are a major problem in Arizona cotton. Whiteflies are sucking insects and their feeding removes nutrients from the plant. Feeding by high populations may result in stunting, poor growth, defoliation, boll shed and reduced yields. As they feed, whiteflies produce large quantities of honeydew that, if deposited on fibers, will reduce cotton quality and may interfere with picking, ginning and spinning.

Importance of insecticides:

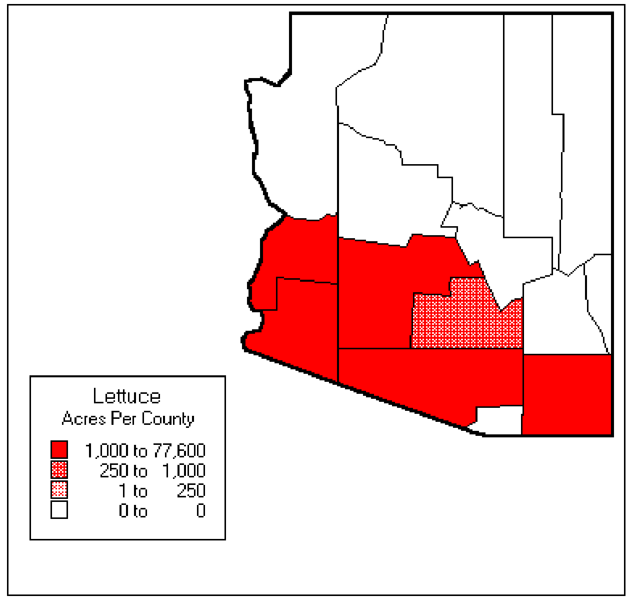
Continuing organophosphates in the cotton insecticide market is important for viability of long-term resistance management activities. Chlorpyrifos is the major organophosphate used in Arizona for armyworm control.. Organophosphates and carbamates that are used to manage lygus populations in Arizona include acephate, aldicarb, chlorpyrifos and oxamyl. Aldicarb and dimethoate are the primary controls for thrips in Arizona cotton. There are currently no commercially viable non-chemical alternatives for management of aphids, whiteflies or lygus bugs in cotton.

The organophosphate acephate and the carbamate oxamyl have demonstrated consistently the most effective knockdown and residual control of lygus under Arizona conditions. The development of resistant whitefly populations led to the development of an insecticide resistance management strategy in which pyrethroids and organophosphates are used following the application of newly registered insect growth regulators. Tank mixes containing chlorpyrifos and acephate are an important part of the whitefly resistance management program in Arizona.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON ARIZONA LETTUCE

ACRES: 71,400
PRODUCTION:
VALUE ($/YR): $410,000,000
VOLUME (LBS/YR): 2,350,500,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	28	19,992
BT	75	53,550
CYPERMETHRIN	93	66,402
DIAZINON**	17	12,138
DIMETHOATE**	43	30,702
ENDOSULFAN	37	26,418
METHOMYL**	90	64,260
THIODICARB**	33	23,562

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Female aphids give birth to live offspring all year without mating. Aphids may become serious enough to destroy a lettuce crop in Arizona. Their presence and the sticky honeydew which they deposit on the heads of lettuce are objectionable when preparing heads for market. Their ability to transmit lettuce mosaic virus is also important, particularly in the Yuma area. Aphids start building up on weed hosts from which they migrate into fields of lettuce where, if uncontrolled, they nearly can cover the heads. Darkling beetles chew off lettuce seedlings. They usually invade lettuce fields from woody areas or from adjacent crops. Flea beetles can destroy quickly most of a lettuce field. Moving out of cotton, large numbers will migrate to lettuce. Large populations of flea beetles can kill or stunt seedlings. They feed on the underside of leaves causing narrow, small or irregularly shaped holes.

Export standards create about zero tolerance for thrips presence. Thrips damage results from feeding and occurs in the form of leaf stippling and rib discoloration, affecting quality at harvest.

Importance of insecticides:

At present, there are no viable non-chemical alternatives to insecticides for control of the pests of lettuce in Arizona. Natural enemies rarely provide adequate control of aphids or thrips on spring crops. Control with insecticides is often the only viable alternative preventing thrip damage or aphids from contaminating harvested lettuce.

Resistance to diazinon, acephate and dimethoate has not been documented for any of their target pests. The organophosphates play a key role in resistance management of aphids and thrips. Newly registered alternatives to the organophosphates are much more expensive. There are no new chemistries in development for control of soil insects at stand establishment. Dimethoate is used in combination with pyrethroids and other organophosphates for control of thrips and aphids, primarily during the spring.

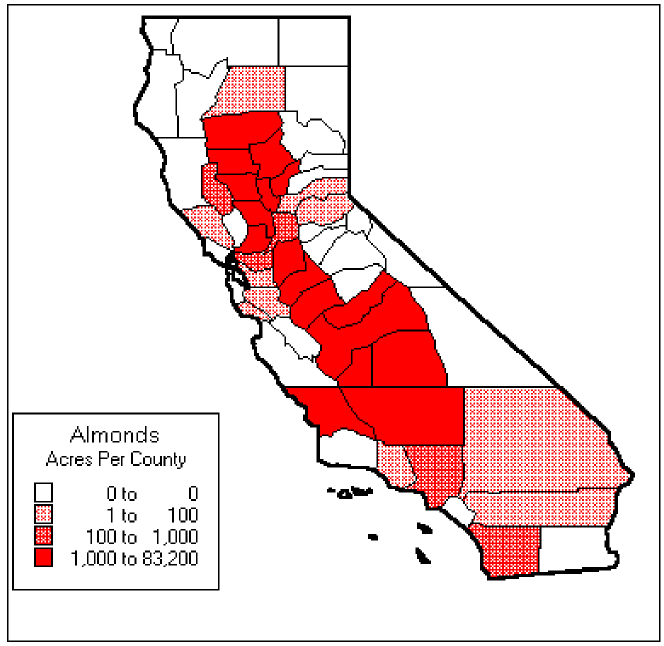
Acephate is used in combination with pyrethroids and other organophosphates for control of whiteflies and lepidopteran complex (beet armyworms, cabbage loopers, tobacco budworms) in the fall and thrips and aphids in the spring.

Diazinon is used alone, or in combination with a pyrethroid, primarily for control of insects that feed on seedlings (darkling beetles, flea beetles, crickets) at stand establishment. Diazinon also is used to suppress leafminer adults in early season.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON CALIFORNIA ALMONDS

ACRES: 471,100
PRODUCTION:
VALUE ($/YR): $1,100,000,000
VOLUME (LBS/YR): 730,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	23	92,000
BT	54	216,000
CARBARYL**	1	4,000
CHLORPYRIFOS**	20	80,000
DIAZINON**	24	96,000
ESFENVALERATE	8	32,000
METHIDATHION**	12	48,000
NALED**	2	8,000
OIL	42	168,000
PERMETHRIN	12	48,000
PHOSMET**	7	28,000
PROPARGITE**	34	136,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The two major insect pests of California almond orchards are the navel orangeworm (NOW) and the peachtwig borer (PTB). Navel orangeworms overwinter as larvae in almond mummies that remain on the trees after harvest. One mummy with six worms can conceivably produce 12,000 NOW by the third generation. NOW larvae enter nuts and feed on the kernel. As the larvae feed and get larger, they consume most of the nut and produce large amounts of frass and webbing. Aflatoxins are associated with almond kernels damaged by NOW larvae. The NOW attacks the almond fruit while they are still drying on the tree. During drying, high temperatures in the orchard and moisture in the hulls provide an environment especially suited for the growth of aflatoxin. Research has shown that the most direct means of controlling aflatoxin contamination of almonds is to reduce insect damage.

Peachtwig borers overwinter as larvae in cells under the thin bark of limb crotches. When the trees bloom in the spring, larvae feed on flower buds and young foliage. PTB mine the tender shoots of the almond trees, killing the tips. PTB can feed directly on the nuts leaving shallow channels and surface grooves in the kernels. Early season damage from PTB creates openings for the NOW to enter. The frass excreted by PTB larvae attracts NOW females to damaged nuts. NOW does not attack sound nuts.

Importance of insecticides:

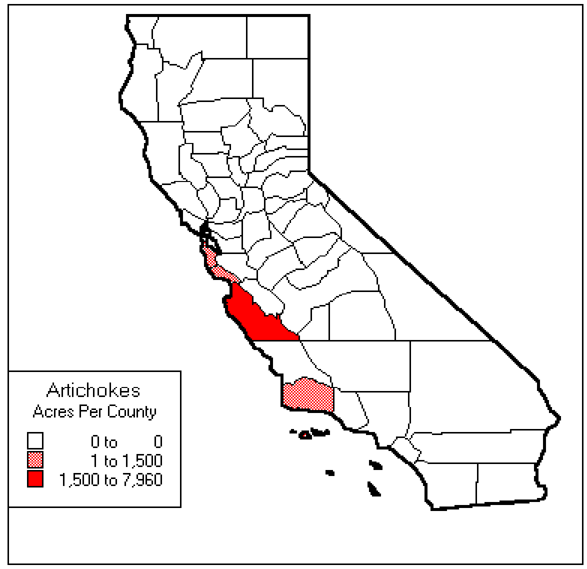
Before the development of organophosphate insecticides in the 1950's, PTB damaged 10-29 percent of the almond crop yearly. In the 1970's, the navel orangeworm became the major pest and insecticides (azinphos methyl and carbaryl) were first registered for NOW control in 1976. Use of pyrethroids often results in need for another insecticide for mite control. Resistance to pyrethroids is a significant issue. Growers can use pyrethroids for two or three years, but then they must seek an alternative.

The IPM recommendation for PTB control is to spray almond trees every year in the winter with a dormant spray of oil and organophosphate insecticides. Properly timed dormant sprays reduce PTB populations by 95 percent. Other pests, such as San Jose Scale, brown mite and European red mite, are simultaneously controlled. PTB can also be controlled during bloom with well-timed treatments of BT, but this treatment does not affect the other pests that are controlled by the dormant spray. Often several applications are required to control PTB with BT's. Mating disruption of NOW and PTB is an area where further research is being conducted, but has not yet reached the stage of widespread practical implementation.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Chris Heintz at the Almond Board of California at (209) 549-8262.

INSECTICIDE USE ON CALIFORNIA ARTICHOKES

ACRES: 9,300
PRODUCTION:
VALUE ($/YR): $45,000,000
VOLUME (LBS/YR): 102,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	1	93
BT	1	93
CARBOFURAN**	34	3,162
DIFLUBENZURON	21	1,953
ESFENVALERATE	60	5,580
METALDEHYDE	66	6,138
METHIDATHION**	60	5,580

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The artichoke plume moth (APM) is the most serious pest of artichokes in California. It has three overlapping generations a year. Consequently, all stages of the moth are present throughout the year. Eggs are deposited on the undersides of leaves or on bud stalks. Upon hatching, larvae move in the plant into the vegetative shoots, where they feed upon leaves and later assume a tunneling habit and feed on the main stem or leaflets. APM is a pest with a low economic injury level. The extent of damage from the plume moth often may determine profit or loss in artichoke production. In the absence of any pest management practices, it can cause crop damage ranging from 15 to 70 percent. The cribrate weevil damages the artichoke crop in two ways: larval damage to the roots and adult feeding damage to the foliage and buds. A density of 50 to 150 grubs per plant is quite common. At such densities, larval feeding results in a restricted root system. Consequently, during the annual cutback operation, such plants are pulled out of the ground inadvertently. The direct feeding injury from the artichoke aphid results in curling and yellowing of artichoke leaves and retarded growth. Aphids also secrete copious amounts of honeydew, that gives artichokes a wet and shiny appearance.

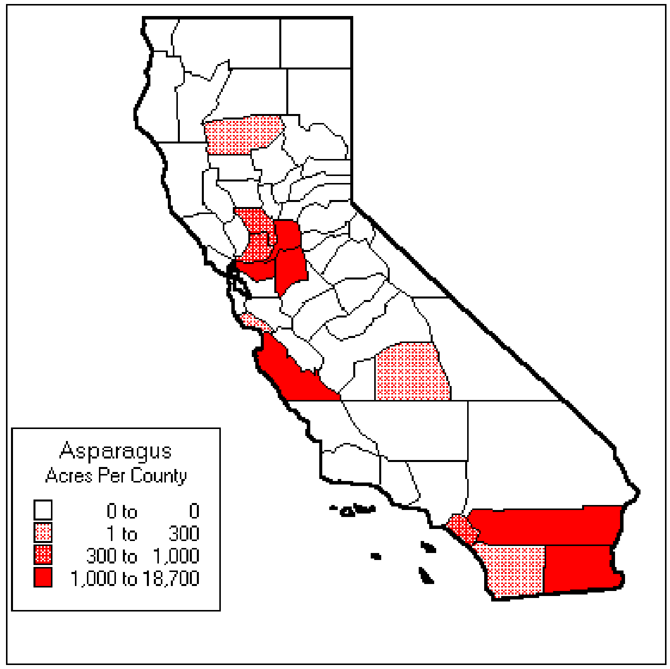
Importance of insecticides:

In June and July after the cutting back period, the organophosphate, methidathion, is applied two or three times to reduce APM larval infestations in the new shoots. This insecticide is registered only for pre-bud use in artichokes, and it cannot be applied after the plants begin producing artichokes. After buds form, pest control advisors recommend a pyrethroid esfenvalerate. The rotation of an organophosphate, methidathion, at the vegetative stage with the pyrethroid, at later stages is recommended as a resistance management strategy. BT is not used on a wide scale because of its lack of efficacy. Multiple sprays of BT applied at short intervals give only moderate control of the artichoke plume moth. The registration of methidathion in 1977 virtually saved the artichoke industry when the crop was facing serious economic losses because of the plume moth in spite of making 20 to 26 applications of parathion each year. Methidathion also controls secondary pests, such as leafminers, aphids, thrips, leafhoppers and spider mites. Sex pheromone-mediated mating disruption has maintained artichoke plume moth at a very low level. However, because of the high cost of the pheromone, this practice is not cost-effective. If methidathion and carbofuran were cancelled, insect pest management on artichokes would be at risk because of resistance development to esfenvalerate in the artichoke plume moth and resurgence of secondary insect pests. Recently registered, diflubenzuron provides effective control of artichoke plume moth in its developmental phases, but does not control adult moths. It also is ineffective against secondary pests of artichokes. Concerned with the growing expense of pest management, growers are using diflubenzuron sparingly.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Mohammad Bari at the Artichoke Research Association (408)755-2871

INSECTICIDE USE ON CALIFORNIA ASPARAGUS

ACRES: 31,610
PRODUCTION:
VALUE ($/YR): $101,694,000
VOLUME (LBS/YR): 99,700,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
BT	4	1,264
CHLORPYRIFOS**	16	5,058
DISULFOTON**	48	15,173
MALATHION**	8	2,529
METHOMYL**	18	5,690
PERMETHRIN	5	1,580

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Asparagus aphid is an extremely serious pest in California. Aphids feed by sucking plant juices. The aphids inject a toxin that causes bushy, stunted new growth. Small plants can be killed by high numbers of aphids. An asparagus crown that has been fed on by asparagus aphids will desiccate. This may result in a substantial loss in yield from each crown. Continuing infestations may cause a loss of the stand. Uncontrolled aphids have resulted in stand losses up to 100 percent with an average of 35 percent. All asparagus aphids present during the growing season are females that produce live female young without mating. A single aphid can produce 50 to 300 individuals in a 24 day period. In California there is high aphid pressure for about 100 days in September, October and November.

Importance of insecticides:

Natural predators and diseases control the asparagus aphid in eastern states (such as Michigan). However, in the drier areas of California, the predators and diseases do not provide adequate control of the explosive growth in aphid populations. Aphids are a new pest in California asparagus. Aphids were first detected in Washington asparagus fields in 1979, and California immediately quarantined all Washington asparagus from entering the state. However, the asparagus aphid found its way to California in the 1980's and has been established ever since. The organophosphate disulfoton has been the most effective in controlling the aphid and is available in California under a special local needs registration. Growers are advised to use the organophosphate chlorpyrifos to control light infestations of the aphid. A recent study from Washington State University concluded that:

Loss of disulfoton would result in total collapse of the California and Washington asparagus industry unless a replacement compound could be made available within one or two years.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or William De Paoli at the California Asparagus Commission (209)474-7581

INSECTICIDE USE ON CALIFORNIA CELERY

ACRES: 24,500
PRODUCTION:
VALUE ($/YR): $207,515,000
VOLUME (LBS/YR): 1,715,000,000

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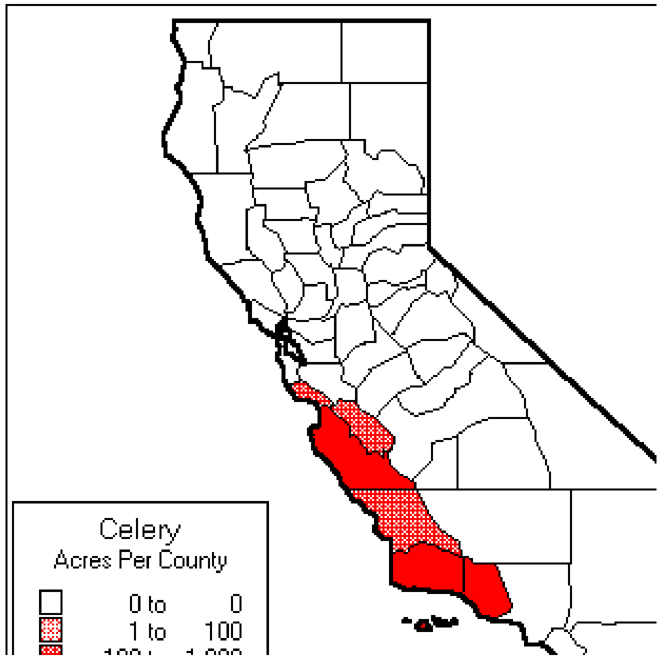


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	68	16,660
ACEPHATE**	51	12,495
BT	54	13,230
METHOMYL**	64	15,680
NALED**	11	2,695
OXAMYL**	79	19,355
PERMETHRIN	86	21,070

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Organophosphate and carbamate insecticides are targeted at aphids, lygus bugs and armyworms. Aphid populations can build up in celery to densities of several thousand per plant. Aphids reduce yields through removal of a significant amount of sap. They transmit virus diseases such as western celery mosaic (a disease that is under quarantine regulations in California because it can result in crop failure in an entire region). Aphids also can contaminate celery with honeydew. Newly hatched beet armyworm larvae feed on celery ribs. The feeding damage can extend to more than five inches in length within the rib. These eaten-out areas can be filled with frass from the armyworm. The presence of larvae or a large amount of fecal material reduces plant marketability. Usually, armyworm damage to no more than three to five percent of harvested celery is tolerated. Lygus feeding damage causes blackheart-like symptoms, resulting in a very serious defect as scored by USDA standards, that is nearly impossible to remove at harvest and can result in total crop failure at a low infestation level.

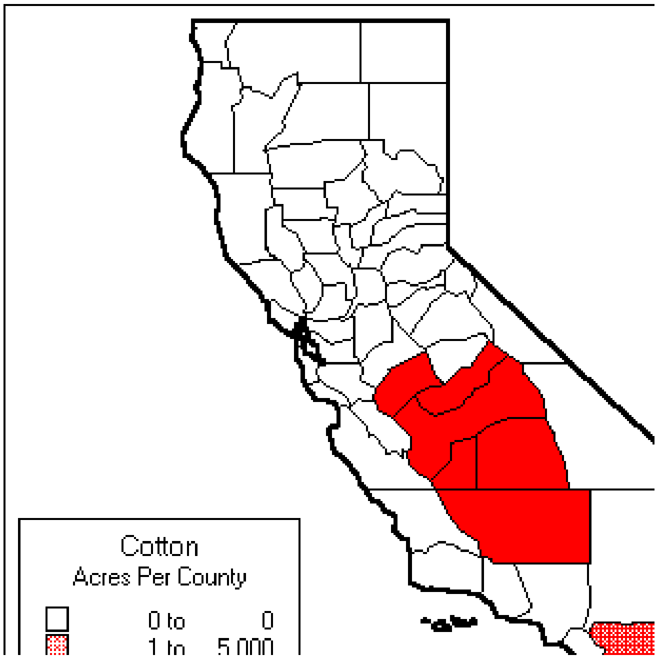
Importance of insecticides:

The only satisfactory alternatives for aphid control are the organophosphate insecticide acephate and the carbamate insecticide oxamyl. Endosulfan is an alternative, but its use is restricted in most coastal counties where celery is produced. Narrow range oils and insecticidal soaps have no residual effects and require frequent applications for aphid control. Historically, methomyl has been the most widely used insecticide for suppressing beet armyworm populations. BT usage for armyworm has increased; however, BT is ineffective in controlling severe outbreaks of beet armyworm. Therefore, the organophosphates and carbamates are applied. The result of the potential loss of organophosphates and carbamates may be an increase in overall pesticide usage because of the need to use high rates of less effective materials to manage resistance. In some regions it may require two or more substitute chemicals to accommodate for the broad spectrum control of acephate, methomyl and oxamyl.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON CALIFORNIA COTTON

ACRES: 650,000
PRODUCTION:
VALUE ($/YR): $778,000,000
VOLUME (LBS/YR): 600,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	55	227,500
ALDICARB**	46	299,000
AMITRAZ	12	78,000
CHLORPYRIFOS**	40	260,000
CYFLUTHRIN	11	71,500
IMIDACLOPRID	55	357,500
NALED**	23	149,500
PHORATE**	15	97,500
PROFENOFOS**	7	45,500

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The Cotton Aphid has become a significant pest of San Joaquin Valley cotton over the last 10 years. Yield losses and threats of contaminated lint from cotton aphid mean that aphid control has become a necessary production cost for California cotton growers. Aphids feed by removing plant juices from the plant leaves. These are the same energy sources that the plant needs to develop squares and to fill/mature bolls. The aphids deposit honeydew on the open lint. With this sticky contamination greatly hindering the ginning of the cotton, it directly reduces the quality, cotton grade and, most importantly, threatens the reputation of the industry. Biological control of the cotton aphid during mid- and late-season is poor. Additional natural enemies are being imported into California for cotton aphid, but these have not established and/or exerted an effect yet. Host-plant resistance of cotton to cotton aphid is not available. Cultural controls alone cannot be used to control aphids. Under favorable field conditions, mid-season aphid numbers have been observed to double about every six to eight days.

Lygus bugs are pests of numerous crops in the San Joaquin Valley. Lygus moves into cotton as tomatoes and safflower dry down and as alfalfa is harvested. Lygus reduces yield by feeding on the upper portions of the plant and taking off cotton squares. The cotton plant grows more vegetation and goes rank. This key cotton insect pest can decide the profitability of a production season, depending on the timing and severity of migrations. In most situations of low populations, single migration episodes or limited reproduction, organophosphate or carbamate insecticides provide adequate control without sacrificing the biological control elements in the cotton field.

Importance of insecticides:

Organophosphate and carbamate insecticides (metasystox, chlorpyrifos, aldicarb) are currently the mainstay of cotton aphid management programs. Many natural enemies have built up some tolerance to organophosphates.

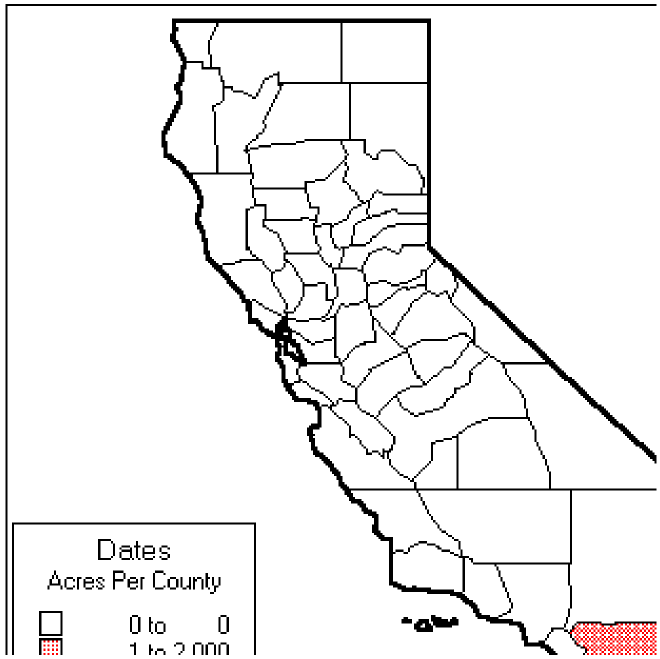
One of the critical needs for managing cotton aphids and for maintaining susceptibility is insecticide class rotation. The loss of the organophosphate, organochlorine, and carbamates through FQPA would critically restrict the available products for cotton aphid. Remaining products would be imidacloprid and amitraz. Imidacloprid is already being heavily used in cotton for aphid control and secondarily for Lygus and whitefly management. The build-up of resistance is a real threat with this use pattern. FQPA could further hasten this process. Amitraz is best used as a tank-mix partner with an organophosphate; alone it has limited applicability. There are few new aphicides that re nearing registration.

Lygus pest control has depended on organophosphates, but due to decreasing susceptibility in the past five years, other classes have become important. Pyrethroids are suggested late in the season with carbamates suggested for use during the early fruiting period. These products include Oxamyl and Aldicarb. Loss of carbamates would greatly impact Lygus control through the increased dependence on pyrethroids that aggravate aphid pressure. No selective insecticides for Lygus are under current development or registration. Fipronil is being developed and is moderately selective.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Peter Goodell at the University of California (209)-646-6515.

INSECTICIDE USE ON CALIFORNIA DATES

ACRES: 4,000
PRODUCTION:
VALUE ($/YR): $18,500,000
VOLUME (LBS/YR): 46,000,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
MALATHION**	95	3,800

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Four species of beetles are of economic importance on dates in California. These four species are pineapple beetle, dried fruit beetle, corn sap beetle and the yellowish nitidulid. The beetles damage dates by entering the fruits and feeding on the pulp. In addition to the primary damage caused by feeding, losses result from the presence of excreta, larvae and the moulting skins in the infested dates. The beetles also serve as mechanical carriers of mold and secondary organisms that cause fruit spoilage. Beetle populations thrive throughout the year on the dates present on the ground under the trees, and the adults move from this population reservoir into the new crop as it ripens on the trees. Crop damage is worse during years with above average rainfall. In 1945, a year of abnormally high humidity and rainfall, beetles and associated fungi caused a loss of between 50 and 75 percent of the date crop.

Importance of insecticides:

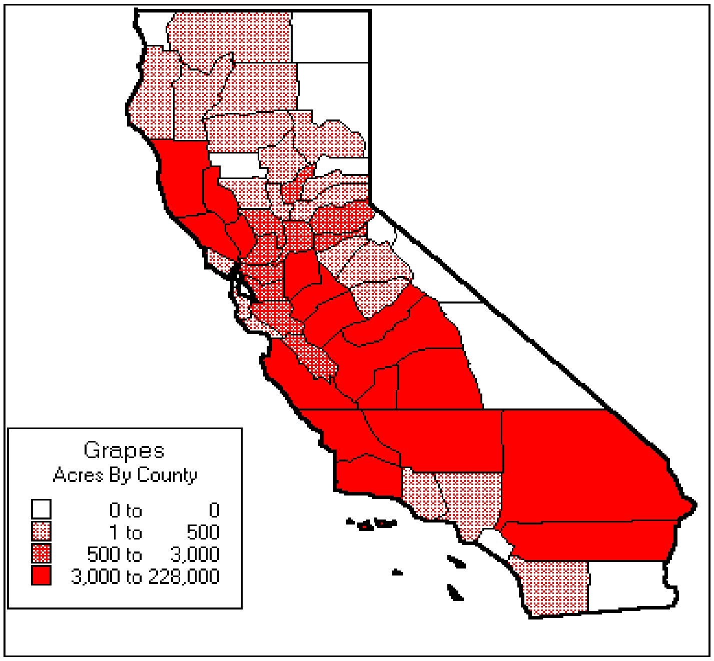
Date bunches are covered by paper wrap, open below, in late July or early August to shelter them partially from occasional summer rains. A powerful, relatively narrow stream of air, bearing insecticide dust, will penetrate the covered bunch. In the early 1950's malathion was selected for intensive testing in dates. In 1952, when beetle populations were unusually high, malathion reduced the number of live beetles in the fruit bunches from over 9,000 to 60. No live beetles were found in treated bunches for two weeks following application of malathion dust, and the bunches tended to remain relatively free from live beetles for up to eight weeks. Since 1953, malathion dust has been recommended for beetle control. Experiments with carbaryl demonstrated a failure to control nitidulid beetles.

Malathion is the only registered insecticide for beetles on dates. Potential alternatives includes pheromones and other chemicals. There has not been any effective alternative treatment developed yet. The date industry is sponsoring research into mating disruption using pheromones but the results are inconclusive. Constraints to alternatives include cost, efficacy and compatibility with the crop. Dates do not take well to wet sprays which cause spotting of the dates. Without malathion the destruction of over half a growers crop to insect pressure is a very real possibility.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Albert Keck, California Date Commission (760)399-5191

INSECTICIDE USE ON CALIFORNIA GRAPES

ACRES: 655,000
PRODUCTION:
VALUE ($/YR): $2,158,000,000
VOLUME (LBS/YR): 10,506,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
BT	6	39,300
CARBARYL**	5	32,750
CARBOFURAN**	2	13,100
CHLORPYRIFOS**	16	104,800
DIAZINON**	2	13,100
DIMETHOATE**	2	13,100
FENAMIPHOS**	14	91,700
FENBUTATIN OXIDE	5	32,750
IMIDACLOPRID	10	65,500
MALATHION**	1	6,550
METHOMYL**	6	39,300
METHYL PARATHION**	1	6,550
NALED**	4	26,200
PROPARGITE**	32	209,600

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Plant parasitic nematodes are microscopic roundworms that feed on plant roots by penetrating and sucking the cell contents with a needle-like mouthpart. Nematodes live in the soil and feed on roots, reducing the vigor and yield of the vine. Nematodes induce giant cell formation (root galls) that disrupt uptake of nutrients and water, and interfere with plant growth. A typical vine may harbor 10 million plant parasitic nematodes.

An adult female grape mealybug is about one-fifth of an inch long and can lay as many as 600 eggs in an ovasac, a loose cottony mass. The crawlers that hatch feed on fruit and foliage. Grape mealybugs contaminate fruit with the cottony egg sacs, immature larvae, adults, excreted honeydew, and black sooty mold growing on honeydew. Mealybug presence and honeydew may cause fruit to be culled.

Importance of insecticides:

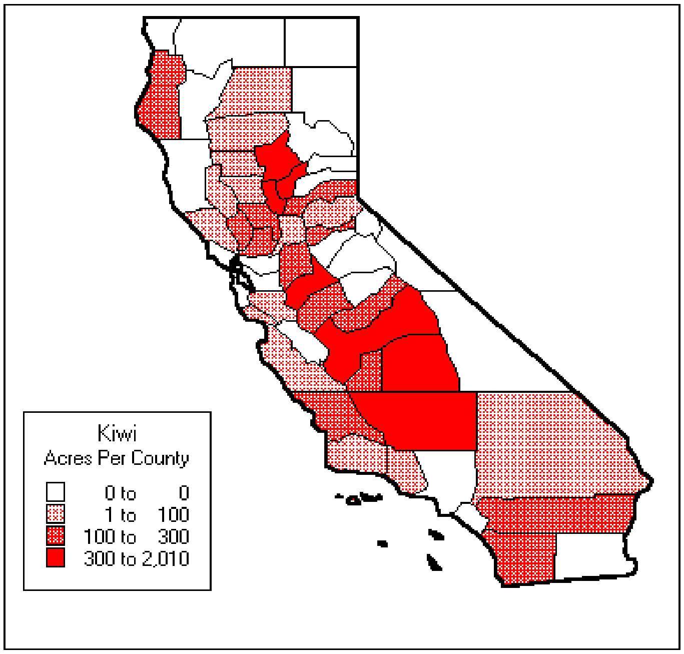
Prior to its cancellation in 1991, ethyl parathion was the primary control measure for grape mealybug. In 1996, a special local needs registration was granted for use of chlorpyrifos to control grape mealybug in California. Research indicated that a dormant application of chlorpyrifos, when directed at vine trunks, proved to be the most effective chemical control of grape mealybug.

Growers are advised to take soil samples and have them diagnosed for nematodes. If nematodes are present in a vineyard in high populations, growers can apply fenamiphos or carbofuran down along the grapevine row for control. Research has shown that the nematicide treatment produces a twenty-fold return on investment within two years. An alternative nematicide treatment used by many conventional and some organic growers is to fumigate the soil with methyl bromide prior to planting new vines. To rid an old vineyard site naturally of nematodes, it is necessary to forgo planting grapes for more than four years.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON CALIFORNIA KIWI

ACRES: 6,600
PRODUCTION:
VALUE ($/YR): $18,413,000
VOLUME (LBS/YR): 64,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
BT	18	1,188
CRYOLITE	24	1,584
FENAMIPHOS**	4	264
METHIDATHION**	16	1,056
OIL	4	264
PHOSMET**	5	330

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Scale insects attack the bark and fruit of kiwi. Heavy infestations affect the vigor of the plant and result in the presence of scales on fruit, causing it to be off grade. Scale infestations also cause premature fruit softening. This is a significant problem to packers storing kiwi fruit for extended periods. In the early 1980's, the kiwi fruit industry suffered significant fruit cullage from scale infestations in older vines. Of equal importance is Japan's importation requirement that any scale-infested fruit lots be fumigated, that results in additional costs and lower grower returns. Kiwi is a most susceptible host for root knot nematode, which causes serious deformity and dysfunction of the root system.

Importance of insecticides:

In the 1980's field research indicated that registered insecticides did not provide adequate control of scale. Subsequent research with methidathion indicated that scale infestations were reduced by 76 - 83 percent in comparison to the untreated check. Currently, methidathion is registered under a special local needs permit to control scale in kiwi. Treatments are applied during the dormant period, preferably after pruning to permit better spray coverage.

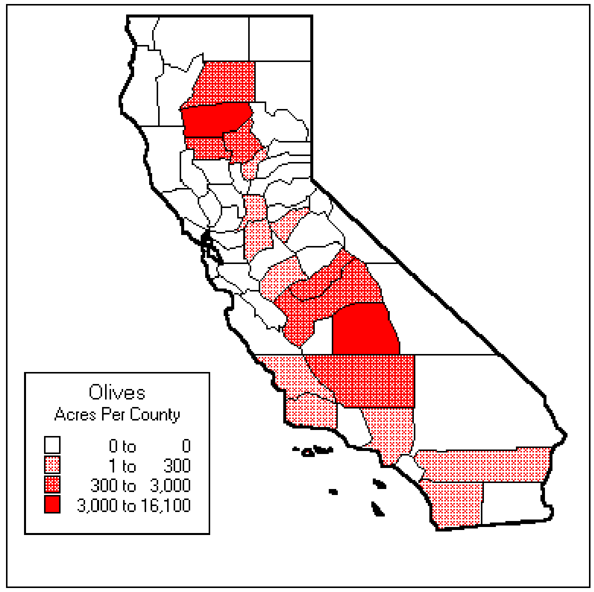
Spray oil is also registered for scale treatment in kiwi. However, research indicates that oil only provides good control where there are low populations of scale but does not give adequate control when scale populations are high. In kiwi vineyards with high populations, methidathion is recommended. The organophosphate phosmet is also used to control scale.

Fenamiphos is the only currently-available postplant nematicide for kiwi fruit. Originally labeled under a Section 18, fenamiphos is applied as a

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON CALIFORNIA OLIVES

ACRES: 35,000
PRODUCTION:
VALUE ($/YR): $63,000,000
VOLUME (LBS/YR): 200,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	17	5,950
METHIDATHION**	8	2,800
OIL	17	5,950

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Black scale is the major pest of olives in California. During the 1950's and 1960's, it was generally controlled by chemical treatments each year targeted against the more serious pest, olive scale. When the biological control of olive scale became fully effective during the late 1960's, chemical treatments for it were discontinued, and black scale reemerged as the predominant pest. Black scale inserts its mouth parts into the plant to extract carbohydrates. This can reduce fruitbud formation, can cause leaf drop and twig dieback and can reduce the next year's crop. Indirect damage also occurs. The sticky honeydew secreted by developing scales may make harvesting difficult and reduce fruit quality. Sooty mold also develops on the honeydew, shades leaves, thereby depressing photosynthesis and respiration. Efforts to control black scale have comprised one of the largest biological control programs ever undertaken. Beginning in the 1890's, about 70 species of natural enemies have been introduced to control black scale in California. Fewer than 15 have become established, and none has proved to be an effective control agent in olives.

Importance of insecticides:

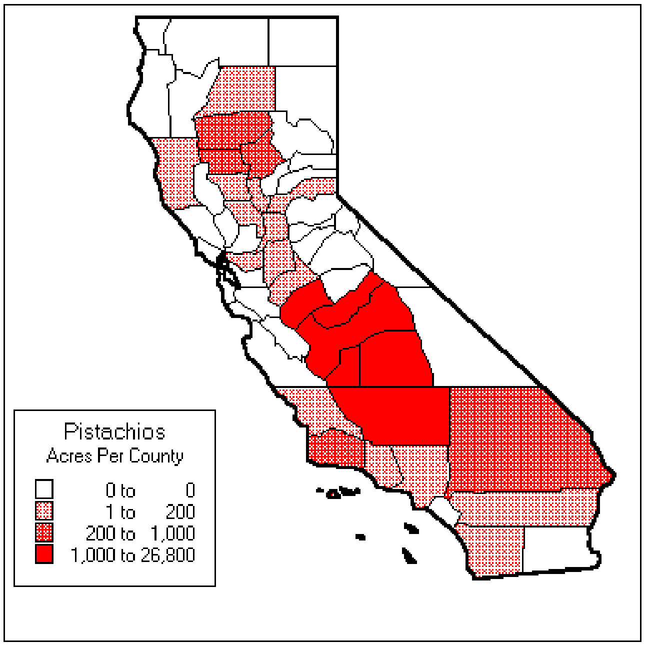
Dormant oil treatments are effective against light to moderate infestations of black scale, especially when used in conjunction with pruning to open the orchard canopy. With less dense foliage, black scale does not survive well in hot, dry growing conditions. This practice is not so effective in cooler, more humid climates. For heavy or serious black scale infestations organophosphate and carbamate insecticides are recommended. Pesticides are most effective against first and second instar nymphs found in summer. Postharvest treatments are also possible.

Diazinon and carbaryl are recommended for summer applications for black scale while methidathion and carbaryl are recommended for postharvest applications.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Adin Hester at the Olive Growers Council (209)734-1710

INSECTICIDE USE ON CALIFORNIA PISTACHIOS

ACRES: 64,300
PRODUCTION:
VALUE ($/YR): $118,680,000
VOLUME (LBS/YR): 179,400,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	30	19,290
BT	1	643
CARBARYL**	10	6,430
OIL	40	25,720
PERMETHRIN	40	25,720

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Pistachio production in California is relatively new. In 1968, less than 300 acres of pistachios were growing in California. Orchard planting expanded rapidly during the 1970's until there were 43,000 acres of pistachios growing in California by 1982. Initially, pistachios were relatively free of insect infestations, but as more orchards came into bearing, reports of nutmeat damage by navel orangeworm (NOW) became common. A sizable portion of the pistachio orchard acreage is located near almond orchards. Pistachio nuts begin to split open and become susceptible to NOW just as the moths of the large second generation emerge from almonds. NOW infected kernels account for 84 percent of aflatoxin in pistachios according to research conducted by the University of California.

Importance of insecticides:

Pistachios are susceptible to infestation by NOW for only a short period during August when the skin of the fruit begins to crack and split, making an attractive place for the adult moths to lay their eggs. The first signs of an infestation are small, pinhole size entries into the nutmeat. As worms grow in size, the entire nut is fed upon and extensive amounts of webbing and frass are present.

Azinphos methyl is the preferred insecticide for navel orangeworm control in pistachios because of its longer residual effect and its effectiveness in the control of hatching NOW. The alternative chemicals have shorter residual effectiveness and do not provide the same level of NOW control. Azinphos methyl continues to provide the only adequate control of the navel orangeworm – the major pest responsible for the spread of aflatoxin.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Gary Weinberger at the California Pistachio Commission (209) 582-3006.

INSECTICIDE USE ON CALIFORNIA STRAWBERRIES

ACRES: 22,572
PRODUCTION:
VALUE ($/YR): $634,126,000
VOLUME (LBS/YR): 1,304,800,000

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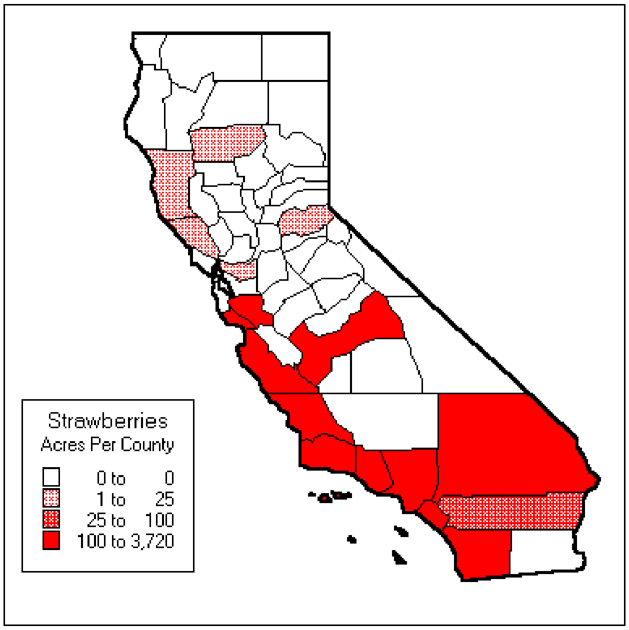

INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	75	16,929
BT	54	12,189
CARBARYL**	25	5,643
CHLORPYRIFOS**	19	4,289
DIAZINON**	18	4,063
MALATHION**	53	11,963
METHOMYL**	23	5,192
NALED**	14	3,160

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The lygus bug is the primary late season pest of summer season strawberries grown in the central coast region. When left uncontrolled, lygus feeding can cause damage to 40 to 60 percent of the summer season fruit. Lygus have piercing, sucking mouthparts. They feed on the surface of the developing fruit, preventing growth of the fruit tissue. Feeding by lygus bugs reduces berry size and weight and causes severe distortion of the fruit, making it unmarketable or of greatly reduced value. Adult lygus bugs overwinter outside of strawberry fields and fly in following planting. Three generations of nymphs hatch in central coast strawberries during the season. Lygus is a native insect. Research has shown that it is extremely difficult to control native insects on introduced cultivated crops with biological control. Also, lygus are a direct pest (feed directly on the fruit) and have an extremely low economic threshold of one bug per 10-20 plants. Caterpillar pests are also controlled by the use of organophosphates and carbamates. They are generally used if Bt's can not control a rapidly increasing population or when weather conditions prevented the application of Bt's at an early stage of the pest life cycle. Bt's are ineffective in controling pre-adult and adult caterpillars. This includes the entire state of California and is critical during winter and early spring in California..

Importance of insecticides:

Most organophosphate and carbamate insecticides (naled, malathion, methomyl) applied to central coast strawberries are targeted at lygus bug. Pest mortality is achieved only by direct contact of the lygus with the insecticide. There is no residual control. Effectiveness of the organophosphates and carbamates is uneven (considerable resistance occurs). The recent registration of two pyrethroid insecticides has increased lygus control options. However, lygus have a history of rapid development of resistant populations. For resistance management purposes, alternating organophosphates, carbamates and pyrethroids is advised. Malathion is the only pesticide currently registered on strawberries for the control of Lygus that works into integrated pest management programs. The other pesticides (pyrethroids) are all very disruptive to the control of the two spotted mite. Two spotted mites are kept under control during the long California production season by management of the natural occuring enemies, introduction of predatory mites, and judicious use of pesticides. The pyrethroids also cost from $15 to $35/A more than the organophosphates. Insecticidal soaps reduce lygus by only 50 percent. The soaps can be phytotoxic to the plants. Bio-control with egg parasitoids is very expensive and fails at even low abundance of lygus bugs. Growers have been experimenting with suction devices (bug-vacs) to control lygus. Research has shown that the bug vacs reduce overall damage to the crop by only 10 percent, and vacuums may increase problems by spreading disease organisms.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Frank Westerlund at the California Strawberry Commission (408)-724-1301

INSECTICIDE USE ON CALIFORNIA SUGARBEETS

ACRES: 101,000
PRODUCTION:
VALUE ($/YR): $125,528,000
VOLUME (LBS/YR): 5,940,000,000

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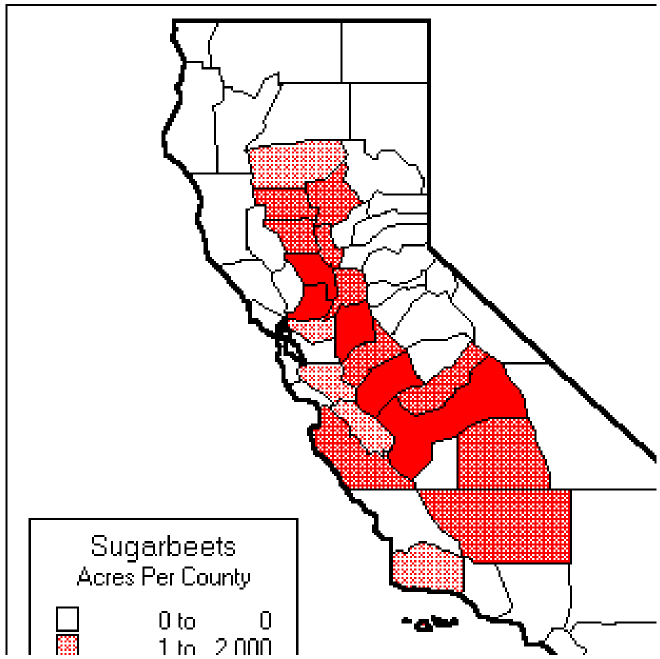


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	5	5,050
BT	2	2,020
CARBARYL**	19	19,190
CHLORPYRIFOS**	83	83,830
DIAZINON**	30	30,300
MALATHION**	13	13,130
METHOMYL**	39	39,390
NALED**	6	6,060
PHORATE**	14	14,140

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Green peach aphid and black bean aphid spread a disease identified as beet yellows virus. This disease can reduce yields of sucrose by 40 percent or better in heavily infected fields, which makes the crop uneconomic. It is controlled by an IPM program to reduce the spread of disease through the establishment of zones of harvest and planting, and planting when the aphids are inactive at temperatures above 85ºF. In addition, aldicarb must be used at planting time to protect seedlings. When aphids infect the crop unexpectedly, growers use carbaryl, diazinon and malathion to control the aphids. Beet leafhoppers spread curly top virus disease to sugarbeets and other crops in California. The disease can cause complete loss to sugarbeet plantings in severe infestations. The disease is controlled by planting varieties that have some resistance to the disease and the use of phorate to control the leafhopper vector. The Curly Top Control Advisory Board also oversees a spraying program, treating non-crop range lands where the beet leafhopper overwinters to control the vector before it moves onto crop lands. Malathion is sprayed to control the insects in the non-crop areas. The treated area amounts to about 200,000 acres of range land annually. Worm complex: A number of species of root- and leaf-feeding worms affect sugarbeets. These are identified as the beet armyworm and a number of cutworm varieties that live above and below soil levels. They can cause complete losses as the crop emerges if not controlled and lesser losses when the pests feed on mature leaf surfaces, reducing plant growth and sugar accumulation. These pests are controlled by using carbaryl, chlorpyrifos and methomyl.

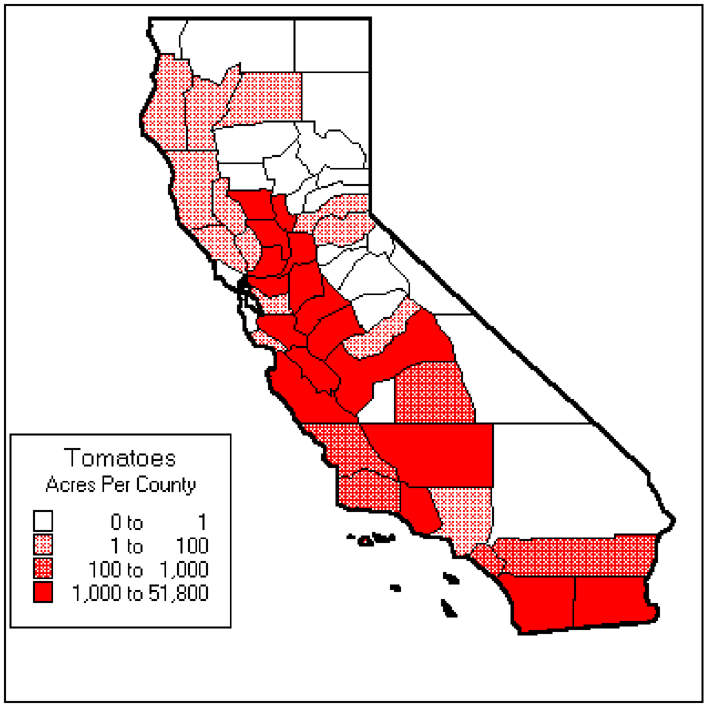
Importance of insecticides:

In spite of naturally-occurring biological control agents, aphid outbreaks commonly occur. In addition, aphid species can transmit viruses in as few as 15 minutes, and predators/parasites may not act quickly enough. No host plant resistance is available to aphids. The implementation of FQPA could result in the loss of registrations of organophosphates, carbamates and organochlorines; this would leave only imidacloprid for aphid management. The availability and use of only one material would be the worst-case situation for IPM. The range of modes of action inhibits the build-up of insecticide resistance in the aphids. The use of biological insecticides has not become established in sugarbeet production. Many growers have tried the many brands of Bt and have decided they are not effective. Armyworm management options presently are limited to insecticide applications. Growers cannot allow the crop to be defoliated by armyworms. Potential loss of chlorpyrifos or methomyl would cause severe hardships on the industry until alternatives are researched and subsequently proven effective to growers. Methomyl and naled have been a good combination for growers attempting to control both leafhoppers and armyworms. Growers monitor for both pests and spray for the combination, even if neither pest by itself would be damaging. There are no known biological controls of leafhoppers. No host plant resistance for leafhopper is known, and, currently, none is being investigated. One of the obvious threats to the curly top program is the potential loss of phorate and malathion. Both insecticides are pivotal for continued field and regional scale management.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Ben Goodwin at the California Beet Growers Association (209)-477-5596

INSECTICIDE USE ON CALIFORNIA TOMATOES

ACRES: 351,000
PRODUCTION:
VALUE ($/YR): $904,580,000
VOLUME (LBS/YR): 22,500,120,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	4	14,040
AZINPHOS-METHYL**	4	14,040
BT	9	31,590
CARBARYL**	15	52,650
DIAZINON**	10	35,100
DIMETHOATE**	30	105,300
ESFENVALERATE	42	147,420
MALATHION**	4	14,040
METHAMIDOPHOS**	14	49,140
METHOMYL**	21	73,710
OXAMYL**	2	7,020

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Organophosphate insecticides are targeted primarily at three insect species in California processing tomato fields: wireworms, potato aphids and stink bugs. Wireworms are soil inhabiting larvae of beetles that injure tomato seedlings by feeding on roots or boring into stems. When wireworms are uncontrolled, stands of tomato plants can be reduced by as much as 60 percent. During the past few years the potato aphid has become an increasingly important pest of processing tomatoes. The potato aphid usually does not appear until early July when temperatures begin to soar. Potato aphids suck juices from the plants, distorting leaves and stems. Aphids produce a sticky honeydew that attracts sooty mold to the fruit. In uncontrolled fields where aphids moved in about eight weeks before harvest, yield reductions of 10 tons per acre occurred. Stink bugs have become a major problem for production of tomatoes grown in California. Stink bugs inject a toxin during feeding that results in a white corky area that is especially noticeable as the fruit ripens, rendering it unmarketable for either the fresh market or whole peeled processing.

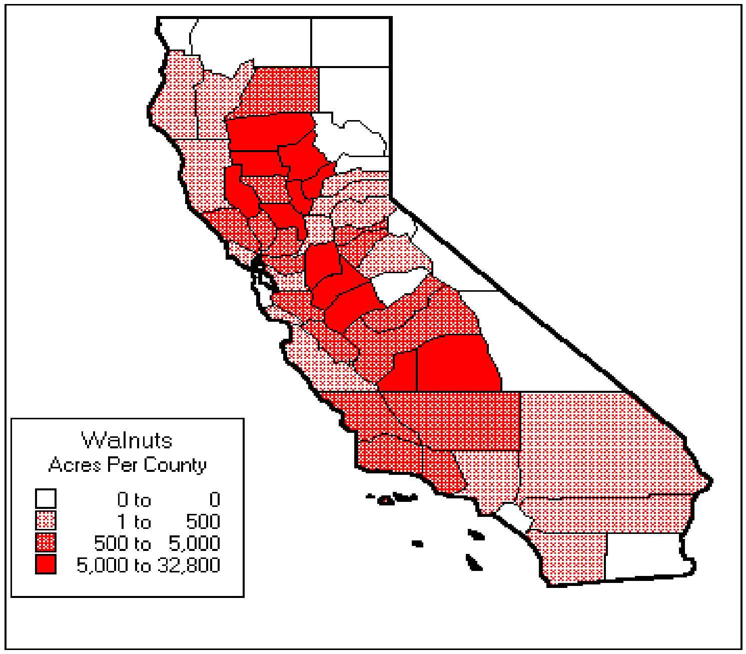
Importance of insecticides:

Diazinon is used at planting for control of wireworms. Fonofos, an alternative, was canceled recently. No other insecticides are recommended for wireworm control. Methamidophos is the most widely-used insecticide for stink bug control, as it is the only effective insecticide for stink bug control. Dimethoate is the only effective treatment for potato aphids. A certain amount of parasitism by natural enemies occurs to aphids. However, since it takes time for the parasites to move in after the aphids reach high levels, natural parasitism usually cannot substitute for a chemical spray. Research with insecticidal soaps indicated control levels of only 40 to 50 percent. The carbamate, methomyl plays a major role in worm treatments as a knockdown tank mix with pyrethroids. The carbamate, carbaryl is used close to harvest for both late worm hatches and to control flea beetle hatching under the fruit calyx, which causes processor rejection due to insect contamination.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Charles Rivera, California Tomato Research Institute (209)838-1594

INSECTICIDE USE ON CALIFORNIA WALNUTS

ACRES: 169,000
PRODUCTION:
VALUE ($/YR): $322,400,000
VOLUME (LBS/YR): 464,000,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	19	32,110
CHLORPYRIFOS**	35	59,150
DIAZINON**	7	11,830
DIFLUBENZURON	7	11,830
ESFENVALERATE	17	28,730
MALATHION**	4	6,760
METHIDATHION**	8	13,520
NALED**	1	1,690
PERMETHRIN	11	18,590
PROPARGITE**	20	33,800
TEBUFENOZIDE	15	25,350

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Controlling codling moth is the key to managing other insects and mite pests in walnuts. No adequate cultural or biologic controls are currently available; so management depends entirely on the use of insecticides. A distinct race of codling moth has evolved that prefers walnuts and has a life cycle well-synchronized with the development of early walnut cultivars. Each overwintering female deposits about 60 eggs singly on leaves near nuts or on nuts themselves. There are two additional generations of codling moth in walnuts prior to harvest. First generation larvae reduce yield directly by causing nutlets to drop from the trees. The excreted frass of the first generation codling moth serves as an egg-laying stimulant for the navel orangeworm, which gravitates to the frass on the nut and burrows in to lay its eggs. Nuts attacked by second and third generation codling moth remain on the trees but are not marketable because of the feeding damage to the kernel.

Importance of insecticides:

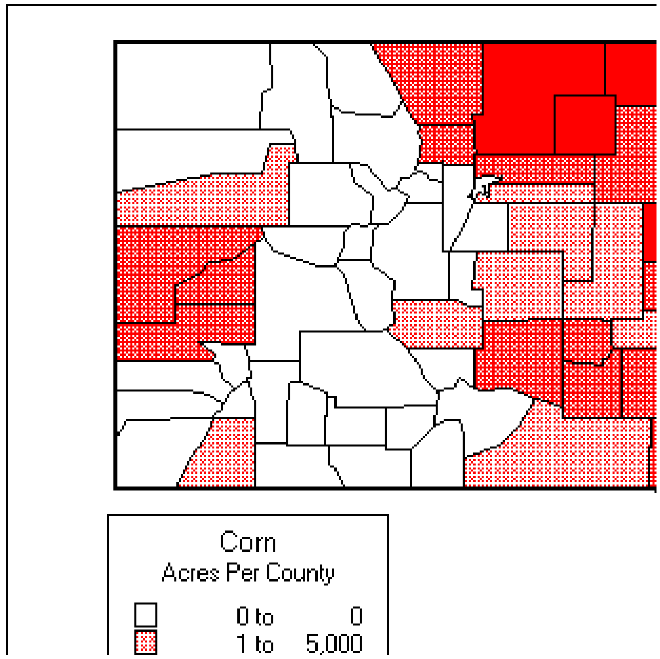
The organophosphate insecticides chlorpyrifos, methidathion and azinphos-methyl are recommended as treatments against all three generations of codling moth in walnuts. Chlorpyrifos has been the most widely-used insecticide for codling moth control in California walnut orchards. Chlorpyrifos is recommended since it is effective, and it is less toxic to beneficial organisms in the orchard, which normally control aphids and mites.

The recent registration of the insect growth regulators diflubenzuron and tebufenozide for codling moth in walnuts has provided growers with an alternative to the use of organophosphates. These new products provide adequate control of low and moderate populations of worms and should help delay the acceleration of resistance to organophosphate insecticides. The IGR's do not affect adult worms. The new products are not as effective as the organophosphates when high populations are present. Application timing and coverage are more critical with the insect growth regulators because the codling moth eggs must be deposited on the residue with diflubenzuron, and the young larvae must ingest the residue with

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON COLORADO CORN

ACRES: 1,030,000
PRODUCTION:
VALUE ($/YR): $398,507,000
VOLUME (LBS/YR): 10,526,600,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBOFURAN**	5	51,500
CHLORPYRIFOS**	3	30,900
DIMETHOATE**	11	113,300
METHYL PARATHION**	1	10,300
PERMETHRIN	14	144,200
PHORATE**	6	61,800
TEFLUTHRIN	4	41,200
TERBUFOS**	39	401,700

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The western corn rootworm (WCR) attacks corn in Colorado. The WCR overwinters in the egg stage, with the eggs starting to hatch in late spring. After hatching, the small rootworm larvae move to nearby corn roots and begin feeding on root hairs and small roots. Larger rootworms feed on and tunnel into primary roots. Under heavy rootworm pressure, root systems can be destroyed completely. Rootworm damage also can result in extensive lodging that makes the crop difficult to harvest mechanically. By early July, most rootworm larvae have finished feeding and have transformed into adult beetles that emerge from the soil to feed, mate and lay eggs. These eggs produce the larvae that will attack the following year's corn crop. Corn rootworm must feed on corn roots in order to develop. If they hatch in a field rotated out of corn, they will starve to death since they are unable to move more than 10 to 20 inches in search of food. There are no commercial varieties resistant to corn rootworms. Some continuous corn fields have rootworm populations large enough to justify the use of a soil insecticide at planting. Colorado growers are advised to scout their corn crop, and if records from the previous year show total beetle counts for a field average more than three-quarters beetle per plant on any day scouted in August or September, insecticide treatment is prudent. Mites can be serious corn pests in Colorado. They feed on the underside of leaves, eventually killing the leaf and leaving it with a scorched or burned appearance. In 18 years of research at Rocky Ford, corn yield losses from mites averaged 21 percent. Many Colorado corn fields go untreated each year because the mites are held in check by various predators. However, during hot dry conditions, biological control agents cannot keep up with the increasing mite populations.

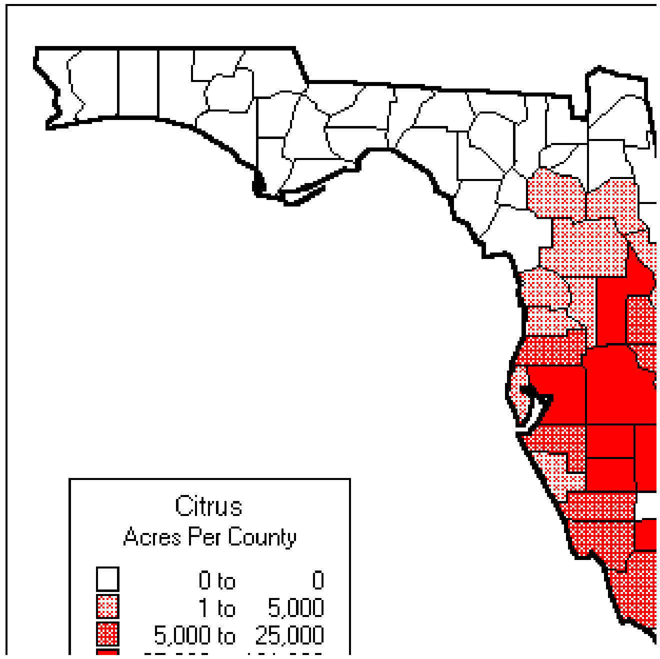
Importance of insecticides:

Granular insecticides applied at cultivation have provided the most consistent control in Colorado State University tests. Approximately 80 percent of Colorado's field corn acreage is planted to continuous corn while the remainder is rotated annual with a dry bean crop. Colorado corn growers most often use the organophosphate insecticide terbufos for rootworm control. The dominant use of terbufos results from its consistent performance over two decades under conditions of heavy pressures of western corn rootworm associated with continuous corn. Colorado corn yields are projected to decline by 12 percent if the rootworm were to be uncontrolled. Eleven percent of Colorado's corn acreage is treated with the organophosphate insecticide dimethoate for control of Banks Grass Mite.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON FLORIDA CITRUS

ACRES: 887,000
PRODUCTION:
VALUE ($/YR): $1,402,000,000
VOLUME (LBS/YR): 24,100,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	56	496,720
ALDICARB**	20	177,400
CHLORPYRIFOS**	9	79,830
ETHION**	21	186,270
FENBUTATIN OXIDE	11	97,570
OIL	92	816,040

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Citrus rust mite is the most serious mite pest of citrus in Florida. Its feeding on a leaf can cause localized de-greening of the upper surface, degreened necrotic spots on the lower surface and subsequent defoliation. Fruit damaged by the exterior feeding of citrus rust mites develop severe blemishes and discoloration on the surface. Severe injury can result in smaller fruit, lower juice volume, alteration in soluble solids and premature fruit drop, thereby reducing the yield and fresh market value. The citrus rust mite inhabits new fruit and foliage each year in March and April. It is common for growers of fresh market citrus to apply three to four miticide sprays during the year. Growers of processing citrus typically apply one to two treatments for mites. This need to spray frequently for citrus mites is influenced by its biological attributes; that is, its inherent ability to increase to enormous populations on fruit quickly and its small size that makes monitoring extremely difficult in the grove.

Fire ants can make harvesting and daily grove work in Florida miserable. When their nests are disturbed during harvesting or typical daily grove work, numerous fire ants will emerge and attack any intruder. These ants are notorious for their painful, burning stings that result in pustules and intense itching that may persist for 10 days.

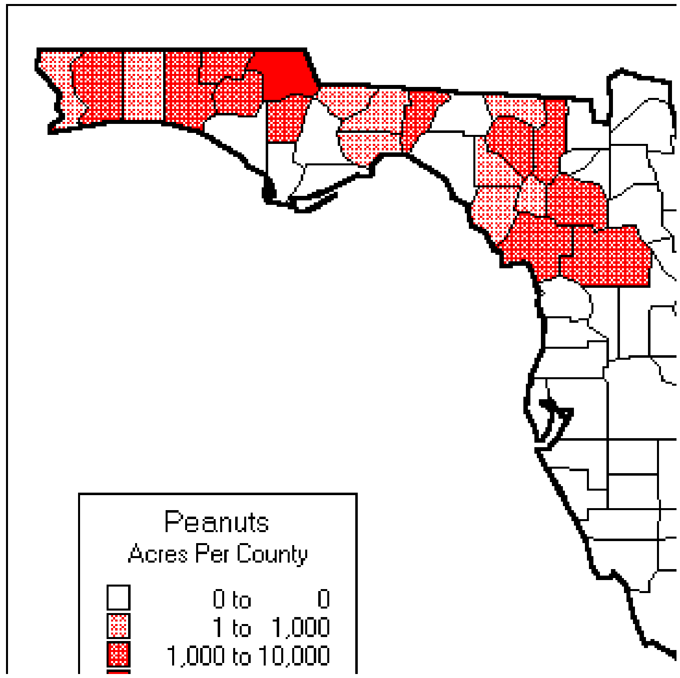
Importance of insecticides:

Prior to the development to synthetic chemicals, the citrus rust mite was controlled in Florida citrus groves almost exclusively by applications of sulfur sprays or dusts. Sulfur no longer is recommended for mite control because it destroys a wide range of natural species that control several insect pests. The organophosphate ethion has been used for 20 years and is a mainstay of Florida citrus pest management. By mixing ethion with oil, there is a synergistic effect that leads to control of the rust mite, spider mites, thrips, scales and whitefly. Recently introduced selective miticides do not have the same broad spectrum, and there is concern that reliance on selective materials will lead to an emergence of secondary pests. Use of ethion allows rotation with other miticides that are not organophosphates. Utilizing insecticides/miticides that have different modes of action is important to Florida citrus pest resistance management programs. After 20 years of use, ethion is still effective on the rust mite. Ethion is less expensive than alternatives, and with the low price of orange juice, growers find it economical to continue ethion applications. Chlorpyrifos is the only insecticide registered for use in bearing citrus groves for control of fire ants. Aldicarb is a granular insecticide that is applied to the soil and provides residual control of the rust mite, whiteflies, nematodes and aphids.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON FLORIDA PEANUTS

ACRES: 92,000
PRODUCTION:
VALUE ($/YR): $55,000,000
VOLUME (LBS/YR): 230,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	5	4,600
ALDICARB**	65	59,800
CARBARYL**	5	4,600
CHLORPYRIFOS**	70	64,400
DISULFOTON**	7	6,440
ESFENVALERATE	2	1,840
METHOMYL**	15	13,800
PHORATE**	5	4,600

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The fungi that produce aflatoxin are found commonly in the light soils used to grow peanuts. Prior to 1960, the contamination of peanuts by aflatoxin was not considered to be a significant problem. By 1960, the peanut industry was much more concerned after it was determined that animals had been poisoned by aflatoxin. When the lesser cornstalk borer (LCB) feeds on peanut pods, they often weaken or pierce the shell. This provides a point of entry for the aflatoxin-producing fungi. Tests show a 94 percent correlation between damage caused by the LCB and the number of aflatoxin-producing fungi.

Thrips feed by rasping tender leaf surfaces and sucking plant juices. This results in dwarfing and malformation of leaves. Thrips feeding spreads tomato spotted wilt virus. The only known method of tomato spotted wilt virus transmission is by thrips. Infection with the virus results in reduction of pod size and number. Seed production in infected plants may be reduced in size, be malformed and have discolored seed coats. Cultivars with complete resistance to the virus are not available. Disease can weaken the plant severely or even kill it.

Importance of insecticides:

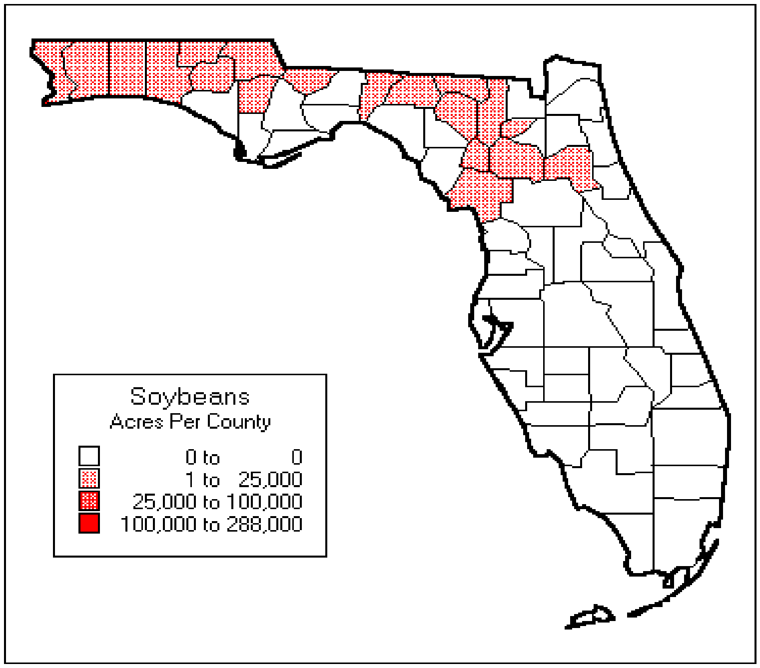
The only recommended treatment for LCB control is the organophosphate insecticide chlorpyrifos, that reduces the LCB populations by 80 percent, while the most efficacious non-organophosphate alternative reduces the LCB populations by only 40 percent. Chlorpyrifos treatments for LCB have been rising in recent years because of the research showing the correlation between LCB and aflatoxin in peanuts. Chlorpyrifos is the only effective insecticide for a number of other soil insect pests of peanuts – wireworms and rootworms. In areas where soil insects are causing economic damage, lack of controls can cost growers several hundred pounds of peanuts per acre. The organophosphate and carbamate insecticides phorate, disulfoton, acephate and aldicarb are used primarily for control of thrips.

Aldicarb and phorate work equally well in suppressing thrips population. Phorate provides significant suppression of spotted wilt epidemics. Phorate may produce a defense response in the peanut plant that allows the plant to resist infection more effectively, or inhibit virus replication. In 22 trials, the use of phorate to control thrips reduced the incidence of tomato spotted wilt virus by 18 percent and increased yields by 32 percent over the untreated check.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON FLORIDA SOYBEANS

ACRES: 49,072
PRODUCTION:
VALUE ($/YR): $7,031,000
VOLUME (LBS/YR): 78,122,220



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
DISULFOTON**	1	491
ESFENVALERATE	10	4,907
METHOMYL**	5	2,454
METHYL PARATHION**	15	7,361
PERMETHRIN	10	4,907

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Stink bugs damage soybeans by inserting their piercing, sucking mouthparts through the pod into the soybean seed. The insect injects a substance into the seed that partially liquefies the tissues so that they can be withdrawn. The result is a discolored and often sunken spot in the seed. In the process of feeding, the stink bugs inoculate pods with yeast bud disease organisms, causing shriveling of the bean seed. When underdeveloped seeds are attacked, pods frequently are aborted. Damaged beans have a poorer milling quality, less vigor and reduced germination. Soybean processors discount soybeans with stink bug damage. Discounts at the elevator because of stink bug damage are determined at one-fourth the actual percentage of damaged seeds. Studies indicate that an average of one stink bug per foot of row reduces soybean yield 10 percent.

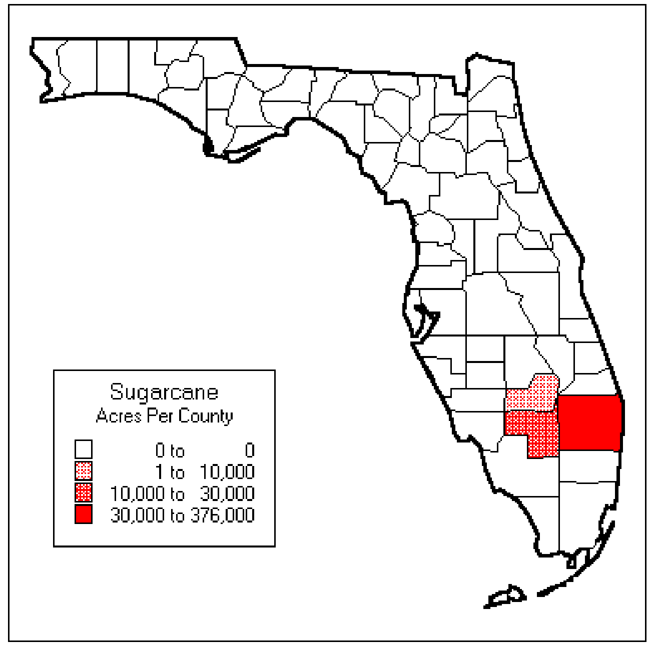
Importance of insecticides:

Currently, the only method of controlling stink bugs is by chemical application. Methyl parathion is effective, economical and widely-used for stink bug control in the South. Growers are advised to scout for stink bugs and treat when the number of stink bugs exceed one to three per foot of row (depending on stage of pod development). Successful biological control of stink bug has been observed in several parts of the world. However, releases of parasites in the U.S. has not reduced stink bug to sub-economic levels. Natural parasites of the stink bugs produce only 25 to 50 percent control. Methyl parathion produces 90 percent control of stink bugs. Many growers are still reluctant to scout for stink bugs, and losses because of untreated stink bugs still occur.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON FLORIDA SUGARCANE

ACRES: 445,999
PRODUCTION:
VALUE ($/YR): $460,621,000
VOLUME (LBS/YR): 30,304,014,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ETHOPROP**	8	35,680
PHORATE**	19	84,739

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Corn wireworm is widespread in all the areas where sugarcane is grown in Florida. Corn wireworms damage the eyes, lateral shoots and young shoots of plant cane. Some form of protection from infestation is needed until the plant is established. Because sugarcane is a three-year perennial crop in Florida, only one-third of the acreage is planted each year.

There are non-chemical management alternatives available. Flooding provides good control of wireworms, but recent water management regulations in Florida restrict the use of this practice. Rotation of sugarcane with paddy rice also provides good control of wireworms. However, this practice is only feasible if the rice crop can be produced profitably.

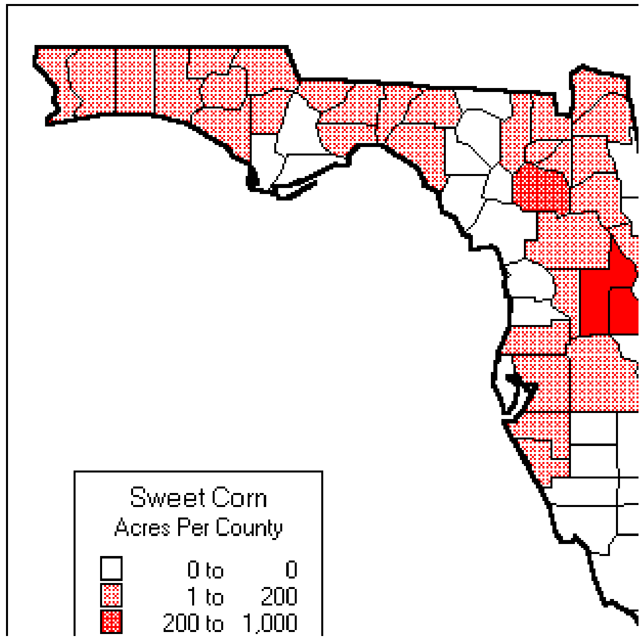
Importance of insecticides:

It is projected that when plant cane is not treated with soil insecticides, there is a yield loss of approximately 10 percent in the first harvest. The yield of the ratoon crop may also be reduced when soil insecticides are not applied at planting. The University of Florida recommends organophosphate or carbamate insecticides be applied at planting for wireworm control. Generally, all the seed cane is treated with organophosphates, ethoprop and phorate being the most widely used. Resistance may not have occurred because wireworm populations are only exposed to the chemicals one year in a three year period.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON FLORIDA SWEET CORN

ACRES: 41,600
PRODUCTION:
VALUE ($/YR): $103,000,000
VOLUME (LBS/YR): 564,200,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	4	1,664
CHLORPYRIFOS**	55	22,880
DIAZINON**	22	9,152
ESFENVALERATE	14	5,824
LAMBDACYHALOTHRIN	41	17,056
METHOMYL**	83	34,528
PERMETHRIN	12	4,992
PHORATE**	20	8,320
TERBUFOS**	22	9,152
THIODICARB**	71	29,536

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The corn earworm and the fall armyworm annually damage the ears of sweet corn grown in Florida. Corn earworm eggs are deposited on the silks, and newly-hatched larvae follow the silks to the kernels. Earworm larvae usually eat tip kernels first. As they get larger, they eat rows of kernels. Larger larvae eat one another, and usually only one reaches maturity in an ear of corn. Masses of fall armyworm eggs are laid on the plants, and larvae find their way to the silk and the ears. Each armyworm female lays about 1,000 eggs in masses of 50 to several hundred. The armyworms and earworms feed directly on the kernels. These two insects make control necessary during the entire time of ear development. They often can be controlled best with insecticides in combination. Wireworms, cutworms and the lesser cornstalk borer attack corn plants underground or at the soil surface.

Aphids attack corn husks, silks, leaves and tassels to suck juices, and they cause sticky surfaces. The allowance for insect damage in U.S. fresh corn is practically zero.

Importance of insecticides:

Prior to the introduction of synthetic chemical insecticides in the late 1940's, the commercial sweet corn industry did not exist in Florida because of the inability to control insect pests. The organochlorine insecticides were used during the 1950's and were replaced by organophosphate and carbamate insecticides, that are still used widely. An at planting application of a granular organophosphate (terbufos or phorate) is recommended to control armyworms, corn earworms or thrips. These treatments control thrips in early plantings and provide some control of worms for seven to ten days after planting. For sweet corn planted in rotation with sugarcane or pasture, there is the risk of wireworm damage, and organophosphates, such as terbufos, are recommended. The most frequently used insecticides – primarily for earworm and armyworm control – are the carbamates methomyl and thiodicarb, that typically are applied seven to nine times during a growing season. Organophosphates, such as chlorpyrifos and diazinon, are recommended for control of aphids, armyworms, billbugs, earworms, corn rootworm (cucumber beetle), cutworms, European corn borers, fleabeetles, borers and seed corn maggots.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON GEORGIA PEANUTS

ACRES: 520,000
PRODUCTION:
VALUE ($/YR): $361,000,000
VOLUME (LBS/YR): 1,336,000,000

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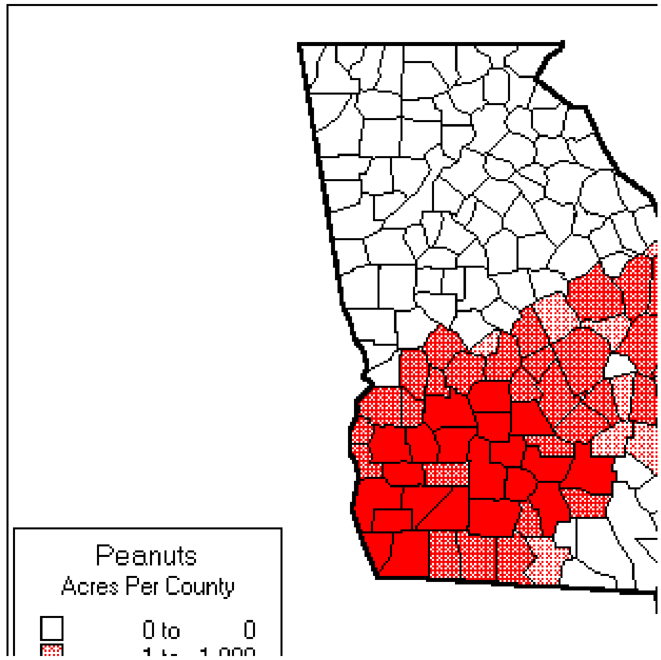


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	12	62,400
ALDICARB**	40	208,000
CARBARYL**	1	5,200
CHLORPYRIFOS**	25	157,576
DISULFOTON**	1	6,303
ESFENVALERATE	10	52,000
LAMBDACYHALOTHRIN	15	78,000
METHOMYL**	15	78,000
PHORATE**	40	208,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:
The fungi that produce aflatoxin are found commonly in the light soils used to grow peanuts. Prior to 1960, the contamination of peanuts by aflatoxin was not considered to be a significant problem. By 1960, the peanut industry was much more concerned after it was determined that animals had been poisoned by aflatoxin. When the lesser cornstalk borer (LCB) feeds on peanut pods, they often weaken or pierce the shell. This provides a point of entry for the aflatoxin-producing fungi. Tests show a 94 percent correlation between damage caused by the LCB and the number of aflatoxin-producing fungi.

Thrips feed by rasping tender leaf surfaces and sucking plant juices. This results in dwarfing and malformation of leaves. Thrips feeding spreads tomato spotted wilt virus. The only known method of tomato spotted wilt virus transmission is by thrips. Infection with the virus results in reduction of pod size and number. Seed production in infected plants may be reduced in size, be malformed and have discolored seed coats. Cultivars with complete resistance to the virus are not available. Disease can weaken the plant severely or even kill it.

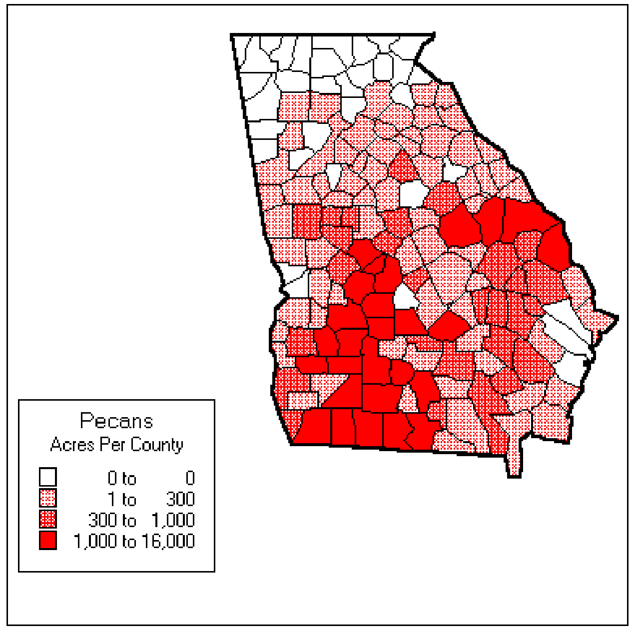
Importance of insecticides:
The only recommended treatment for LCB control is the organophosphate insecticide chlorpyrifos, that reduces the LCB populations by 80 percent, while the most efficacious non-organophosphate alternative reduces the LCB populations by only 40 percent. Chlorpyrifos treatments for LCB have been rising in recent years because of the research showing the correlation between LCB and aflatoxin in peanuts. Chlorpyrifos is the only effective insecticide for a number of other soil insect pests of peanuts – wireworms and rootworms. In areas where soil insects are causing economic damage, lack of controls can cost growers several hundred pounds of peanuts per acre. The organophosphate and carbamate insecticides phorate, disulfoton, acephate and aldicarb are used primarily for control of thrips.

Aldicarb and phorate work equally well in suppressing thrips population. Phorate provides significant suppression of spotted wilt epidemics. Phorate may produce a defense response in the peanut plant that allows the plant to resist infection more effectively, or inhibit virus replication. In 22 trials, the use of phorate to control thrips reduced the incidence of tomato spotted wilt virus by 18 percent and increased yields by 32 percent over the untreated check.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON GEORGIA PECANS

ACRES: 128,016
PRODUCTION:
VALUE ($/YR): $79,961,000
VOLUME (LBS/YR): 75,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	13	16,642
CARBARYL**	25	32,004
CHLORPYRIFOS**	65	83,210
CYPERMETHRIN	40	51,206
DIMETHOATE**	45	57,607
DISULFOTON**	6	7,681
ENDOSULFAN	20	25,603
ESFENVALERATE	10	12,802
LINDANE**	25	32,004
METHYL PARATHION**	15	19,202
PHOSMET**	25	32,004

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Organophosphate insecticides are targeted primarily for control of the pecan nut casebearer, the hickory shuckworm, stink bugs and aphids. The pecan nut casebearer is the most severe early-season pecan nut feeder. It can reduce yields greatly if uncontrolled. The larvae bore inside immature nuts, and each larva destroys several clusters of nuts. Each larva moves from nut to nut, spinning a silken web over the nuts. Often this netting is the only thing that holds the nuts to the stems after they finish feeding. Four to five generations of the hickory shuckworm occur each season. Eggs are deposited on the outside of the pecan shuck, and the hatched larvae bore directly into the shuck. Larvae feed inside the shuck for 15 to 20 days. Stink bugs puncture pecan nuts to feed. The punctures bleed brown sap and the damaged nuts drop from the tree. After shell hardening ,the nuts that stink bugs feed on do not drop from the tree but contain blacks spots on the kernel. This damage lowers quality considerably but it is only apparent after the pecans have been shelled.

Aphids feed on pecan foliage. Aphid feeding results in excreted honeydew that supports the growth of a sooty mold fungus. When they feed, black pecan aphids inject a toxin that can cause the leaf to drop from the tree. Large-scale defoliation can occur in orchards with heavy populations.

Mite feeding can result in the loss of water from leaves and severe defoliation. Mites are often held in check in most pecan orchards by natural enemies.

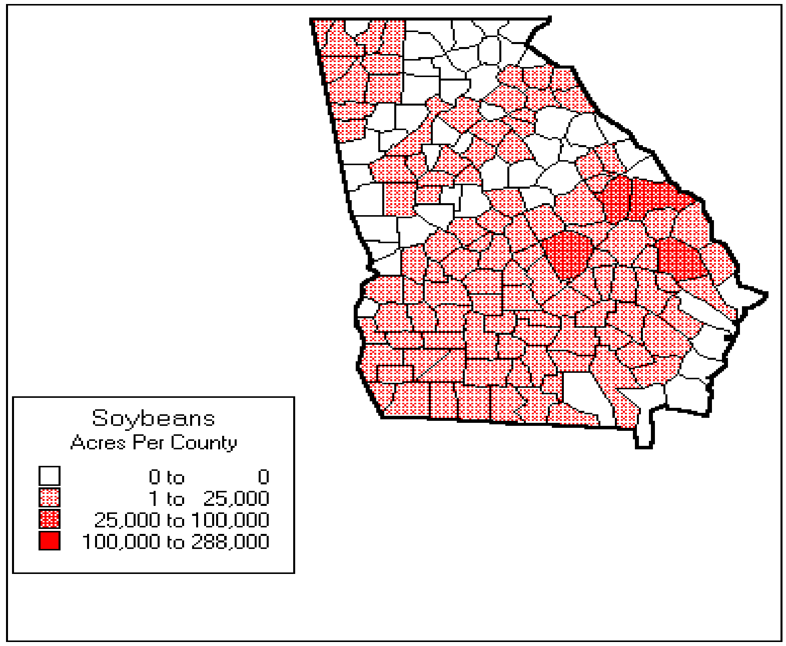
Importance of insecticides:

Chlorpyrifos and phosmet are used primarily for control of pecan nut casebearer and hickory shuckworm. This use grew in the 1990's because of the cancellation of phosalone, which had a longer residual. Methyl parathion is targeted largely for stink bug control while dimethoate and disulfoton are used primarily for aphid control. Pyrethroids are effective for pecan nut casebearer and hickory shuckworm. However, pyrethroids are not recommended for early season applications because of their destruction of beneficial insects and mites, which usually help suppress mite and aphid populations. The use of pyrethroids as alternatives to the OP's would likely result in the need to make miticide applications. Without OP's, resistance to pyrethroids is highly likely to accelerate. Currently, the recommendation is to use an OP with the pyrethroid to forestall resistance to pyrethroids. BT is not a widely-used alternative because of its lack of residual control. There are no viable, effective non-chemical controls currently available

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Thomas Crocker at The University of Georgia (912)-386-3410

INSECTICIDE USE ON GEORGIA SOYBEANS

ACRES: 513,781
PRODUCTION:
VALUE ($/YR): $82,925,000
VOLUME (LBS/YR): 930,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	11	56,516
CHLORPYRIFOS**	1	5,138
METHOMYL**	12	61,654
METHYL PARATHION**	20	102,756
PERMETHRIN	7	35,965
THIODICARB**	5	25,689
TRALOMETHRIN	10	51,378

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Stink bugs damage soybeans by inserting their piercing, sucking mouthparts through the pod into the soybean seed. The insect injects a substance into the seed that partially liquefies the tissues so that they can be withdrawn. The result is a discolored and often sunken spot in the seed. In the process of feeding, the stink bugs inoculate pods with yeast bud disease organisms, causing shriveling of the bean seed. When underdeveloped seeds are attacked, pods frequently are aborted. Damaged beans have a poorer milling quality, less vigor and reduced germination. Soybean processors discount soybeans with stink bug damage. Discounts at the elevator because of stink bug damage are determined at one-fourth the actual percentage of damaged seeds. Studies indicate that an average of one stink bug per foot of row reduces soybean yield 10 percent.

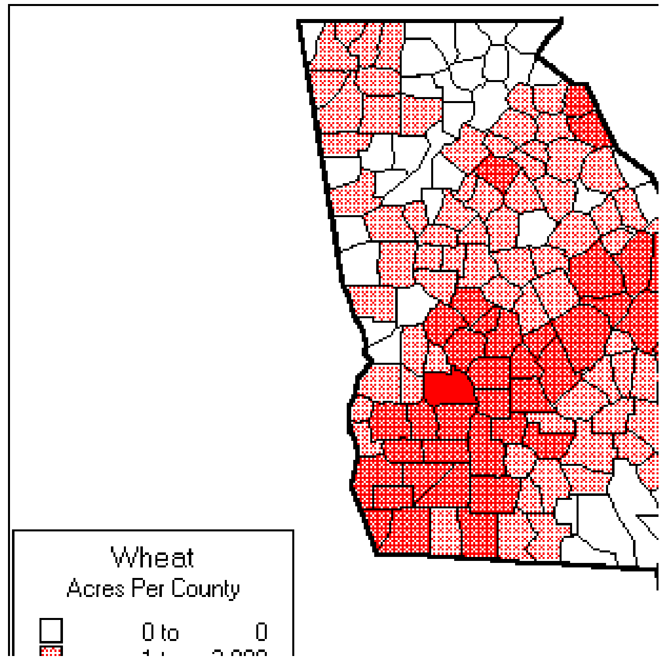
Importance of insecticides:

Currently, the only method of controlling stink bugs is by chemical application. Methyl parathion is effective, economical and widely-used for stink bug control in the South. Growers are advised to scout for stink bugs and treat when the number of stink bugs exceed one to three per foot of row (depending on stage of pod development). Successful biological control of stink bug has been observed in several parts of the world. However, releases of parasites in the U.S. has not reduced stink bug to sub-economic levels. Natural parasites of the stink bugs produce only 25 to 50 percent control. Methyl parathion produces 90 percent control of stink bugs. Many growers are still reluctant to scout for stink bugs, and losses because of untreated stink bugs still occur. In 1992, in Georgia uncontrolled stink bugs caused three million dollars worth of damage to soybeans.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON GEORGIA WHEAT

ACRES: 360,000
PRODUCTION:
VALUE ($/YR): $51,000,000
VOLUME (LBS/YR): 950,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
METHYL PARATHION**	5	18,000
PHORATE**	25	90,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The two main insect pests of wheat in Georgia are the Hessian fly and aphids. The fly reportedly came to America during the Revolutionary War on ships that carried the Hessian mercenaries, their horses and the wheat straw that served as fodder. Hessian fly adults live 24 to 48 hours and a female lays an average of 200 eggs. The hatched larvae move to the base of the leaf where they suck plant juices from the stem. Stems may die, but usually lodge before harvest. Frequently the heads are smaller and poorly filled with low quality grain.

In recent years, problems with aphids and barley yellow dwarf, an aphid vectored virus, have increased in importance in some wheat growing areas of Georgia. Barley yellow dwarf is probably the most destructive virus disease of wheat. Diseased plants usually are dwarfed. Leaf discoloration in shades of yellow, red or purple is a typical symptom of the virus. Seedling infestations, if not controlled, slow plant growth. Aphids can be carried on wind currents for miles. Aphids acquire the virus by feeding on infected plants, then transmit the virus by feeding on healthy plants. Infections can occur throughout the growing season. Controlling aphids in wheat fields with insecticides can reduce the incidence of barley yellow dwarf and increase yields, especially when autumn infections are reduced.

Importance of insecticides:

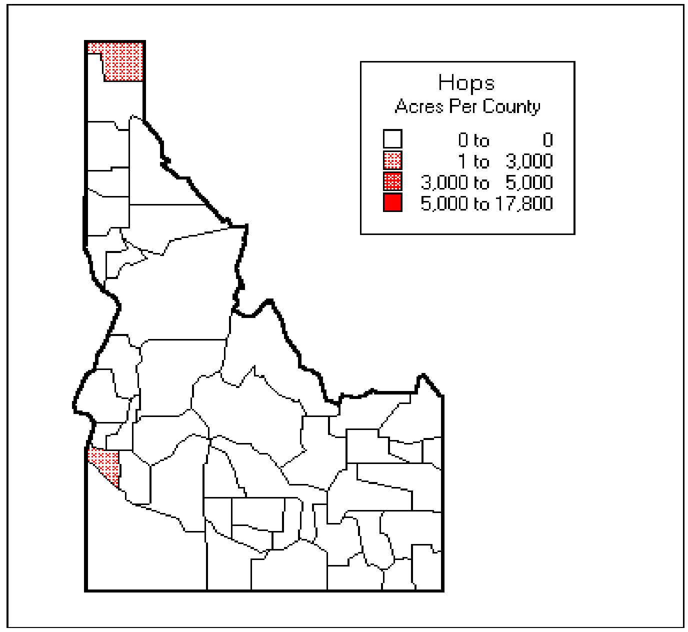
Experimental treatments with organophosphates at planting increased yields of wheat by 10 to 12 bushels per acre by providing control of Hessian fly. Systemic organophosphate insecticides (disulfoton and phorate) are recommended in Georgia at planting to eliminate the risk of wheat stand loss from Hessian flies in early plantings. Repeated tests have shown that in furrow treatments with organophosphates provide excellent control of fall and winter Hessian fly generations. Egg laying also is reduced by controlling the two prior generations.

An additional benefit to using insecticides at planting is a reduction in aphid infestations in the fall, that, in turn, should reduce fall infections of barley yellow dwarf virus. In Georgia, the only insecticides recommended for Hessian fly and aphid control are organophosphates. For aphids, growers are advised to use malathion, methyl parathion or dimethoate when an average of 25 aphids per grain head are found. University of Georgia entomologists estimate that approximately 25 percent of the state's wheat acreage needs control for aphids. However, not all of these acres are treated. In 1996, it was estimated that growers lost 168,000 bushels of wheat to untreated aphid infestations.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON IDAHO HOPS

ACRES: 3,889
PRODUCTION:
VALUE ($/YR): $8,171,309
VOLUME (LBS/YR): 5,484,100



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	100	3,889
BIFENTHRIN	50	1,945
DIAZINON**	90	3,500
IMIDACLOPRID	25	972
PROPARGITE**	50	1,945

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Hop aphid is a primary pest of hops in the U. S., and chemicals are used on 100 percent of U. S. hop acreage for its control every year. Aphids feed directly on hop plants extracting cell sap with their sucking mouth parts. High aphid populations (1,000/leaf) reduce yields and severely weaken plants. The hop aphid may also cause serious economic damage at very low densities if hop cones are infested. Hop aphids excrete prolific amounts of honeydew (plant cell sap passed through the aphid's digestive system). Sooty mold grows on the honeydew and can render hop cones unmarketable as moldy hops cannot be used for brewing. The hop aphid was first discovered in 1890. Losses were estimated at one-twelfth of annual production. Growers were encouraged to spray toxic wood chip solutions, whale soaps and kerosene for control of the aphid. Historically, worms (loopers, armyworms, cutworms) have been minor pests of hops. These pests feed on and skeletonize leaves.

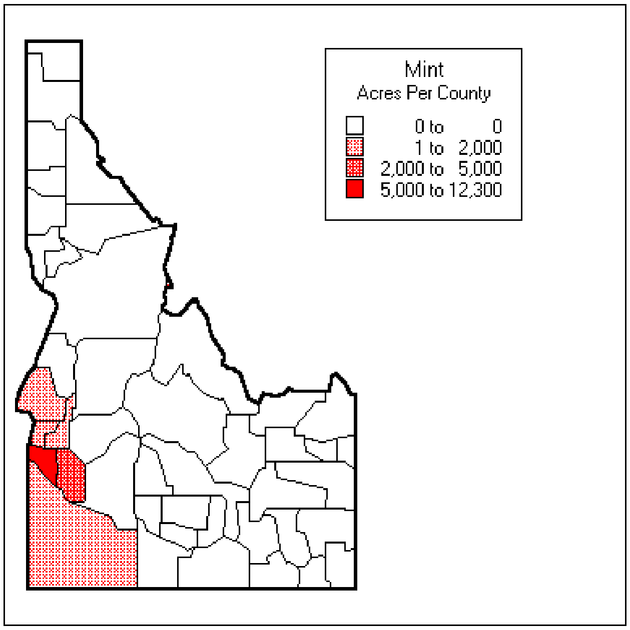
Importance of insecticides:

Until the mid 1940's, nicotine dust was the primary control for hop aphid. Organophosphates have been widely used since the 1950's for aphid control. Following the cancellation of several organophosphate registrations, hop growers had only the organophosphate diazinon for controlling aphid, and diazinon has been used essentially on 100 percent of Idaho hop acreage for aphid control (1990-1997). Unlike Oregon and Washington, Idaho hop growers have had no resistance problems with diazinon. Less than five percent of Idaho's hops have been treated with the newly-registered imidacloprid. Cost of imidacloprid is probably the main reason for its low use in Idaho ($25/A vs. $9/A).

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Ann George at the US Hop Industry Plant Protection Commission (509)453-4749

INSECTICIDE USE ON IDAHO MINT

ACRES: 25,750
PRODUCTION:
VALUE ($/YR): $28,852,000
VOLUME (LBS/YR): 2,375,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	65	16,738
CHLORPYRIFOS**	70	18,025
DICOFOL	5	1,288
MALATHION**	5	1,288
OXYDEMETON-METHYL**	4	1,030
PROPARGITE**	70	18,025

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests, including cutworms, aphids and spider mites. The mint stem borer is also a serious pest in Idaho. Cutworms emerge in June and deposit eggs in clusters of up to 500 on the leaves. Cutworms feed on the foliage for four to six weeks. Mint rootborers feed upon the underground stems of mint plants for 70 to 80 days in the fall. Damage is not noticeable right away, but come next spring, the mint field will have dry dead patches. In some instances mint rootborers have wiped out entire fields. The damage caused by the larvae boring in the mint roots severely weakens plants so that they are more susceptible to winter injury. High populations of aphids can cause extreme defoliation by piercing and sucking mint plant juices. Summer populations of spider mites can also cause complete defoliation if not controlled.

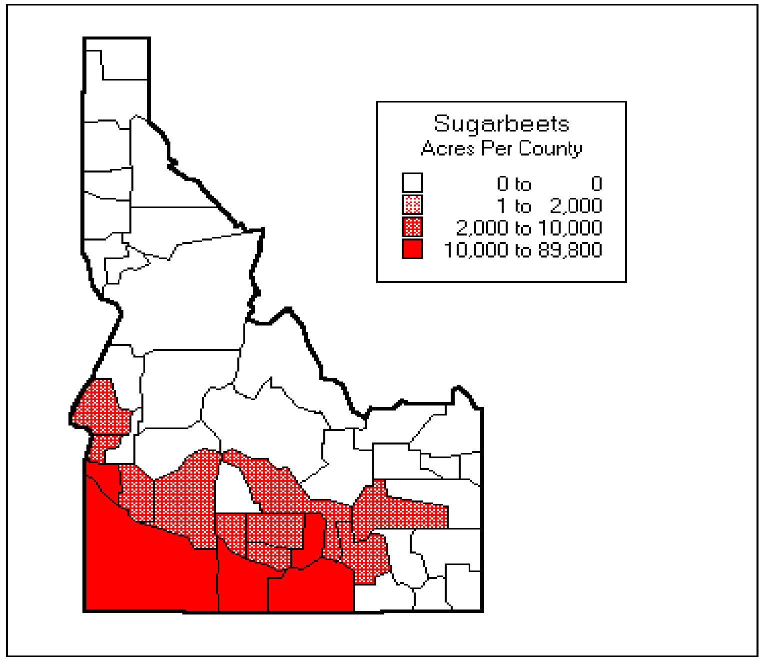
Importance of insecticides:

From about early June until harvest, as part of mint IPM programs developed by university researchers, fields are monitored for damaging populations of spider mites, cutworms and aphids. Frequently, populations of these pests are maintained under economic thresholds by natural biological controls, such as predator mites and lady beetles. If spider mite populations exceed the economic threshold, low rates of propargite can reduce populations without harming beneficial insects. If cutworms or aphids are found at levels above the threshold, the organophosphate acephate is applied. Acephate reduces the pest populations and allows the survival of the natural enemies. Alternatives to acephate are a carbamate and BT – neither of which is as effective. Mint rootborer used to be controlled by fall tillage. However, tillage is no longer practiced in mint in order to prevent the distribution of verticillium wilt. Fields are sampled in the fall for mint rootborer. Populations of borers exceeding the economic threshold are treated with chlorpyrifos – currently the only available control alternative for mint rootborer. Previously, a biological control (insect killing nematodes) was available for mint rootborer. Unfortunately, however, the product was discontinued.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at The Mint Industry Research Council (509)427-3601

INSECTICIDE USE ON IDAHO SUGARBEETS

ACRES: 202,115
PRODUCTION:
VALUE ($/YR): $195,000,000
VOLUME (LBS/YR): 9,466,020,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	40	80,846
CARBARYL**	2	4,042
CARBOFURAN**	10	20,212
CHLORPYRIFOS**	6	12,127
DIAZINON**	1	2,021
METHOMYL**	9	18,190
PHORATE**	5	10,106
TERBUFOS**	36	72,761

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The sugarbeet root maggot occurs wherever sugarbeets are grown in Idaho. The sugarbeet root maggot overwinters in previously planted beet fields. Flies emerge in May, and fly to near-by beet fields. Each female lays up to 200 eggs in clusters around beet plants. The eggs hatch and the small white larvae begin to feed on succulent roots of sugarbeet. The larvae scrape the root surface with their mouth hooks, causing irregular openings through which sap escapes from the root. The insect reduces beet stands, retards plant growth and reduces yield. Uncontrolled sugarbeet root maggots can reduce sugarbeet yields by 50 percent.

Importance of insecticides:

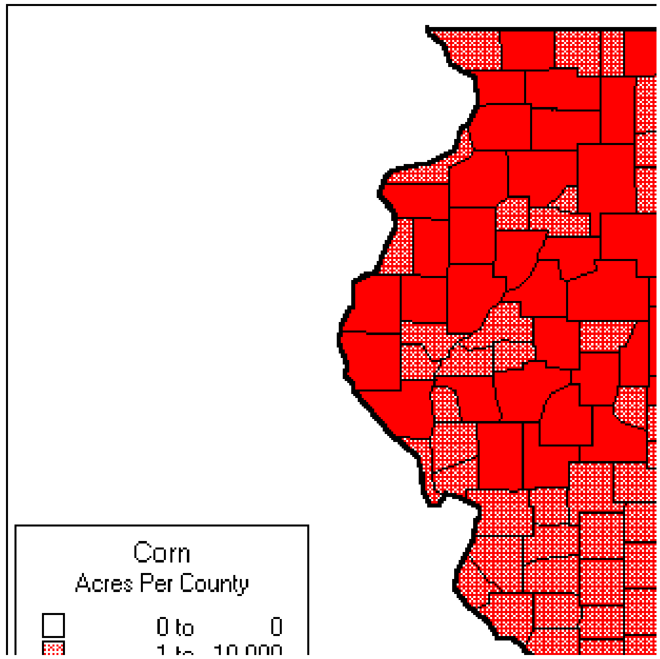
Most growers rely on insecticides to control the sugarbeet root maggot. The registered insecticides are the organophosphates terbufos and chlorpyrifos and the carbamates carbofuran and aldicarb. In most areas of Idaho, post-emergence applications are more cost effective than planting time applications. Growers are advised to monitor maggot flies with sticky traps and to time insecticide applications based on peak fly emergence (45 flies per trap from the beginning of the season). In the Mini-Cassia Area, heavy, prolonged fly emergence is typical by mid-May. Growers in the Mini-Cassia Area are advised to make an at planting insecticide treatment as well as a post-emergence application.

Considerable research has been completed regarding biological control of the sugarbeet root maggot. No commercially viable alternatives to insecticides are available currently to growers. Experiments with BT, natural bacteria and parasitic nematodes have failed to produce reliable effective control alternatives.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON ILLINOIS CORN

ACRES: 11,200,000
PRODUCTION:
VALUE ($/YR): $3,850,000,000
VOLUME (LBS/YR): 100,000,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	16	560,000
CYFLUTHRIN	2	224,000
PERMETHRIN	9	1,008,000
TEFLUTHRIN	4	448,000
TERBUFOS**	4	448,000

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The corn rootworm is the most important insect pest affecting corn production in Illinois. Damage by root-feeding insects reduces water and nutrient movement in corn plants, resulting in unfilled corn ears and reductions in yields of up to 55 percent. Rootworm feeding weakens the corn root system, causing maturing plants to tilt or tip over. A single female rootworm can lay up to 1,000 eggs in late summer; the eggs hatch the following spring; and the larvae feed on the roots of corn. Corn rootworm traditionally have been managed by using crop rotation or insecticide applications in continuous corn. In the past, rootworm females laid their eggs exclusively in corn fields. Thus, rootworm eggs were not present in corn planted after soybeans. In addition, rootworm larvae could not survive on soybean roots, so larvae starved to death in soybean before the field was rotated back to corn. Intensive crop rotation inadvertently has selected for rootworms that lay eggs in soybean fields, resulting in rootworm larvae feeding in the corn that is rotated into the field the following year. Since 1993, incidence of rootworm larval damage in corn planted after soybeans has increased dramatically in Illinois.

Wireworms, seed corn maggots and white grubs also feed on seed, roots and shoots and can cause significant reductions in stand and ultimately result in yield loss. Cutworms burrow into the ground and cut the plant in two below the soil surface. Plants cut above the growing point often will recuperate, but plants cut off below the growing point will die. A single cutworm is capable of cutting four to six corn plants in its lifetime.

Rootworm larvae and adults appear to be remarkably immune to attacks by micro-organisms, predators and parasites. There are no commercially available corn varieties resistant to corn rootworms. Most insecticides in corn are applied in a band down the row of corn plants at planting to protect the roots. Rootworm larvae and eggs outside the narrow insecticide ban are unaffected.

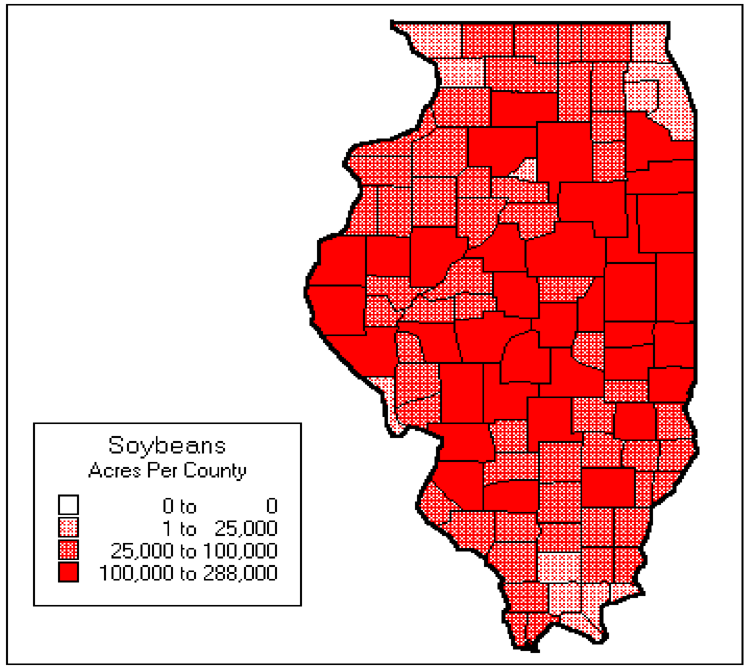
Importance of insecticides:

In addition to controlling rootworms, soil-applied organophosphates are efficacious in controlling other soil-inhabiting insect pests: maggots, grubs, wireworms and cutworms. The primary use of the organophosphate insecticides chlorpyrifos and terbufos in Illinois corn is for corn rootworm control in cornfields planted continuously to corn, although usage has increased in recent years in first year corn fields following soybeans because of the recent failure of crop rotation to control rootworms. A non-organophosphate alternative, the pyrethroid tefluthrin, is used for the same purpose and is rated equally as effective as the organophosphates for control of rootworm larvae. However, as the only suitable alternative for rootworm control, tefluthrin use most likely would predominate if the organophosphates were no longer available. The reliance on a single pesticide to suppress the pest would increase significantly the potential for the development for pest resistance to tefluthrin. The degree to which fipronil is a suitable control for rootworms has not been determined fully. Field trials generally have produced inconsistent results. The use of a non-organophosphate insecticide, carbaryl, applied aerially to prevent egg laying by rootworm adults is not a practical alternative to soil-applied organophosphates since too few crop scouts are available to assess the need for such aerial applications, and too few aerial applicators are available to cover the many fields that would need such application. For white grubs, tefluthrin and fipronil do not provide adequate control. The use of pyrethroids for cutworm control is effective only on cutworm larvae feeding above ground, and has little effect on cutworms feeding below the soil's surface.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON ILLINOIS SOYBEANS

ACRES: 9,430,000
PRODUCTION:
VALUE ($/YR): $2,411,090,000
VOLUME (LBS/YR): 25,743,900,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
(1988 USAGE)		
CHLORPYRIFOS**	6	558,000
DIMETHOATE**	30	3,040,000

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Most soybean insect pests are attacked by natural enemies or biological control agents. These agents include predatory insects, spiders, insect-eating birds and insect diseases, that usually help to keep pest populations well below economic injury levels. Two-spotted spider mites usually are present in soybean fields at low population levels. In hot dry weather, spider mites thrive and overwhelm natural controls. Spider mites usually lay more eggs, survive at a higher rate and live longer when conditions are hot and dry. The mites use their piercing, sucking mouthparts to remove fluids from plant cells, and the cells usually collapse. As the damage progresses, several or all of the leaves on a plant may die. The damage from spider mites is irreversible. Once the leaves become discolored, they do not contribute to yield potential.

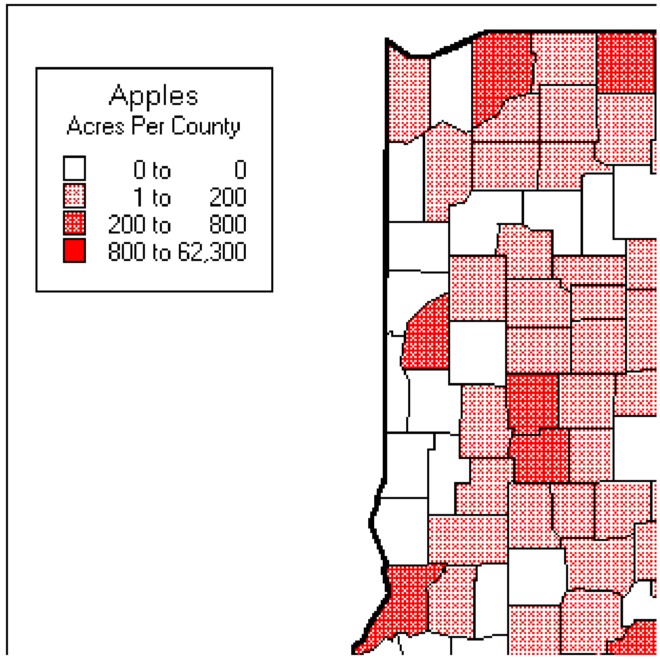
Importance of insecticides:

In 1988, during a period of prolonged drought in Illinois, spider mite populations exploded and overwhelmed the control potential of natural processes. Approximately four million acres of soybeans were treated in Illinois. The insecticides that were registered for use and were effective were the organophosphates dimethoate and chlorpyrifos. It has been estimated that the use of the insecticides prevented a yield loss of eight bushels an acre (one-third of the yield on treated acres). After subtracting the cost of the insecticides, it is estimated that soybean producers in Illinois saved $220,000,000 of soybeans by applying the organophosphate insecticides. Dimethoate was the preferred insecticide because it provides about 10 days of residual control in comparison to about three days with chlorpyrifos. The need to spray Midwestern soybean fields with dimethoate in 1988 essentially used up all the supplies of the chemical in North America.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON INDIANA APPLES

ACRES: 4,000
PRODUCTION:
VALUE ($/YR): $12,200,000
VOLUME (LBS/YR): 50,000,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	43	1,720
CARBARYL**	32	1,280
CHLORPYRIFOS**	33	1,320
DIAZINON**	11	440
DIMETHOATE**	14	560
OIL	82	3,280
PHOSMET**	75	3,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The codling moth, apple maggot, plum curculio and aphids are the most important insect pests of apples in Indiana. Larvae of the codling moth tunnel into fruit and render it unmarketable as fresh fruit.

After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae.

After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed.

Aphids overwinter in the egg stage. As soon as they hatch, the young seek out the open buds of apples. They feed by sucking the sap from the stems and the newly-formed fruits. Their feeding causes the leaves to curl. The aphids congregate in immense numbers and cause leaves to die. Feeding on the leaves often results in malformation of the developing fruit.

Importance of insecticides:

Codling moth, plum curculio, and apple maggot feed directly on the fruit, and in the absence of effective controls, they can destroy 50 to 90 percent of the crop. These pests have very poor or no effective natural predators, controls or IPM alternatives. Organophosphate insecticides (azinphos methyl, phosmet, chlorpyrifos and methyl parathion) are the only effective options for plum curculio and apple maggot control. There are no experimental insecticides or non-chemical strategies currently under development for controlling these pests. Alternative pyrethroid insecticides are highly disruptive to mite populations. (Pyrethroids kill natural mite predators while the organophosphates do not.)

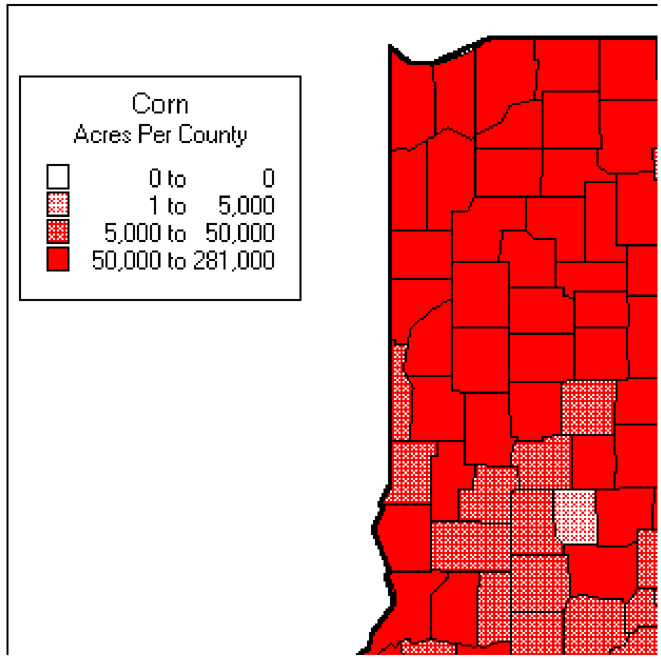
Dimethoate is used to control aphids, for which the alternative, imidacloprid, performs well. However, resistance to imidacloprid would be expected to develop if aphids were controlled with a single non-organophosphate alternative.

A wide variety of arthropod species regularly colonize apple orchards from native habitats, but do not reach pest status because they are incidentally controlled by broad-spectrum insecticides, such as OP's targeted for the key pests. If OP's were eliminated or reduced in Indiana apple orchards, some of these incidental pests could develop into damaging populations.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON INDIANA CORN

ACRES: 5,850,000
PRODUCTION:
VALUE ($/YR): $1,942,785,000
VOLUME (LBS/YR): 50,368,500,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	11	643,500
TEFLUTHRIN	3	175,500
TERBUFOS**	8	468,000

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The corn rootworm is the most important insect pest affecting corn production in Indiana. Damage by root-feeding insects reduces water and nutrient movement in corn plants, resulting in unfilled corn ears and reductions in yields of up to 55 percent. Rootworm feeding weakens the corn root system, causing maturing plants to tilt or tip over. A single female rootworm can lay up to 1,000 eggs in late summer; the eggs hatch the following spring; and the larvae feed on the roots of corn. Corn rootworm traditionally have been managed by using crop rotation or insecticide applications in continuous corn. In the past, rootworm females laid their eggs exclusively in corn fields. Thus, rootworm eggs were not present in corn planted after soybeans. In addition, rootworm larvae could not survive on soybean roots, so larvae starved to death in soybean before the field was rotated back to corn. Intensive crop rotation inadvertently has selected for rootworms that lay eggs in soybean fields, resulting in rootworm larvae feeding in the corn that is rotated into the field the following year. Since 1993, incidence of rootworm larval damage in corn planted after soybeans has increased dramatically in Indiana.

Wireworms, seed corn maggots and white grubs also feed on seed, roots and shoots and can cause significant reductions in stand and ultimately result in yield loss. Cutworms burrow into the ground and cut the plant in two below the soil surface. Plants cut above the growing point often will recuperate, but plants cut off below the growing point will die. A single cutworm is capable of cutting four to six corn plants in its lifetime.

Rootworm larvae and adults appear to be remarkably immune to attacks by micro-organisms, predators and parasites. There are no commercially available corn varieties resistant to corn rootworms. Most insecticides in corn are applied in a band down the row of corn plants at planting to protect the roots. Rootworm larvae and eggs outside the narrow insecticide ban are unaffected.

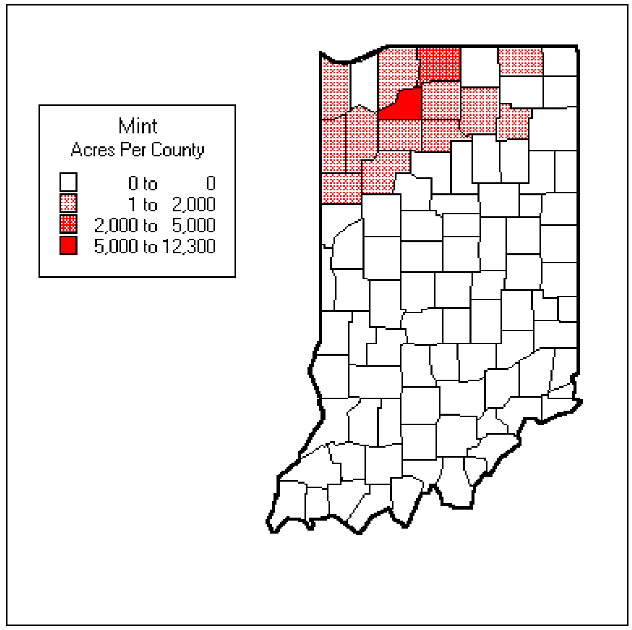
Importance of insecticides:

In addition to controlling rootworms, soil-applied organophosphates are efficacious in controlling other soil-inhabiting insect pests: maggots, grubs, wireworms and cutworms. The primary use of the organophosphate insecticides chlorpyrifos and terbufos in Indiana corn is for corn rootworm control in cornfields planted continuously to corn, although usage has increased in recent years in first year corn fields following soybeans because of the recent failure of crop rotation to control rootworms. A non-organophosphate alternative, the pyrethroid tefluthrin, is used for the same purpose and is rated equally as effective as the organophosphates for control of rootworm larvae. However, as the only suitable alternative for rootworm control, tefluthrin use most likely would predominate if the organophosphates were no longer available. The reliance on a single pesticide to suppress the pest would increase significantly the potential for the development for pest resistance to tefluthrin. The degree to which fipronil is a suitable control for rootworms has not been determined fully. Field trials generally have produced inconsistent results. The use of a non-organophosphate insecticide, carbaryl, applied aerially to prevent egg laying by rootworm adults is not a practical alternative to soil-applied organophosphates since too few crop scouts are available to assess the need for such aerial applications, and too few aerial applicators are available to cover the many fields that would need such application. For white grubs, tefluthrin and fipronil do not provide adequate control. The use of pyrethroids for cutworm control is effective only on cutworm larvae feeding above ground, and has little effect on cutworms feeding below the soil's surface.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON INDIANA MINT

ACRES: 22,280
PRODUCTION:
VALUE ($/YR): $10,498,000
VOLUME (LBS/YR): 876,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	1	223
MALATHION**	27	6,016

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests. Female mint flea beetles lay eggs in the soil near the crowns of plants in July to early August and continue laying eggs until late fall. The eggs hatch the following April or May. The young larvae feed on underground mint plant parts for about four to five weeks. High populations of mint flea beetle can devastate mint stands. The flea beetle was first found in Midwestern mint fields during the 1920's. Annual production in a field with heavy infestations of flea beetle dropped from 44 pounds per acre to three pounds per acre.

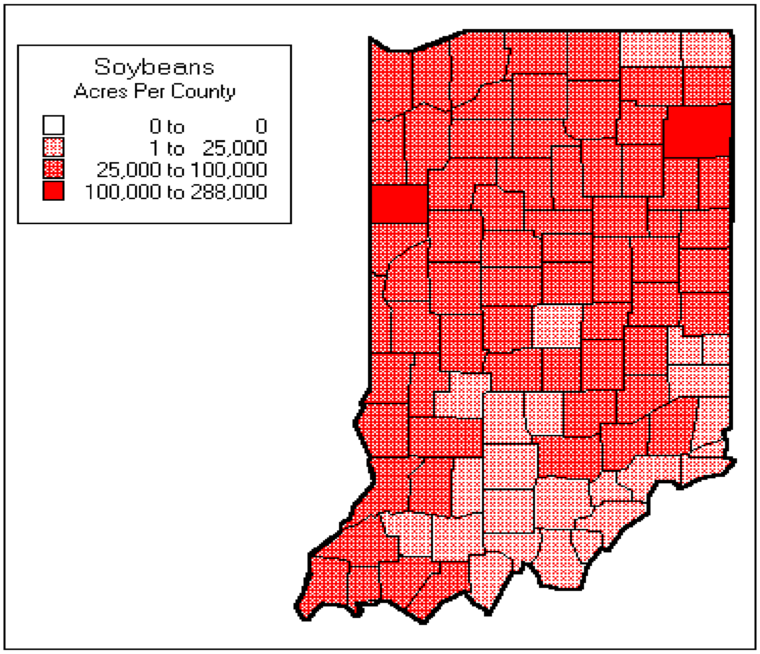
Importance of insecticides:

Mint fields are monitored for flea beetles at the adult emergence stage. Fields above economic thresholds are treated with the organophosphate malathion. Currently, malathion is the only insecticide recommended for mint flea beetle control. It is economical, efficacious, and does not harm beneficial insects. Malathion applications are targeted at the adult fly stage to prevent egg laying. Peak adult emergence falls between July 25th and August 10th. Even though malathion has a short half life and may be applied up to seven days prior to mint harvest, treatments in the Midwest are usually made after harvest at which time the mint stubble is treated.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at the Mint Industry Research Council at (509) 427-3601.

INSECTICIDE USE ON INDIANA SOYBEANS

ACRES: 4,520,000
PRODUCTION:
VALUE ($/YR): $1,187,784,000
VOLUME (LBS/YR): 12,915,600,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
(1988 USAGE)		
CHLORPYRIFOS**	7	285,000
DIMETHOATE**	14	614,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Most soybean insect pests are attacked by natural enemies or biological control agents. These agents include predatory insects, spiders, insect-eating birds and insect diseases, that usually help to keep pest populations well below economic injury levels. Two-spotted spider mites usually are present in soybean fields at low population levels. In hot dry weather, spider mites thrive and overwhelm natural controls. Spider mites usually lay more eggs, survive at a higher rate and live longer when conditions are hot and dry. The mites use their piercing, sucking mouthparts to remove fluids from plant cells, and the cells usually collapse. As the damage progresses, several or all of the leaves on a plant may die. The damage from spider mites is irreversible. Once the leaves become discolored, they do not contribute to yield potential.

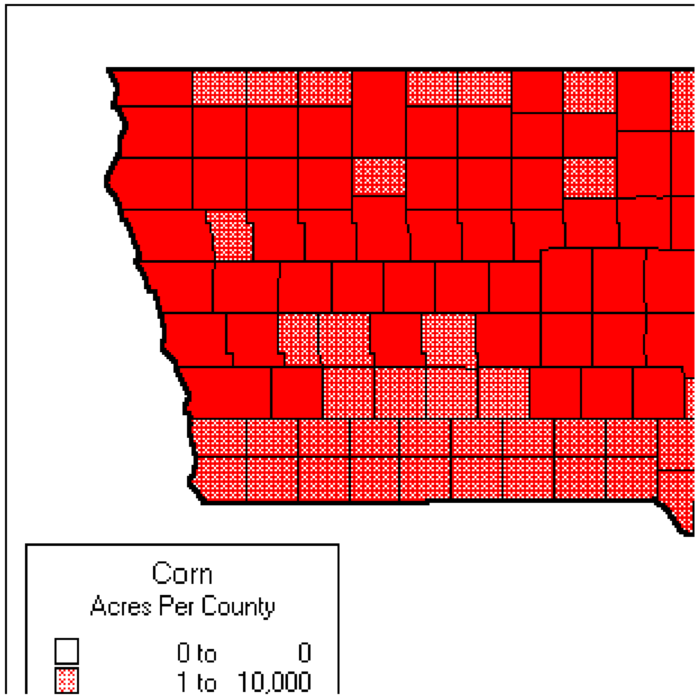
Importance of insecticides:

In 1988, during a period of prolonged drought in Indiana, spider mite populations exploded and overwhelmed the control potential of natural processes. Approximately one million acres of soybeans were treated in Indiana. The insecticides that were registered for use and were effective were the organophosphates dimethoate and chlorpyrifos. It has been estimated that the use of the insecticides prevented a yield loss of eight bushels an acre (one-third of the yield on treated acres). After subtracting the cost of the insecticides, it is estimated that soybean producers in Indiana saved $55,000,000 in soybeans by applying the organophosphate insecticides. Dimethoate was the preferred insecticide because it provides about 10 days of residual control in comparison to about three days with chlorpyrifos. The need to spray Midwestern soybean fields with dimethoate in 1988 essentially used up all the supplies of the chemical in North America.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON IOWA CORN

ACRES: 12,000,000
PRODUCTION:
VALUE ($/YR): $4,140,000,000
VOLUME (LBS/YR): 115,920,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBOFURAN**	2	240,000
CHLORPYRIFOS**	6	720,000
CYFLUTHRIN	3	360,000
TEFLUTHRIN	3	360,000
TERBUFOS**	6	720,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The corn rootworm is the most important insect pest affecting corn production in Iowa. Damage by root-feeding insects reduces water and nutrient movement in corn plants, resulting in unfilled corn ears and reductions in yields of up to 55 percent. Rootworm feeding weakens the corn root system, causing maturing plants to tilt or tip over. A single female rootworm can lay up to 1,000 eggs in late summer; the eggs hatch the following spring; and the larvae feed on the roots of corn.

Rootworm larvae and adults appear to be remarkably immune to attacks by micro-organisms, predators and parasites. There are no commercially available corn varieties resistant to corn rootworms. Most insecticides in corn are applied in a band down the row of corn plants at planting to protect the roots. Rootworm larvae and eggs outside the narrow insecticide ban are unaffected.

Importance of insecticides:

Two integrated pest management strategies are used widely in Iowa to protect corn roots from corn rootworm injury: crop rotation and insecticides. The biological basis for crop rotation is simple. When corn is rotated with soybeans, the larvae that hatch during the soybean crop can't survive on soybean roots and, therefore, starve. Crop rotation is a highly successful method of preventing corn rootworm injury in corn the following year in most situations. The one notable exception is in northwestern and north central Iowa. Here some northern corn rootworm eggs survive the soybean rotation and don't hatch until two years after they are laid. This two-year delay in the hatch is called extended diapause.

If corn is not rotated or if extended diapause has been documented to occur in a particular field, a soil insecticide might necessary to protect the roots. Iowa corn growers are advised to scout corn fields in August to determine which fields have high enough beetle counts to warrant an insecticide application the following spring when corn is planted. In Iowa the primary insecticides used to control rootworms are: the organophosphates terbufos, chlorpyrifos and phorate; a carbamate, carbofuran; and a pyrethroid, tefluthrin. The recently-registered new corn rootworm insecticide, fipronil, has provided consistent root protection under light pressure, but not under moderately heavy rootworm pressure.

Approximately 50 percent of Iowa's corn acreage is estimated to be continuously planted to corn while the remainder is rotated with another crop. Without the use of soil insecticides to control rootworm, corn yields in Iowa are projected to decline by seven percent.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON KANSAS CORN

ACRES: 2,700,000
PRODUCTION:
VALUE ($/YR): $1,023,165,000
VOLUME (LBS/YR): 27,027,000,000

THE ISSUE:

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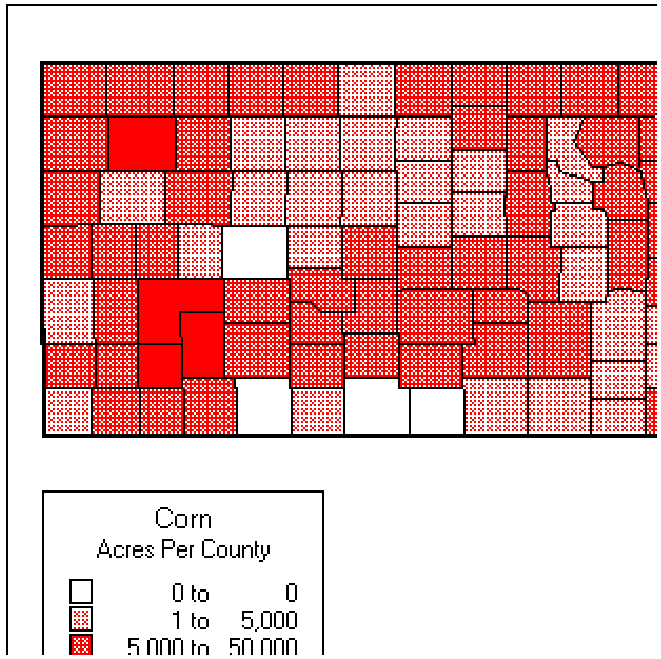


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
BIFENTHRIN	20	540,000
METHYL PARATHION**	15	405,000
TERBUFOS**	8	216,000

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

In Kansas, corn rootworms are the most serious pest of corn. In Kansas, the western corn rootworm (WCR) is the primary rootworm species found in most corn fields.

Corn rootworms may cause economic damage in at least three ways. Larvae tunnel into and prune corn roots as they feed. Severe damage limits the soil nutrients the plant can take up and greatly reduces the plant's ability to tolerate drought. Reduction in the plant root system may cause the plant to lean over or "lodge," thereby reducing the sunlight gathering ability of the leaves and possibly aggravating harvesting problems. "Goosenecked" plants at harvest, usually indicative of past lodging, are often caused by root pruning. Silk clipping by the adult beetle before pollination is complete can sometimes contribute to further yield reductions. Corn rootworm insecticides provide four to six weeks of activity against corn rootworm larvae.

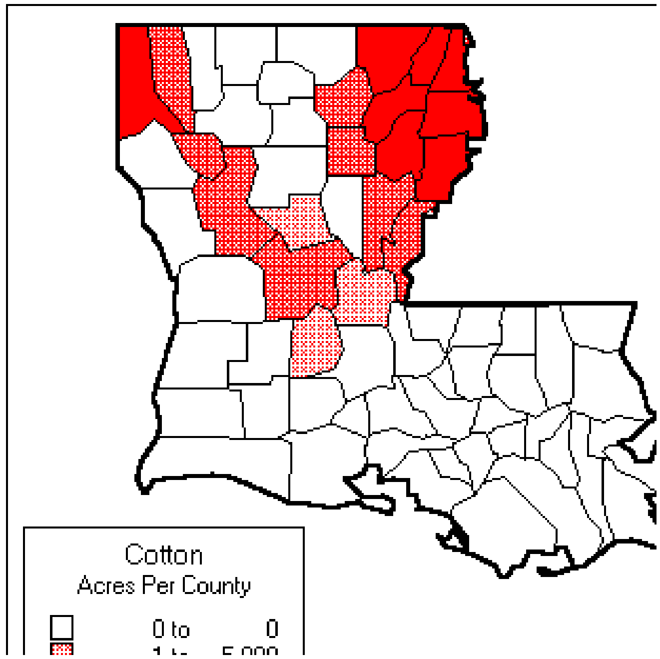
Importance of insecticides:

Approximately 75 percent of Kansas's corn acreage is planted to continuous corn while 25 percent is rotated annually with another crop. Rootworm insecticides are needed only rarely if corn is planted in rotation. Rootworm larvae can move only 10 to 20 inches to find food, and require corn plants in order to feed. If they hatch in a field of another crop, they starve to death. Without the use of insecticides in Kansas continuous corn fields, yield is projected to decline by 15 percent. Generally, granular insecticides are recommended for most consistent rootworm control in Kansas. In continuous corn fields, counts of fall egg-laying beetles can be used to determine whether soil insecticides will be necessary the following spring. Corn rootworm also can be controlled by spraying the adults. This suppresses egg-laying below levels that can result in economic damage by the larvae the next summer. If beetle counts reach one per plant and 10 percent of the females are swollen with eggs, an aerial application of the organophosphate methyl parathion is warranted.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON LOUISIANA COTTON

ACRES: 885,000
PRODUCTION:
VALUE ($/YR): $312,000,000
VOLUME (LBS/YR): 473,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	23	203,550
ALDICARB**	38	336,300
CYFLUTHRIN	22	194,700
DICROTOPHOS**	16	141,600
DIMETHOATE**	4	35,400
LAMBDACYHALOTHRIN	39	345,150
METHYL PARATHION**	63	557,550
OXAMYL**	17	150,450
PROFENOFOS**	12	106,200
THIODICARB**	16	141,600

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Boll weevils spend the winter as adults in protected areas around cotton fields. They return to cotton in the spring and summer. The weevil uses chewing mouthparts to chew holes in squares and soft bolls. The female lays a single egg in the boll and seals it. Eggs hatch into grub-like larvae that eat inside the square. High boll weevil infestations can reduce cotton yields by 90 percent or more. There are no effective biological controls for boll weevils. None of the beneficial insects in cotton fields feed on boll weevils.

Adult fleahoppers fly to cotton about the time the squares start to form. They feed on cotton as long as the plants are tender and growing. High infestations of fleahoppers inhibit the formation of fruiting branches, and the cotton develops excessive vegetative growth.

Aphids damage cotton by sucking sap from the plants and excreting a sticky material called honeydew, that drips on lint in open bolls. A black sooty mold grows on the honeydew, staining the lint and reducing its quality.

Seedling cotton is attacked by several species of thrips, but tobacco thrips is the main species infesting cotton in Louisiana. Tobacco thrips breed all year in Louisiana. Both the larvae and adults damage cotton leaves and terminal buds. They rupture the cells with their rasping sucking mouthparts and suck up the sap.

Importance of insecticides:

At planting applications of acephate and aldicarb are recommended in Louisiana for thrips control. Louisiana State University (LSU) recommends only organophosphates and carbamates for thrips control. Most of these in-furrow applications have thrip and cotton aphid activity. Current research indicates that aldicarb has the greatest efficacy against thrips and aphids.

Louisiana growers use dimethoate for aphid control during the season when honeydew symptoms begin to appear uniformly.

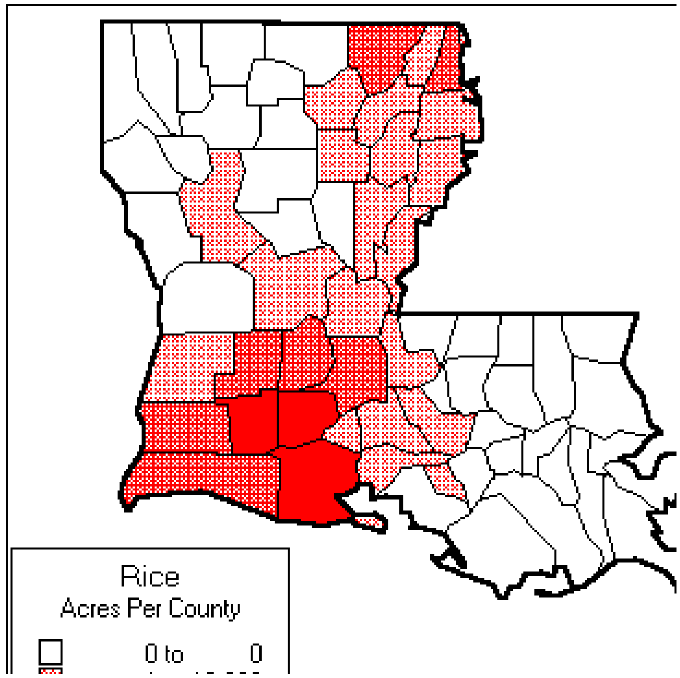
Pyrethroid insecticides will provide boll weevil control. LSU recommends that pyrethroid insecticides not be used before July because their application causes increased aphid and mite populations because of destruction of natural enemies. Louisiana growers rely on the organophosphates methyl parathion and the carbamate oxamyl for boll weevil control. LSU recommends that treatment begin when 15 percent of the squares have been punctured by boll weevils.

Dicrotophos is used for control of plant bugs.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON LOUISIANA RICE

ACRES: 548,000
PRODUCTION:
VALUE ($/YR): $256,000,000
VOLUME (LBS/YR): 2,500,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBOFURAN**	59	323,320
LAMBDACYHALOTHRIN	12	65,760
METHYL PARATHION**	20	109,600

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Rice water weevils (RWW) occur throughout Louisiana's rice growing area. The larvae feed on rice roots for about three weeks and cause injury by pruning the root system. Yield losses in untreated fields typically range from 10 to 33 percent, but can be as high as 50 to 70 percent under heavy pressure. Control of rice water weevils by draining rice fields was first suggested in 1881. Soil drying may prevent the establishment of RWW larvae in the root zones of rice plants. However, drainage of fields can result in the loss of fertilizer, can promote weed growth and increase disease severity. In addition, frequent rains prevent fields from drying out completely. Although extensive host plant resistance research has been conducted, no varieties capable of providing significant levels of protection from RWW have been identified.

The rice stink bug sucks the juices from the kernels. Florets, fed on early, are often wholly drained of their contents. Feeding on larger kernels results in discolored spots on the rice kernel, and, thus, reductions in quality and price received. Management of rice stink bugs relies significantly on naturally occurring biological control agents. However, chemical control is recommended when stink bugs emerge from natural controls, and growers find more than three stink bugs per 10 net sweeps.

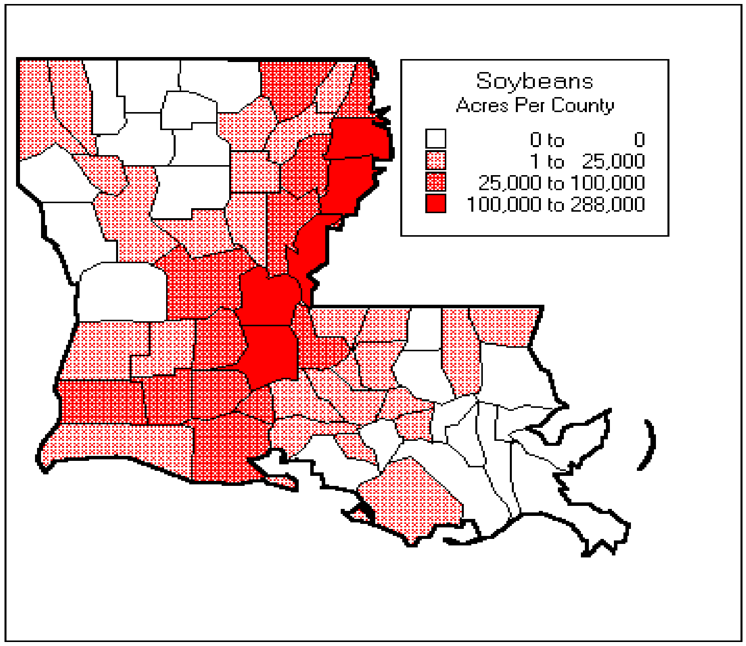
Importance of insecticides:

In the early 1960's effective rice water weevil control was achieved by applications of aldrin to rice seed. However, this success was short-lived as aldrin resistant rice water weevils appeared in the mid-1960's. For thirty years (1967-1997) carbofuran was the only insecticide registered for rice water weevil control. Growers are advised to pull up plant roots to determine whether rice water weevils are present and to use carbofuran if populations are high enough. In 1998, two new insecticides were registered for rice water weevil control – fipronil is applied to the seed and has provided season-long control in research plots. However, growers would have to decide to treat their fields prior to planting and not on the basis of an observable problem. For dry seeded rice the decision to treat must be made at least 1 to 2 months prior to planting to allow the seed dealer time to treat and bag seed. Lambdacyhalothrin is applied to rice foliage to kill adult rice water weevils. However, the scouting procedures for adults is new. Lambdacyhalothrin may have to be applied more than once for adequate control of adult weevils. Methyl parathion has been preferred for stink bug control because of economics, quick action and longer residual control. Although registered for rice stink bugs, carbaryl is not used as it is two to three times more expensive and it has significantly less residual control than methyl parathion.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Joe Musick at Louisiana State University at (318) 788-7531.

INSECTICIDE USE ON LOUISIANA SOYBEANS

ACRES: 1,112,815
PRODUCTION:
VALUE ($/YR): $181,888,000
VOLUME (LBS/YR): 1,948,800,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	2	22,256
METHYL PARATHION**	34	378,357
THIODICARB**	5	55,641

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Stink bugs damage soybeans by inserting their piercing, sucking mouthparts through the pod into the soybean seed. The insect injects a substance into the seed that partially liquefies the tissues so that they can be withdrawn. The result is a discolored and often sunken spot in the seed. In the process of feeding, the stink bugs inoculate pods with yeast bud disease organisms, causing shriveling of the bean seed. When underdeveloped seeds are attacked, pods frequently are aborted. Damaged beans have a poorer milling quality, less vigor and reduced germination. Soybean processors discount soybeans with stink bug damage. Discounts at the elevator because of stink bug damage are determined at one-fourth the actual percentage of damaged seeds. Studies indicate that an average of one stink bug per foot of row reduces soybean yield 10 percent.

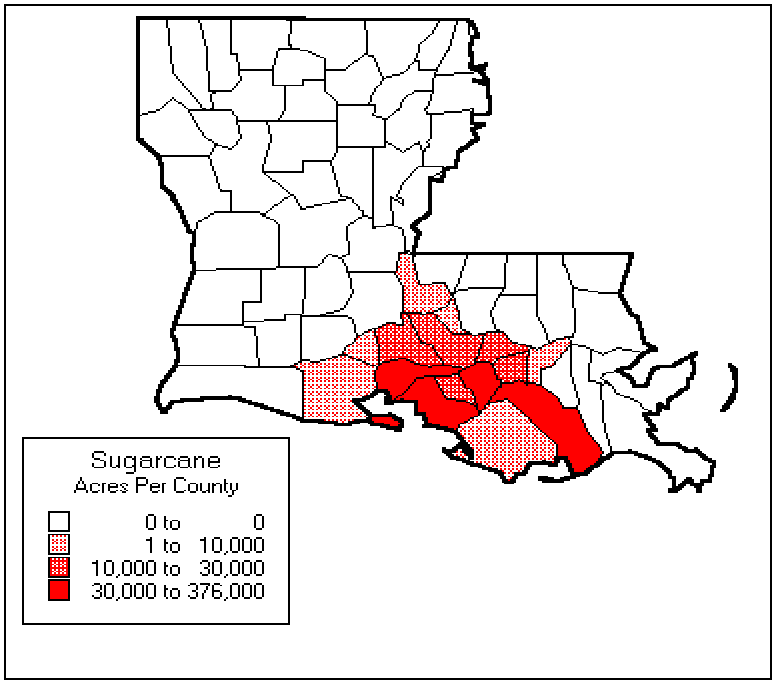
Importance of insecticides:

Currently, the only method of controlling stink bugs is by chemical application. Methyl parathion is effective, economical and widely-used for stink bug control in the South. Growers are advised to scout for stink bugs and treat when the number of stink bugs exceed one to three per foot of row (depending on stage of pod development). Successful biological control of stink bug has been observed in several parts of the world. However, releases of parasites in the U.S. has not reduced stink bug to sub-economic levels. Natural parasites of the stink bugs produce only 25 to 50 percent control. Methyl parathion produces 90 percent control of stink bugs. Many growers are still reluctant to scout for stink bugs, and losses because of untreated stink bugs still occur.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON LOUISIANA SUGARCANE

ACRES: 378,436
PRODUCTION:
VALUE ($/YR): $222,600,000
VOLUME (LBS/YR): 17,808,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	46	174,081
CARBOFURAN**	11	41,628
ESFENVALERATE	23	87,040
ETHOPROP**	1	3,784

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The sugarcane borer reduces sugar yields by causing retarded growth and stunted stalks, thus causing losses in plant weight (tonnage). There are four to five generations of borers per year and each female lays up to 700 eggs. Sugarcane borer populations are partially suppressed through the use of resistant cultivars and natural predators. Insecticide applications are recommended when five percent of the stalks are infested with small larvae.

Despite the repeated use of inorganic compounds such as cryolite and ryania, sugarcane fields in Louisiana lost an average of about 13 percent of their cane yield to the sugarcane borer in the 1930 - 1960 time period. Since 1964, the organophosphate azinphos methyl has been the primary insecticide used in Louisiana for control of the sugarcane borer. Two azinphos methyl applications substituted for 12 annual insecticide

Importance of insecticides:

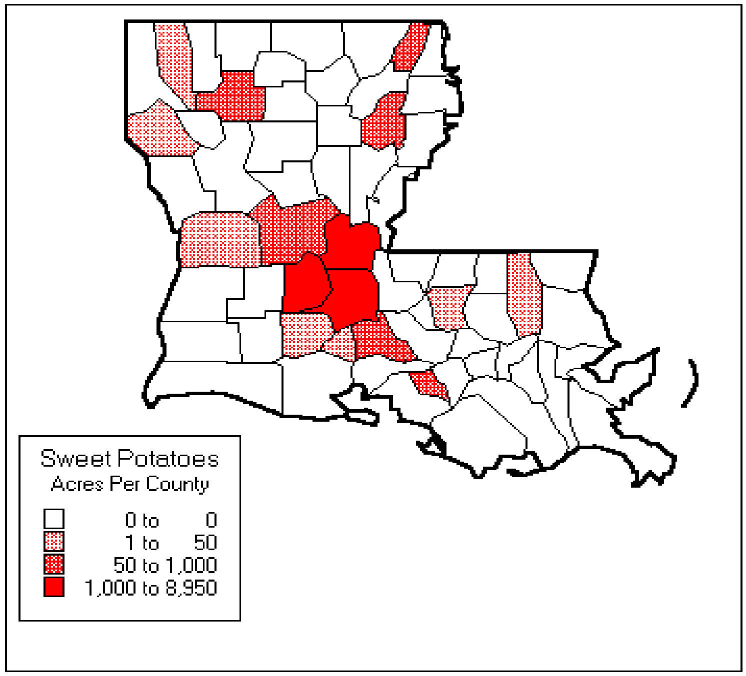
Currently, azinphos methyl usage is limited to one application per year by prescription use only. It is applied following an application of a pyrethroid. Pyrethroids and a carbamate are the primary alternatives to azinphos methyl. Applications of the pyrethroids can cause secondary outbreaks of yellow sugarcane aphids because of disruption of natural enemies of this pest. The carbamate is not so effective as azinphos methyl in controlling sugarcane borers.

Research has demonstrated that tebufenozide and lambdacyhalothrin are as effective as azinphos methyl in controlling sugarcane borer and do not precipitate aphid outbreaks. Sugarcane registrations for these compounds are being pursued by the registrants.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON LOUISIANA SWEET POTATOES

ACRES: 10,548
PRODUCTION:
VALUE ($/YR): $44,897,000
VOLUME (LBS/YR): 323,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	20	2,110
CHLORPYRIFOS**	40	4,219
ENDOSULFAN	20	2,110
ETHOPROP**	40	4,219
METHYL PARATHION**	60	6,329
PHOSMET**	50	5,274

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Larvae of the sweet potato weevil tunnel throughout the sweet potato root. Infested sweet potatoes are riddled with small holes and galleries, especially in the stem end. They turn bitter and are unfit for consumption by either humans or livestock. Yield losses from weevil damage of 60 to 97 percent have been reported where proper management techniques were not followed.

The larvae of several other species of insects also attack the underground parts of the sweet potato plant: sweet potato flea beetle, wireworms, white grubs and the whitefringed beetle. These soil insects feed on the surface of the sweet potato fleshy root, causing holes, scars, surface tunnels and other blemishes. Total root biomass is not reduced, but the quality is lower, thereby reducing marketable yield. The feeding injury provides entry sites for decay organisms. Five year averages from test plots showed 61 percent of the root were injured by soil insects. In the southeastern U.S., chlorpyrifos incorporated at transplanting has provided effective control of soil insects. Chlorpyrifos is the most widely used insecticide in sweet potato production. Since the half-life of chlorpyrifos does not exceed six weeks, a second insecticide application at root enlargement is sometimes

Importance of insecticides:

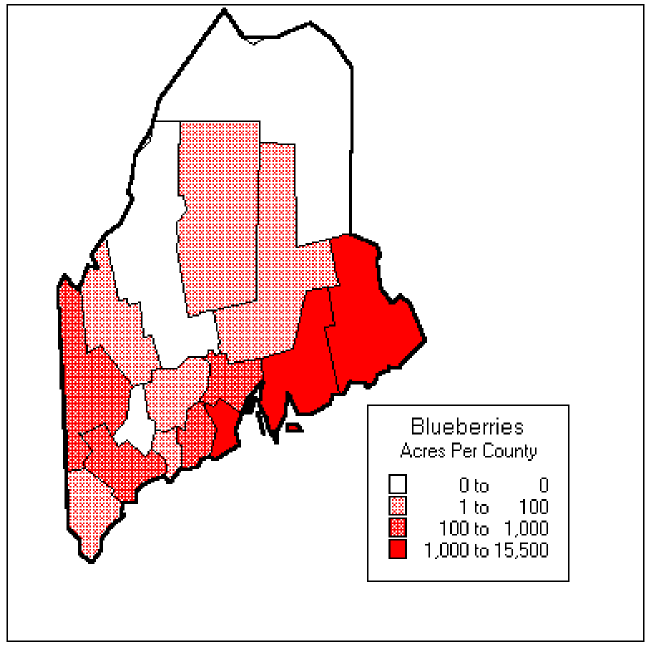
The only insecticides registered for control of larvae of the soil borne sweet potato insects are organophosphates. Chlorpyrifos is the most widely used organophosphate because of its control efficacy of a large number of insect species. Chlorpyrifos is incorporated into the soil at planting. The organophosphate insecticides diazinon and ethoprop are used to lesser extent for control of soil borne insect pests. Recent research at LSU demonstrated the effectiveness of foliar applications of the organophosphate insecticides methyl parathion and phosmet in controlling adult sweet potato weevils. A state 24C label for Louisiana has been established for the use of these OP's.

Recently the organophosphate fonofos was withdrawn from use. Fonofos was used by sweet potato growers because of its efficacy in controlling whitefringed beetles. There are currently no practical non-chemical alternatives effective for management of soil insect pests of sweet potatoes. LSU has maintained a sweet potato breeding program since 1964. However, field performance of improved lines has been marginal

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MAINE LOWBUSH BLUEBERRIES

ACRES: 30,000
PRODUCTION:
VALUE ($/YR): $58,869,000
VOLUME (LBS/YR): 65,410,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	48	14,400
BT	8	4,800
CARBARYL**	1	150
DIAZINON**	1	150
MALATHION**	1	600
METHOXYCHLOR	1	150
PHOSMET**	2	1,200

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The blueberry maggot, or blueberry fruit fly, is the major insect pest of blueberries in Maine.

Flies emerge from the soil from June through August. Once mated, the females seek ripening blueberries in which to lay eggs. In seven to 10 days the eggs hatch, and the larva (maggot) begins feeding. As the larva feeds and grows, the berry begins to shrink. After two to three weeks the berry is destroyed almost completely. The presence of infested fruit at harvest can result in the condemnation of whole fields of harvested fruit. USDA regulations prohibit interstate commerce of fruit with any maggots. Maggots became serious problems in Maine blueberries in the 1920's. Dusting with arsenic was the common control method employed in the 1930 - 1950 time period. Currently, blueberry fruit fly emergence is monitored with sticky traps. Action thresholds have been developed to guide the timing and necessity of treatment.

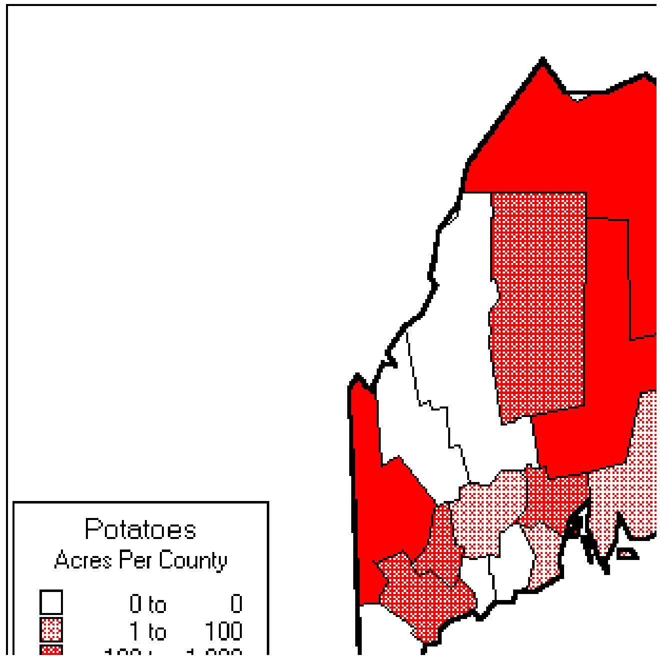
Importance of insecticides:

The only insecticides recommended by the University of Maine for blueberry maggot control are organophosphates (azinphos methyl, phosmet, malathion) and a carbamate (carbaryl). Azinphos methyl and phosmet are most widely used because they are the most effective. Some Maine growers who do not use insecticides use the tactic of late harvesting as a means of eliminating some of the maggot infested berries, as these berries tend to drop off the bush as the maggots inside them mature. Research results suggest that this technique may work well in some years, but not in others. In addition, by allowing the larvae to drop to the soil, this method can result in a very large increase in maggot problems in subsequent years and will result in significant yield loss.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or David Bell of the Wild Blueberry Commission of Maine (207)-581-1475

INSECTICIDE USE ON MAINE POTATOES

ACRES: 71,000
PRODUCTION:
VALUE ($/YR): $88,180,000
VOLUME (LBS/YR): 1,917,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	3	2,130
DISULFOTON**	7	4,970
ETHOPROP**	10	7,100
IMIDACLOPRID	77	54,670
METHAMIDOPHOS**	30	21,300
PHOSMET**	8	5,680

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Wireworm problems normally are associated with fields that are being rotated out of grain crops, sod or pasture. With potatoes, wireworms may attack the seed cases, causing a poor stand. The roots may also be attacked, resulting in plants with reduced yields. If one wireworm larva per square foot of soil six inches deep is found, a slow-release, granular insecticide (such as ethoprop) provides good control. A single female wireworm can lay 175 eggs.

Flea beetles appear on potato vines in Maine as soon as the plants emerge and puncture small round holes in leaves, causing yield reductions. Eggs are laid soon after the beetles appear. The larvae feed on potato roots, and the second brood of adult beetles appears in August, causing further damage. The best control program is to kill the adult flea beetles before the eggs are laid in the spring.

Maine is a major potato seed supplier for the eastern seaboard.

In late spring, the green peach aphid migrates into Maine potato fields. Once on the potato, the female aphids produce live females, without mating with male aphids. The winged aphids fly from plant to plant probing each with their beaks. This constant probing vectors leafroll virus into potatoes in Maine. Virus diseases have caused severe losses to Maine's potato industry in terms of decreased yields, malformed tubers and internal discolorations.

Aphid control is especially important for seed production where low levels of virus infections are required for certification.

Importance of insecticides:

In Maine, the key insect pests of potatoes include wireworms, flea beetles, aphids and Colorado Potato Beetle. Imidacloprid is used to control the Colorado Potato Beetle. Organophosphate insecticides play a key role in controlling the other pests, as well as continuing to provide control of the Colorado Potato Beetle.

Effective biological controls are not available to control wireworms infesting potatoes. The long life cycle of wireworms (2 – 6 years) reduces the effectiveness of crop rotation for the management of wireworm populations.

If potentially damaging populations of wireworms are present in a field in which potatoes are to be planted, applications of soil insecticides is the only viable management option.

It is difficult to control aphids to acceptable levels with natural enemies. One aphid can infect many plants, and most natural enemies are not capable of controlling the aphids at low population densities.

At planting applications of the organophosphate insecticide ethoprop are used for wireworm control in Maine potato fields. At planting applications of the organophosphate insecticide disulfoton provide aphid and flea beetle control. Foliar applications of azinphos methyl provide control of flea beetle while foliar applications of phosmet provide effective control of Colorado Potato Beetle.

Foliar applications of the organophosphate insecticide methamidophos are used during the season when aphid populations exceed economic thresholds. Seed potato producers in Maine use multiple applications of methamidophos for aphid control.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MASSACHUSETTS APPLES

ACRES: 5,250
PRODUCTION:
VALUE ($/YR): $7,000,000
VOLUME (LBS/YR): 60,000,000

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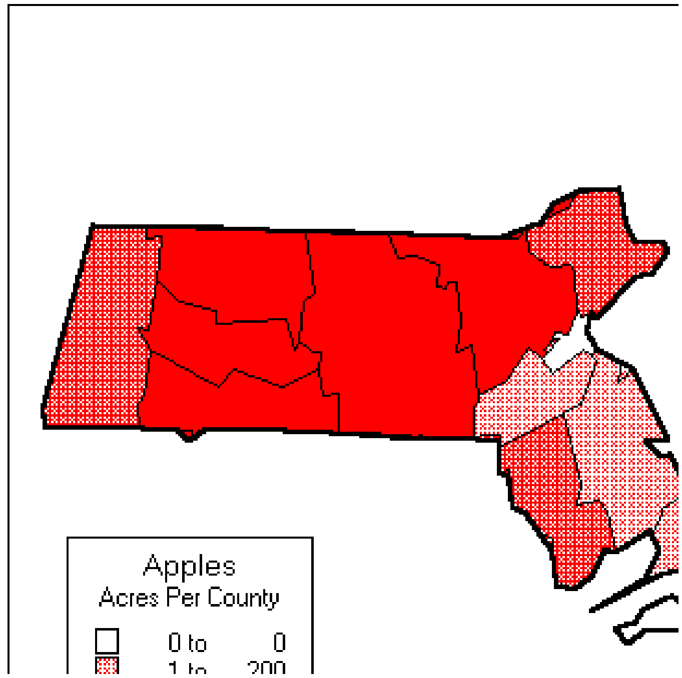


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	85	4,463
CARBARYL**	37	1,943
CHLORPYRIFOS**	5	263
ENDOSULFAN	10	525
OIL	79	4,148
OXAMYL**	7	368
PERMETHRIN	8	420
PHOSMET**	22	1,155

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Organophosphate insecticides are the primary controls used for three major insect pests (tarnished plant bugs, apple maggots and plum curculio) and one minor pest (San Jose scale) in Massachusetts. After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae. After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed. Overwintering tarnished plant bug adults begin feeding on apple buds and lay eggs in blossom buds. Affected fruit exhibit both feeding and egg laying injury. Feeding punctures are usually small, but the egg-laying punctures cause deep depressions and distortions of the fruit. After mating, female San Jose scale begin producing living young at the rate of nine or ten per day. These crawlers insert their mouthparts through bark and begin sucking sap. The descendants from a single female could number more than 300 million per year. Heavy scale infestations can stress the tree causing thin foliage, decaying branches and, eventually, tree death. The scale also infects leaves and fruit. Scaly fruit is unsightly and not marketable.

Importance of insecticides:

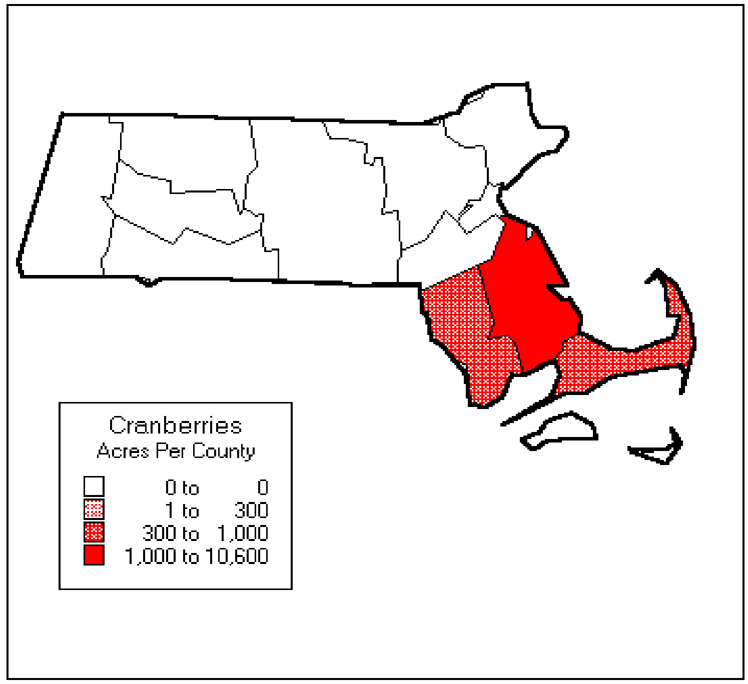
The only practical means of controlling the apple maggot is to kill the flies before females deposit eggs. At present, no practical method of treating soil to destroy the pupal stage has been devised.Organophosphate insecticides (azinphos methyl and phosmet) are directed at adult plum curculio during the egg-laying stage. No materials other than organophosphates provide acceptable commercial control. Despite intensive study for the past 20 years, no IPM strategies have been identified. Without an effective control agent for plum curculio, commercial apple production in Massachusetts would be impossible within three to five years. San Jose scale is a very minor pest in Massachusetts. Only limited acreage (5%) is treated with chlorpyrifos for this pest. No other material is effective against the crawler stage. The organophosphate insecticides azinphos methyl and phosmet are effective against apple maggots at one-half to one-fourth the full labeled rate. Full rates of azinphos methyl and phosmet are used to control plum curculio and tarnished plant bug.

For tarnished plant bug, synthetic pyrethroids are effective. However, their usage has not been encouraged because of detrimental effects on mite predators. Organophosphate materials do not destroy the mite predators, and, as a result, miticide use is low. If pyrethroids were used as replacements for the organophosphates, explosions in mite populations would occur, IPM practices would be disrupted and a significant increase in miticide use would result.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MASSACHUSETTS CRANBERRIES

ACRES: 12,186
PRODUCTION:
VALUE ($/YR): $99,180,000
VOLUME (LBS/YR): 190,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	18	2,193
AZINPHOS-METHYL**	26	3,168
BT	14	1,706
CARBARYL**	42	5,118
CHLORPYRIFOS**	85	10,358
DIAZINON**	75	9,140
PYRETHRIN	30	3,656

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

There are many species of insects that affect the roots, shoots and fruit of the cranberry plant. The cranberry fruitworm is the most economically important insect pest, causing direct damage to maturing berries. When left uncontrolled, feeding can result in greater than 50 percent fruit loss. The cranberry girdler lives in leaf litter and feeds on the bark and wood of the cranberry vines from late July until after harvest. Girdled vines die. Fireworms feed primarily on the foliage, skeletonizing leaves and giving the vines a burnt appearance. Cutworms and spanworms feed by nipping the terminal buds, leaves and blossoms. Vines may be defoliated and fruit set reduced as the stems of buds and blossoms are severed.

Importance of insecticides:

If the four major insecticides, chlorpyrifos, diazinon, azinphos methyl and acephate, were no longer available . . . in most places yields would be significantly reduced since the remaining insecticides are not as effective and cultural or biological alternatives do not provide as good or as fast control as the chemicals. At least half of the crop could be lost to direct pests alone, the first year in East Coast beds, with yield reductions of 15 to 50 percent estimated elsewhere. In subsequent years, pest pressure would be higher, and losses more severe, enough to drive many growers out of business.

USDA, Biological and Economic Assessment
of Pesticide Usage in Cranberry, 1994

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Jere Downing at The Cranberry Institute (508)-295-4132

INSECTICIDE USE ON MASSACHUSETTS POTATOES

ACRES: 2,700
PRODUCTION:
VALUE ($/YR): $3,813,000
VOLUME (LBS/YR): 67,500,000

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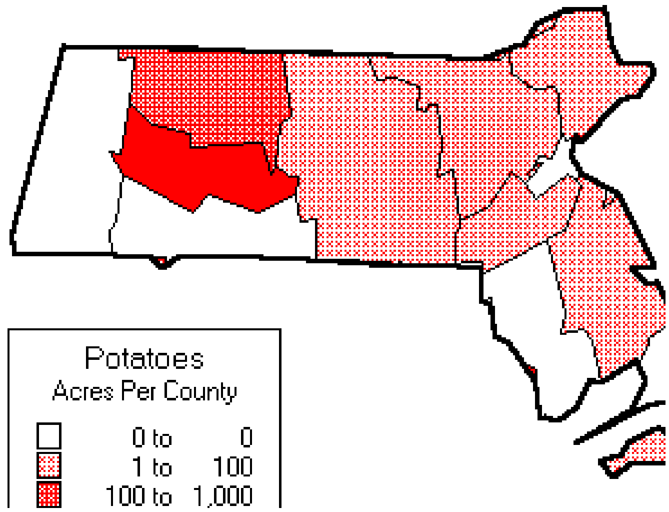


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
BT	10	270
IMIDACLOPRID	90	2,430
METHAMIDOPHOS**	60	1,620

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

In Massachusetts the major insect pests of potatoes are the Colorado Potato Beetle and Green Peach Aphid. The Colorado Potato Beetle is effectively controlled through applications of imidacloprid and BT. The organophosphate insecticide methamidophos is used to control the aphids.

In late spring, the green peach aphid migrates into Massachusetts potato fields. Once on the potato, the female aphids produce live females, without mating with male aphids. The winged aphids fly from plant to plant probing each with their beaks. This constant probing vectors leafroll virus into potatoes. Virus diseases have caused severe losses to Massachusett's potato industry in terms of decreased yields, malformed tubers and internal discolorations.

Aphids are capable of traveling long distances. Green peach aphid migrants have been known to travel 1,000 miles and have been found in the atmosphere at altitudes of up to 10,000 feet.

It is difficult to control aphids to acceptable levels with natural enemies. One aphid can infect many plants, and most natural enemies are not capable of controlling the aphids at low population densities.

Importance of insecticides:

When aphid populations reach the accelerated growth phase of their seasonal cycle, natural enemies cannot be expected to reduce the populations below economic levels. Direct control of aphids with insecticides has been found to be the only effective means of control.

One foliar application of an insecticide may be necessary to control aphids after about mid-season.

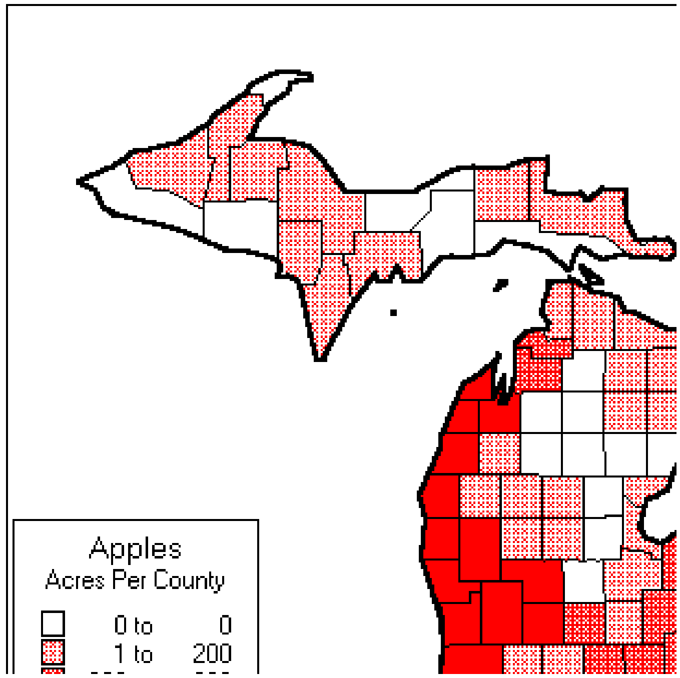
Methamidophos has been the primary foliar insecticide used in Massachusetts for aphid control since 1973.

One alternative for aphid control is the application of mineral oil to potato plants. However, because of the cost and the need for weekly applications, this method is not used widely for aphid control. Insecticidal soaps also have to be applied repeatedly to control aphids.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MICHIGAN APPLES

ACRES: 83,800
PRODUCTION:
VALUE ($/YR): $81,300,000
VOLUME (LBS/YR): 1,000,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	83	69,554
CARBARYL**	34	28,492
CHLORPYRIFOS**	81	67,878
DIMETHOATE**	17	14,246
METHYL PARATHION**	15	12,570
OIL	60	50,280
PHOSMET**	47	39,386

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The codling moth, apple maggot, plum curculio and aphids are the most important insect pests of apples in Michigan. Larvae of the codling moth tunnel into fruit and render it unmarketable as fresh fruit.

After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae.

After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed.

Aphids overwinter in the egg stage. As soon as they hatch, the young seek out the open buds of apples. They feed by sucking the sap from the stems and the newly-formed fruits. Their feeding causes the leaves to curl. The aphids congregate in immense numbers and cause leaves to die. Feeding on the leaves often results in malformation of the developing fruit.

Importance of insecticides:

Codling moth, plum curculio, and apple maggot feed directly on the fruit, and in the absence of effective controls, they can destroy 50 to 90 percent of the crop. These pests have very poor or no effective natural predators, controls or IPM alternatives. Organophosphate insecticides (azinphos methyl, phosmet, chlorpyrifos and methyl parathion) are the only effective options for plum curculio and apple maggot control. There are no experimental insecticides or non-chemical strategies currently under development for controlling these pests. Alternative pyrethroid insecticides are highly disruptive to mite populations. (Pyrethroids kill natural mite predators while the organophosphates do not.)

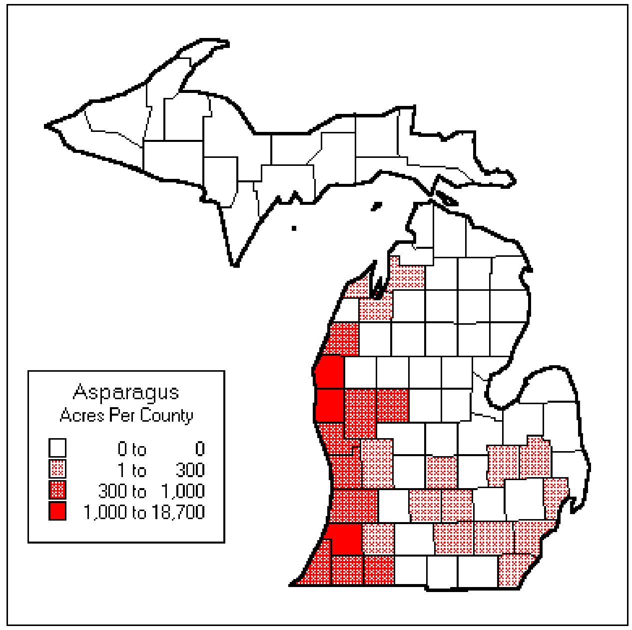
Dimethoate is used to control aphids, for which the alternative, imidacloprid, performs well. However, resistance to imidacloprid would be expected to develop if aphids were controlled with a single non-organophosphate alternative.

A wide variety of arthropod species regularly colonize apple orchards from native habitats, but do not reach pest status because they are incidentally controlled by broad-spectrum insecticides, such as OP's targeted for the key pests. If OP's were eliminated or reduced in Michigan apple orchards, some of these incidental pests could develop into damaging populations.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Mark Arney at The Michigan Apple Committee (517)-669-8353

INSECTICIDE USE ON MICHIGAN ASPARAGUS

ACRES: 18,000
PRODUCTION:
VALUE ($/YR): $20,000,000
VOLUME (LBS/YR): 29,800,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	65	11,700
CHLORPYRIFOS**	28	5,040
PERMETHRIN	29	5,220

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

White cutworms overwinter as larvae damaging spears from the beginning of the season until early June. White cutworms climb asparagus plants and feed on the growing tip of the asparagus spears causing cullage. Dark sided cutworms feed on spears just above the soil surface, causing crooked spears. Adult cutworms are highly migratory, moving in and out of fields on a daily (nightly) basis, so that control measures must be directed at larvae.

The asparagus beetle can cause widespread damage to the crop. Adults feed and deposit eggs on the asparagus spears. Asparagus beetles can defoliate large areas of asparagus ferns in a short time. Asparagus beetles are a serious problem during the harvest in Michigan because adults lay eggs directly on the spears. There is zero tolerance for asparagus beetle eggs on spears.

Importance of insecticides:

Cold Michigan winters used to provide sufficient control of overwintering cutworm larvae. However, since asparagus growers have converted to no-tillage systems (to prevent the spread of fusarium) a large percentage of cutworm larvae now successfully overwinter in crop debris. Uncontrolled cutworms may damage from 80 to 90 percent of the spears in individual fields.

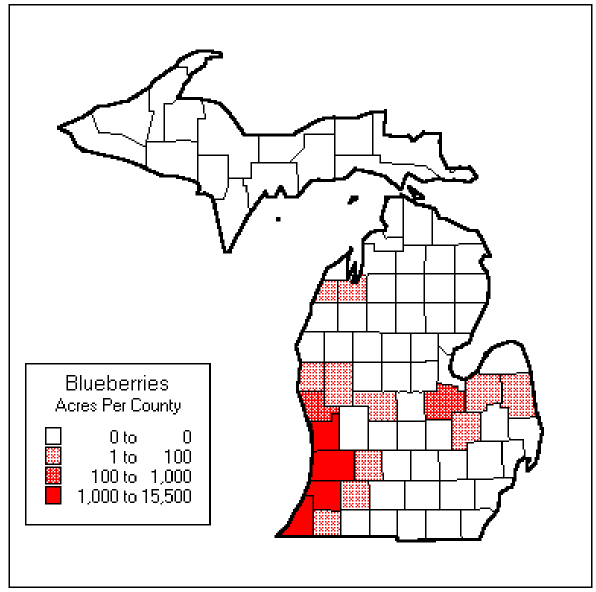
The organophosphate chlorpyrifos is used to control cutworms. Chlorpyrifos is applied 10 to 14 days prior to harvest when no spears have emerged; this is done in years when conditions are right for a potential outbreak of cutworms. The only alternatives are pyrethroids which have a history of becoming ineffective in a short period of time.

In Michigan, asparagus beetles are controlled with carbaryl, both during harvest to decrease cullage by preventing egg laying, and during the fern stage. Carbaryl can be applied up to one day prior to harvest. During the harvest period, carbaryl is the only chemical available for use since the crop is often harvested every day. With only a one day reentry period, carbaryl is the only product that can be used to allow workers back in fields on the following day.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Perry DeKryger at The Michigan Asparagus Advisory Board (517)-669-4250

INSECTICIDE USE ON MICHIGAN BLUEBERRIES

ACRES: 17,800
PRODUCTION:
VALUE ($/YR): $36,330,000
VOLUME (LBS/YR): 47,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	61	10,858
BT	5	890
CARBARYL**	18	3,204
MALATHION**	82	14,596
METHOMYL**	47	8,366
PHOSMET**	31	5,518

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Insects of greatest concern to blueberry growers include blueberry maggot, (blueberry fruit fly), fruitworm and Japanese Beetle. These insects are fruit or foliage feeders. The blueberry maggot is the most important pest because processors will reject any load of blueberries in which they discover a single maggot.

Blueberry fruit flies emerge from the soil from June through August. Once mated, the females seek ripening blueberries in which to lay eggs. In seven to 10 days the eggs hatch, and the larva (maggot) begins feeding. As the larva feeds and grows, the berry begins to shrink. After two to three weeks the berry is destroyed almost completely. The presence of infested fruit at harvest can result in the condemnation of whole fields of harvested fruit. Fruitworms web together several berries with silk, feeding inside as many as four. Fruitworm infestations are characterized by masses of brown frass (excrement) and silk.

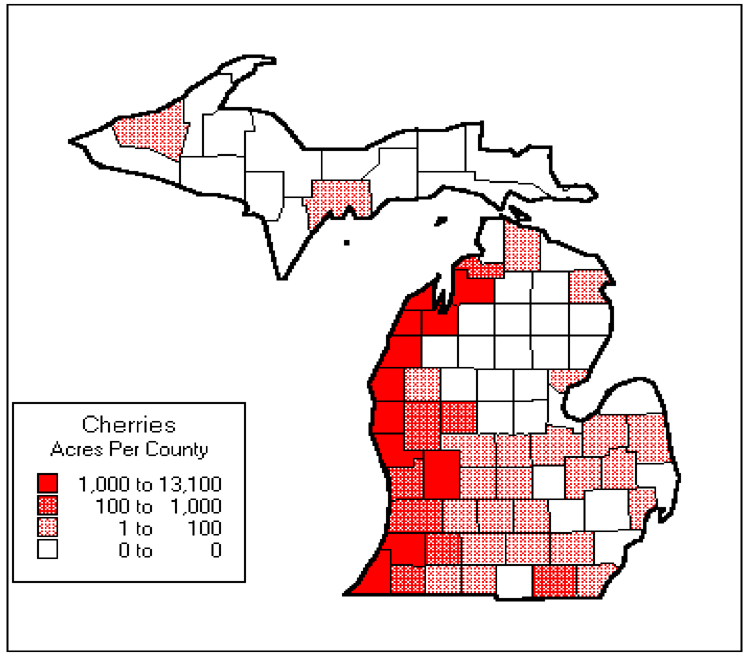
Importance of insecticides:

Malathion is used primarily for blueberry maggot control because of its short (one day) PHI (pre-harvest interval). Each bush of each blueberry variety is harvested repeatedly throughout that variety's three- to five-week ripening period. The interval between these harvests is often very short and approach the minimum PHI for malathion during the peak harvest. Phosmet has a minimum PHI of three days. Phosmet is increasing in usage in Michigan blueberries because of the increasing problem of Japanese Beetles. Phosmet is the only efficacious material that has a PHI shorter than seven days. Azinphos methyl has a minimum PHI of seven days and is targeted against fruitworms, which are problems in late spring and early summer. BT's are used when fruitworm emergence coincides with the blueberry bloom period. However, efficacy of BT's have been variable. Non-chemical insect post management alternatives are not available.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Dave Trinka of the Michigan Blueberrry Growers Association at (616) 434-6791.

INSECTICIDE USE ON MICHIGAN CHERRIES

ACRES: 37,300
PRODUCTION:
VALUE ($/YR): $48,291,821
VOLUME (LBS/YR): 244,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	81	30,213
CARBARYL**	14	5,222
CHLORPYRIFOS**	18	6,714
CLOFENTEZINE	15	5,595
ESFENVALERATE	22	8,206
METHYL PARATHION**	6	2,238
OIL	3	1,119
PERMETHRIN	15	5,595
PHOSMET**	31	11,563

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The most important insect pests in Michigan tart cherry orchards are cherry fruit fly and plum curculio. Both insects directly damage the fruit. Female fruit flies lay their eggs under the skin of the fruit (each female can lay from 50 to 200 eggs). The hatched larvae feed inside the fruit. A Food and Drug Administration rule mandates a zero tolerance for cherry fruit fly maggots in processed cherries. In unsprayed trees a high percentage of fruit is likely to be attacked. Both adult and larval stages of plum curculio feed directly on the cherries.

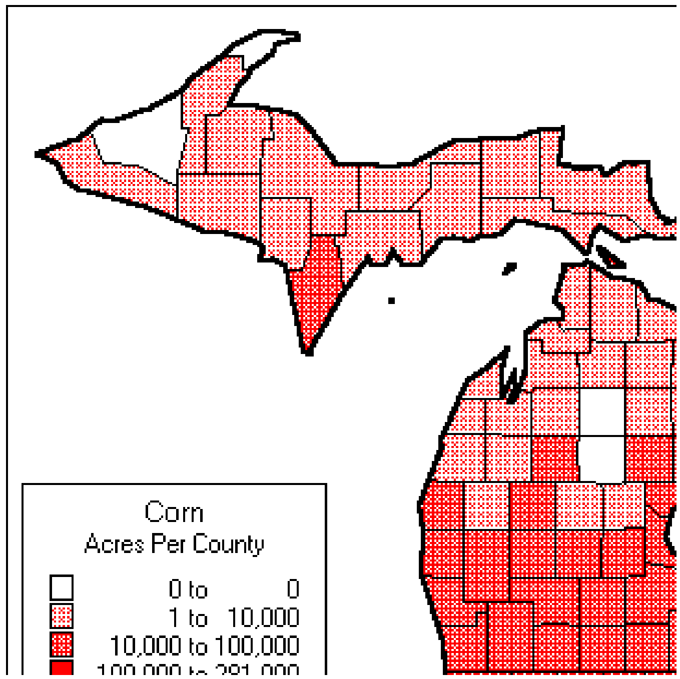
Importance of insecticides:

The organophosphate insecticides azinphos methyl, phosmet and chlorpyrifos are used widely in Michigan tart cherry orchards because they provide effective control of all the major insect species. Alternatives to the organophosphates include pyrethroids, which are less effective and more costly. It has been estimated that without the organophosphate insecticides there could be years when as much as 80 percent of Michigan's tart cherries would not be harvested because of concerns regarding cherry maggot infestations. Unlike the organophosphates, the pyrethroids destroy beneficial mites which totally disrupt a good IPM program. With the resulting build-up of damaging mite species, miticide use would have to be increased.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Phil Korson at The Cherry Marketing Institute (517)-669-4264

INSECTICIDE USE ON MICHIGAN CORN

ACRES: 2,250,000
PRODUCTION:
VALUE ($/YR): $671,288,000
VOLUME (LBS/YR): 18,427,500,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	7	157,500
TERBUFOS**	7	157,500

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The corn rootworm is the most important insect pest affecting corn production in Michigan. Damage by root-feeding insects reduces water and nutrient movement in corn plants, resulting in unfilled corn ears and reductions in yields of up to 55 percent. Rootworm feeding weakens the corn root system, causing maturing plants to tilt or tip over. A single female rootworm can lay up to 1,000 eggs in late summer; the eggs hatch the following spring; and the larvae feed on the roots of corn.

Rootworm larvae and adults appear to be remarkably immune to attacks by micro-organisms, predators and parasites. There are no commercially available corn varieties resistant to corn rootworms. Most insecticides in corn are applied in a band down the row of corn plants at planting to protect the roots. Rootworm larvae and eggs outside the narrow insecticide ban are unaffected.

Importance of insecticides:

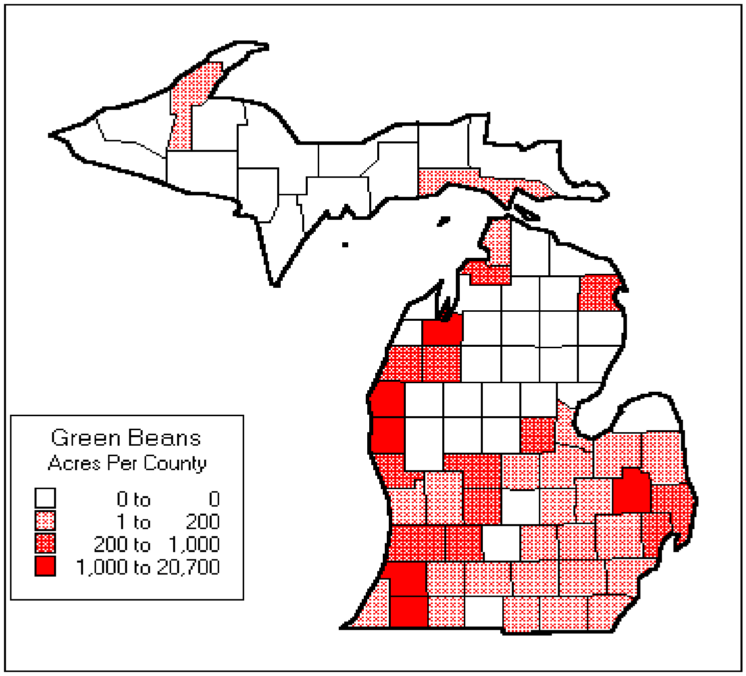
Most corn grown in Michigan is rotated annually with another crop. Fields planted to corn for three years or more (continuous corn) account for 30 percent of the state's acreage. Many Michigan corn growers apply soil insecticides for rootworm control at less than the label rate. Nineteen percent of the growers have reported use of soil insecticides at three-quarters rate or less. Approximately 80 percent of the continuous corn acreage in Michigan is treated with a soil insecticide at planting for rootworm control. The two main products are the organophosphate insecticides chlorpyrifos and terbufos. Among Michigan growers who have incurred yield losses from corn rootworm, an average of 26 bushels per acre was lost.

The primary use of the organophosphate insecticides is for corn rootworm control in cornfields planted continuously to corn. A non-organophosphate alternative, the pyrethroid tefluthrin is rated equally as effective as the organophosphates for control of rootworm larvae. However, as the only suitable alternative for rootworm control, tefluthrin use most likely would predominate if the organophosphates were no longer available. The reliance on a single pesticide to suppress the pest would increase significantly the potential for the development for pest resistance to tefluthrin. The degree to which fipronil is a suitable control for rootworms has not been determined fully. Field trials generally have produced inconsistent results.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MICHIGAN GREEN BEANS

ACRES: 19,553
PRODUCTION:
VALUE ($/YR): $13,699,000
VOLUME (LBS/YR): 164,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	37	7,235
CARBARYL**	4	196
DIMETHOATE**	11	2,151
DISULFOTON**	37	7,235
ESFENVALERATE	10	1,955
METHYL PARATHION**	14	2,737

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

European corn borer is the most serious insect pest of snap beans in Michigan, even though injury rarely exceeds one or two percent of the pods. Larvae bore into the pod and feed on the bean. Larvae may be present in the pods at harvest. For beans grown for processing, preventive treatment is necessary because buyers require 100 percent pest-free beans. Processors will reject a load of snap beans if they find more than one borer per 1,000 beans. Insecticide treatments are recommended to begin at least two weeks prior to harvest to protect against pod injury and to have the crop free of European corn borer by harvest time.

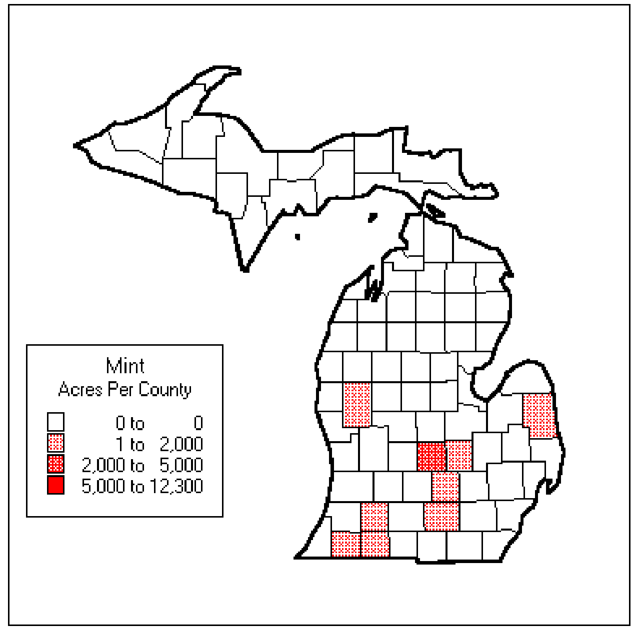
Importance of insecticides:

There are no biological or cultural controls that are available to achieve the low tolerance for damage from the European corn borer. BT has been tested, but does not achieve a zero damage rating. Although registered for use, a pyrethroid is not recommended because of poor control at currently labeled rates. The only reliable options for European corn borer control in green beans are organophosphate insecticides: acephate and methyl

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MICHIGAN MINT

ACRES: 2,300
PRODUCTION:
VALUE ($/YR): $1,100,650
VOLUME (LBS/YR): 86,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
MALATHION**	30	690

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests. Female mint flea beetles lay eggs in the soil near the crowns of plants in July to early August and continue laying eggs until late fall. The eggs hatch the following April or May. The young larvae feed on underground mint plant parts for about four to five weeks. High populations of mint flea beetle can devastate mint stands. The flea beetle was first found in Midwestern mint fields during the 1920's. Annual production in a field with heavy infestations of flea beetle dropped from 44 pounds per acre to three pounds per acre.

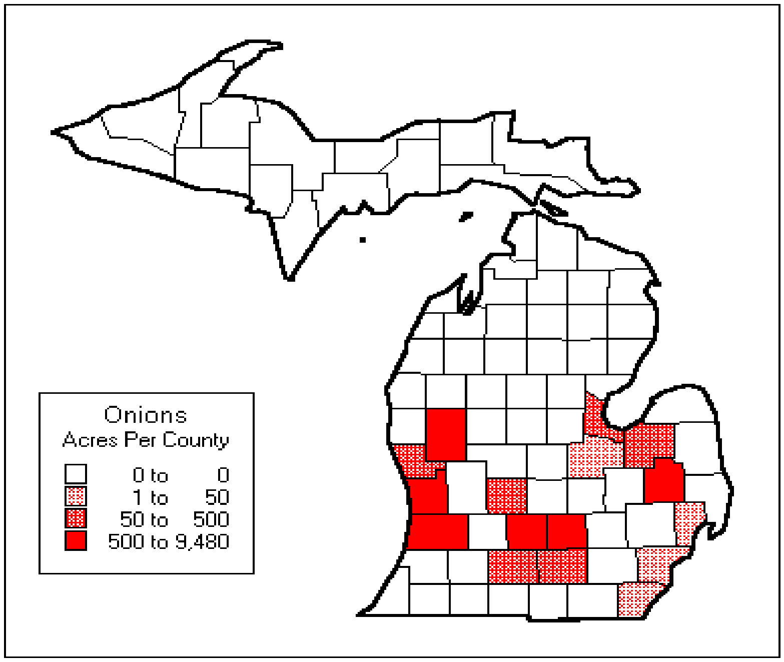
Importance of insecticides:

Mint fields are monitored for flea beetles at the adult emergence stage. Fields above economic thresholds are treated with the organophosphate malathion. Currently, malathion is the only insecticide recommended for mint flea beetle control. It is economical, efficacious, and does not harm beneficial insects. Malathion applications are targeted at the adult fly stage to prevent egg laying. Peak adult emergence falls between July 25th and August 10th. Even though malathion has a short half life and may be applied up to seven days prior to mint harvest, treatments in the Midwest are usually made after harvest at which time the mint stubble is treated.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at the Mint Industry Research Council at (509) 427-3601.

INSECTICIDE USE ON MICHIGAN ONIONS

ACRES: 6,771
PRODUCTION:
VALUE ($/YR): $17,419,000
VOLUME (LBS/YR): 230,800,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	7	474
CHLORPYRIFOS**	36	2,438
CYPERMETHRIN	76	5,146
DIAZINON**	10	677
LAMBDACYHALOTHRIN	80	5,417
METHOMYL**	5	339
METHYL PARATHION**	28	1,896
PERMETHRIN	21	1,422

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The onion maggot is the most serious insect pest of onions in Michigan. The maggots feed on roots and burrow into the developing bulb. Onion seedlings wilt and typically die due to maggot damage. A single maggot will kill a growing seedling by tunneling up the interior of the stem. On older bulbs a number of maggots may be found eating out the interior. Whole sections of onion fields may be affected with up to 90 percent crop loss. Onion and maggot flies can disburse over a wide area and are attracted to damaged plants or bulbs for egg-laying. There are normally three generations of onion maggots each year. Reduction of the first generation of onion maggots by furrow applications of a soil insecticide at planting is key to managing the onion maggot. Historically, onion maggots have been controlled by oil (1930's), mercury (1940's), organochlorines (1950's), and organophosphate insecticides (1960's to present).

Importance of insecticides:

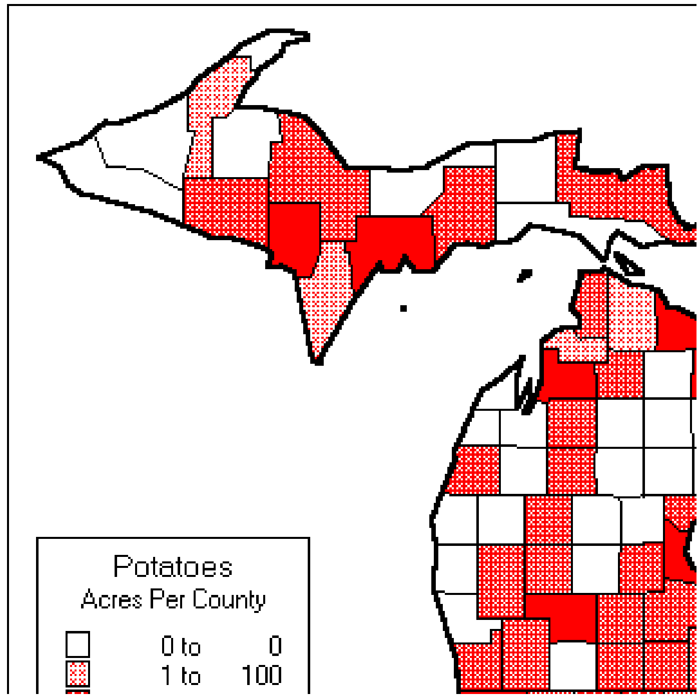
Research with chlorpyrifos applied as an in furrow treatment at planting indicated a less than 10 percent stand loss from maggots with onion maggot damage at four percent. Chlorpyrifos applied at planting protects the onion plants through the development of the first generation onion maggot, which does most of the onion damage in Michigan. No protective means are available if a soil insecticide is not applied and maggots develop. Existing foliar sprays applied to kill adults are largely ineffective because only a fraction of the adult population is in the field at any given time, and sprays labeled for onions have a very short residual.

Onion flies respond to volatile onion attractants in the field at distances of at least one mile. This mobility limits the potential of crop rotation as a control method for onion maggot. It has been estimated that reliance on crop rotation instead of chlorpyrifos would result in 70 to 80 percent crop losses. With the recent voluntary cancellation of fonofos, chlorpyrifos is the only insecticide available for in furrow treatment of the onion maggot.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MICHIGAN POTATOES

ACRES: 47,500
PRODUCTION:
VALUE ($/YR): $82,650,000
VOLUME (LBS/YR): 1,425,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	12	5,700
CARBARYL**	9	4,275
ESFENVALERATE	38	18,050
ETHOPROP**	12	5,700
IMIDACLOPRID	78	37,050
METHAMIDOPHOS**	24	11,400
PHORATE**	12	5,700
PHOSMET**	7	3,325

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The damage caused by potato leafhopper includes, not only loss of leaf area to feeding, but also reduced photosynthetic efficiency in the remaining leaf tissue. Potato leafhopper adults overwinter along the Gulf of Mexico. In spring, flying adults are caught in updrafts and transported in upper level air currents to Michigan. Female leafhoppers lay an average of two to three eggs a day and can lay as many as 200 in a lifetime. If leafhopper populations exceed economic thresholds, insecticides provide the only effective means of controlling this pest in potatoes. Leafhoppers feed by inserting their piercing sucking mouthparts into the plants and withdrawing sap. Damage is caused by extracting plant nutrients and water and by releasing a toxin in the plant from the salivary gland. Nematodes damage potato plants by feeding on roots and tubers and causing injury below ground. This leads to stunting, mineral deficiencies and wilting. Nematodes may survive as cysts in soil for as long as five years without a suitable host. Aphids overwinter as eggs on peach or other stone fruit trees. Winged aphids migrate to potatoes. Once on the potato, the female aphids produce live females, without mating with male aphids. The winged aphids fly from plant to plant probing each with their beaks. This constant probing vectors leafroll virus into potatoes. Virus diseases have caused severe losses to Michigan's potato industry in terms of decreased yields, malformed tubers and internal discolorations. Aphid control is especially important for seed production where low levels of virus infections are required for certification. Prevention of virus transmission by aphids is crucial to potato seed producers because the use of infected seed will result in a direct reduction of tuber yields in subsequent years.

Importance of insecticides:

In Michigan, the key insect pests of potatoes are the Colorado Potato Beetle, leafhoppers and aphids. Root lesion, root knot and potato rot nematodes also infest potato fields. At planting applications of imidacloprid provide the primary control of the Colorado Potato Beetle. Organophosphates have key roles in managing the insect and nematode pests of potatoes in Michigan. The use of phorate at planting provides control of aphids, leafhoppers and some control of the Colorado Potato Beetle. Ethoprop applications at planting provide control of wireworms and nematodes. Although foliar applications of imidacloprid provide excellent control of aphids and leafhoppers, growers are discouraged from using foliar applications of imidacloprid if an at planting application was made, so as to minimize resistance development. Foliar applications of the organophosphates phosmet and azinphos methyl provide control of Colorado Potato Beetles and leafhoppers.

The standard industry practice for leafhopper control is to apply foliar sprays. Leafhoppers seem to have few effective natural enemies. At the present time, biological control is not a viable management option for leafhoppers.

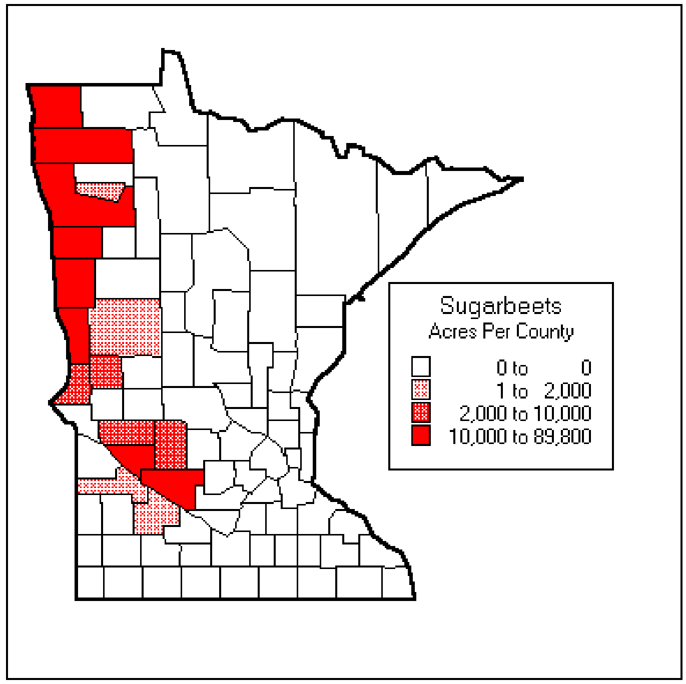
Foliar applications of methamidophos control infestations of aphids and leafhoppers in mid-season.

There are several thousand acres of potatoes grown for seed production in Michigan

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Ben Kudwas at the Michigan Potato Industry Commission at (517)-669-8377.

INSECTICIDE USE ON MINNESOTA SUGARBEETS

ACRES: 371,388
PRODUCTION:
VALUE ($/YR): $218,570,000
VOLUME (LBS/YR): 10,688,020,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	14	51,994
TERBUFOS**	57	211,694

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The sugarbeet root maggot overwinters in previously planted beet fields. Flies emerge in early June, and fly to near-by beet fields. Each female lays up to 200 eggs in clusters around beet plants. The eggs hatch and the small white larvae begin to feed on succulent roots of sugarbeet. The larvae scrape the root surface with their mouth hooks, causing irregular openings through which sap escapes from the root. The insect reduces beet stands, retards plant growth and reduces yield. Uncontrolled sugarbeet root maggots can reduce sugarbeet yields by 50 percent.

Importance of insecticides:

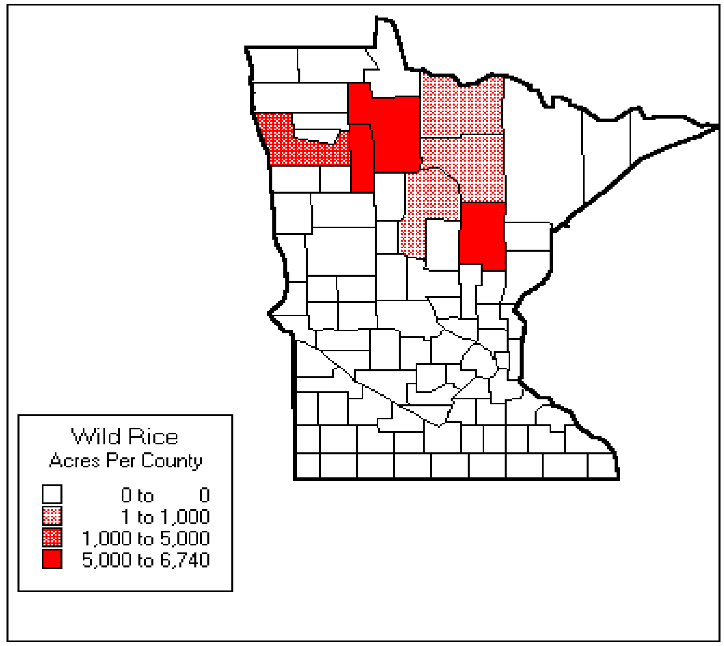
Most growers rely on insecticides to control the sugarbeet root maggot. The registered insecticides are the organophosphates terbufos and chlorpyrifos and the carbamates carbofuran and aldicarb. Terbufos and chlorpyrifos are the most widely used because of their high degree of control. Crop rotation is practiced extensively in the Red River Valley to control soil-borne diseases. Ninety-five percent of the acreage is planted to sugarbeets in three- or four -year rotations. However, the ability of the maggot to fly long distances in search of sugarbeets negates the control potential of rotation. The use of the organophosphates increased significantly in the Red River Valley from 1983 to 1990, reflecting the increased range and population density of sugarbeet root maggots. Organophosphates are banded down the row of sugarbeet plants at planting. After damage has been observed, applying insecticides as rescue treatments are not effective.

Considerable research has been completed regarding biological control of the sugarbeet root maggot. No commercially viable alternatives to insecticides are available currently to growers. Experiments with BT, natural bacteria and parasitic nematodes have failed to produce reliable

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON MINNESOTA WILD RICE

ACRES: 21,717
PRODUCTION:
VALUE ($/YR): $9,000,000
VOLUME (LBS/YR): 6,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
MALATHION**	27	5,864

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Minnesota and the surrounding Great Lakes region is the origin of wild rice. It is the only cereal native to North America that has been domesticated from a wild plant. Most wild rice in Minnesota is now harvested mechanically from cultivated paddies. Commercial production in California now rivals that of Minnesota.

The riceworm is the most important pest of wild rice in Minnesota. Eggs of the worm are deposited inside wild rice florets. Research has demonstrated that from 2 to 152 eggs can be deposited in a single floret. The tiny larvae feed inside the floret and, within a day or so, bore out and continue to feed on the kernels in the head and increase in size. The larvae not only consume the kernels of wild rice, but leave remnants of silk and starchy excrement. Severely injured panicles are conspicuous with their matted silk, masses of white starchy frass and ruined kernels. It is estimated that one larva per plant will reduce yields by 11 percent. One paddy was observed in 1975 with three to four riceworms per panicle, and the yield was practically negligible.

Importance of insecticides:

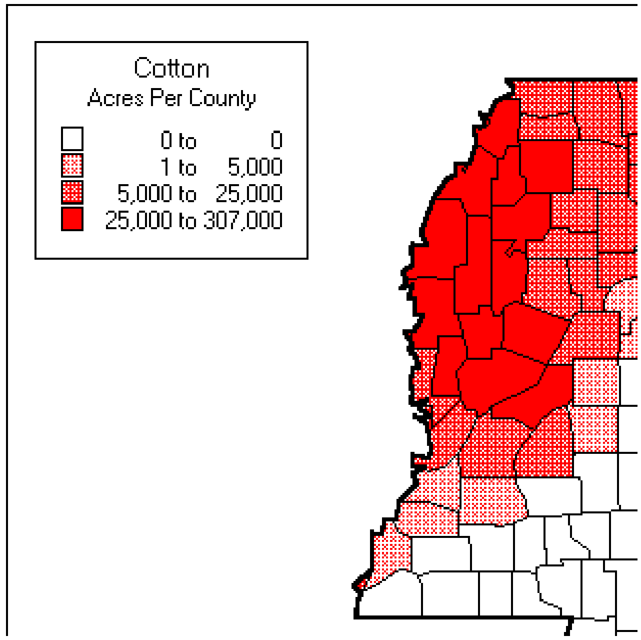
Replicated experiments in 1971 indicated that malathion applied at a rate of 1.0 lb. active ingredient/acre gave excellent control of riceworms. An air application of malathion reduced riceworms from 200/100 panicles to 17/100 panicles (92% control).

Preliminary research using carbaryl, BT and diflubenzuron indicates poor efficacy against the riceworm. Research has indicated that malathion is efficacious in controlling riceworm and is the only product registered. There are no cultural alternatives for riceworm control. The wild rice industry has contacted hundreds of chemical dealers and manufacturers to identify possible alternatives. No potential new use has been identified.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Beth Nelson at the Minnesota Cultivated Wild Rice Council (612)-638-1955

INSECTICIDE USE ON MISSISSIPPI COTTON

ACRES: 985,000
PRODUCTION:
VALUE ($/YR): $566,500,000
VOLUME (LBS/YR): 710,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	39	384,150
ALDICARB**	39	384,150
DICROTOPHOS**	40	394,000
DISULFOTON**	10	98,500
LAMBDACYHALOTHRIN	27	265,950
MALATHION**	34	334,900
METHYL PARATHION**	63	620,550
OXAMYL**	28	275,800
PHORATE**	6	59,100
PROFENOFOS**	19	187,150

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Organophosphate insecticides are used to control numerous insect species in Mississippi cotton fields, with the key target pests being plant bugs, whiteflies, aphids, boll weevils, stink bugs, budworms and bollworms. Plant bugs feed by inserting their needle-like mouthparts into terminals, squares, small bolls and other tender plant parts. Small squares usually turn dark and drop off while bolls may develop abnormally. Aphids damage cotton by sucking juices from the plant and secreting honeydew. Plants may become stunted and die. During late season the secretion of honeydew falls onto open cotton and the lint may be stained by a black sooty mold that develops on the lint. Stink bugs can begin invading cotton in early July and build to damaging levels in August. They damage cotton by feeding on the soft developing seeds. The boll weevil emerges from overwintering sites in the spring and enters cotton fields. Female boll weevils lay eggs inside cotton plants. One female can lay an average of 150 eggs in two weeks. Eggs hatch and larvae feed for seven to ten days.

Organophosphate and carbamate chemistries are key tools for practicing integrated pest management in Mississippi cotton. Approximately 60% to 70% of all insecticide treatments used anually on Mississippi cotton belong to these classes of chemistry. Some of the major strengths of these two classes of chemistry are their effectiveness against key pests, such as boll weevils and tarnished plant bugs; their relatively low cost; their effectiveness against minor pests such as whiteflies, for which effective alternatives are not available; and their role in resistance management.

Importance of insecticides:

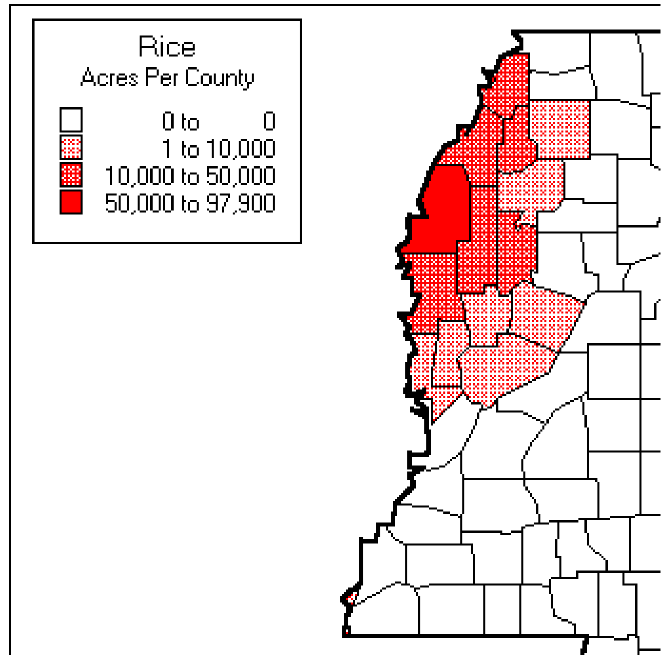
The immediate short-term impact (first 1 to 3 years) of losing the organophosphate and carbamate insecticides in cotton in Mississippi is estimated to increase cost of insect control by approximately $60 per acre n the Delta area and by approximately $29 per acre in the Hill area. This alone would have a devastating impact on cotton acreage, in this area where producers are already struggling with narrow profit margins. The long term impact (3 to 5+ years) would likely be much more severe. Placing a heavier use burden on remaining chemistry would accelerate selection for resistance in pests such as aphids, plant bugs, tobacco budworms, and even bollworms. Initially, this would result in using higher insecticide rates, more reliance on tank mixtures, and more frequent treatment. All of these consequences of resistance would serve to further elevate costs. Ultimately, in the absence of any new control tools, this would result in inability to control resistant pests at any cost, making cotton production infeasible in areas affected by resistant pests.

However, the factor that would be of even greater importance to cotton producers would be the increased risk of insect related disasters that they would face. This risk is already high, but would be greatly increased if the pool of available insecticide chemistries were to be reduced. Again, one of the primary reasons for the increase in risk would be the increased selection for resistance that would result from narrowing the list of available insecticides. Per acre costs of producing cotton can exceed $500, and Mississippi cotton is host to several pests that have the capacity to reduce yields by 50% to 100% in the absence of effective control.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Blake Layton at Mississippi State University (601)-325-2085.

INSECTICIDE USE ON MISSISSIPPI RICE

ACRES: 238,000
PRODUCTION:
VALUE ($/YR): $144,000,000
VOLUME (LBS/YR): 1,380,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBOFURAN**	18	42,840
LAMBDACYHALOTHRIN	10	23,800
MALATHION**	10	23,800
METHYL PARATHION**	70	166,600

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Rice water weevils (RWW) occur throughout Mississippi's rice growing area. The larvae feed on rice roots for about three weeks and cause injury by pruning the root system. Yield losses in untreated fields typically range from 10 to 33 percent, but can be as high as 50 to 70 percent under heavy pressure. Control of rice water weevils by draining rice fields was first suggested in 1881. Soil drying may prevent the establishment of RWW larvae in the root zones of rice plants. However, drainage of fields can result in the loss of fertilizer, can promote weed growth and increase disease severity. In addition, frequent rains prevent fields from drying out completely. Although extensive host plant resistance research has been conducted, no varieties capable of providing significant levels of protection from RWW have been identified.

The rice stink bug sucks the juices from the kernels. Florets, fed on early, are often wholly drained of their contents. Feeding on larger kernels results in discolored spots on the rice kernel, and, thus, reductions in quality and price received. Management of rice stink bugs relies significantly on naturally occurring biological control agents. However, chemical control is recommended when stink bugs emerge from natural controls, and growers find more than three stink bugs per 10 net sweeps.

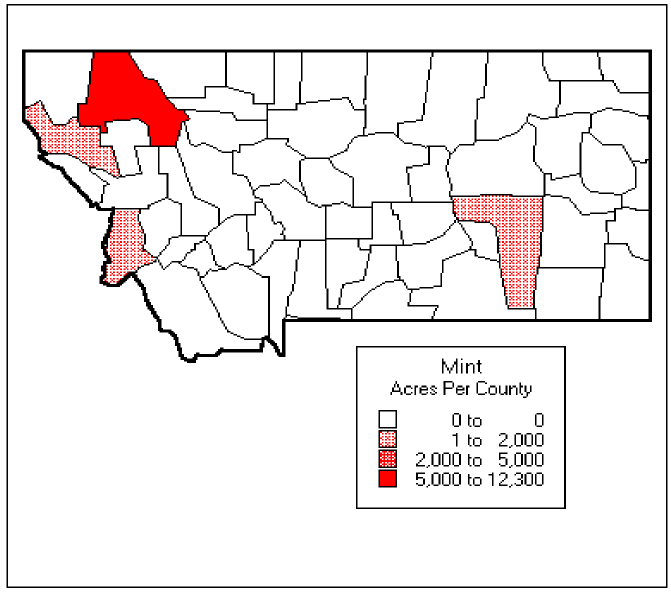
Importance of insecticides:

In the early 1960's effective rice water weevil control was achieved by applications of aldrin to rice seed. However, this success was short-lived as aldrin resistant rice water weevils appeared in the mid-1960's. For thirty years (1967-1997) carbofuran was the only insecticide registered for rice water weevil control. Growers are advised to pull up plant roots to determine whether rice water weevils are present and to use carbofuran if populations are high enough. In 1998, two new insecticides were registered for rice water weevil control – fipronil is applied to the seed and has provided season-long control in research plots. However, growers would have to decide to treat their fields prior to planting and not on the basis of an observable problem. For dry seeded rice the decision to treat must be made at least 1 to 2 months prior to planting to allow the seed dealer time to treat and bag seed. Lambdacyhalothrin is applied to rice foliage to kill adult rice water weevils. However, the scouting procedures for adults is new. Lambdacyhalothrin may have to be applied more than once for adequate control of adult weevils. Methyl parathion has been preferred for stink bug control because of economics, quick action and longer residual control. Although registered for rice stink bugs, carbaryl is not used as it is two to three times more expensive and it has significantly less residual control than methyl parathion.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Joe Street at Mississippi State University at (601)-686-3271.

INSECTICIDE USE ON MONTANA MINT

ACRES: 8,100
PRODUCTION:
VALUE ($/YR): $7,371,000
VOLUME (LBS/YR): 526,500



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	80	6,480
CHLORPYRIFOS**	26	2,106
DICOFOL	5	405
METHOMYL**	16	1,296
OXAMYL**	15	1,215
PROPARGITE**	55	4,455

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests, including cutworms, aphids and spider mites. Cutworms emerge in June and deposit eggs in clusters of up to 500 on the leaves. Cutworms feed on the foliage for four to six weeks. Mint rootborers feed upon the underground stems of mint plants for 70 to 80 days in the fall. Damage is not noticeable right away, but come next spring, the mint field will have dry dead patches. In some instances mint rootborers have wiped out entire fields. The damage caused by the larvae boring in the mint roots severely weakens plants so that they are more susceptible to winter injury. High populations of aphids can cause extreme defoliation by piercing and sucking mint plant juices. Summer populations of spider mites can also cause complete defoliation if not controlled.

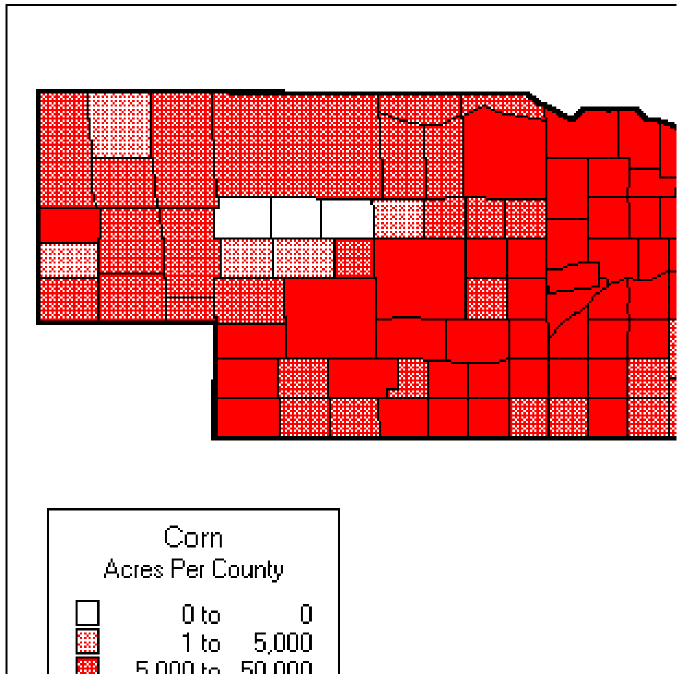
Importance of insecticides:

From about early June until harvest, as part of mint IPM programs developed by university researchers, fields are monitored for damaging populations of spider mites, cutworms and aphids. Frequently, populations of these pests are maintained under economic thresholds by natural biological controls, such as predator mites and lady beetles. If spider mite populations exceed the economic threshold, low rates of propargite can reduce populations without harming beneficial insects. If cutworms or aphids are found at levels above the threshold, the organophosphate acephate is applied. Acephate reduces the pest populations and allows the survival of the natural enemies. Alternatives to acephate are a carbamate and BT – neither of which is as effective. Mint rootborer used to be controlled by fall tillage. However, tillage is no longer practiced in mint in order to prevent the distribution of verticillium wilt. Fields are sampled in the fall for mint rootborer. Populations of borers exceeding the economic threshold are treated with chlorpyrifos – currently the only available control alternative for mint rootborer. Previously, a biological control (insect killing nematodes) was available for mint rootborer. Unfortunately, however, the product was discontinued.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at The Mint Industry Research Council at (509)427-3601.

INSECTICIDE USE ON NEBRASKA CORN

ACRES: 8,725,000
PRODUCTION:
VALUE ($/YR): $2,936,835,000
VOLUME (LBS/YR): 80,640,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBOFURAN**	10	872,500
CHLORPYRIFOS**	13	1,134,250
METHYL PARATHION**	13	1,134,250
PERMETHRIN	10	872,500
TEFLUTHRIN	10	872,500
TERBUFOS**	9	785,250

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Western corn rootworms are one of Nebraska's most serious insect pests of corn. Eggs laid in the soil from late July through September overwinter and begin hatching in late May or early June. Larvae feed on corn roots, causing plants to lodge, and may reduce grain yields. The greatest injury usually occurs from late June to mid-July, when all corn roots may be destroyed if infestations are heavy. Fully grown larvae pupate in the soil and change into adult beetles. Beetles emerge from pupae in the soil and are present in cornfields from early July until frost. Counting beetles in the cornfield throughout the summer helps growers decide whether or not to use a soil insecticide if corn is to be planted in that field the following spring.

Rootworm larvae and adults appear to be remarkably immune to attacks by micro-organisms, predators and parasites. There are no commercially available corn varieties resistant to corn rootworms. Most insecticides in corn are applied in a band down the row of corn plants at planting to protect the roots. Rootworm larvae and eggs outside the narrow insecticide ban are unaffected.

Importance of insecticides:

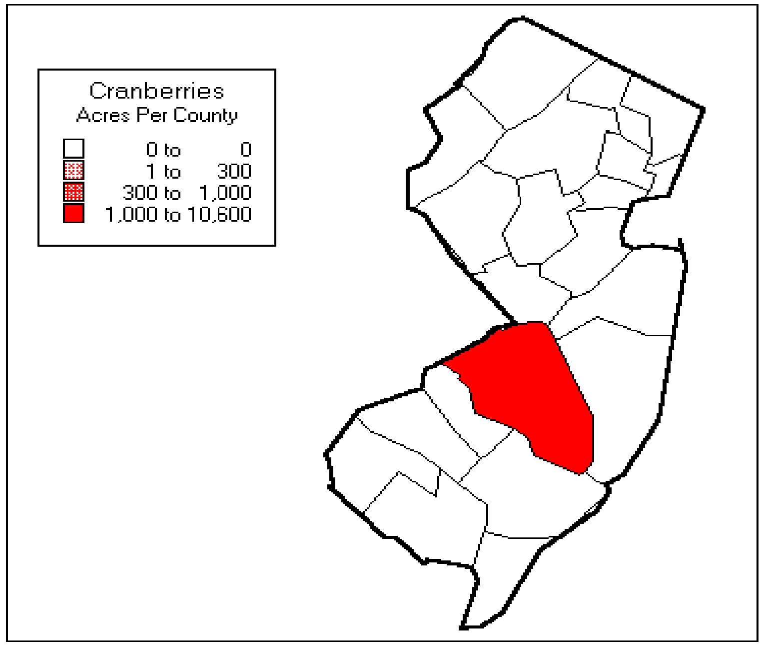
The primary use of the organophosphate insecticides is for corn rootworm control in cornfields planted continuously to corn. A non-organophosphate alternative, the pyrethroid tefluthrin is rated equally as effective as the organophosphates for control of rootworm larvae. However, as the only suitable alternative for rootworm control, tefluthrin use most likely would predominate if the organophosphates were no longer available. The reliance on a single pesticide to suppress the pest would increase significantly the potential for the development for pest resistance to tefluthrin. The degree to which fipronil is a suitable control for rootworms has not been determined fully. Field trials generally have produced inconsistent results.

Approximately 85 percent of Nebraska's corn is planted annually to corn while 15 percent of the acreage is rotated annually to another crop.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NEW JERSEY CRANBERRIES

ACRES: 3,170
PRODUCTION:
VALUE ($/YR): $26,712,000
VOLUME (LBS/YR): 56,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	51	1,617
AZINPHOS-METHYL**	43	1,363
CARBARYL**	6	190
CHLORPYRIFOS**	66	2,092
DIAZINON**	9	285
PYRETHRIN	4	127

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

There are many species of insects that affect the roots, shoots and fruit of the cranberry plant. The cranberry fruitworm is the most economically important insect pest, causing direct damage to maturing berries. When left uncontrolled, feeding can result in greater than 50 percent fruit loss. The cranberry girdler lives in leaf litter and feeds on the bark and wood of the cranberry vines from late July until after harvest. Girdled vines die. Fireworms feed primarily on the foliage, skeletonizing leaves and giving the vines a burnt appearance. Cutworms and spanworms feed by nipping the terminal buds, leaves and blossoms. Vines may be defoliated and fruit set reduced as the stems of buds and blossoms are severed.

Importance of insecticides:

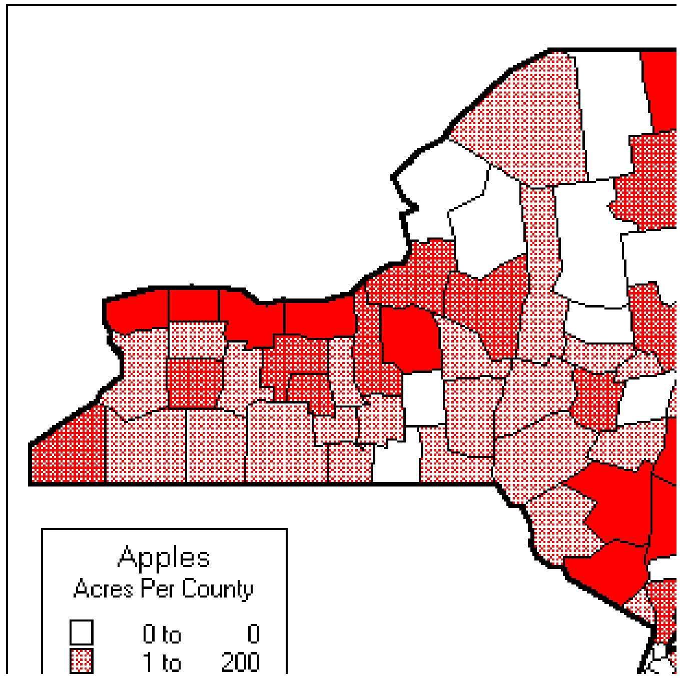
If the four major insecticides, chlorpyrifos, diazinon, azinphos methyl and acephate, were no longer available . . . in most places yields would be significantly reduced since the remaining insecticides are not as effective and cultural or biological alternatives do not provide as good or as fast control as the chemicals. At least half of the crop could be lost to direct pests alone, the first year in East Coast beds, with yield reductions of 15 to 50 percent estimated elsewhere. In subsequent years, pest pressure would be higher, and losses more severe, enough to drive many growers out of business.

USDA, Biological and Economic Assessment
of Pesticide Usage in Cranberry, 1994

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Jere Downing at The Cranberry Institute (508)-295-4132

INSECTICIDE USE ON NEW YORK APPLES

ACRES: 55,000
PRODUCTION:
VALUE ($/YR): $114,000,000
VOLUME (LBS/YR): 1,120,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	85	46,750
BT	10	5,500
CARBARYL**	37	20,350
CHLORPYRIFOS**	63	34,650
CLOFENTEZINE	16	8,800
DIMETHOATE**	9	4,950
ESFENVALERATE	29	15,950
METHYL PARATHION**	41	22,550
OIL	82	45,100
PERMETHRIN	6	3,300
PHOSMET**	22	12,100

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Key pests in New York apple orchards include apple maggots, plum curculio and aphids.

After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae. After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed.

Aphids overwinter in the egg stage. As soon as they hatch, the young seek out the open buds of apples. They feed by sucking the sap from the stems and the newly-formed fruits. Their feeding causes the leaves to curl. The aphids congregate in immense numbers and cause leaves to die. Feeding on the leaves often results in malformation of the developing fruit.

Importance of insecticides:

There is a large complex of insect pests in New York apple orchards. Regular sprays of organophosphate insecticides for several decades have reduced several species, such as codling moth and oriental fruit moth, to secondary status. New York apple orchards receive a regular series of eight to ten cover sprays. The organophosphate insecticides phosmet, methyl parathion, chlorpyrifos and azinphos methyl, are used regularly in these sprays because of their effectiveness in controlling multiple key pests of apples in New York. Two of the key pests that organophosphates control are apple maggots and plum curculio. Dimethoate is used primarily for control of aphids.

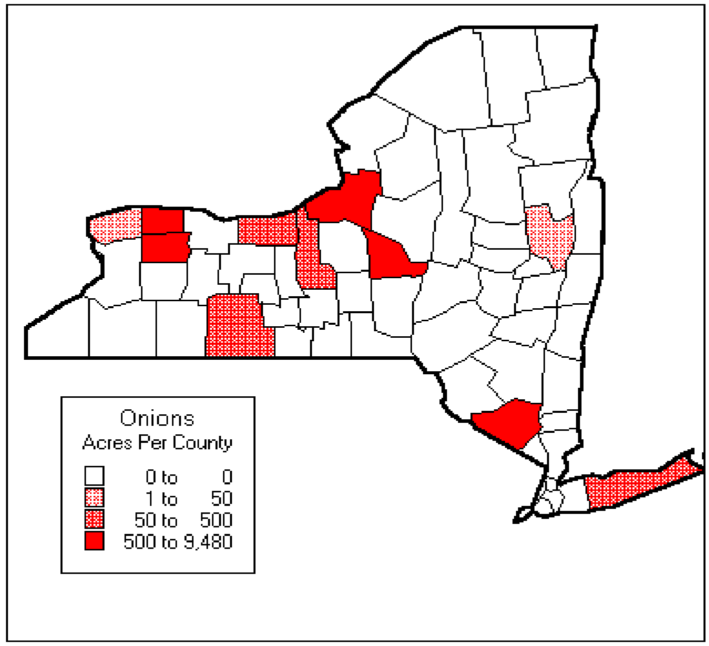
The only practical means of controlling the apple maggot is to kill the flies before females deposit eggs. At present, no practical method of treating soil to destroy the pupal stage has been devised.

Organophosphate insecticides (azinphos methyl and phosmet) are directed at adult plum curculio during the egg-laying stage. No materials other than organophosphates provide acceptable commercial control. Despite intensive study for the past 20 years, no IPM strategies have been identified. Without an effective control agent for plum curculio, commercial apple production in New York would be impossible within three to five years.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NEW YORK ONIONS

ACRES: 12,066
PRODUCTION:
VALUE ($/YR): $38,694,000
VOLUME (LBS/YR): 384,400,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	4	483
BT	6	724
CHLORPYRIFOS**	67	8,084
CYPERMETHRIN	33	3,982
DIAZINON**	9	1,086
METHOMYL**	8	965
METHYL PARATHION**	4	483
PERMETHRIN	92	11,101

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The onion maggot is the most serious insect pest of onions in New York. The maggots feed on roots and burrow into the developing bulb. Onion seedlings wilt and typically die due to maggot damage. A single maggot will kill a growing seedling by tunneling up the interior of the stem. On older bulbs a number of maggots may be found eating out the interior. Whole sections of onion fields may be affected with up to 90 percent crop loss. Onion and maggot flies can disburse over a wide area and are attracted to damaged plants or bulbs for egg-laying. There are normally three generations of onion maggots each year. Reduction of the first generation of onion maggots by furrow applications of a soil insecticide at planting is key to managing the onion maggot. Historically, onion maggots have been controlled by oil (1930's), mercury (1940's), organochlorines (1950's), and organophosphate insecticides (1960's to present).

Importance of insecticides:

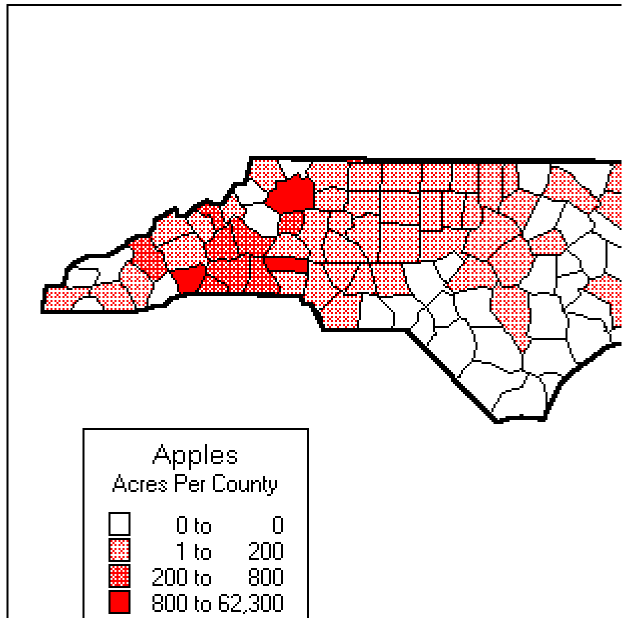
Research with chlorpyrifos applied as an in furrow treatment at planting indicated a less than 10 percent stand loss from maggots with onion maggot damage to bulbs at four percent. Chlorpyrifos applied at planting protects the onion plants through the development of the first generation onion maggot, which does most of the onion damage in New York. No protective means are available if a soil insecticide is not applied and maggots develop. Existing foliar sprays applied to kill adults are largely ineffective because only a fraction of the adult population is in the field at any given time, and sprays labeled for onions have a very short residual.

Onion flies respond to volatile onion attractants in the field at distances of at least one mile. This mobility limits the potential of crop rotation as a control method for onion maggot. It has been estimated that reliance on crop rotation instead of chlorpyrifos would result in 70 to 80 percent crop losses. With the recent voluntary cancellation of fonofos, chlorpyrifos is the only insecticide available for in furrow treatment of the onion maggot.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NORTH CAROLINA APPLES

ACRES: 9,500
PRODUCTION:
VALUE ($/YR): $15,000,000
VOLUME (LBS/YR): 152,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	66	6,270
CARBARYL**	21	1,995
CHLORPYRIFOS**	72	6,840
ENDOSULFAN	16	1,520
IMIDACLOPRID	13	1,235
METHYL PARATHION**	49	4,655
OIL	74	7,030
PHOSMET**	59	5,605

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The codling moth completes three generations per year and is considered the most important insect pest of apples in North Carolina. Larvae of the codling moth tunnel into fruit and render it unmarketable as fresh fruit.

After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae.

After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed.

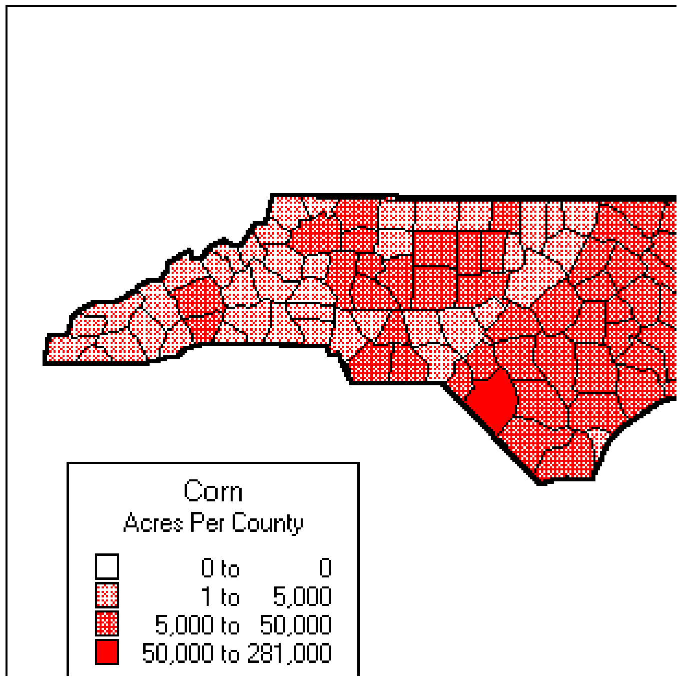
Importance of insecticides:

There are more than 20 arthropods that potentially can damage the North Carolina apple crop in a given year. Among this group, 10 to 12 occur in almost every orchard every year. Management programs for direct pests have relied extensively on synthetic chemical insecticides, because they have provided the most cost-effective method of control. On average, eight insecticide applications are made annually to commercial apples. The use and availability of organophosphate insecticides has been an important component of the apple IPM program for more than 25 years, because many biological control agents of secondary pests are tolerant to OP insecticides. Virtually all commercial apple orchards are sprayed with organophosphate insecticides (azinphos methyl, phosmet, chlorpyrifos or methyl parathion) for control of codling moth. Insecticides are the only reliable method for controlling plum curculio in commercial apples. In North Carolina a single organophosphate insecticide application at petal fall has provided control. The organophosphates provide the most effective control of the apple maggot, and one or two applications are made for its control. OP's applied for codling moth, plum curculio and apple maggot usually control other pests as well, including oriental fruit moth, lesser apple worm and green fruit worm. Although pyrethroid insecticides are effective on certain of these key pests, their use is discouraged strongly in North Carolina because they are toxic to certain predators of mites. If the pyrethroids were used instead of the organophosphates, mite populations would increase significantly, with an associated increase in miticide applications.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NORTH CAROLINA CORN

ACRES: 950,000
PRODUCTION:
VALUE ($/YR): $228,000,000
VOLUME (LBS/YR): 5,400,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBOFURAN**	5	47,500
CHLORPYRIFOS**	10	95,000
ETHOPROP**	5	47,500
PHORATE**	10	95,000
TERBUFOS**	35	332,500

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

In the seedling stage, the corn plant is most easily damaged, and a relatively low population of insects can reduce stands substantially. Billbugs, wireworms, cutworms, seed corn maggots and armyworms are the most commonly encountered seedling insect pests of North Carolina corn. Wireworm larvae eat the germinating seed as well as the seedlings. Billbug adults feed on seedling corn and lay eggs into the stalks. The incidence of corn rootworm has increased greatly in the last decade in western North Carolina, and has been found well into the Coastal Plain. Rotations of corn with other crops is very effective in controlling western and northern corn rootworm, but not the southern. Furthermore, farmers in the western half of the state have limited opportunity to rotate and, thus, use at-planting insecticides to reduce rootworms. All corn in billbug areas is rotated to another crop annually. However, high billbug populations move from where they reproduced the previous year into newly-planted adjacent corn fields.

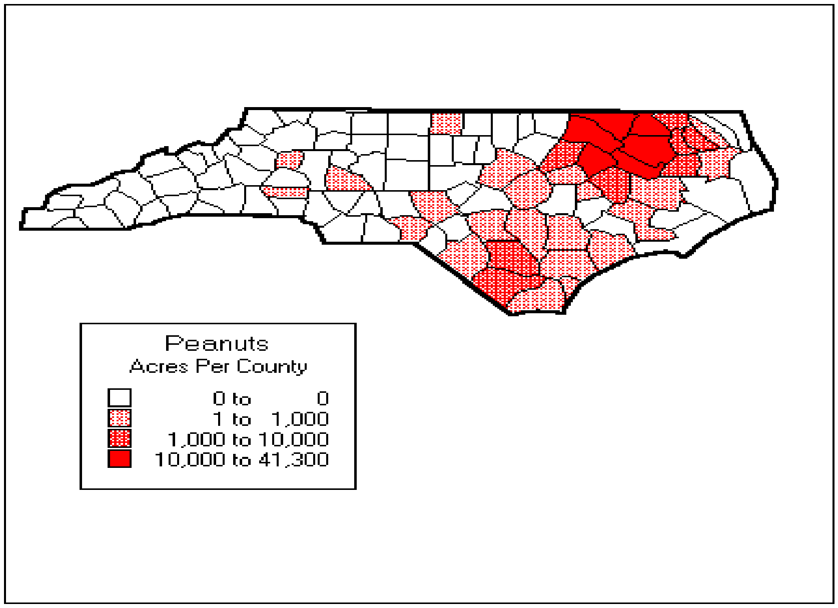
Importance of insecticides:

Much of North Carolina's corn acreage is planted on soils with high organic content. Currently only two insecticides (terbufos and carbofuran) remain viable alternatives for billbug and wireworm control in high organic soils. (Other insecticides are deactivated by the organic matter.) North Carolina has two Section 24-C labels for use of terbufos at a high rate for control of billbugs in soils with high organic matter. The use of terbufos at a high rate in these areas has allowed farmers to keep high corn billbug problems confined to a very small acreage. A preventative insecticide treatment currently is used at planting time in areas where wireworms are perceived to be a significant risk. There are no cultural control methods directed specifically to wireworm management. There is no treatment for wireworm that can be applied after planting. In the last five years, insecticide use for management of rootworms has increased greatly in North Carolina. In the eastern corn-growing areas of North Carolina early generation southern corn rootworm is controlled fortuitously by at-planting insecticides used against wireworm and/or billbug.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NORTH CAROLINA PEANUTS

ACRES: 149,210
PRODUCTION:
VALUE ($/YR): $134,813,000
VOLUME (LBS/YR): 481,475,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	15	22,382
ALDICARB**	75	111,908
CARBARYL**	10	14,921
CHLORPYRIFOS**	60	89,526
DISULFOTON**	10	14,921
ESFENVALERATE	20	29,842
ETHOPROP**	5	7,460
METHOMYL**	10	14,921
PHORATE**	15	22,382

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The most serious soil-inhabiting insect pest of peanuts in the Virginia-Carolina region is the southern corn rootworm. Adults emerge from corn during June/July and are attracted to flowering peanut plants. Eggs laid by adults begin hatching during August. The larvae prefer to feed directly on immature soft peanut pods. Economic loss results from reductions in pod yield and nut quality. Egg laying only occurs when soil moisture exceeds five percent. In a field with soil organic matter of less than one percent (sandy soils that dry quickly), the eggs and larvae desiccate, and insecticides are not required. Insecticides can be applied any time from early July until the first of August. Once the larvae hatch and begin feeding, an insecticide treatment is not effective. This fact prevents growers from waiting to see whether there is sufficient rainfall to cause a rootworm problem.

Thrips usually occur in peanut fields each year. Environmental conditions during the spring favor population development of thrips. Feeding causes distorted, scarred leaflets that have reduced photosynthetic ability and stunts young plants. In the Virginia-Carolina region, where peanut cultivars with long maturity requirements are being produced in a relatively short growing season, preventing thrips from delaying crop maturity is critical to profitable peanut production.

Importance of insecticides:

Research has shown that in peanut fields treated with chlorpyrifos pod damage was reduced to less than one percent, while in the untreated plots, rootworms damaged 33 percent of the pods. Losses from larval feeding can reduce the yield of whole seed by as much as 80 percent. The only insecticides recommended for southern corn rootworm are organophosphates (chlorpyrifos, ethoprop and phorate) and a carbamate (carbofuran). Research with tefluthrin and fipronil resulted in mediocre control of rootworm in peanuts.

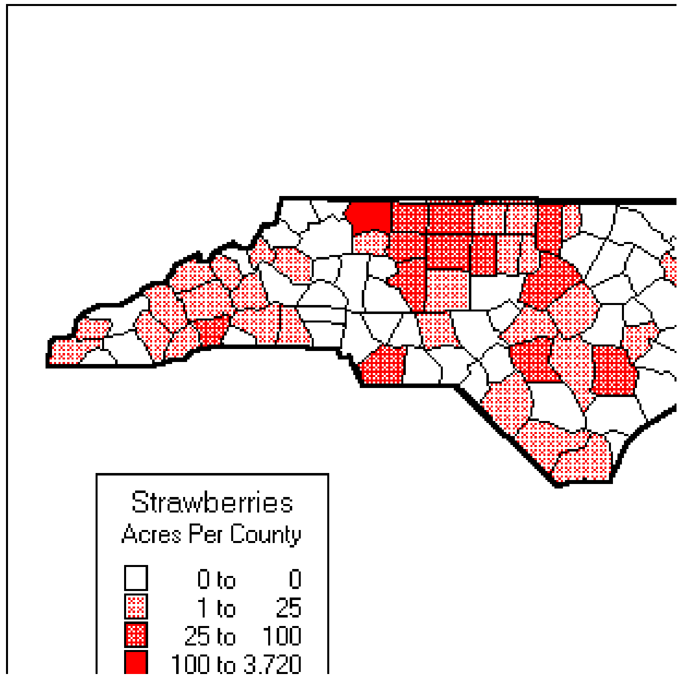
The cultivar NC6 was developed for its high degree of resistance to southern corn rootworm. However, the resistant cultivar is not widely planted because of a preference for new, higher-yielding, susceptible cultivars with more attractive seed and shelling characteristics.

Most of the acreage in Virginia-Carolina is treated for thrips control preventatively with organophosphates or carbamates: phorate, disulfoton, aldicarb or acephate. This eliminates the need for most foliar insecticide applications.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NORTH CAROLINA STRAWBERRIES

ACRES: 1,500
PRODUCTION:
VALUE ($/YR): $12,600,000
VOLUME (LBS/YR): 18,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	2	30
CARBARYL**	51	765
CHLORPYRIFOS**	30	450
DIAZINON**	8	120
DICOFOL	21	315
ENDOSULFAN	5	75
FENBUTATIN OXIDE	10	150
MALATHION**	5	75

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The damage caused by the strawberry weevil is confined to the destruction of flower buds. Injured buds will be found hanging down with the stems almost severed near the bud. Damaged buds dry and turn brown before they fall to the ground. This characteristic damage has resulted in the strawberry weevil being referred to as the "clipper." The strawberry weevil appears every year and, when numerous, it greatly reduces the crop. Uncontrolled strawberry weevils would lower yields by 60 percent. The female weevil chews a hole with her mouthparts through the side of a bud. When the hole is sufficiently deep, she reverses her body and deposits an egg in the hole. Before going to another bud, the weevil cuts a deep notch in the stem an eighth to a quarter of an inch below the bud. The bud remains hanging for a few days but eventually falls to the ground. The egg hatches in about a week, and the small grub feeds on the pollen. Strawberry weevil occurrence is sporadic. Considerable variation in damage occurs from year to year and from location to location. Though the reasons for this sporadic appearance of the weevil are not known, it is believed to result from control by natural enemies.

Importance of insecticides:

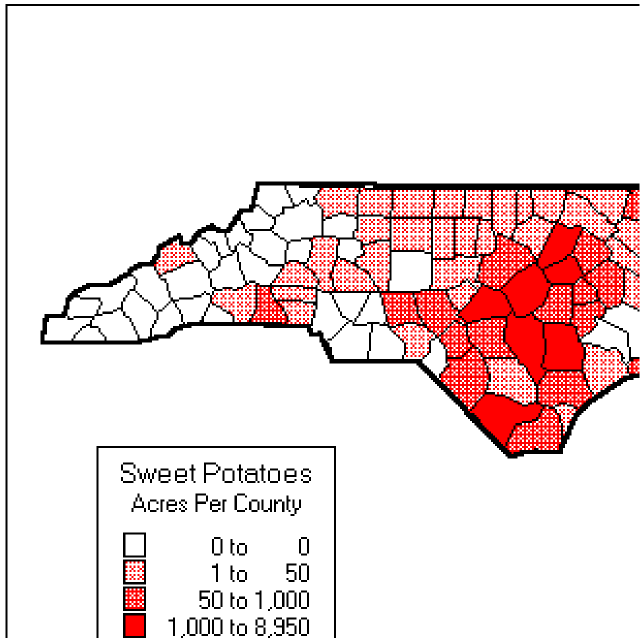
The strawberry weevil can be controlled by spraying with an insecticide. If the field has a history of clipper infestation, control measures should be taken as soon as any clipper injury is observed. This is because the problem can escalate to severe levels within a couple of years if this insect is allowed to gain a "toe-hold" in a field. If clipper presence is limited to the edge of a field near woods, a border application of insecticide (5-10 rows in) may be sufficient for its control. Attempts to use row covers to exclude clippers have not been effective, presumably because some individuals will overwinter in the strawberry field and then will emerge under the row cover.

The organophosphate insecticide chlorpyrifos is used to control the strawberry weevil in North Carolina because of its superior efficacy. It has been estimated that if the next best alternative were used (carbaryl, a carbamate), strawberry yields would decline by 30 percent.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NORTH CAROLINA SWEET POTATOES

ACRES: 31,000
PRODUCTION:
VALUE ($/YR): $52,000,000
VOLUME (LBS/YR): 465,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	3	930
CARBARYL**	5	1,550
CHLORPYRIFOS**	90	27,900
DIAZINON**	1	310
ENDOSULFAN	5	1,550
ETHOPROP**	3	930
FONOFOS**	20	6,200

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The larvae of several species of insects attack the underground parts of the sweet potato plant in North Carolina: Flea beetles, three species of wireworms, white grubs and the whitefringed beetle. These insets feed directly on the developing roots and chew small, shallow, circular holes through the skin and gouge broad, shallow to deep irregular areas on the surface of the root.

Importance of insecticides:

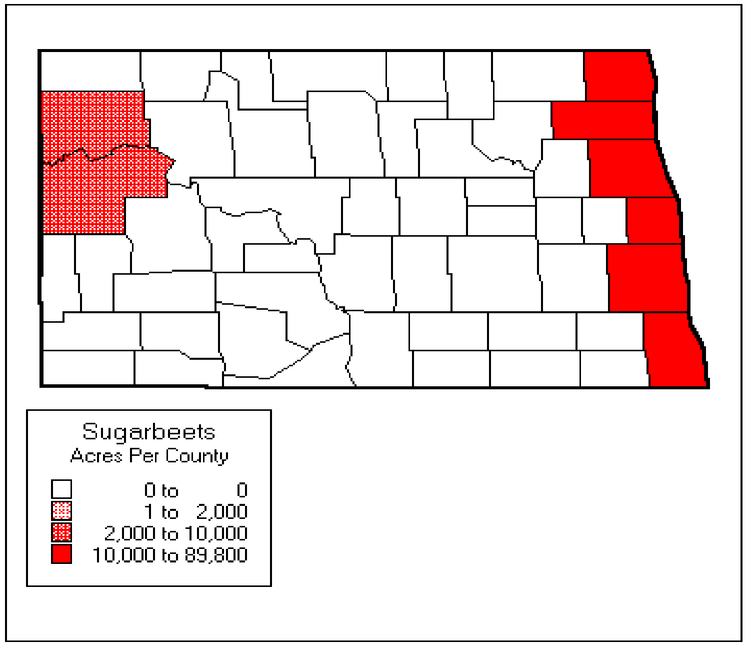
Presently insecticides are the only practical, economical controls available for these destructive soil insects. Generally, growers apply a preplant soil-incorporated organophosphate insecticide – usually chlorpyrifos – that kills soil-dwelling insects. No other products are labeled for soil insect control in sweet potatoes. The organophosphates provide residual control of four to six weeks. Chlorpyrifos is the most widely-used soil-applied insecticide because of its control efficacy for a large number of insect species.

It is estimated that 100 percent of North Carolina's sweet potato acreage is rotated to other crops, resulting in a decline in the populations of soil insects prior to subsequent plantings of sweet potatoes.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON NORTH DAKOTA SUGARBEETS

ACRES: 201,111
PRODUCTION:
VALUE ($/YR): $127,903,000
VOLUME (LBS/YR): 6,223,990,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	1	2,011
CHLORPYRIFOS**	7	14,078
TERBUFOS**	34	68,378

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The sugarbeet root maggot overwinters in previously planted beet fields. Flies emerge in early June, and fly to near-by beet fields. Each female lays up to 200 eggs in clusters around beet plants. The eggs hatch and the small white larvae begin to feed on succulent roots of sugarbeet. The larvae scrape the root surface with their mouth hooks, causing irregular openings through which sap escapes from the root. The insect reduces beet stands, retards plant growth and reduces yield. Uncontrolled sugarbeet root maggots can reduce sugarbeet yields by 50 percent.

Importance of insecticides:

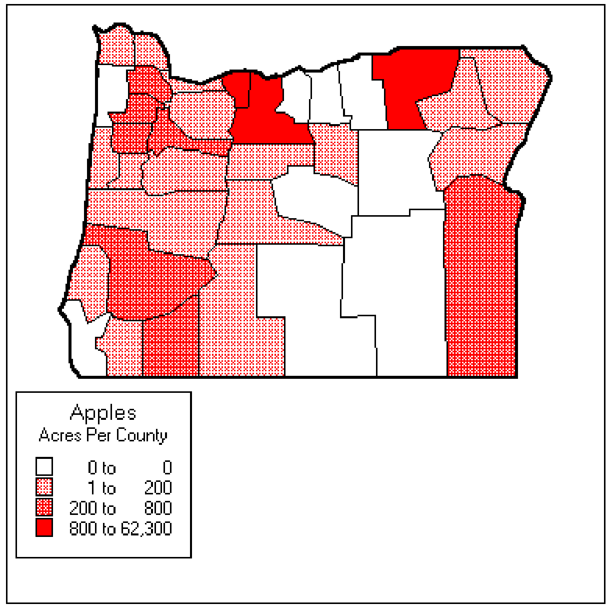
Most growers rely on insecticides to control the sugarbeet root maggot. The registered insecticides are the organophosphates terbufos and chlorpyrifos and the carbamates carbofuran and aldicarb. Terbufos and chlorpyrifos are the most widely used because of their high degree of control. Crop rotation is practiced extensively in the Red River Valley to control soil-borne diseases. Ninety-five percent of the acreage is planted to sugarbeets in three- or four -year rotations. However, the ability of the maggot to fly long distances in search of sugarbeets negates the control potential of rotation. The use of the organophosphates increased significantly in the Red River Valley from 1983 to 1990, reflecting the increased range and population density of sugarbeet root maggots. Organophosphates are banded down the row of sugarbeet plants at planting. After damage has been observed, applying insecticides as rescue treatments are not effective.

Considerable research has been completed regarding biological control of the sugarbeet root maggot. No commercially viable alternatives to insecticides are available currently to growers. Experiments with BT, natural bacteria and parasitic nematodes have failed to produce reliable

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON OREGON APPLES

ACRES: 8,700
PRODUCTION:
VALUE ($/YR): $21,400,000
VOLUME (LBS/YR): 200,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	85	7,395
BT	46	4,002
CARBARYL**	49	4,263
CHLORPYRIFOS**	81	7,047
DIMETHOATE**	27	2,349
IMIDACLOPRID	26	2,262
MALATHION**	20	1,740
METHYL PARATHION**	41	3,567
OIL	92	8,004
OXAMYL**	39	3,393
PHOSMET**	18	1,566

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

San Jose scale, leafrollers, and codling moth are three of the key pests which organophosphate insecticides control. The scale is a tiny insect that sucks the plant juices from twigs, branches, fruit and foliage. This pest is of continual concern to apple growers in Oregon because of the importance of exports, as phytosanitary regulations ban infested fruit from some countries. The most effective method of San Jose scale control is to use oil plus an organophosphate insecticide, such as diazinon, methidathion or chlorpyrifos during the dormant season. Oil could be used at higher rates without the organophosphates, but increased use of oil could lead to increased plant injury. The only insecticides recommended for scale control during the summer are the organophosphates. Oil can not be used in the summer at sufficiently high rates. Although it could control scale insects, a pyrethroid is not recommended as a summer spray since it is very toxic to beneficial insects and mites, and its application would be disruptive of the biological control of harmful mite species. Codling moth is the most destructive pest of apples in Oregon State. Apple losses from this insect alone would exceed 50 percent in one or two years if no insecticides were applied for control. Its larvae bore deeply into the fruit and feed on seeds. Brown frass, or excrement, extrudes from the hole. Leafrollers feed on the leaves and fruit and are becoming an increasing cause of fruit damage in orchards throughout the state.

Importance of insecticides:

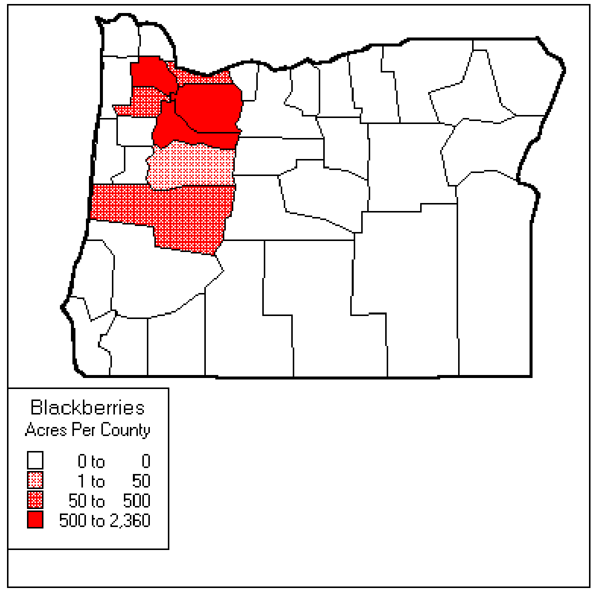
Available alternatives to the organophosphates tend to be less effective, more expensive or disruptive of IPM programs. The organophosphates azinphos methyl, chlorpyrifos, malathion and methyl parathion control many of the key apple pests. The threat of potential mite problems has resulted in Oregon State University's deliberately not recommending synthetic pyrethroids as alternatives in apples. Codling moth has not been controlled adequately with BT's in the northwest. Generally, these compounds, even when applied five to seven times as often as azinphos methyl, do not provide equal control. A synthetic insect pheromone (Isomate C) is available to disrupt codling moth mating. Mating disruption is a less effective alternative in areas of high codling moth pressure. Growers in this situation usually supplement mating disruption with azinphos methyl. Leafrollers have emerged as a key pest under conditions of codling moth pheromone mating disruption. Overall reduced use of pesticides in this option allows leafrollers to become more prevalent. The organophosphate chlorpyrifos is the most widely used alternative to control leafrollers in the northwest.

While BT's are useful for leafroller control and can be effective if applied a sufficient number of times, no currently registered alternatives (other than OP's) allow control of damaging populations should they inadvertently be allowed to build up in an orchard

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Mike Willett at the Northwest Horticultural Council (509)-453-3193

INSECTICIDE USE ON OREGON BLACKBERRIES

ACRES: 5,000
PRODUCTION:
VALUE ($/YR): $25,000,000
VOLUME (LBS/YR): 37,700,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	55	2,750
BT	23	1,150
CARBARYL**	29	1,450
DIAZINON**	35	1,750
ESFENVALERATE	19	950
MALATHION**	25	1,250
OIL	13	650

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Blackberries are perennial plants with erect, semierect or trailing canes. Canes grow from a crown, produce fruit in the second year and then the cane will die. The raspberry crown borer is one of the most damaging pests of blackberries in North America. Females land on foliage and lay reddish brown eggs. After hatching the larvae migrate to the base of the cane. The larvae begin a two year life cycle by forming a blister-like hibernaculum just below soil level at the base of the stem. In the spring, the larvae form numerous galleries and by the middle of the second summer the crown may be damaged extensively. After mating, a female lays about 140 eggs and a new cycle begins.

Two species of leafrolling caterpillars, the orange tortix and the oblique banded leafroller, commonly infest blackberries. Both species cause little direct damage to the fruit and canes. However, substantial economic losses can occur when larvae become contaminants of the fruit at harvest.

Many insects and spiders are shaken from plants during machine picking of berries and are a potential contaminant of berries going into trays. Aphids, leafhoppers, gnats and many other insects present a problem when berries are harvested by machines.

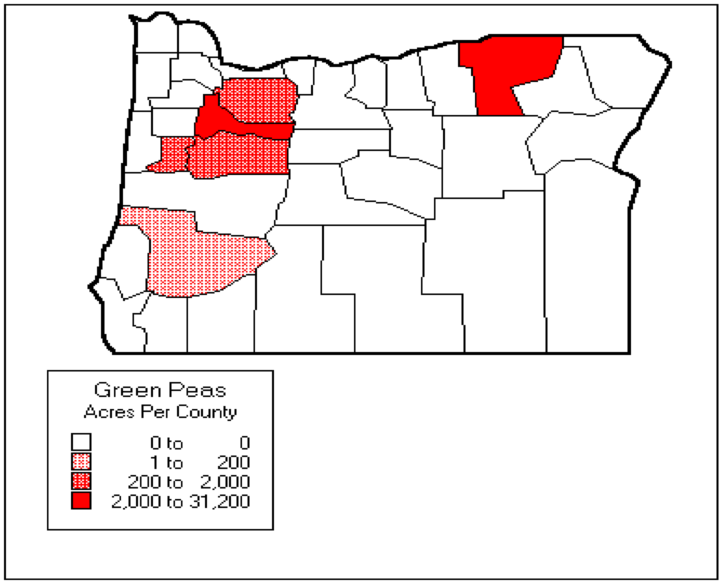
Importance of insecticides:

Diazinon is applied as a delayed dormant drench over the row to kill young crown borer larvae as they feed, prior to tunneling into the crown. Once they are inside the crown, they cannot be killed with insecticides. Since they have a two year life cycle, insecticides must be applied every year for two or more years to kill all of the newly-emerged larvae. Azinphos methyl is used to control leafhoppers and aphids. Wettable powder applications of malathion are recommended for machine harvested berries for general cleanup of insects just before harvest.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Joe DeFrancesco at The Oregon Raspberry and Blackberry Commission (541)-737-0718.

INSECTICIDE USE ON OREGON GREEN PEAS

ACRES: 33,316
PRODUCTION:
VALUE ($/YR): $12,664,000
VOLUME (LBS/YR): 107,320,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	5	1,666
DIAZINON**	5	1,666
DIMETHOATE**	57	18,990
ESFENVALERATE	28	9,328
MALATHION**	12	3,998
METHOMYL**	36	11,994

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Eggs of the pea aphid overwinter in alfalfa fields. In April or May, the eggs hatch into young aphids, called nymphs, that feed on alfalfa. A large proportion of the next generation will fly to pea fields in late May and early June. Wind currents may carry them far – perhaps 50 miles. Reproduction on peas is rapid. Female aphids can produce young without fertilization; in spring and summer, all aphids are females. In warm weather a female may produce 10 to 14 young per day – on one acre of peas there might be millions of aphids, that can ruin a crop quickly. The aphids feed by sucking sap from the pea plants. In the fall, the aphids fly back to alfalfa fields; some of the aphids become males; and after the males and females have mated, fertile eggs are laid in alfalfa fields.

A few aphids can kill small pea plants. A heavy infestation on more mature plants can reduce yields or even destroy the crop. The plants become stunted and produce fewer and smaller pods. Aphids attack the pods and cause them to shrink and to be filled only partially with peas.

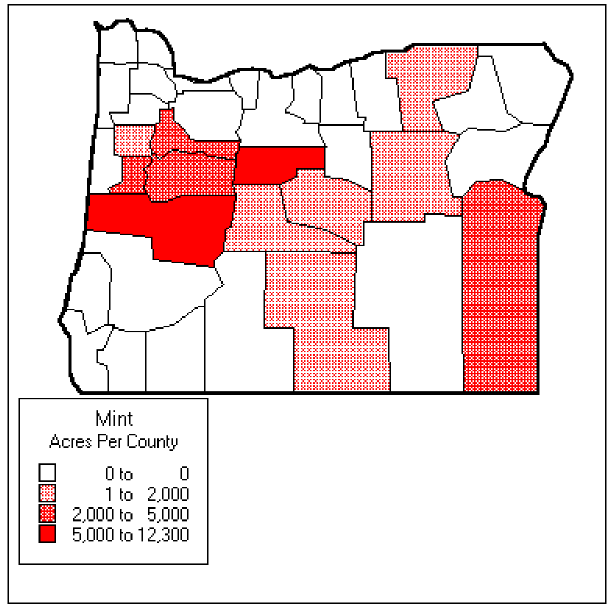
Importance of insecticides:

Before the development of organophosphate insecticides in the early 1950's, failure to control pea aphids were common. In 1918, aphids destroyed the entire Oregon pea crop. During the 1930's, the Clatsbania area, where several hundred acres of peas had been grown, was abandoned completely for pea production because of losses from aphids. In 1934, half of the crop of processing peas in Umatilla County was lost because of pea aphid. In the 1930's and 1940's, nicotine was applied to kill aphids. Control often was poor. Ladybird beetles were shipped in and released in many green pea fields, but control was uneven. Spray volumes were increased to 300 to 500 gallons per acre, containing rotenone and oil. Parathion was the primary organophosphate used for control of the aphid for many years. The organophosphate dimethoate is used currently. Usually, one application of dimethoate will reduce aphid populations sufficiently. A pyrethroid is registered for pea aphid control; however, the pyrethroid is much less effective and five times more expensive per acre.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON OREGON MINT

ACRES: 48,130
PRODUCTION:
VALUE ($/YR): $47,600,000
VOLUME (LBS/YR): 3,404,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	28	13,476
CHLORPYRIFOS**	25	12,032
MALATHION**	3	1,444
METHOMYL**	6	2,888
OXAMYL**	44	21,177
PROPARGITE**	41	19,733

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests, including cutworms, aphids and spider mites. In central Oregon, mint flea beetle can also be a serious pest in mint. Cutworms emerge in June and deposit eggs in clusters of up to 500 on the leaves. Cutworms feed on the foliage for four to six weeks. Mint rootborers feed upon the underground stems of mint plants for 70 to 80 days in the fall. Damage is not noticeable right away, but come next spring, the mint field will have dry dead patches. In some instances mint rootborers have wiped out entire fields. The damage caused by the larvae boring in the mint roots severely weakens plants so that they are more susceptible to winter injury. High populations of aphids can cause extreme defoliation by piercing and sucking mint plant juices. Summer populations of spider mites can also cause complete defoliation if not controlled.

In western Oregon (Willamette Valley), the garden symphylan is an extremely important pest in mint. The pest prefers soils high in organic matter, characteristic of soils in western Oregon. The symphylan is a small white centipede-like animal that feeds on the roots of the plant, causing the mint plant to die. Symphylan populations in the range of 40 to 60 per square foot can reduce mint stands by more than 90 percent. Colder temperatures beginning in the fall and dryness in the summer cause them to migrate deep into the soil.

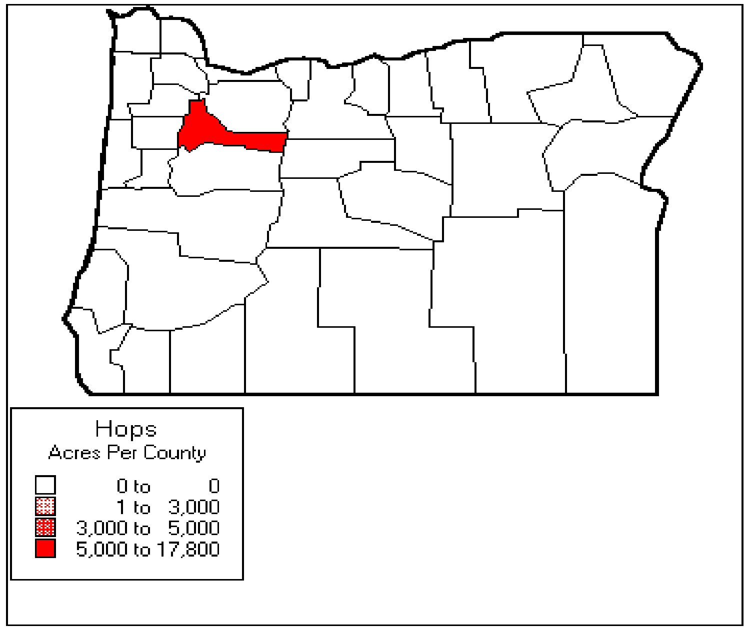
Importance of insecticides:

From about early June until harvest, as part of mint IPM programs developed by university researchers, fields are monitored for damaging populations of spider mites, cutworms and aphids. Frequently, populations of these pests are maintained under economic thresholds by natural biological controls, such as predator mites and lady beetles. If spider mite populations exceed the economic threshold, low rates of propargite can reduce populations without harming beneficial insects. If cutworms or aphids are found at levels above the threshold, the organophosphate acephate is applied. Acephate reduces the pest populations and allows the survival of the natural enemies. Alternatives to acephate are a carbamate and BT – neither of which is as effective. Mint rootborer used to be controlled by fall tillage However, tillage is no longer practiced in mint in order to prevent the distribution of verticillium wilt. Fields are sampled in the fall for mint rootborer. The population of borers exceeding the economic threshold is treated with chlorpyrifos – currently the only available control alternative for mint rootborer. Previously, a biological control (insect killing nematodes) was available for mint rootborer. Unfortunately, however, the product was discontinued. The organophosphate insecticide fonofos is effective at controlling garden symphylans, but the recent voluntary cancellation by its registrant has left mint growers with no effective viable option for controlling this pest. The organophosphate insecticide chlorpyrifos is the only remaining partially effective control for this pest.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at the Mint Industry Research Council (509)-427-3601

INSECTICIDE USE ON OREGON HOPS

ACRES: 8,351
PRODUCTION:
VALUE ($/YR): $22,122,360
VOLUME (LBS/YR): 13,592,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	90	7,516
BIFENTHRIN	5	418
BT	15	1,253
DIAZINON**	25	2,088
DICOFOL	1	88
ETHOPROP**	31	2,588
IMIDACLOPRID	100	8,351
NALED**	15	1,253
PROPARGITE**	10	835

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Hop aphid is a primary pest of hops in the U. S., and chemicals are used on 100 percent of U. S. hop acreage for its control every year. Aphids feed directly on hop plants extracting cell sap with their sucking mouth parts. High aphid populations (1,000/leaf) reduce yields and severely weaken plants. The hop aphid may also cause serious economic damage at very low densities if hop cones are infested. Hop aphids excrete prolific amounts of honeydew (plant cell sap passed through the aphid's digestive system). Sooty mold grows on the honeydew and can render hop cones unmarketable as moldy hops cannot be used for brewing. The hop aphid was first discovered in 1890. Losses were estimated at one-twelfth of annual production. Growers were encouraged to spray toxic wood chip solutions, whale soaps and kerosene for control of the aphid. Historically, worms (loopers, armyworms, cutworms) have been minor pests of hops. These pests feed on and skeletonize leaves. The garden symphylan is a small centipede-like animal that feeds on roots of hop plants, particularly in the highly organic soils of western Oregon. In the past five years, there has been a drastic change in the varietal demands of brewers to Noble European hop varieties, that are very delicate with less plant vigor and are easily killed by garden symphylan. The newly planted hops require a year to grow in the ground and have been devastated by garden symphylans, as there is no registered pesticide for control of this pest in hops

Importance of insecticides:

Until the mid 1940's, nicotine dust was the primary control for hop aphid. Organophosphates have been widely used since the 1950's for aphid control. Following the cancellation of several organophosphate registrations, hop growers had only the organophosphate diazinon for controlling aphid, and diazinon was used essentially on 100 percent of the hops acreage for aphid control (1986-1992). Exclusive use of diazinon induced resistance problems in aphid populations. Diazinon lacks residual control of aphid populations. The recent registration of the selective insecticide imidacloprid has reduced the use of diazinon for aphid control purposes.

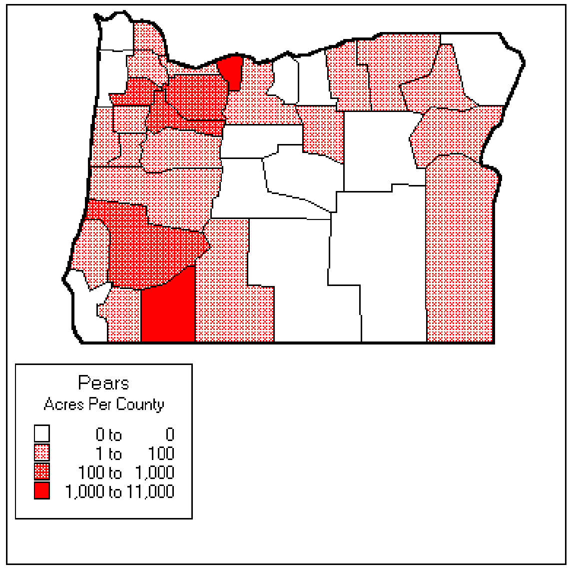
Diazinon is used currently as an early season spray for aphid control and is also very important for resistance management for imidacloprid. Growers are encouraged to rotate imidacloprid and diazinon usage. Diazinon is also considerably less expensive than imidacloprid ($9/A vs. $25/A). The use of the selective insecticide imidacloprid has resulted in an increase of worm populations in the State of Oregon. These populations are approaching emergency situations on many farms. Diazinon is sprayed primarily for aphids, but also for control of worms.

For 1997, Oregon hop growers received a Section 18 for use of the organophosphate ethoprop for control of the garden symphylan.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Ann George at the US Hop Industry Plant Protection Commission (509)453-4749

INSECTICIDE USE ON OREGON PEARS

ACRES: 17,000
PRODUCTION:
VALUE ($/YR): $80,000,000
VOLUME (LBS/YR): 460,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	67	11,390
AMITRAZ	25	4,250
AZINPHOS-METHYL**	77	13,090
CARBARYL**	6	1,020
CHLORPYRIFOS**	52	8,840
DIAZINON**	8	1,360
ESFENVALERATE	31	5,270
FENOXYCARB**	57	9,690
METHYL PARATHION**	7	1,190
OIL	97	16,490
PHOSMET**	57	9,690

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

In pear orchards organophosphate insecticides are targeted for codling moth, grape mealybugs, true bugs, leafrollers, San Jose scale, and overwintering aphid and mite eggs. Historically, codling moth has been one of the principal pests of pears. Larvae bore through the fruit skin and penetrate to the core, consuming fruit tissues and seeds. A syrupy frass, or worm excrement, may exude from the entry hole. Fruit attacked by codling moth larvae cannot be used for fresh shipments or commercial canning and is rejected during sorting and grading. Grape mealybug has become an increasingly severe pest of pears since the 1970's. Honeydew excreted by grape mealybug is very toxic to the skin of the fruit and causes a black coarse russeting. These insects crawl inside the calyx of the fruit and feed there. Fruit with either type of damage has to be culled.

Importance of insecticides:

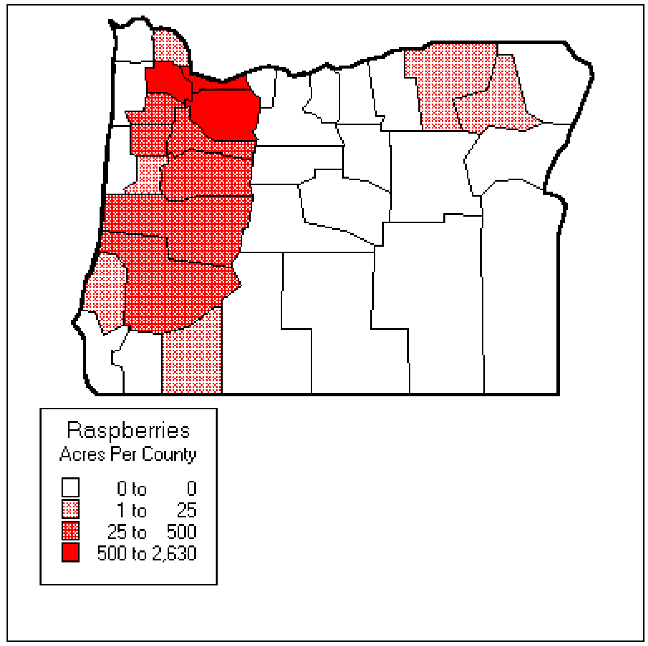
The organophosphates azinphos methyl, chlorpyrifos and phosmet are widely used to control key pear pests. Adequate codling moth control is a concern particularly in areas of moderate to heavy codling moth pressure. In these areas, the only current registered alternative to OP's, mating disruption, needs to be supplemented and usually is a substantially more expensive alternative than current OP-based programs. San Jose scale control would also become more difficult. While oil will provide suppression of San Jose scale during the pre-bloom period, there are currently no known alternatives for summer control of the larvae called crawlers.

There are no known alternatives to the OP's for control of lygus bug, box elder bug or stink bugs aside from carbamate insecticides. These pests feed directly on the fruit and appear to be causing increasing levels of damage in pear orchards where growers are experimenting with reducing organophosphate use. Where it is a problem, grape mealybug is almost exclusively controlled through the use of OP's. Imidacloprid is effective, but cannot be used until after pollination is completed because of bee toxicity. Therefore, the critical pre-bloom control window is not available for this compound. Resistance management may also be challenged. Loss of the OP's would increase reliance on a few pesticides, which will likely have to be used more often, particularly for control of aphids and grape mealybug.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Mike Willett at The Northwest Horticultural Council (509)-453-3193

INSECTICIDE USE ON OREGON RASPBERRIES

ACRES: 5,200
PRODUCTION:
VALUE ($/YR): $23,545,000
VOLUME (LBS/YR): 25,800,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	11	572
BT	40	2,080
CARBARYL**	30	1,560
DIAZINON**	30	1,560
DICOFOL	18	936
ESFENVALERATE	15	780
FENAMIPHOS**	10	520
FENBUTATIN OXIDE	12	624
MALATHION**	70	3,640

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Raspberries are perennial plants with erect canes. Canes grow from a crown, produce fruit in the second year and then the cane will die. The raspberry crown borer is one of the most damaging pests of raspberries in North America. Females land on foliage and lay brown eggs. After hatching the larvae migrate to the base of the cane. The larvae begin a two year life cycle. In the spring, the larvae form numerous galleries and by the middle of the second summer the crown may be damaged extensively. After mating, a female lays about 140 eggs and a new cycle begins.

Insect contaminants are any insect pests residing in the canopy. These insects, shaken loose by machine harvesting, contaminate the crop. Contamination can result in downgrading of product with a loss of up to $1,400 per acre. Over 60 families of insects, as well as spiders have been identified as living in raspberry foliage. All are potential contaminants of the harvested fruit.

Root lesion nematodes are widespread in northwest red raspberry acreage. As populations increase and more damage occurs, feeder roots die. In the final stages, all feeder roots have died leaving only the large diameter roots, that have little capacity for nutrient and water uptake. Reduced cane number, diameter and general plant vigor mark the slow decline of the above ground cane growth.

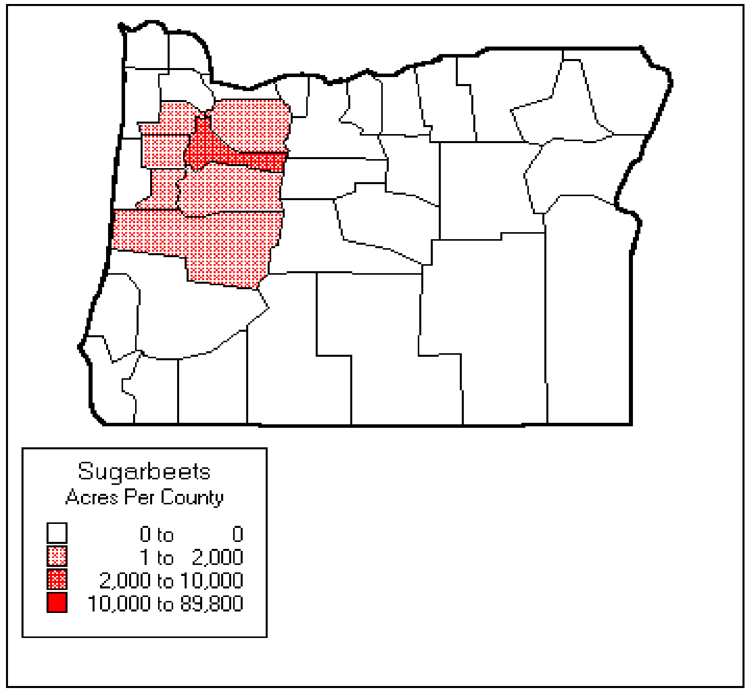
Importance of insecticides:

Insecticide tests have indicated that malathion essentially reduces lygus and aphid contamination of harvested raspberries to zero. Currently the only nematicide registered for use in established raspberries in the U.S. is fenamiphos. Studies in the northwestern U.S. have shown that root lesion nematode densities of 1,000 and 4,000 per 500 cm3 of soil require a treatment rate of 3-6 lbs. AI / A of fenamiphos. Diazinon is applied as a dormant drench over the row to kill young crown borer larvae as they feed, prior to tunneling into the crown. Once they are inside the crown, they cannot be killed with insecticides. Since they have a two year life cycle, insecticides must be applied every year for two or more years to kill all of the newly-emerged larvae.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Joe DeFrancesco at The Oregon Raspberry and Blackberry Commission (541)737-0718.

INSECTICIDE USE ON OREGON SUGARBEETS

ACRES: 20,179
PRODUCTION:
VALUE ($/YR): $14,917,000
VOLUME (LBS/YR): 743,990,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	15	3,027
BT	2	404
CARBARYL**	35	7,063
CARBOFURAN**	10	2,018
CHLORPYRIFOS**	20	4,036
NALED**	5	1,009
TERBUFOS**	85	17,152

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The sugarbeet root maggot overwinters in previously planted beet fields. Flies emerge in early June, and fly to near-by beet fields. Each female lays up to 200 eggs in clusters around beet plants. The eggs hatch and the small white larvae begin to feed on succulent roots of sugarbeet. The larvae scrape the root surface with their mouth hooks, causing irregular openings through which sap escapes from the root. The insect reduces beet stands, retards plant growth and reduces yield. Uncontrolled sugarbeet root maggots can reduce sugarbeet yields by 50 percent. Root maggots were first discovered in Oregon in 1982 and have continued as a major pest problem ever since. Other pests of sugarbeets in Oregon include wireworms, white grubs, crown borers and leafhoppers.

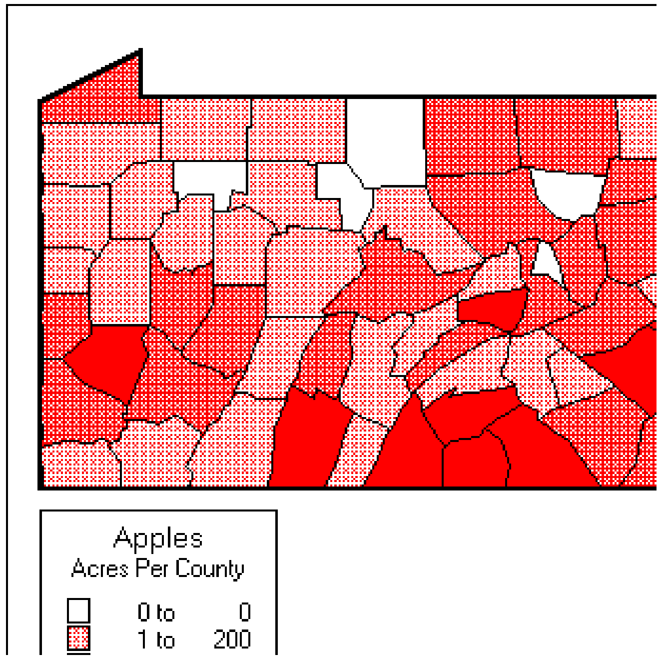
Importance of insecticides:

Most growers rely on insecticides to control the sugarbeet root maggot. The registered insecticides are the organophosphates terbufos and chlorpyrifos and the carbamates carbofuran and aldicarb. Terbufos is the most widely used because an at-planting treatment controls maggots, wireworms, white grubs and crown borers. The ability of the maggot to fly long distances in search of sugarbeets negates the control potential of rotation. Organophosphates are banded down the row of sugarbeet plants at planting. After damage has been observed, applying insecticides as rescue treatments for maggots is not effective. Crown borers in fields untreated at planting can be controlled by the organophosphate chlorpyrifos.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON PENNSYLVANIA APPLES

ACRES: 23,000
PRODUCTION:
VALUE ($/YR): $48,905,000
VOLUME (LBS/YR): 535,000,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	92	21,160
CHLORPYRIFOS**	33	7,590
CLOFENTEZINE	25	5,750
DIAZINON**	14	3,220
DIMETHOATE**	3	690
IMIDACLOPRID	68	15,640
METHIDATHION**	18	4,140
METHYL PARATHION**	54	12,420
PHOSMET**	17	3,910

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Key pests in Pennsylvania's apple orchards include apple maggot, plum curculio and aphids.

After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae. After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed.

Aphids overwinter in the egg stage. As soon as they hatch, the young seek out the open buds of apples. They feed by sucking the sap from the stems and the newly-formed fruits. Their feeding causes the leaves to curl. The aphids congregate in immense numbers and cause leaves to die. Feeding on the leaves often results in malformation of the developing fruit.

Importance of insecticides:

The organophosphates azinphos methyl, chlorpyrifos, diazinon, methidathion and phosmet are used widely in Pennsylvania apple orchards because of their effectiveness in controlling multiple key pests, including codling moth, lesser appleworm, oriental fruit moth, plum curculio, European apple sawfly, apple maggot, oblique banded leafroller, redbanded leafroller, plant bug, rosy apple aphids, San Jose scale, tufted apple bud moth, dogwood borer, green aphids, leafhoppers and green fruitworm.

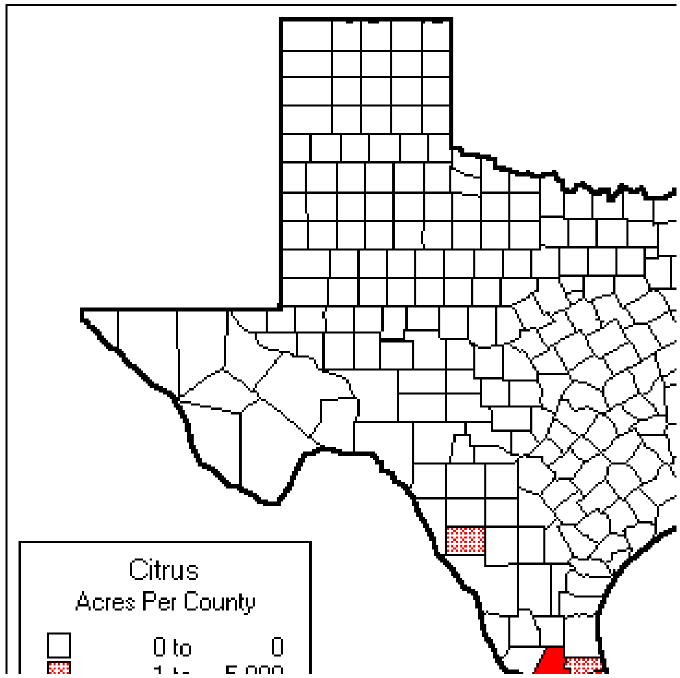
Alternatives to the organophosphates generally have shorter periods of residual control efficacy than the organophosphates (OP's). For certain key pests, such as plum curculio, the alternatives are much less effective than the OP's. Pyrethroids, although highly effective on several key pests are not recommended to avoid disrupting the biological control of European red mites. (The pyrethroids kill the natural predators while the OP's do not.) New insecticides do not have the broad spectrum of the OP's.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

1999 as a Phase 1 deadline for re-assessing the registrations of

INSECTICIDE USE ON TEXAS CITRUS

ACRES: 33,000
PRODUCTION:
VALUE ($/YR): $25,319,000
VOLUME (LBS/YR): 548,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	30	9,900
ALDICARB**	35	11,550
AZINPHOS-METHYL**	1	330
CARBARYL**	1	330
CHLORPYRIFOS**	65	21,450
DICOFOL	35	11,550
ETHION**	5	1,650
FENBUTATIN OXIDE	70	23,100
METHIDATHION**	10	3,300
OIL	15	4,950
OXAMYL**	1	330

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mites, scale insects and ants are key pests in Texas citrus orchards. Most serious are citrus rust mites, whose feeding causes fruit rind blemishes, "russeting," that reduces eye appeal significantly and fruit marketability. Heavy infestations of two foliage-feeding spider mite species, the Texas citrus mite and citrus red mite, cause severe tree stress and often reduce productivity. Armored scale are mobile for only a short time after hatching; when they settle to feed, they lose their legs and antennae. Scale insects feed on all parts of the citrus tree, including leaves, twigs, branches and fruit, sucking sap from plant tissues with long tube-like mouthparts. Fruit, even moderately infested with armored scale, are downgraded in the packing house. The most serious damage the scale causes is to tree health, with severe infestations resulting in yellowed leaves, defoliation, twig die back and fruit drop. Uncontrolled armored scale on mature trees can result in fruit yield reduction of 20 percent or more. Leaf-cutting ants and tropical fire ants are common in Texas orchards, causing damage to both young and mature trees. Leaf-cutting ants usually work at night sometimes defoliating entire trees, with leaf tissue transported to underground nests for "fungus gardens" that provide food for the ant colony. Not only do fire ants feed on leaves and bark of trees, at times completely girdling and killing young trees; but they also interfere with biological control of pests by killing beneficial insects, and are a real menace by inflicting painful "stings" to orchard workers.

Importance of insecticides:

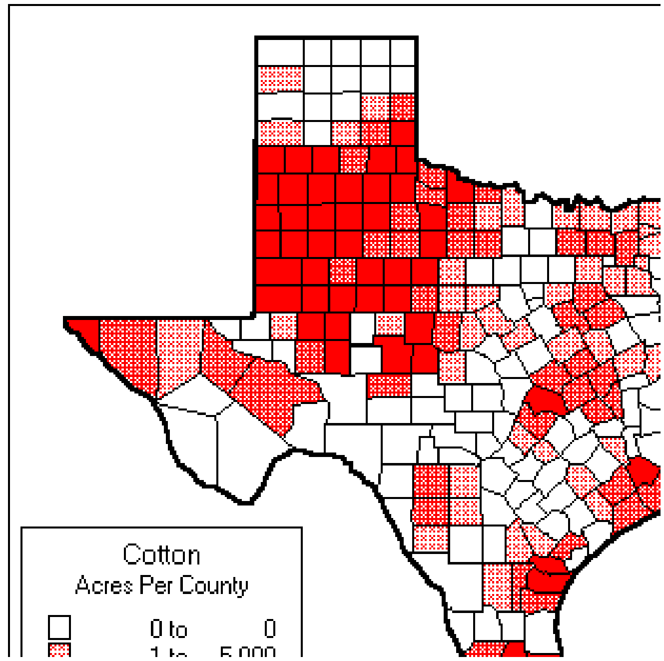
For many years armored scales were controlled in Texas citrus orchards by applying oil to smother the insects. However, oil applications can be damaging to the citrus fruit and foliage. The most commonly occurring symptoms of oil damage are leaf and fruit spotting, defoliation and fruit drop. Currently, the organophosphate chlorpyrifos is the most widely insecticide for scale control in Texas orchards. Chlorpyrifos is more effective than alternatives in controlling scale. In addition chlorpyrifos is not so damaging to beneficial insects as are the alternatives. As a result, chlorpyrifos applications help to facilitate the biological control of mites and other insect pests of Texas citrus orchards.

Some growers use alternative organophosphates, methidathion and ethion, for scale control. For mite control, soil applications of aldicarb granules provide effective control. Many growers use foliar applications of dicofol, fenbutatin oxide, oxamyl or abamectin for in season mite control. For late season or fall treatments of brown softscale, growers are advised to use azinphos methyl or carbaryl. The organophosphate chlorpyrifos also is used to treat ant mounds on the orchard floor. Individual ant mounds and often entire colonies of ants are treated.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Ray Prewett of Texas Citrus Mutual (956)-584-1772

INSECTICIDE USE ON TEXAS COTTON

ACRES: 5,150,000
PRODUCTION:
VALUE ($/YR): $1,577,000,000
VOLUME (LBS/YR): 2,500,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	3	154,500
ALDICARB**	13	669,500
AZINPHOS-METHYL**	6	309,000
BT	4	206,000
CARBOFURAN**	6	309,000
DICROTOPHOS**	6	309,000
LAMBDACYHALOTHRIN	7	360,500
MALATHION**	19	978,500
METHYL PARATHION**	5	257,500
OXAMYL**	18	927,000
PHORATE**	6	309,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Boll weevils spend the winter as adults in protected areas around cotton fields. They return to cotton in the spring and summer. The weevil uses chewing mouthparts to chew holes in squares and soft bolls. The female lays a single egg in the boll and seals it. Eggs hatch into grub-like larvae that eat inside the square. High boll weevil infestations can reduce cotton yields by 90 percent or more. There are no effective biological controls for boll weevils. None of the beneficial insects in cotton fields feed on boll weevils.

Adult fleahoppers fly to cotton about the time the squares start to form. They feed on cotton as long as the plants are tender and growing. High infestations of fleahoppers inhibit the formation of fruiting branches, and the cotton develops excessive vegetative growth.

Aphids damage cotton by sucking sap from the plants and excreting a sticky material called honeydew, that drips on lint in open bolls. A black sooty mold grows on the honeydew, staining the lint and reducing its quality.

Thrips attack seedling cotton plants. They rupture cells with their rasping sucking mouthparts and suck up the sap. Thrips feeding results in stunted plant growth

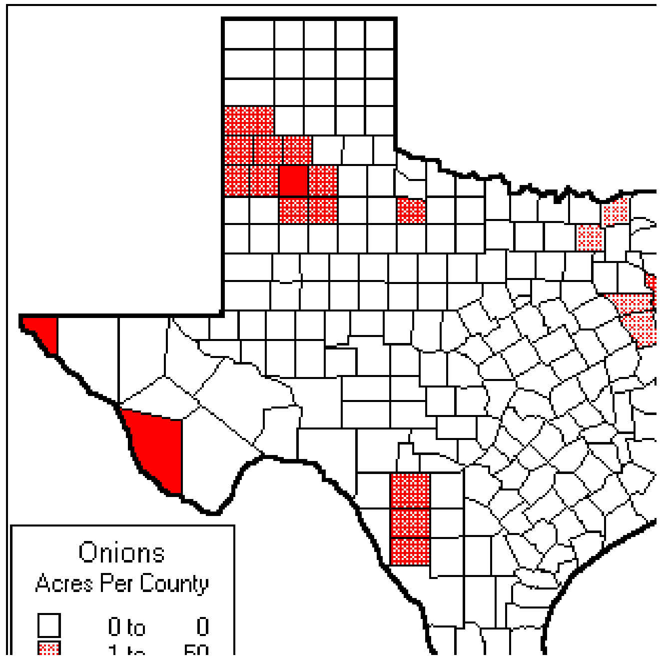
Importance of insecticides:

Historically, boll weevils pose the greatest challenge to Texas cotton fields. Texas growers prefer to use one of three chemicals for weevil control, the organophosphates, azinphos methyl and methyl parathion, and the carbamate oxamyl. Fleahoppers are a common early-season problem in the central and southern parts of Texas. Growers use dicrotophos, acephate and aldicarb to control fleahoppers. Aphids, generally, are a mid- to late-season pest, causing yield reductions and down grading of lint quality because of the honeydew and sticky deposits on foliage and fiber. Growers, typically, monitor aphid populations and will treat when thresholds dictate. Growers rely on carbofuran and dicrotophos for aphid control. Insecticides are used to control thrips in western parts of Texas. Seventy-five percent of the treatments for thrips consist of an in furrow application of aldicarb or phorate, that are applied in anticipation of thrips. Acephate is the primary insecticide used by Texas cotton growers to control whiteflies – mostly in south Texas. Plants infested with whiteflies lack vigor, and honeydew secretions cause sticky cotton and price discounts from the mill. Ongoing research for fleahopper control includes host plant resistance and importation of parasites, but successful commercial use of these practices has not occurred yet. For thrips control, plant breeders are developing hairy leafed cotton cultivars. The substitution of pyrethroids, carbamates and biological insecticides for organophosphates in Texas would likely result in yield decreases of 3 to 15 percent for specific regions in the state.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON TEXAS ONIONS

ACRES: 19,700
PRODUCTION:
VALUE ($/YR): $54,000,000
VOLUME (LBS/YR): 495,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CYPERMETHRIN	40	7,880
DIAZINON**	31	5,254
LAMBDACYHALOTHRIN	18	3,051
METHOMYL**	61	12,017

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Soilborne insect pests of onions include white grubs, wireworms and ants. Unless these insects are eliminated prior to planting, they will destroy, or reduce severely, onion plant stands. It is standard procedure on Rio Grande Valley onion acreage for growers to apply diazinon at planting to control these pests. White grubs are a year-round presence in the Rio Grande Valley, and ants move into onion fields following irrigation.

Thrips rasp onion plant leaves and suck the juices out. Thrips damage may cause a decrease in bulb size resulting in a reduction in grade and a lower price. Leaf areas damaged by thrips appear silvery and may be speckled with black fecal spots. The rasping of leaf tissues by thrips may also predispose onions to infections by diseases. Research has resulted in a significant decrease in the threshold for spray decisions for thrips. Formerly based on 25 thrips per plant, it has been reduced to one to five thrips per plant.

Importance of insecticides:

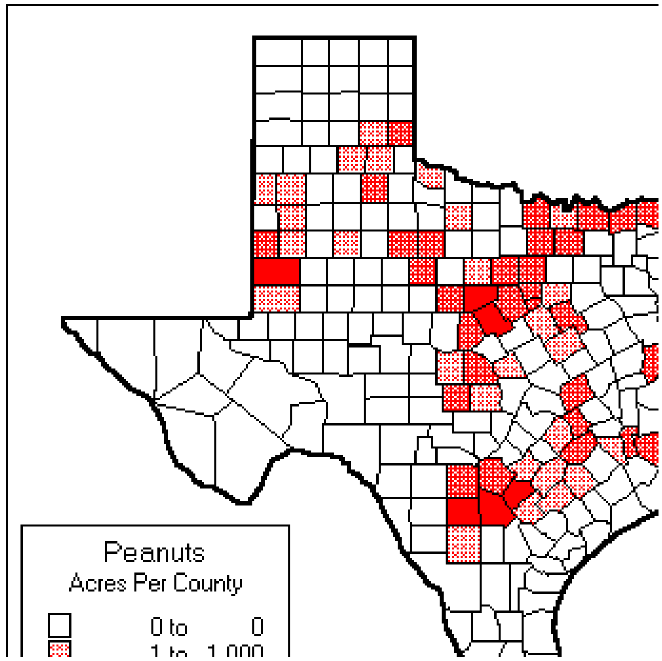
There is no registered alternative to diazinon for control soilborne insect pests of onion. Without diazinon, it is predicted that onion yields would decline by 10 percent in the Rio Grande Valley as a result of stand reduction. Diazinon is used also as a foliar treatment for the control of Western Flower Thrips on onions in the Rio Grande Valley.

In addition to diazinon, the carbamate insecticides methomyl and oxamyl also control Western Flower Thrips. Although alternative pyrethroid insecticides control other thrip species, pyrethroids do not control the Western Flower Thrips. It is estimated that, on onion acreage untreated for thrip control, onion yields would decline 50 percent without the use of diazinon.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Juan Anciso at Texas A&M University (956)-383-1026.

INSECTICIDE USE ON TEXAS PEANUTS

ACRES: 319,000
PRODUCTION:
VALUE ($/YR): $190,000,000
VOLUME (LBS/YR): 811,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	10	31,900
CHLORPYRIFOS**	5	15,950
DISULFOTON**	1	3,190
PHORATE**	4	12,760

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Lesser cornstalk borer (LCB) larvae bore tunnels into peanut stems, impairing water and nutrient uptake. Economic losses result from direct yield loss and, ultimately, from the introduction of aflatoxin, that is highly correlated with peanuts damaged by the LCB.

Burrowing bugs feed on young plants, and their feeding produces a light-to-dark brown mottling of the kernels.

Thrips feed by rasping tender leaf surfaces and sucking plant juices. This results in dwarfing and malfunction of leaves. Thrips feeding spreads tomato spotted wilt virus. Infection with the virus results in reduction in pod size and number. Seed production in infected plants may be reduced in size, malformed and have discolored seed coats. During the mid-1980's, losses in some fields in Texas were 100 percent. Cultivars with complete resistance to the virus are not available.

Importance of insecticides:

With the recent withdrawal of the insecticide fonofos, chlorpyrifos is the only recommended insecticide for LCB control in Texas. Chlorpyrifos provides residual soil control of LCB for 28 to 60 days. Chlorpyrifos is also the only effective choice for control of the burrowing bug in peanuts. Although two percent of Texas peanut acres are treated for burrowing bug, yield losses without treatment would be 25 percent on those acres

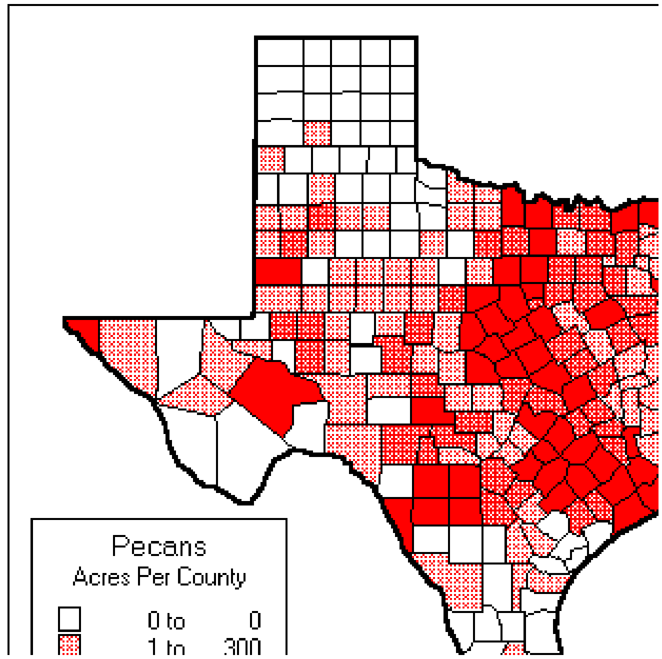
Phorate, disulfoton and aldicarb are used primarily for control of thrips in Texas peanuts. Growers are advised to apply insecticides at planting to control the thrips. Granular, systemic insecticides are preferred over foliar insecticides because they are ecologically selective and less harmful to beneficial insects residing in the foliage.

Currently, there are no practical, economical control alternatives to chlorpyrifos for management of soil insect pests of peanuts.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON TEXAS PECANS

ACRES: 160,000
PRODUCTION:
VALUE ($/YR): $52,700,000
VOLUME (LBS/YR): 35,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	1	1,600
CARBARYL**	25	40,000
CHLORPYRIFOS**	25	40,000
DIMETHOATE**	5	8,000
ESFENVALERATE	5	8,000
LINDANE**	1	1,600
MALATHION**	7	11,200
PHOSMET**	15	24,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The major insect pests of pecans in Texas are the pecan nut casebearer, the hickory shuckworm and the pecan weevil. The casebearer and the shuckworm are managed with organophosphate insecticides while the weevil is managed with a carbamate (carbaryl). Insect problems in Texas pecans were noted beginning in the early 1900's. In 1917, losses of Texas pecans to the pecan nut casebearer were estimated at 75 %. The pecan nut casebarer overwinters as a small larva in dormant pecan buds. The larvae emerge and tunnel in growing pecan tree shoots. Females lay eggs in nutlets. Hatched larvae feed on the buds and tunnel into the nutlets. A single larva can destroy two to four nutlets. The hickory shuckworm primarily damages pecan nuts through larval tunneling through the shoot, that interferes with nutrient flow into the developing kernels during late summer and early fall. Nuts attacked by hickory shuckworm lack nutrients to complete the process of nut development.

Importance of insecticides:

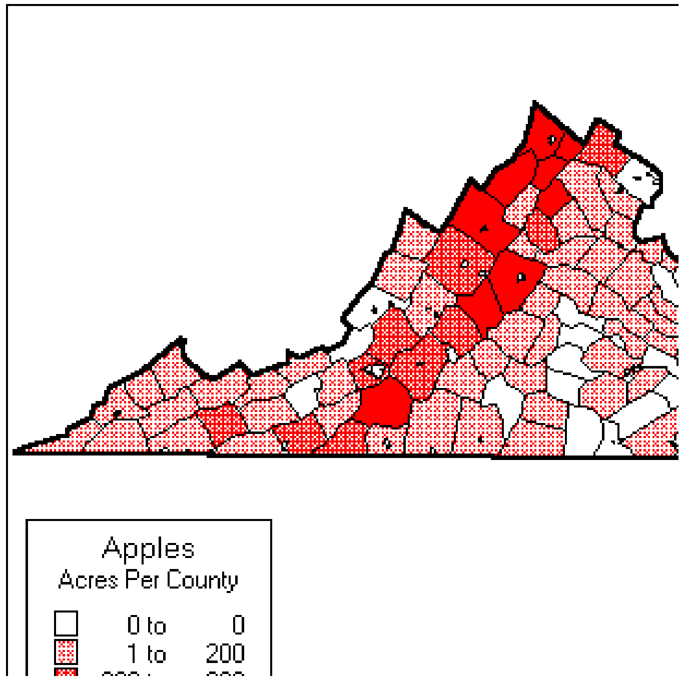
Chlorpyrifos and phosmet are used for control of the pecan nut casebearer and hickory shuckworm in Texas. Early season use of the organophosphates minimizes aphid and mite flare-ups associated with other products, especially pyrethroids. BT is not used for pecan nut casebearer control because of the need for a residual control period. BT is not used for hickory shuckworm control because the larval stage is spent inside the pecan shoot; therefore, short-lived products sprayed on the trees have little efficacy. Insect populations are usually very low in native unmanaged pecan areas in Texas because of their biennial bearing – insects starve to death during the year that the trees are not producing. Currently, no viable non-chemical control alternatives are available or effective for pecan nut casebearer, hickory shuckworm, pecan weevil and aphids. Aphids are usually held in check by natural enemies. When aphid populations build up, dimethoate, typically, is the material of choice.

In 1996, several Texas pecan producers experienced losses of up to 95 percent as a result of uncontrolled pecan nut casebearer. Managing damaging populations of pecan nut casebearer and hickory shuckworm requires a properly timed insecticide treatment.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON VIRGINIA APPLES

ACRES: 17,000
PRODUCTION:
VALUE ($/YR): $24,400,000
VOLUME (LBS/YR): 270,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	78	13,260
CARBARYL**	14	2,380
CHLORPYRIFOS**	41	6,970
DIMETHOATE**	38	6,460
METHYL PARATHION**	61	10,370
OIL	62	10,540
PERMETHRIN	5	850
PHOSMET**	9	1,530

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The codling moth is considered the most important insect pest of apples in Virginia. Larvae of the codling moth tunnel into fruit and render it unmarketable as fresh fruit.

After mating, female apple maggot flies seek out apples. They place their eggs just under the skin. Maggots hatching from these eggs tunnel through the apples, causing a breakdown and discoloration of the pulp. The mature maggots leave the fruit and enter the soil where they overwinter as pupae.

After mating, the female plum curculio deposits eggs into apples. Each female is capable of laying from 100 to 500 eggs. The growing larvae bore to the center of the fruit where they feed.

Aphids overwinter in the egg stage. As soon as they hatch, the young seek out the open buds of apples. They feed by sucking the sap from the stems and the newly-formed fruits. Their feeding causes the leaves to curl. The aphids congregate in immense numbers and cause leaves to die. Feeding on the leaves often results in malformation of the developing fruit.

Importance of insecticides:

In Virginia, organophosphate insecticides are targeted primarily at plum curculio, codling moth, leafrollers and apple maggot. Other insect pests controlled by OP's include San Jose scale, aphids, Japanese beetles, tarnished plant bugs and leafhoppers.

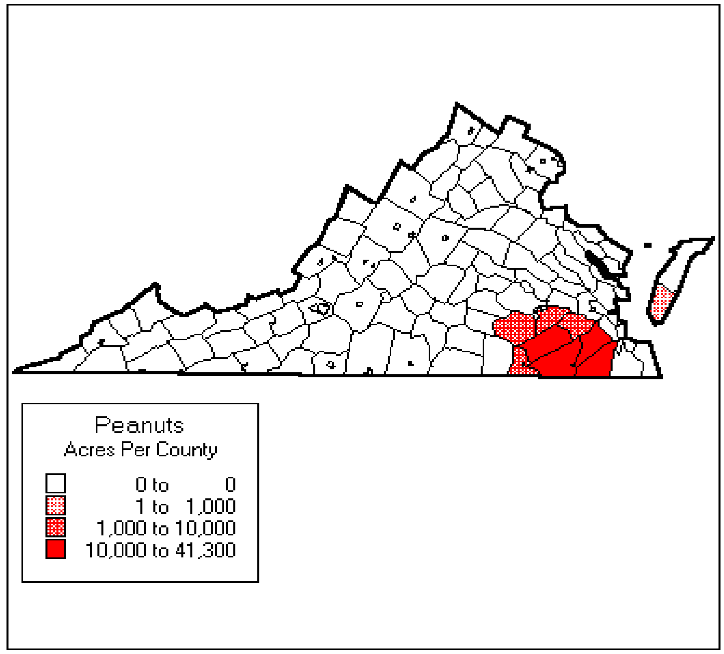
For plum curculio and apple maggots, alternatives are less effective. For codling moth, alternatives are highly toxic to mite predators, necessitating miticide applications Several of the alternatives have shorter residual control periods, that would necessitate more frequent applications.

The only practical means of controlling the apple maggot is to kill the flies before females deposit eggs. At present, no practical method of treating soil to destroy the pupal stage has been devised.Organophosphate insecticides (azinphos methyl and phosmet) are directed at adult plum curculio during the egg-laying stage. No materials other than organophosphates provide acceptable commercial control. Despite intensive study for the past 20 years, no IPM strategies have been identified.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON VIRGINIA PEANUTS

ACRES: 93,720
PRODUCTION:
VALUE ($/YR): $83,564,000
VOLUME (LBS/YR): 288,151,724



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	87	81,536
ALDICARB**	60	56,232
CHLORPYRIFOS**	52	48,734
DISULFOTON**	3	2,812
ETHOPROP**	5	4,686
PHORATE**	15	14,058

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The most serious soil-inhabiting insect pest of peanuts in the Virginia-Carolina region is the southern corn rootworm. Adults emerge from corn during June/July and are attracted to flowering peanut plants. Eggs laid by adults begin hatching during August. The larvae prefer to feed directly on immature soft peanut pods. Economic loss results from reductions in pod yield and nut quality. Egg laying only occurs when soil moisture exceeds five percent. In a field with soil organic matter of less than one percent (sandy soils that dry quickly), the eggs and larvae desiccate, and insecticides are not required. Insecticides can be applied any time from early July until the first of August. Once the larvae hatch and begin feeding, an insecticide treatment is not effective. This fact prevents growers from waiting to see whether there is sufficient rainfall to cause a rootworm problem.

Thrips usually occur in peanut fields each year. Environmental conditions during the spring favor population development of thrips. Feeding causes distorted, scarred leaflets that have reduced photosynthetic ability and stunts young plants. In the Virginia-Carolina region, where peanut cultivars with long maturity requirements are being produced in a relatively short growing season, preventing thrips from delaying crop maturity is critical to profitable peanut production.

Importance of insecticides:

Research has shown that in peanut fields treated with chlorpyrifos pod damage was reduced to less than one percent, while in the untreated plots, rootworms damaged 33 percent of the pods. Losses from larval feeding can reduce the yield of whole seed by as much as 80 percent. The only insecticides recommended for southern corn rootworm are organophosphates (chlorpyrifos, ethoprop and phorate) and a carbamate (carbofuran). Research with tefluthrin and fipronil resulted in mediocre control of rootworm in peanuts.

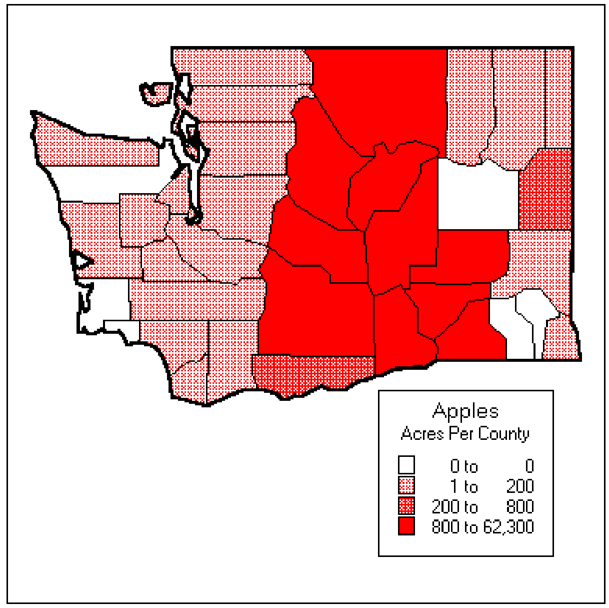
The cultivar NC6 was developed for its high degree of resistance to southern corn rootworm. However, the resistant cultivar is not widely planted because of a preference for new, higher-yielding, susceptible cultivars with more attractive seed and shelling characteristics.

Most of the acreage in Virginia-Carolina is treated for thrips control preventatively with organophosphates or carbamates: phorate, disulfoton, aldicarb or acephate. This eliminates the need for most foliar insecticide applications.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WASHINGTON APPLES

ACRES: 155,000
PRODUCTION:
VALUE ($/YR): $943,700,000
VOLUME (LBS/YR): 5,700,000,000



THE ISSUE:

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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	94	145,700
BT	21	32,550
CARBARYL**	60	93,000
CHLORPYRIFOS**	80	124,000
DIMETHOATE**	10	15,500
IMIDACLOPRID	26	40,300
MALATHION**	22	34,100
METHYL PARATHION**	19	29,450
OIL	77	119,350
OXAMYL**	15	23,250

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

San Jose scale, leafrollers, and codling moth are three of the key pests which organophosphate insecticides control. The scale is a tiny insect that sucks the plant juices from twigs, branches, fruit and foliage. This pest is of continual concern to apple growers in Washington because of the importance of exports, as phytosanitary regulations ban infested fruit from some countries. The most effective method of San Jose scale control is to use oil plus an organophosphate insecticide, such as chlorpyrifos during the dormant season. Oil could be used at higher rates without the organophosphate, but increased use of oil could lead to increased plant injury. The only insecticides recommended for scale control during the summer are the organophosphates. Oil can not be used in the summer at sufficiently high rates. Although it could control scale insects, a pyrethroid is not recommended as a summer spray since it is very toxic to beneficial insects and mites, and its application would be disruptive of the biological control of harmful mite species. Codling moth is the most destructive pest of apples in Washington State. Apple losses from this insect alone would exceed 50 percent in one or two years if no insecticides were applied for control. Its larvae bore deeply into the fruit and feed on seeds. Brown frass, or excrement, extrudes from the hole. Leafrollers feed on the leaves and fruit and are becoming an increasing cause of fruit damage in orchards throughout the state.

Importance of insecticides:

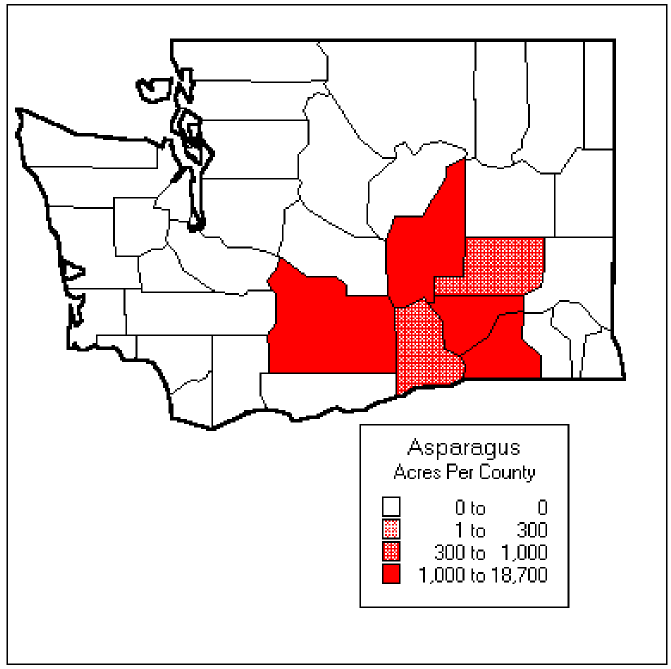
The organophosphate azinphos methyl, chlorpyrifos, malathion and methyl parathion control many of the key apple pests. Available alternatives to the organophosphates tend to be less effective, more expensive or disruptive of IPM programs. The threat of potential mite problems has resulted in Washington State University's deliberately not recommending synthetic pyrethroids as alternatives in apples. Codling moth has not been controlled adequately with BT's in the northwest. Generally, these compounds, even when applied five to seven times as often as azinphos methyl, do not provide equal control. A synthetic insect pheromone (Isomate C) is available to disrupt codling moth mating. Mating disruption is a less effective alternative in areas of high codling moth pressure. Growers in this situation usually supplement mating disruption with azinphos methyl. Leafrollers have emerged as a key pest under conditions of codling moth pheromone mating disruption. Overall reduced use of pesticides in this option allows leafrollers to become more prevalent. The organophosphate chlorpyrifos is the most widely used alternative to control leafrollers in the northwest.

While BT's are useful for leafroller control and can be effective if applied a sufficient number of times, no currently registered alternatives (other than OP's) allow control of damaging populations should they inadvertently be allowed to build up in an orchard.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Mike Willett at The Northwest Horticultural Council (509)-453-3193

INSECTICIDE USE ON WASHINGTON ASPARAGUS

ACRES: 24,504
PRODUCTION:
VALUE ($/YR): $63,312,000
VOLUME (LBS/YR): 88,800,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CARBARYL**	38	9,312
CHLORPYRIFOS**	8	1,960
DISULFOTON**	69	16,908
MALATHION**	13	3,186
PERMETHRIN	22	5,391

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The asparagus aphid was first discovered in Washington State in the fall of 1979. The aphids feed by sucking plant juices. There appears to be a toxic reaction causing bushy, stunted new growth. Shriveling, dwarfing and death of shoots from aphid feeding caused an estimated $10 - 12 million of damage in 1980. A survey of Washington growers in infested areas revealed that yield losses averaged 6.4 percent with stalk losses averaging 35 percent. Natural enemies and diseases have kept the aphid under control in the eastern United States, but have not proven effective in Washington.

Importance of insecticides:

Malathion was used initially in Washington to fight asparagus aphid.. This treatment temporarily depressed populations, but did not have the necessary residual activity. Eight insecticides were tested for efficacy against the aphid with the organophosphate pesticide disulfoton demonstrating the most effective control and the best residual activity. Special Local Needs registrations (Section 24 (c)) permit disulfoton applications to asparagus in Washington for control of the asparagus aphid.

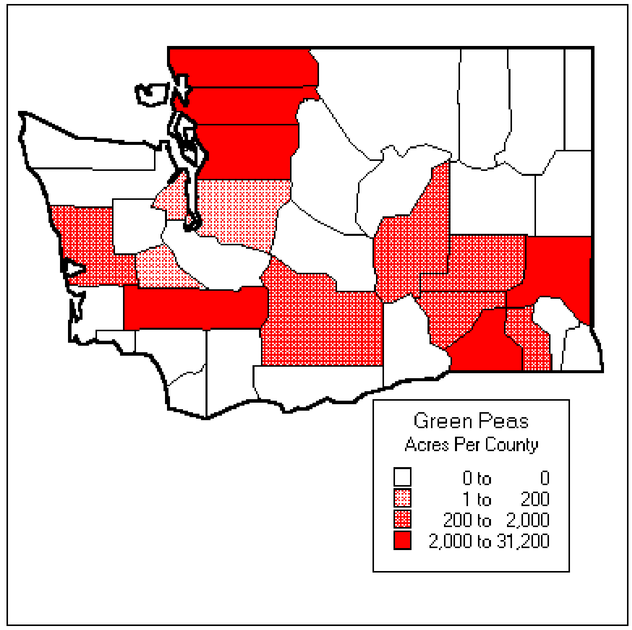
A recent study from Washington State University recently concluded that:

Loss of disulfoton would result in total collapse of the Washington and California asparagus industry unless a replacement compound could be

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WASHINGTON GREEN PEAS

ACRES: 57,830
PRODUCTION:
VALUE ($/YR): $33,805,000
VOLUME (LBS/YR): 243,200,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
DIAZINON**	5	2,892
DIMETHOATE**	54	31,228
ESFENVALERATE	25	14,458
METHYL PARATHION**	38	21,975

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Eggs of the pea aphid overwinter in alfalfa fields. In April or May, the eggs hatch into young aphids, called nymphs, that feed on alfalfa. A large proportion of the next generation will fly to pea fields in late May and early June. Wind currents may carry them far – perhaps 50 miles. Reproduction on peas is rapid. Female aphids can produce young without fertilization; in spring and summer, all aphids are females. In warm weather a female may produce 10 to 14 young per day – on one acre of peas there might be millions of aphids, that can ruin a crop quickly. The aphids feed by sucking sap from the pea plants. In the fall, the aphids fly back to alfalfa fields; some of the aphids become males; and after the males and females have mated, fertile eggs are laid in alfalfa fields.

A few aphids can kill small pea plants. A heavy infestation on more mature plants can reduce yields or even destroy the crop. The plants become stunted and produce fewer and smaller pods. Aphids attack the pods and cause them to shrink and to be filled only partially with peas.

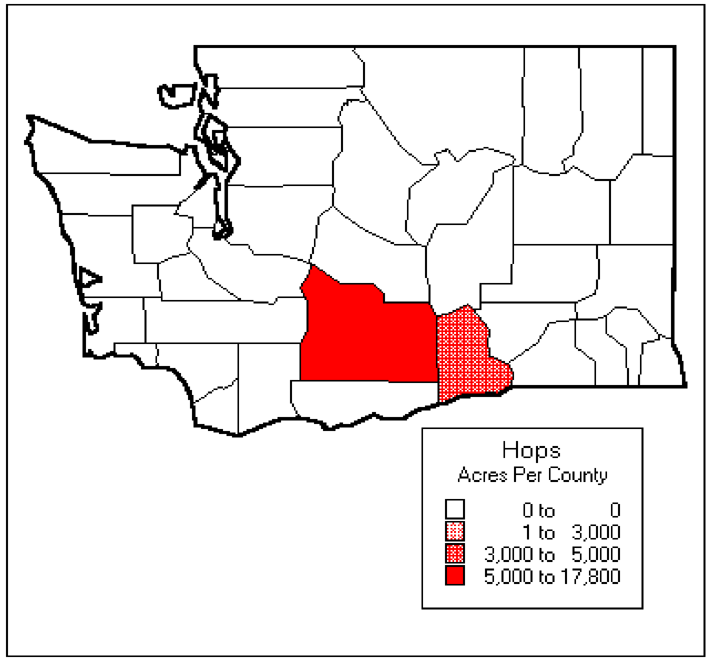
Importance of insecticides:

Before the development of organophosphate insecticides in the early 1950's, failure to control pea aphids were common. In the 1930's and 1940's, nicotine was applied to kill aphids. Control often was poor. Ladybird beetles were shipped in and released in many green pea fields, but control was uneven. Spray volumes were increased to 300 to 500 gallons per acres, containing rotenone and oil. Parathion was the primary organophosphate used for control of the aphid for many years. The organophosphate dimethoate is used currently. Usually, one application of dimethoate will reduce aphid populations sufficiently. A pyrethroid is registered for pea aphid control; however, the pyrethroid is much less effective and five times more expensive per acre.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WASHINGTON HOPS

ACRES: 32,214
PRODUCTION:
VALUE ($/YR): $87,631,120
VOLUME (LBS/YR): 55,816,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	100	32,214
BIFENTHRIN	75	24,160
BT	1	322
DIAZINON**	5	1,610
DICOFOL	2	644
IMIDACLOPRID	100	32,214
PROPARGITE**	25	8,054

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Hop aphid is a primary pest of hops in the U. S., and chemicals are used on 100 percent of U. S. hop acreage for its control every year. Aphids feed directly on hop plants extracting cell sap with their sucking mouth parts. High aphid populations (1,000/leaf) reduce yields and severely weaken plants. The hop aphid may also cause serious economic damage at very low densities if hop cones are infested. Hop aphids excrete prolific amounts of honeydew (plant cell sap passed through the aphid's digestive system). Sooty mold grows on the honeydew and can render hop cones unmarketable as moldy hops cannot be used for brewing. The hop aphid was first discovered in 1890. Losses were estimated at one-twelfth of annual production. Growers were encouraged to spray toxic wood chip solutions, whale soaps and kerosene for control of the aphid. Historically, worms (loopers, armyworms, cutworms) have been minor pests of hops. These pests feed on and skeletonize leaves.

Importance of insecticides:

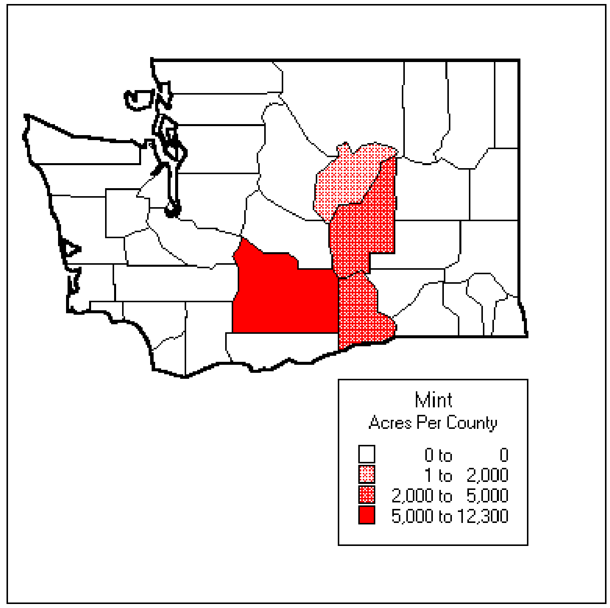
Until the mid 1940's, nicotine dust was the primary control for hop aphid. Organophosphates have been widely used since the 1950's for aphid control. Following the cancellation of several organophosphate registrations, hop growers had only the organophosphate diazinon for controlling aphid, and diazinon was used essentially on 100 percent of the hops acreage for aphid control (1986-1992). Exclusive use of diazinon induced resistance problems in aphid populations. Diazinon lacks residual control of aphid populations. The recent registration of the selective insecticide imidacloprid has reduced the use of diazinon for aphid control purposes.

Diazinon is used currently as an early season spray for aphid control and is also very important for resistance management for imidacloprid. Growers are encouraged to rotate imidacloprid and diazinon usage. Diazinon is also considerably less expensive than imidacloprid ($9/A vs. $25/A).

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Ann George at the US Hop Industry Plant Protection Commission (509)453-4749

INSECTICIDE USE ON WASHINGTON MINT

ACRES: 43,525
PRODUCTION:
VALUE ($/YR): $58,407,600
VOLUME (LBS/YR): 4,782,175



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	27	11,752
CHLORPYRIFOS**	9	3,917
DICOFOL	3	1,306
MALATHION**	4	1,741
METHOMYL**	1	435
OXAMYL**	1	435
PROPARGITE**	27	11,752

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests, including cutworms, aphids and spider mites. Cutworms emerge in June and deposit eggs in clusters of up to 500 on the leaves. Cutworms feed on the foliage for four to six weeks. Mint rootborers feed upon the underground stems of mint plants for 70 to 80 days in the fall. Damage is not noticeable right away, but come next spring, the mint field will have dry dead patches. In some instances mint rootborers have wiped out entire fields. The damage caused by the larvae boring in the mint roots severely weakens plants so that they are more susceptible to winter injury. High populations of aphids can cause extreme defoliation by piercing and sucking mint plant juices. Summer populations of spider mites can also cause complete defoliation if not controlled.

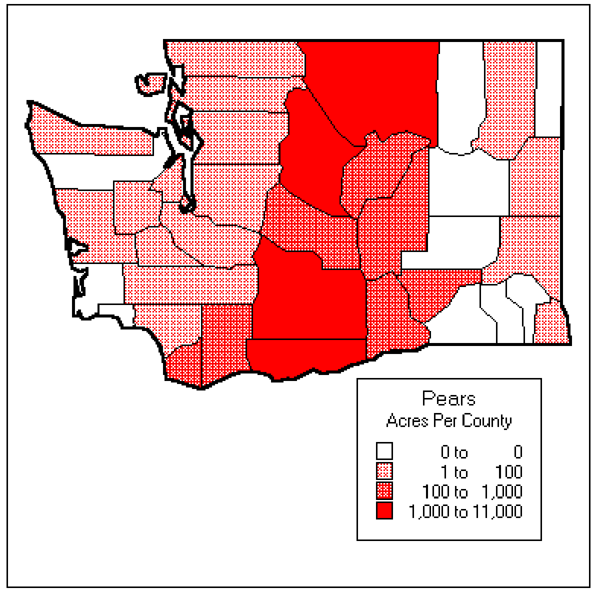
Importance of insecticides:

From about early June until harvest, as part of mint IPM programs developed by university researchers, fields are monitored for damaging populations of spider mites, cutworms and aphids. Frequently, populations of these pests are maintained under economic thresholds by natural biological controls, such as beneficial insects and lady beetles. If spider mite populations exceed the economic threshold, low rates of propargite can reduce populations without harming beneficial insects. If cutworms or aphids are found at levels above the threshold, the organophosphate acephate is applied. Acephate reduces the pest populations and allows the survival of the natural enemies. Alternatives to acephate are a carbamate and BT – neither of which is as effective. Mint rootborer used to be controlled by fall tillage. However, tillage is no longer practiced in mint in order to prevent the distribution of verticillium wilt. Fields are sampled in the fall for mint rootborer. Populations of borers exceeding the economic threshold are treated with chlorpyrifos – currently the only available control alternative for mint rootborer. Previously, a biological control (insect killing nematodes) was available for mint rootborer. Unfortunately, however, the product was discontinued.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at The Mint Industry Research Council (509)427-3601

INSECTICIDE USE ON WASHINGTON PEARS

ACRES: 24,200
PRODUCTION:
VALUE ($/YR): $124,000,000
VOLUME (LBS/YR): 784,000,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ABAMECTIN	77	18,634
AMITRAZ	25	6,050
AZINPHOS-METHYL**	78	18,876
CARBARYL**	6	1,452
CHLORPYRIFOS**	37	8,958
DIAZINON**	20	4,840
ESFENVALERATE	14	3,388
FENOXYCARB**	57	13,794
METHYL PARATHION**	7	1,694
OIL	86	20,812
PHOSMET**	19	4,598

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

In pear orchards organophosphate insecticides are targeted for codling moth, grape mealybugs, true bugs, leafrollers, San Jose scale, and overwintering aphid and mite eggs. Historically, codling moth has been one of the principal pests of pears. Larvae bore through the fruit skin and penetrate to the core, consuming fruit tissues and seeds. A syrupy frass, or worm excrement, may exude from the entry hole. Fruit attacked by codling moth larvae cannot be used for fresh shipments or commercial canning and is rejected during sorting and grading. Grape mealybug has become an increasingly severe pest of pears since the 1970's. Honeydew excreted by grape mealybug is very toxic to the skin of the fruit and causes a black coarse russeting. These insects crawl inside the calyx of the fruit and feed there. Fruit with either type of damage has to be culled.

Importance of insecticides:

The organophosphates azinphos methyl, chlorpyrifos and phosmet are widely used to control key pear pests. Adequate codling moth control is a concern particularly in areas of moderate to heavy codling moth pressure. In these areas, the only current registered alternative to OP's, mating disruption, needs to be supplemented and usually is a substantially more expensive alternative than current OP-based programs. San Jose scale control would also become more difficult. While oil will provide suppression of San Jose scale during the pre-bloom period, there are currently no known alternatives for summer control of the larvae called crawlers.

There are no known alternatives to the OP's for control of lygus bug, box elder bug or stink bugs aside from carbamate insecticides. These pests feed directly on the fruit and appear to be causing increasing levels of damage in pear orchards where growers are experimenting with reducing organophosphate use. Where it is a problem, grape mealybug is almost exclusively controlled through the use of OP's. Imidacloprid is effective, but cannot be used until after pollination is completed because of bee toxicity. Therefore, the critical pre-bloom control window is not available for this compound. Resistance management may also be challenged. Loss of the OP's would increase reliance on a few pesticides, which will likely have to be used more often, particularly for control of aphids and grape mealybug.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Mike Willett at The Northwest Horticultural Council (509)-453-3193

INSECTICIDE USE ON WASHINGTON POTATOES

ACRES: 148,000
PRODUCTION:
VALUE ($/YR): $418,000,000
VOLUME (LBS/YR): 8,806,000,000

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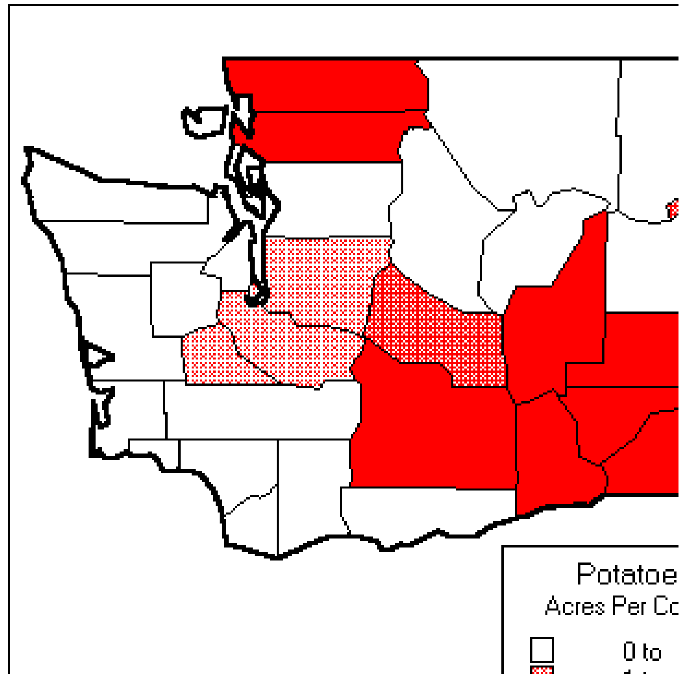


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ALDICARB**	28	41,440
CARBOFURAN**	39	57,720
DIMETHOATE**	22	32,560
ESFENVALERATE	14	20,720
METHAMIDOPHOS**	78	115,440
PERMETHRIN	7	10,360
PHORATE**	14	20,720
PROPARGITE**	26	38,480

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Three of the most important insect pests of potatoes in Washington are the Green Peach Aphid (GPA), the Colorado Potato Beetle (CPB) and the Great Basin Wireworm (GBW). GPA is the most important vector of potato leafroll virus, that not only causes yield reductions but also grade reductions because of net necrosis in tubers. CPB cause yield reductions by defoliation. GBW reduce marketable quality of tubers by their feeding injury.

The GPA overwinter in the egg stage in peach trees in Washington. After three generations spawn in fruit trees, the winged generations of the GPA develop and migrate to potato fields. At the height of the flight, 2.5 million aphids can blanket an acre of potatoes. The virus they carry causes a disease called net necrosis, that causes a black web inside a potato. GPA eggs are produced by sexual females in the fall, but otherwise the cycle is asexual with females giving birth to females for 10 to 25 generations during the growing season. Each aphid is capable of producing 30 to 80 offspring. A single peach tree potentially can produce enough winged aphids to establish economic infestations on 500 acres of potatoes. Seed potato tolerance for the leafroller virus spread by green peach aphids is so low that fields should be treated for the insects upon detection.

Wireworm larvae feed upon potato seed pieces and roots in the spring. This early feeding opens the seed pieces and stems to rotting organisms, resulting in poor stands. Wireworms also burrow into developing tubers.

Importance of insecticides:

When aphid populations reach the accelerated growth phase of their seasonal cycle, natural enemies cannot be expected to reduce the populations below economic levels. Direct control of aphids with insecticides has been found to be the only effective means of control. The soil systemic insecticides aldicarb, carbofuran, disulfoton and phorate are used to control the foliage-feeding pests (GPA and CPB) while minimizing the effects on beneficial insects. Soil applications of phorate effectively control wireworms.

The major breakthrough for long-term aphid control came in 1975 when aldicarb began to be applied to potatoes. Aldicarb provides good aphid control for the first 90 days of the season. In 1990, the manufacturer of aldicarb voluntarily agreed to halt its sales for use on potatoes because of concerns regarding residues. Aldicarb use on potatoes was approved for reinstatement by EPA in 1995, following the development of application methods that minimize residues. A Washington State University study estimated that the loss of aldicarb resulted in annual losses of $27 million to potato growers in Washington, resulting from poorer control of aphids with a subsequent large increase in the incidence of net necrosis.

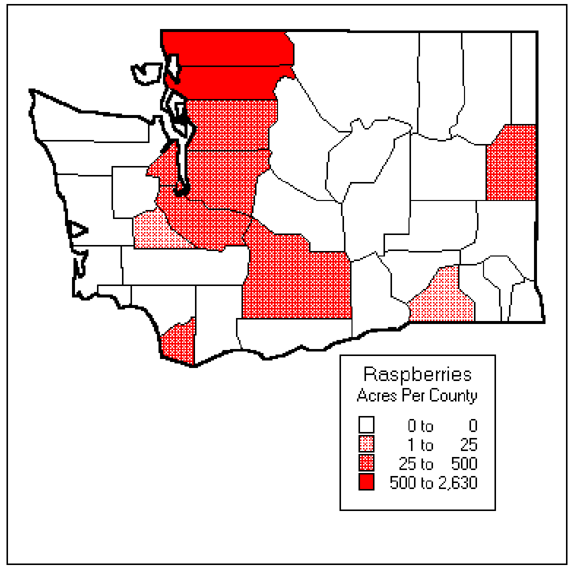
The systemic insecticide applications at the time of planting provide effective aphid control until mid-season. One foliar application of an insecticide may be necessary to control aphids after about mid-season.

Methamidophos has been the primary foliar insecticide used in Washington for aphid control since 1973.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WASHINGTON RASPBERRIES

ACRES: 5,900
PRODUCTION:
VALUE ($/YR): $39,423,000
VOLUME (LBS/YR): 46,740,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
AZINPHOS-METHYL**	11	649
BT	64	3,776
DIAZINON**	60	3,540
FENAMIPHOS**	13	767
FENBUTATIN OXIDE	45	2,655
MALATHION**	54	3,186

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Raspberries are perennial plants with erect canes. Canes grow from a crown, produce fruit in the second year and then the cane will die. The raspberry crown borer is one of the most damaging pests of raspberries in North America. Females land on foliage and lay reddish brown eggs. After hatching the larvae migrate to the base of the cane. The larvae begin a two year life cycle by forming a blister-like hibernaculum just below soil level at the base of the stem. In the spring, the larvae form numerous galleries and by the middle of the second summer the crown may be damaged extensively. After mating, a female lays about 140 eggs and a new cycle begins.

Insect contaminants are any insect pests residing in the canopy. These insects, shaken loose by machine harvesting, contaminate the crop. Contamination can result in downgrading of product with a loss of up to $1,400 per acre. Over 60 families of insects, as well as spiders have been identified as living in raspberry foliage. Most of these are either beneficial as predators or have no effect on raspberry plants. However, all are potential contaminants of the harvested fruit.

Root lesion nematodes are widespread and endemic in most red raspberry growing regions worldwide. As populations increase and more damage occurs, feeder roots die. In the final stages, all feeder roots have died leaving only the large diameter roots, that have little capacity for nutrient and water uptake. Reduced cane number, diameter and general plant vigor mark the slow decline of the above ground cane growth. Raspberry plantings with populations at or just below detectable levels of nematodes at the time of planting generally begin to decline in years six through 8 with dieout occurring two to three years afterward.

Importance of insecticides:

Insecticide tests have indicated that malathion essentially reduced lygus and aphid contamination of harvested raspberries to zero. Currently the only nematicide registered for use in established raspberries in the U.S. is fenamiphos. Studies in the northwestern U.S. have shown that root lesion nematode densities of 1,000 and 4,000 per 500 cm3 of soil require a treatment rate of 3-6 lbs. AI /A of fenamiphos. Diazinon is applied as a dormant drench over the row to kill young crown borer larvae as they feed, prior to tunneling into the crown. Once they are inside the crown, they cannot be killed with insecticides. Since they have a two year life cycle, insecticides must be applied every year for two or more years to kill all of the newly-emerged larvae.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WISCONSIN CORN

ACRES: 3,050,000
PRODUCTION:
VALUE ($/YR): $1,006,500,000
VOLUME (LBS/YR): 28,182,000,000

THE ISSUE:

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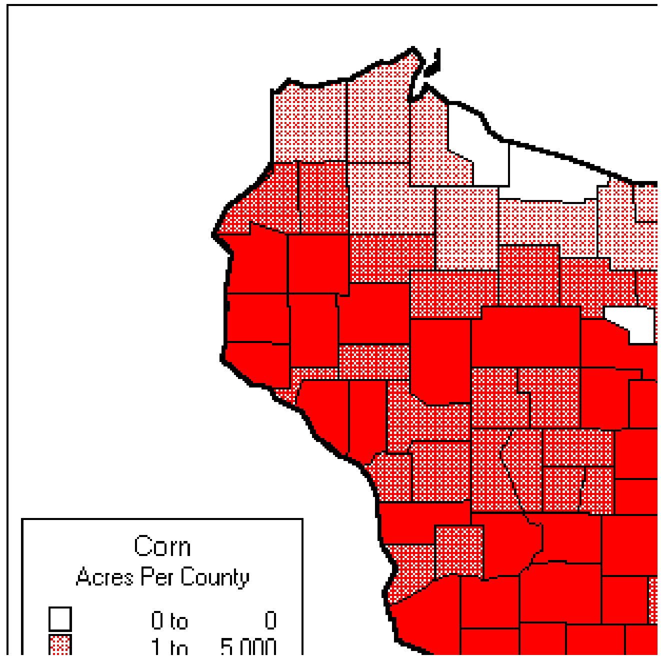


INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	6	183,000
PHORATE**	2	61,000
TEFLUTHRIN	5	152,500
TERBUFOS**	10	305,000

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The corn rootworm is the most important insect pest affecting corn production in Wisconsin. Damage by root-feeding insects reduces water and nutrient movement in corn plants, resulting in unfilled corn ears and reductions in yields of up to 55 percent. Rootworm feeding weakens the corn root system, causing maturing plants to tilt or tip over. A single female rootworm can lay up to 1,000 eggs in late summer; the eggs hatch the following spring; and the larvae feed on the roots of corn.

Rootworm larvae and adults appear to be remarkably immune to attacks by micro-organisms, predators and parasites. There are no commercially available corn varieties resistant to corn rootworms. Most insecticides in corn are applied in a band down the row of corn plants at planting to protect the roots. Rootworm larvae and eggs outside the narrow insecticide ban are unaffected.

Importance of insecticides:

The primary use of the organophosphate insecticides is for corn rootworm control in cornfields planted continuously to corn. A non-organophosphate alternative, the pyrethroid tefluthrin is rated equally as effective as the organophosphates for control of rootworm larvae. However, as the only suitable alternative for rootworm control, tefluthrin use most likely would predominate if the organophosphates were no longer available. The reliance on a single pesticide to suppress the pest would increase significantly the potential for the development for pest resistance to tefluthrin. The degree to which fipronil is a suitable control for rootworms has not been determined fully. Field trials generally have produced inconsistent results.

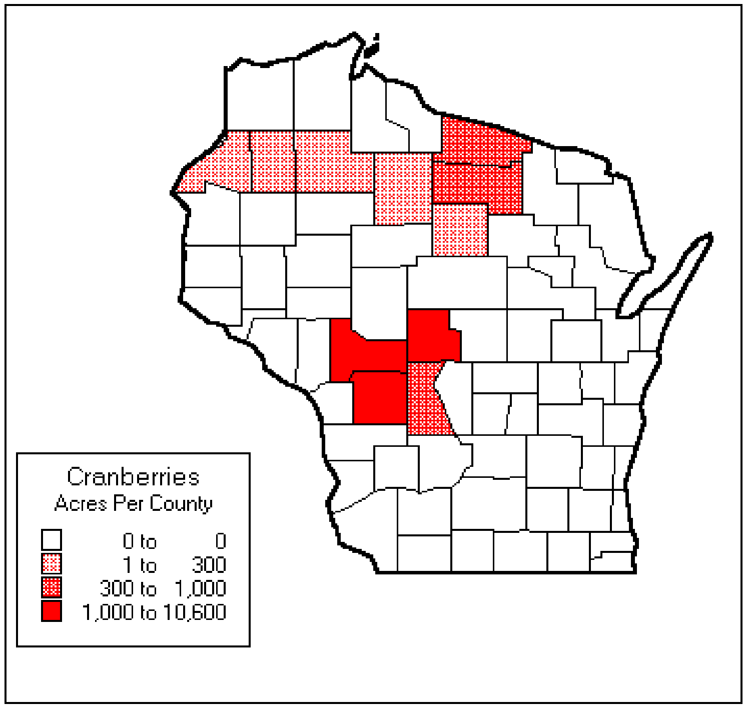
Phorate is particularly suited for Wisconsin, where the predominant species is the less aggressive northern corn rootworm. Phorate is an economical choice for control of these populations.

Approximately 50 percent of Wisconsin's corn acreage is rotated to another crop on an annual basis. Yield loss without the use of insecticides to control corn rootworm in Wisconsin is projected at seven percent.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WISCONSIN CRANBERRIES

ACRES: 10,999
PRODUCTION:
VALUE ($/YR): $76,542,600
VOLUME (LBS/YR): 153,700,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	44	4,840
AZINPHOS-METHYL**	60	6,599
BT	5	550
CARBARYL**	50	5,500
CHLORPYRIFOS**	32	3,520
DIAZINON**	72	7,919
PYRETHRIN	30	3,300

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

There are many species of insects that affect the roots, shoots and fruit of the cranberry plant. The cranberry fruitworm is the most economically important insect pest, causing direct damage to maturing berries. When left uncontrolled, feeding can result in greater than 50 percent fruit loss. The cranberry girdler lives in leaf litter and feeds on the bark and wood of the cranberry vines from late July until after harvest. Girdled vines die. Fireworms feed primarily on the foliage, skeletonizing leaves and giving the vines a burnt appearance. Cutworms and spanworms feed by nipping the terminal buds, leaves and blossoms. Vines may be defoliated and fruit set reduced as the stems of buds and blossoms are severed.

Importance of insecticides:

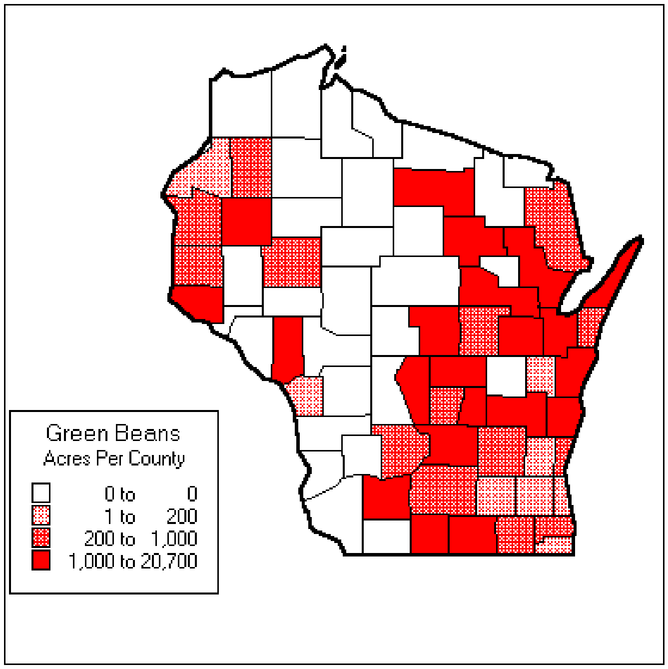
If the four major insecticides, chlorpyrifos, diazinon, azinphos methyl and acephate, were no longer available . . . in most places yields would be significantly reduced since the remaining insecticides are not as effective and cultural or biological alternatives do not provide as good or as fast control as the chemicals. At least half of the crop could be lost to direct pests alone, the first year in East Coast beds, with yield reductions of 15 to 50 percent estimated elsewhere. In subsequent years, pest pressure would be higher, and losses more severe, enough to drive many growers out of business.

USDA, Biological and Economic Assessment
of Pesticide Usage in Cranberry, 1994

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Jere Downing at The Cranberry Institute (508)-295-4132

INSECTICIDE USE ON WISCONSIN GREEN BEANS

ACRES: 76,589
PRODUCTION:
VALUE ($/YR): $40,068,000
VOLUME (LBS/YR): 572,400,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE**	51	39,060
DIMETHOATE**	12	9,191
METHYL PARATHION**	43	32,933

** *Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

European corn borer is the most serious insect pest of snap beans in Wisconsin, even though injury rarely exceeds one or two percent of the pods. Larvae bore into the pod and feed on the bean. Larvae may be present in the pods at harvest. For beans grown for processing, preventive treatment is necessary because buyers require 100 percent pest-free beans. Processors will reject a load of snap beans if they find more than one borer per 1,000 beans. Insecticide treatments are recommended to begin at least two weeks prior to harvest to protect against pod injury and to have the crop free of European corn borer by harvest time.

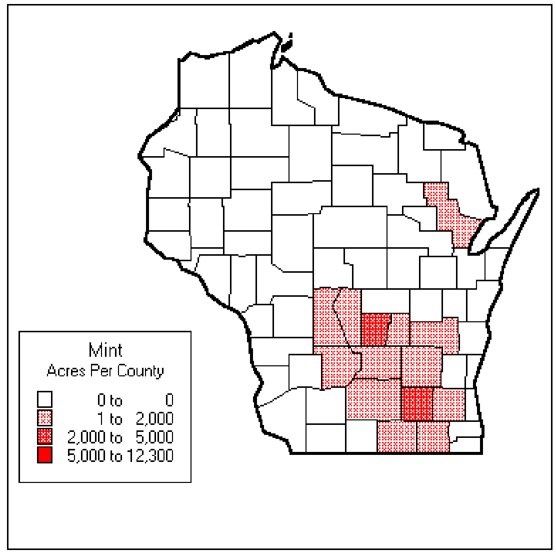
Importance of insecticides:

There are no biological or cultural controls that are available to achieve the low tolerance for damage from the European corn borer. BT has been tested, but does not achieve a zero damage rating. Although registered for use, a pyrethroid is not recommended because of poor control at currently labeled rates. The only reliable options for European corn borer control in green beans are organophosphate insecticides: acephate and methyl

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.

INSECTICIDE USE ON WISCONSIN MINT

ACRES: 9,425
PRODUCTION:
VALUE ($/YR): $4,749,975
VOLUME (LBS/YR): 351,850



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
ACEPHATE	4	377
MALATHION**	40	3,770
METHOMYL**	1	94
OXYDEMETON-METHYL**	2	188

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

Mint is a perennial crop that produces for three to seven years. Mint foliage is fed upon by several insect pests. Female mint flea beetles lay eggs in the soil near the crowns of plants in July to early August and continue laying eggs until late fall. The eggs hatch the following April or May. The young larvae feed on underground mint plant parts for about four to five weeks. High populations of mint flea beetle can devastate mint stands. The flea beetle was first found in Midwestern mint fields during the 1920's. Annual production in a field with heavy infestations of flea beetle dropped from 44 pounds per acre to three pounds per acre.

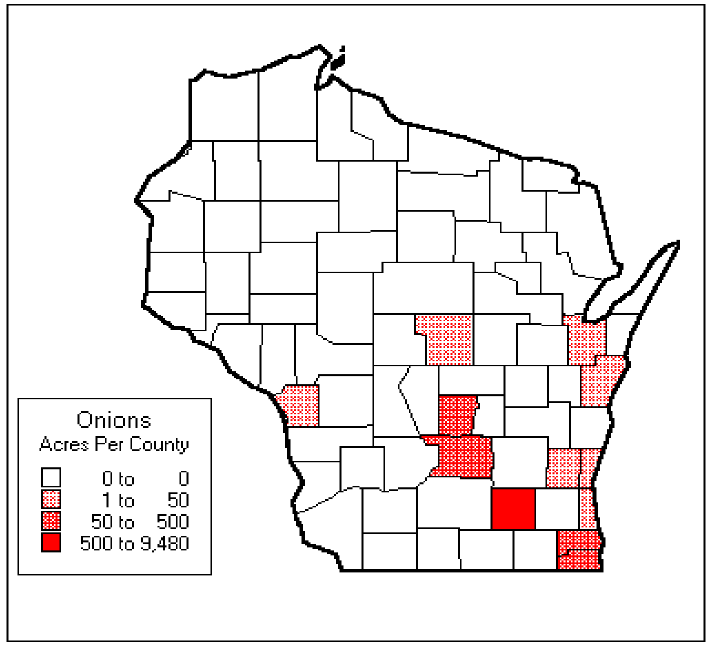
Importance of insecticides:

Mint fields are monitored for flea beetles at the adult emergence stage. Fields above economic thresholds are treated with the organophosphate malathion. Currently, malathion is the only insecticide recommended for mint flea beetle control. It is economical, efficacious, and does not harm beneficial insects. Malathion applications are targeted at the adult fly stage to prevent egg laying. Peak adult emergence falls between July 25th and August 10th. Even though malathion has a short half life and may be applied up to seven days prior to mint harvest, treatments in the Midwest are usually made after harvest at which time the mint stubble is treated.

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036 or Rocky Lundy at The Mint Industry Research Council at (509) 427-3601.

INSECTICIDE USE ON WISCONSIN ONIONS

ACRES: 1,928
PRODUCTION:
VALUE ($/YR): $3,050,000
VOLUME (LBS/YR): 64,600,000



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INSECTICIDE USE

ACTIVE INGREDIENT	% ACRES TREATED	ACRES TREATED
CHLORPYRIFOS**	69	1,330
CYPERMETHRIN	71	1,369
LAMBDACYHALOTHRIN	5	96
METHYL PARATHION**	75	1,446
PERMETHRIN	43	829

*** Active ingredient included in Phase 1 of FQPA rule making*

VERSION # 1.0

Key insect pests:

The onion maggot is the most serious insect pest of onions in Wisconsin. The maggots feed on roots and burrow into the developing bulb. Onion seedlings wilt and typically die due to maggot damage. A single maggot will kill a growing seedling by tunneling up the interior of the stem. On older bulbs a number of maggots may be found eating out the interior. Whole sections of onion fields may be affected with up to 90 percent crop loss. Onion and maggot flies can disburse over a wide area and are attracted to damaged plants or bulbs for egg-laying. There are normally three generations of onion maggots each year. Reduction of the first generation of onion maggots by furrow applications of a soil insecticide at planting is key to managing the onion maggot. Historically, onion maggots have been controlled by oil (1930's), mercury (1940's), organochlorines (1950's), and organophosphate insecticides (1960's to present).

Importance of insecticides:

Research with chlorpyrifos applied as an in furrow treatment at planting indicated a less than 10 percent stand loss from maggots with onion maggot damage at four percent. Chlorpyrifos applied at planting protects the onion plants through the development of the first generation onion maggot, which does most of the onion damage in Wisconsin. No protective means are available if a soil insecticide is not applied and maggots develop. Existing foliar sprays applied to kill adults are largely ineffective because only a fraction of the adult population is in the field at any given time, and sprays labeled for onions have a very short residual.

Onion flies respond to volatile onion attractants in the field at distances of at least one mile. This mobility limits the potential of crop rotation as a control method for onion maggot. It has been estimated that reliance on crop rotation instead of chlorpyrifos would result in 70 to 80 percent crop losses. With the recent voluntary cancellation of fonofos, chlorpyrifos is the only insecticide available for in furrow treatment of the onion maggot

For further information, please contact Leonard Gianessi at the National Center for Food and Agricultural Policy at (202) 328-5036.