II.11 Baits for Controlling Rangeland Grasshoppers: An Overview

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NOTE: Acephate is no longer approved by EPA for rangeland grasshopper control.

The first use of baits for grasshopper control began in the late 1800's. In 1878, the U.S. Entomological Commission reported bait experiments with mixtures of paris green and flour. In 1885, a bran bait containing arsenic, sugar, and water was used against grasshoppers in the San Joaquin Valley of California (Coquillet 1886). Over the next several decades, there was extensive testing to improve baits.

The work to improve baits concentrated on testing substances for attractiveness to grasshoppers and substitutes or diluents (diluting agents) for bran. Some of these substances were molasses (beet and cane), salt, calcium chloride, citrus fruits, lemon and vanilla extracts, geraniol nitobenzine, amyl acetate, propyl acetate, butyl acetate, apples, apple flavoring, anise, corn oil, fusel oil, saccharin, sugar, vinegar, stale beer, sawdust, shorts (grain byproducts), whey, soap, and even horse manure (Shotwell 1942). Some of the substrates studied to replace bran were sawdust, cottonseed hulls, rolled wheat, ground wheat screenings, citrus meal, chopped and ground alfalfa, ground flax fiber, ground peanut shells, bagasse, pear and apple pomace, peat moss, ground beet pulp, ground corncobs, chopped cornstalks, cornmeal, soybean meal, pea bran, oat hulls, and low-grade wheat flour (Parker 1952).

Over the years, different toxic substances were studied for effectiveness against grasshoppers. These toxins included paris green, white arsenic, dry and liquid sodium arsenate, barium fluosilicate, and sodium fluosilicate (Shotwell 1942). However, until 1942, when sodium fluosilicate became the preferred toxic agent, arsenic was most often used (Parker 1952). The chlorinated hydrocarbon insecticides introduced in the 1940's soon replaced the previously used toxic agents. Because sprays of these insecticides were so effective, widespread use of baits discontinued by 1950.

New insecticides that were equally effective, but environmentally safer, later replaced the chlorinated hydrocarbons. The development of acceptable spray agents and spray technology, even though extremely efficient, did not eliminate the use of bran bait completely. Bait commonly was used against Mormon cricket (a longhorn grasshopper) in the 1970's and continues today.

Although liquid sprays are very effective and economically superior, baits offer several environmental advantages, and work has continued to improve them. Ewen (1990) reviewed some of the more recent reported results with baits. His review included studies on the organophosphates (dimethoate, pyridaphenthion, fenitrothion, and malathion), the carbamates (propoxur, carbofuran, carbaryl, and cloethocarb); and the synthetic pyrethroids (fenvalerate and cypermethrin). In addition to these chemicals, chlorpyrifos and acephate, both organic phosphates, and diflubenzuron, an insect growth regulator, have also recently been studied in bait formulations. Studies of these toxicants in baits are noted in the references at the end of this chapter.

Of the toxicants recently studied, dimethoate, fenitrothion, carbofuran, cloethocarb, chlorpyrifos, diflubenzuron, and carbaryl are very effective in bait formulations against susceptible species of grasshoppers. However, most of these toxicants are not currently registered for use in baits against grasshoppers. Carbaryl is currently registered for use in the United States against grasshoppers and is commonly used on rangeland when bait treatments are indicated. It has been extensively used as a preventive "hot-spot" treatment in the Grasshopper Integrated Pest Management Project's North Dakota demonstration area. Dimethoate is registered for use in Canada in baits against grasshoppers.

Even though extensive research has been conducted with baits, two general areas of concern still detract from their widespread use against grasshoppers. Grasshopper populations on rangeland are seldom composed of only species that readily consume baits, and control of bait-consuming species is usually less with baits than with sprays. The cost of applying baits, particularly by air, usually exceeds the cost of applying sprays. Also, because applicators have less experience with baits, they perceive more difficulty in calibrating equipment for baits than for sprays.

On the other hand, baits have some considerable environmental advantages. The increased interest in protecting the environment and reducing the effects on nontarget species make baits more attractive than in the past. Compared to sprays, baits require less active ingredient to achieve reduction in grasshopper populations and are

much more specific toward grasshoppers and affect significantly fewer nontarget organisms than sprays. Baits are also easier to direct toward the target area than sprays. Also, the increased knowledge that allows for use of treatments that do not provide almost total control of pest species adds to the attractiveness of baits. Other chapters in this section describe the recent developments, methods, and potential strategies for the use of bait formulations for controlling grasshoppers.

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