Northwest Center for Alternatives to Pesticides

CHLORPYRIFOS ALTERNATIVES

THE RIGHT THING FOR OREGON KIDS, FARMWORKERS AND FISH!

Sold under various trade names (Lorsban, Dursban and others), chlorpyrifos is used to kill insects and mites in many grains, vegetables, nuts, and fruit crops, as well as in non-food crops such as grass seed, Christmas trees and nursery plants. Strawberries, apples, hazelnuts, and corn are some of the common foods grown in Oregon that are frequently treated with chlorpyrifos. While chlorpyrifos was deemed harmful enough to human health that it was banned years ago for most residential uses, those who grow our food are not protected, absorbing chlorpyrifos through the skin and inhalation as they pick, pack and tend the crops.

In an average diet we unknowingly consume chlorpyrifos all the time, resulting in exposures many times the level EPA deems safe. Additionally, In 2017, the National Marine Fisheries Service determined that this chemical jeopardizes the survival and recovery of all listed salmon and steelhead in Oregon, Washington and California. Orca whales in Washington are also jeopardized by chlorpyrifos.

Alternative Growing Practices

Now is the time for Oregon growers to end the use of chlorpyrifos. Many growers in Oregon, and beyond, already utilize cost-effective, ecosystem-based alternatives that reduce insect pressure without the use of this harmful broad-spectrum pesticide. By adopting a combination of ecological growing techniques such as those listed, farmers will naturally reduce their reliance on chemical inputs.

Cultural control:

- **Building overall soil health** using tools such as compost, green manure, mulch, and other organic matter as well as beneficial microorganisms and organic amendments contribute to strong crops that are inherently more resistant to pests and disease.
- **Altering planting or harvest dates** can inhibit pests including a variety of maggot species, such as cabbage maggot, onion maggot, seedcorn maggot as well as other pests including the flea beetle and many others.
- **Crop rotation** may interrupt the life cycle for pests and can be an important tool for building soil. *Examples of Use:* Used to control corn rootworm, wireworms, Colorado potato beetle, and symphylans.[1] In onions, it is not advised to plant successive crops without rotating as fields likely contain overwintered onion maggot pupae.[2]
- **Cover cropping** adds diversity and can be used to incorporate naturally beneficial plants, animals, insects and nutrients to the field. Cover cropping involves crop rotation to help build soil and break pest cycles. *Examples of Use:* Crop-damaging nematodes and soil-borne pests can be controlled by the proper use of specific cover crops. The natural biochemicals exuded from certain varieties suppress the growth of nematodes by inducing the eggs to hatch prematurely without a suitable food source. This causes them to starve and interrupts the reproductive cycle.[3]

Keep Farmworkers, Families and Fish Safe

- **Intercropping** adds diversity and can be used to incorporate naturally beneficial plants that support the crop or attract other beneficials. *Examples of Use:* Planting sunflowers in vegetable fields to attract birds that may also eat pest insects.
- **Conservation tillage** helps to build soil biology and support beneficial soil microorganisms that lend to the overall health of the crop.

Biological control:

- **Biocontrol** by natural enemies such as predators, parasites and fungal pathogens. *Examples of Use:* Parasitic wasps help manage herbivorous pests such as aphids, corn earworms, cutworms, whiteflies and other larvae in a variety of commercial fruit and vegetable crops.
- **Habitat conservation** by creating on-farm habitats that support natural enemies.[4] Such habitats also provide habitat for native pollinators, important to many Oregon crops.
- **Monitor and disrupt life cycles.** This can be done in a number of ways including the use of pheromones, chemicals produced by an insect to communicate. Pheromones are used in many crops for mass trapping or mating disruption, and suppressing insect populations. *Examples of Use:* Mating disruption for codling moth is currently used on 90% of the apple and pears grown in Washington State and is an increasingly used option in Oregon crops like hazelnuts.

Genetic control:

- **Pest-resistant cultivars**, when available, include heirloom, locally adapted and indigenous varieties tend to have higher levels of innate resistance to pests and disease.
- **Diversification of the agroecosystem** and practices such as intercropping can reduce pest pressure targeted to a specific crop.

Physical control:

- **Monitoring** of pests and as well as beneficial insects and pests natural enemies to better understand their life cycles, habitats, and periods of expansion and vulnerability.
- **Mass-trapping pests** with the use of light traps, water traps, fruit fly traps, sweep nets, bird perches, sticky board traps, soil baits, soil traps, trap crops, pheromone technology or baits. *Examples of Use:* Mass-trapping with the aid of a pheromone was found to significantly reduce western flower thrip in strawberries.[5] In Washington and Idaho, trap crop designs including mustard and pak choi were found to reduce populations of flea beetles on broccoli more effectively than trap crops with only one species.[6]
- **Exclusion or barrier** techniques including physical barriers, row covers, hedgerows, buffers and trap crops. *Examples of Use:* Covering row crops with reemay provides a physical barrier that prevents pests from accessing the crops. Another example includes bagging pome and stone fruits to reduce aesthetic damage to the fruit by pests.
- **Heat and steam treatments, cold treatments and pressure-washing** to remove pests, sanitize and reduce overall cross contamination. Examples of Use: Steam sanitizing equipment contaminated with pests such as the vine mealybug and pressure washing citrus to remove scale.
- **Field sanitation** - remove infestations, alternate plant hosts and other residues to reduce resources and favorable habitats for pests. *Examples of Use:* In onions, it is advised to remove volunteer onions and cull piles as they are likely to be contaminated with pests.[2]
- **Electrical currents** that can either kill a pest or produce unfavorable conditions. *Examples of Use:* Electrostatic sweeper to control whiteflies in the greenhouse.[7]

Chemical Alternatives

If pesticides are deemed necessary, below is a list of effective, least-toxic alternatives that do not pose significant health effects to humans and wildlife. List is in alphabetical order.

Alternative	Example Brands	Description	Used to Treat	Commonly Used On
Bacillus thuringiensis (Bt)	Xentari, Dipel	Biological insecticide made of naturally occurring bacterium found in the soil	A wide variety of lepidoptera larvae including armyworm, cabbageworm, gypsy moth, corn earworm and many others	A wide variety of vegetable crops, fruit trees and forest lands
Borax (Boric Acid and Sodium Borate Salts)	MotherEarth	Naturally occurring product that, when combined with other elements, can have varying levels of toxicity	Wide range of pests including insects, spiders, mites, ants, algae, mold, fungi, and weeds	A wide variety of crops
Horticultural Oils	Superior Spray Oil	A refined phytonomic oil used as an insecticide and miticide on plant foliage as well as plants in the dormant stage	A wide variety of pests including scale, mites, mealybug, powdery mildew, aphid, pear psylla, peach twig borer	A wide variety of crops
Insecticidal oils (Rosemary, Clove Peppermint, Neem and many others)	Vegol	Fumigant, insecticide and repellent that blocks neuroreceptors and may affect growth rate, reproduction, and behavior of insect pests	Broad spectrum of pests	A wide variety of crops
Insecticidal soaps (Potassium Salts of Fatty Acids)	M-pede, DES-X	Biofungicide, beneficial fungi and bacteria, produced by adding potassium hydroxide to fatty acids found in animal fats and plant oils. Fatty acids penetrate an insects body covering and disrupt the cell membranes.	A wide variety of pests and fungal diseases including mites, aphids, beetles, caterpillars, fly maggots, leafhopper, leafminer, mealybugs, scale, whiteflies, powdery mildew and others	Greenhouse crops, christmas trees, grass and ornamentals
Kaolin Clay	Surround WP	Applied as a spray to leaves, stems and fruit. Acts as a repellent and reduces the chance of fungal disease	A wide variety of insect pests such as lygus bug, spotted-wing drosophila, apple rust mite, apple maggot and many others	Wide variety of fruit and vegetable crops
Mycoinsecticides (Beauveria bassiana)	BotaniGard ES	Liquid emulsifiable biological insecticide	Wide range of soft-bodied pests including whiteflies, thrips, aphids, psyllids, mealybugs, plant bugs, weevils and other lepidoptera insects	Variety of greenhouse and field crops

Chemical Alternatives (continued)

Alternative	Example Brands	Description	Used to Treat	Commonly Used On
Neem Oil (Azadirachtin)	Trilogy, Neemix, Blue, EcoWorks	Botanical insecticide and fungicide that can be applied as a foliar spray or soil drench. When used systemically, neem oil can prevent larvae from maturing, reduce or interrupt mating behavior or may inhibit an insect's ability to molt.	A wide variety of pests including aphids, mites, mealybugs, leafminers, leafhoppers, corn earworm, cabbage worm, whiteflies, weevils, thrips, snails, nematodes, moths, scale, root rot, sooty mold, and powdery mildew	A wide variety of ornamental and edible crops including christmas trees, peppers, melons, strawberries and many others
Pyrethrin	PyGanic, Safer, PireKrone	Botanical insecticide extracted from chrysanthemum flowers that targets the pests nervous system	Broad-spectrum of pests such as aphids, beetles, caterpillars, moths, fruit flies, mites, ants, thrips	A wide variety of crops including fruits, vegetables, ornamental plants, and nut tree
Spinosad	Entrust	Microbial insecticide produced through the fermentation of naturally occurring soil bacterium	A wide variety of foliage feeding pests like weevils, leafminers, armyworm, wireworm, thrips, corn rootworm, corn maggot, spider mites, ants, moths and various larvae	A wide variety of fruits and vegetables including pome fruits, corn, and berries, tuberous vegetables, field crops and more
Sucrose octanoate esters (SOEs)	SucraShield and others	Sugar-based insecticide derived from natural sugar esters	Wide range of soft-bodied pests including aphids, whiteflies, mites, thrips, mealy bugs, leafhopper, psyllid, caterpillars, scale and more	Variety of fruit trees, nut trees, field crops, nursery and greenhouse crops, christmas trees, ornamentals and landscaping

Conclusion

When considering the use of chlorpyrifos, we must consider all aspects of health, including human, environmental as well as economic health. We can no longer put profit before people and wildlife, especially when there are viable alternatives. In order to protect all aspects of human, environmental and economic health, we must invest in alternatives – including educational opportunities for Oregon growers and public sector research that advances the use of least-toxic pesticides across the state.

US Fish & Wildlife Service

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