

Benefits and Trends of Insecticide Use in California Crops

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California ranks first in grower expenditures on insecticides accounting for 20% of the US total for all crops and states. An examination of the historical record documents the importance of insecticides in California in preventing crop losses to destructive insect and mite species. Trends in the uses of insecticides are documented in the Department of Pesticide Regulation's full use reports for 1990-2007. Ten fruit, nut and vegetable crops have been selected for the initial insecticide benefits and use trends study: artichokes, asparagus, avocados, dates, nectarines, olives, peaches, pears, pistachios, and walnuts. For five of the crops, more than 90% of the acres receive insecticide treatments each year: (artichokes, dates, olives, peaches, pears) while 60-80% of the acreage of the other five crops is typically treated (asparagus, avocados, nectarines, pistachios, walnuts).

- In the early 1950s, *artichoke* losses due to plume moth damage reached major proportions often as high as 50-70%. [1] Insecticides came into common use in the 1960s following research showing reduced infestations of plume moth from 80% to 2%. [2] In recent years, use of older insecticides (methidathion, esfenvalerate) have declined while newer ones (diflubenzuron, deltamethrin,) have increased.
- Historically, the production of *avocados* in California required little usage of insecticides. Avocado pests were generally kept under commercially acceptable control by beneficial organisms. This situation changed in 1996 with the arrival of avocado thrips. Some growers had 80-90% of their fruit downgraded. [3] Insecticide acre-treatments in avocados increased from 500 to 97000.
- Frequent use of sulfur to control mites in *dates* was effective until the 1980s. [4] Beginning then, growers reported that sulfur was no longer effective and yield losses due to mites were as high as 35%. Following research that showed 99% control of mites, hexythiazox was registered for use by date growers. The use of hexythiazox is credited with preventing the demise of the California date industry. [5] The overall number of treatments has been reduced by 90% because of the increased effectiveness of hexythiazox.
- The production of *nectarines* in California was relatively small until the early 1960s. One of the major factors accounting for the rapid growth was the development of insecticides for control of western flower thrips. [6] Early reports on nectarine growing in California refer to sections of the state where thrips were so serious that production was practically impossible. Without thrips control, the nectarine industry in California would not exist today. [7] In recent years, use of older insecticides (formetanate, methomyl) has declined while newer active ingredients (spinosad) have increased.
- Traditionally, California *olive* orchards were infrequently treated with insecticides. The most significant pests were under good biological control. That changed in 1998 with the arrival of the olive fruit fly, the most serious insect pest of olives in the world. Olive processors enforce a zero tolerance of olive fruit fly.

- To guarantee that fruit will be free of olive fruit fly, insecticide sprays are necessary. [8] Insecticide acre-treatments in olives increased from 4000 to 80000.
- In 1984 the *asparagus* aphid was first found in California. Natural enemies that provide sufficient control in the eastern US and Europe did not control the pest in California. A serious aphid infestation in Riverside County destroyed 85% of the county's crop. [10] Without an effective insecticide for asparagus aphid control, a total collapse of the California asparagus industry would occur within one to two years. [11] In recent years, there has been a decline of 67% in insecticide treatments for asparagus aphid due to the declining economic viability of the crop.
 - California entered the world pistachio market in 1976 with its first commercial crop. Initially, pistachios were relatively free of insect infestations, but as more orchards came into bearing, reports of nut meat damage by navel orangeworm (NOW) larvae became common. [16] NOW-infested kernels account for 84% of the aflatoxins in pistachio nuts. [17] Research has shown that NOW infestations in pistachio orchards are reduced to 1% with insecticide sprays. [18] Insecticide treatments in pistachio orchards have increased five-fold in recent years as the value of the crop has doubled.
 - *Pears* cannot be grown profitably on a commercial scale without adequate control of insects. Consumers do not accept fruit damaged by insect feeding or its byproducts. If damage exceeds 1%, sorting fruit prior to packing becomes very difficult. The presence of too many insects in fruit destined for the processing market is not acceptable due to the risk of contamination of processed products by insect parts and rot. [15] Codling moth has the potential to destroy a high proportion (50-80%) of the California pear crop each year if not controlled. Current control programs result in less than .25% codling moth infested fruit at harvest. Codling moth mating disruption products have been adopted on close to 90% of California's pear acres leading to a 50% decline in insecticide treatments.
 - In 1887, a 50% loss of *peaches* in California due to peach twig borer was noted in some districts. [12] The loss of peaches in California in the 1920s was estimated as 20-60%. [13] The Oriental fruit moth reached California in 1942. Experiments with organophosphate insecticides controlled both Oriental fruit moth and peach twig borer reducing the percent wormy fruit to 2%. [14] Overall insecticide treatments have declined about 20% as peach growers have adopted mating disruption products for Oriental fruit moth on about 50% of the acres.
 - The codling moth has been known to attack *walnuts* in California since the early 1900s. [9] Growers placed the infestation as high as 50% in some orchards. The early research demonstrated that there was but one thoroughly satisfactory method for control: insecticide sprays. By 1926, spraying was the commercial practice employed in all the codling moth infested groves. Insecticide treatments in walnuts have increased by about 50% in recent years. Much of the increase was to control codling moth. Walnut growers have used codling moth mating disruption products on less than 10% of the acres due to the large size of the trees which increases labor application costs. Another factor leading to increased insecticide use is the need to treat for walnut aphid which is increasingly escaping from biological control due to the emergence of a new form of the aphid and hyperparasitoids of the aphid parasite

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