[4] Experimental applications have demonstrated that Dimilin-RAATs provide more than 90 percent mortality when ground temperatures exceed air temperatures by as much as 15°F. Extensive research in Australia has demonstrated that when ground temperatures exceed air temperatures, thermal updrafts can limit insecticide deposition of aerial applications unless there are winds of 2 to 10 miles per hour (ideally, perpendicular to the swaths). Oil adjuvants in the insecticide carrier will ensure that evaporation will not cause application failure.

[5] Using canola or corn oil rather than crop oil as a carrier may significantly improve the effectiveness of RAAT applications. Canola and corn oils are effective attractants and feeding stimulants for many rangeland grasshopper species. To emulsify the oil with water use a minimum of one part crop oil concentrate to seven parts canola or corn oil.

[6] Small-scale trials under optimal conditions indicate that 80 to 85% grasshopper control can be achieved using 100-foot swaths with the following rates and coverages: 5 fluid ounces per acre with 33-foot untreated swaths, 6 ounces with 50-foot untreated swaths, and 7 ounces with 100-foot untreated swaths. It is also possible to use 4 ounces of canola oil combined with 4 ounces of malathion with 100-foot treated and untreated swaths.

Exceptions to the "Rules"

Higher rates and/or coverages may be needed if:

1. treatments are applied to late instar nymphs (especially if using Dimilin® 2L),
2. ground temperatures exceed air temperatures (especially if using malathion),
3. grasshopper densities are extreme (e.g., >40 per square yard),
4. forage cover is tall and/or dense, and
5. terrain is rough.

In all cases, grasshopper management software (CARMA[1] or HOPPER[2]) should be used to assess program options. Always apply insecticides in accordance with label directions and established guidelines for buffers around water, bees, and human habitations.

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[1]For more information on RAATs or to download CARMA, visit: www.wygisc.uwyo.edu/grasshopper/

[2]Available from the USDA-ARS Northern Plains Agricultural Research Laboratory at:

www.sidney.ars.usda.gov/grasshopper/Support/Hopper.htm

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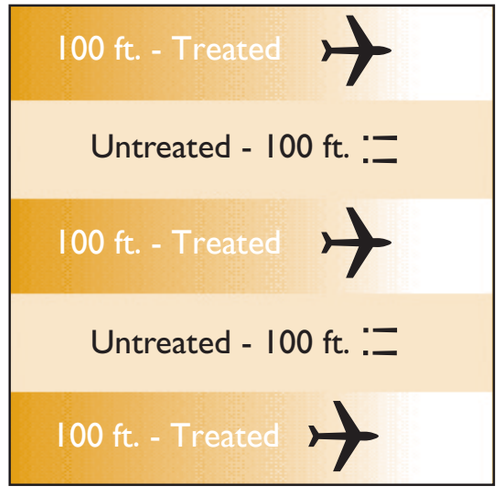
A schematic of an aerial RAAT application with 50% coverage.



Funding for RAAT research has been provided by the state of Wyoming (legislature, department of agriculture, weed and pest districts, University of Wyoming), U.S. Department of Agriculture (Western Regional IPM Project, APHIS, and CSREES), and cooperating industries.

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UNIVERSITY OF WYOMING
2004 **MP-95**

AERIAL-RAAT STRATEGY

Do more with less using

Reduced Agent and Area Treatments (RAATs)

An IPM strategy for rangeland grasshopper infestations - an economical and environmental win-win approach to pest management

What are RAATs?

RAATs are a method of integrated pest management (IPM) for rangeland grasshoppers in which the rate of insecticide is reduced from levels recommended by the label and untreated swaths (refuges) are alternated with treated swaths.

RAATs work through *chemical control*, meaning grasshoppers are killed in treated swaths and as they move out of untreated swaths, and *conservation biological control*, which allows predators and parasites preserved in untreated swaths to suppress grasshoppers. This IPM approach can reduce the cost of control and the amount of insecticide used by more than 50 percent.

Why use RAATs?

Economics

Inflation and the restructuring of the USDA cost-share program have tripled the cost of rangeland grasshopper management for ranchers compared with the control cost during the last major outbreak in the late 1980s. Most states no longer subsidize grasshopper programs; therefore, the cost of traditional control tactics will usually exceed the benefits. Even though certain federal or state subsidies for grasshopper control are becoming available in some states, the expenses of a management program remain largely a producer's burden because of high insecticide and treatment costs.

Environment

Less insecticide in the environment lowers the risk to native plant and animal species (including fish and wildlife), water quality, and humans. The untreated swaths provide a refuge for organisms with lower mobility than grasshoppers, and even those organisms that move into the treated swaths will be largely unaffected unless they feed on the foliage. RAATs are the preferred option in the USDA-APHIS EIS if grasshopper control is required.

What to expect from Aerial-RAATs

Efficacy

This method will normally result in 80 to 95% control, which is approximately a 5 to 15% lower mortality than with a conventional (higher rate, blanket coverage) treatment. Leaving low, residual densities of grasshoppers after RAATs does not necessarily result in a subsequent outbreak (see ***Environment*** below).

Economics

Using RAATs will greatly reduce the cost of control programs, depending on the agent and swath width. In some cases, costs are reduced by two-thirds. It should be noted that the greatest economic benefits derive from increased swath spacing since this effectively decreases both the cost of insecticide and application.

Environment

RAATs mean 50 to 75% less insecticide is applied to our rangelands for grasshopper control. The untreated swaths harbor species essential to rangeland ecosystems including biocontrol agents of grasshoppers and weeds. Low densities of surviving grasshoppers allow predators and parasites in the untreated refuges to recolonize and thereby reestablish natural regulation of grasshopper populations. For these reasons, RAAT programs may also allow for higher densities of birds than blanket applications.

How to use RAATs

Research conducted from 1995 to 2003 by University of Wyoming and USDA scientists, in cooperation with state departments of agriculture and weed and pest districts, has involved 260 experimental plots of 40 acres each and 19 operational trials on 640-acre areas at densities of 7 to 70 grasshoppers per square yard. Successful operational RAAT programs have been conducted in 10 western states. The following tactics most often optimize economic returns and are recommended by the National Grasshopper Management Board:

1. Apply carbaryl (Sevin® XLR Plus) at a rate of 8 fluid ounces (=113 grams of active ingredient) per acre with an equal volume of water[1,2] at pH#7 in 100-foot swaths[3], alternating with 100-foot untreated swaths (*compared with the conventional approach of using 16 fluid ounces per acre in a blanket coverage*).
2. Apply[4] diflubenzuron (Dimilin® 2L) at a rate of 0.75 fluid ounce (=5.3 grams of active ingredient) per acre with 8 fluid ounces of water and 4 fluid ounces of oil adjuvant in 100-foot swaths[3], alternating with 100-foot untreated swaths, OR apply at a rate of 1 ounce per acre with 16 ounces of water and 8 ounces of canola or corn oil[5] in 100-foot swaths[3], alternating with 200-foot untreated swaths (*compared with the conventional approach of using 1 fluid ounce per acre in a blanket coverage*).
3. Apply malathion (Fyfanon® ULV) at a rate of 4 fluid ounces (=138 grams of active ingredient) per acre in 100-foot swaths[3], alternating with 25-foot untreated swaths[6] (*compared with the conventional approach of using 8 fluid ounces per acre in a blanket coverage*).

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[1] This low volume (16 fluid oz. total) method has been adopted on the product label for RAATs.

[2] Increasing the volume of water above the 1:1 ratio with carbaryl will not improve and may reduce efficacy and washoff resistance. Alkaline water should be buffered to neutral to prevent chemical degradation of carbaryl.

[3] Wider treated swaths (>100 foot) may be used depending on the spraying equipment. While it may be possible to proportionately expand untreated swaths, this approach has not been tested. Therefore, the most prudent tactic at this time would be to maintain the fixed widths of the recommended untreated swaths, which should never exceed 200 feet in any case.