# GRASSHOPPER MANAGEMENT

PEST MANAGEMENT TECHNICAL NOTE

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***Abstract:*** *Although grasshoppers are difficult to control, their impact can be minimized by preventive management over the long term. This publication outlines non-chemical strategies, including cultural and biological controls, available to the grower.*

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Although the grasshopper occurs throughout the continental U.S., most of the damage it causes is restricted to "sub-humid, semi-arid" areas, extending from Montana and Minnesota to Texas and New Mexico (1).

## Life cycle

There are three stages in a grasshopper's lifecycle, the egg, nymph (the young grasshopper), and the adult. Most grasshopper species over-winter as eggs, which are laid in clusters in late summer and early fall and hatch in spring, when soil temperatures warm up.

It takes approximately 40 to 60 days for the nymph to fully develop into an adult. During this time, it sheds its exoskeleton several times as it moves from one nymphal stage—called an instar—to another. The best time to control the insect pest is during early nymphal development, when it is most vulnerable to disease, parasites, predators, insecticides, and inopportune weather. Adult grasshoppers are virtually impossible to control, hence preventive management is of the essence.


It is helpful to obtain a positive identification of the grasshopper species on the farm. Several hundred species of grasshoppers occur in the United States, and not all of them are pests (2). Information on its life cycle will reveal when the pest is most vulnerable, and treatment may

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be scheduled accordingly. Your local or state Extension service can help identify the grasshopper species and provide information on its life cycle.

## Weather

Grasshopper outbreaks are determined by a complex interaction of several factors, of which weather is the most important (3). Warm and dry spring conditions encourage nymphal growth. An early spring followed by cloudy, damp weather encourages diseases that sicken and kill hoppers. A long, hot summer ensures a plentiful food supply and encourages early maturity of grasshoppers and a long egg-laying period. On the other hand, a cool summer and early fall slows down grasshopper maturity and reduces time for laying eggs.

## Cultural controls

The long-term control of grasshoppers is possible through the use of cultural practices like tillage, fall clean-up, trap cropping, early seeding, and early harvest. The use of these tools may be guided effectively by fall egg counts and regular scouting to identify hatching locations. Cultural measures, in conjunction with biological controls and practices that increase farm biodiversity, provide good sustainable control in the long run.

Grasshoppers breed and grow in weedy, undisturbed areas like roadside ditches, fence rows, untilled pastures, and in crops that stay around for more than a single growing season.

A survey of the area after the eggs hatch helps to ascertain where populations are developing. Optimal control is possible when the insects are still immature and restricted to their breeding areas. Growers may use organically approved botanical products like sabadilla or pyrethrin to knock down nymphs in the first or second instar.

## Tillage

Tillage in late summer discourages females from laying eggs in the ground. It also destroys eggs by exposing them to the weather, predators, and parasites. Spring tillage is effective primarily because it eliminates food sources for the newly hatched nymphs (4). However, fall tillage and sanitation procedures that reduce winter soil cover may not be compatible with the goals of sustainable farming and should be used sparingly.

## Trap crops

Trap crops are small plantings established within or next to the main crop to draw the pests away and concentrate their populations where they can be destroyed. In spring, tilling all plant matter will probably not work because nymphs mobile enough to search for food will simply move to adjacent crops. Strips of vegetation left untilled will concentrate their populations and make insecticide treatments, whether synthetic or organic, more efficient.

In summer, when the surrounding rangeland vegetation begins to dry up, trap crops act as a barrier to migrating grasshoppers (5). In the case of a market garden, an irrigated "greenbelt" along the perimeter acts as a trap crop for migrating grasshoppers when the surrounding vegetation begins to dry up in late summer. The annual kochia (*Kochia scoparia*) is attractive to the grasshopper and reportedly works well as a shelter belt (6). Grasshoppers dislike cilantro, and some organic growers suggest planting a wide barrier of the crop for protection (7).

## Predators

Natural predators and parasites rank next in importance to weather in keeping grasshopper populations in check. In addition to IPM programs that reduce pesticide usage, actions that increase the numbers of beneficial insects and other organisms in the agro-ecosystem must be encouraged. For additional information, see ATTRA's publications *Farmscaping to Enhance Biological Control* and *Biointensive Integrated Pest Management*. Crop rotation and other organic practices that increase bio-diversity offer a certain degree of protection against pests. Grasshoppers are drawn to monocultures and dislike nitrogen-fixing crops like peas and sweet clover (8). Rotation, cover cropping, and other practices that promote bio-diversity make farm habitats more attractive to the host of natural predators and parasites that control localized grasshopper infestations.

Domesticated poultry like chickens, turkeys, guinea fowl, geese, and ducks are good for keeping grasshopper populations in check, although they tend to damage the plants in the garden too. One way to handle this is to confine the birds to the greenbelt. Another is to enclose them in wire fencing along the perimeter so that they can prey on visiting grasshoppers while staying out of the crop.

## Biological controls

A well-known biological control for grasshoppers is *Nosema locustae*, a naturally occurring protozoan that causes disease and death in crickets and grasshoppers. Spores of the parasite are impregnated into wheat bran flakes and applied on the field. It takes one to three weeks for the grasshoppers to be infected. Following ingestion, the spore ruptures and activates the disease in the grasshopper. Infected individuals are lethargic and slow, making them easy prey for birds. *Nosema locustae* is not toxic to birds, animals, or other insects.

Growers are advised to locate spring hatching areas. Bait broadcast over these locations will sicken and kill the nymphs. *Nosema* is effective against adults too but most effective against the second and third instars. Reports on the success of *N. locustae* are mixed. It is not a good "rescue" treatment and will not result in instant adult mortality. According to Jerome Onsager, one of the first *Nosema* researchers at the USDA Rangeland Insect Laboratory in Bozeman, Montana, *Nosema* was developed as a long-term management tool, not to provide instant control. Onsager says that *Nosema* research has been most successful on rangeland. Information on the USDA's grasshopper IPM project is available from Research Entomologists Jerry Onsager or David Branson (9).

The Maxwell National Wildlife Refuge in northeastern New Mexico has reported good success with *Nosema* as part of an overall effort toward sustainable agriculture. For additional information, contact Patricia Hoban, Manager (10).

The fungus *Beauveria bassiana* is yet another biopesticide registered for grasshopper control. Suppliers of the product are listed at the end of this publication.

Neem has not shown much success as an antifeedant against grasshopper species in the United States but has promise as a growth regulator. A summary of this subject is available on an Internet site maintained by Michael Bomford of Simon Fraser University at http://www.sfu.ca/bisc/bisc-842/michael/web_page/antifeed.htm.

## Physical barriers and traps

References to mechanical trapping of grasshoppers in the literature date as far back as 1877. An early incarnation of the 'hopper dozer' was a metal scoop coated with tar that was dragged across the fields to trap grasshoppers (11). A more contemporary, low-tech version of the hopper dozer consists of a tractor that has a long narrow trough hooked on the front end. The trough has a 3' screen in the back and is filled with dry ice or water laced with kerosene. When the trough is pushed across the field, the hoppers jump up and slap against the screen and fall in to the trough where they are chilled by the dry ice or drown in the water (12). The hopper dozer only eases pest pressure; it does not control grasshoppers, nor can it prevent additional invasions from surrounding areas.

Another tool called the hopper whopper was built by Vern Erickson (13), a Minnesota farmer, to reduce grasshopper populations on his CRP acreage. An article titled "Hopper Whopper Keeps CRP Acres Grasshopper-Free," published in the magazine *Farm Show*, has the following description (14):

> *Erickson built his "hopper whopper" by suspending six rows of tires from a 14-ft. long, 4 by 4 in. toolbar that attaches to the front-end loader on his…tractor. A pair of brackets welded to the top of the bar fasten with pins to the loader arms.*
>
> *There are five tires per row. The wheel rims of all five tires in each stack are welded together, and the top rim on each row is bolted to an old carwheel hub. The hub's spindle is welded to the steel bar, allowing each stack of tires to spin freely. An orbit motor mounted on the steel bar and connected to a gearbox (salvaged from the straw spreader off a…combine) drives a roller chain that's wrapped around a top tire on the third stack in from one end. This "drive" tire causes all of the other tires to rotate, with each pair of tires turning inward. Chains hanging from a rod out in front of the tires drag through the grass and cause grasshoppers to jump up so they can be caught and crushed by the rotating tires.*

Erickson uses the rig early in the season, when the nymphs are still young and cannot fly out of the way.

During particularly bad infestations, market gardeners may use row covers and protective screens to temporarily exclude pests from specific plants or an entire garden. Suppliers of row covers are listed at the end of this publication.

## Conclusion

A healthy and diverse farm environment usually discourages the build-up of a lasting pest infestation. Improving the bio-diversity on the farm will be the single most important step to take. Cultural practices that increase organic matter in the soil and make habitat more attractive to predators improve the vigor and resistance of the farm. Some cultural practices such as fall tillage may be inconsistent with long-term sustainable farming. These practices should be viewed as transitional or 'rescues' and phased out over time.

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7) Cooper, S. 1994. Tales from the grasshopper wars. The Farm Connection. Volume 2, No. 6. p. 2.

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9) Jerome Onsager / David Branson
1500 Northcentral Avenue
Sydney, MT 59270
406-482-2020

10) Maxwell NWR
P.O. Box 276
Maxwell, NM 87728
Phone and FAX: 505-375-2331

11) Editor. 1877. St. Paul Pioneer Press Editorial. May 31. Newspaper Microfilms Collections State Archives, Minnesota Historical Society. No page #.

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13) Vern Erickson
Route 1, Box 205
Fertile, MN 56540
218-945-6617

14) Anon. Hopper whopper keeps CRP acres grasshopper-free. Farm Show. Vol. 15(5). p. 36. A copy of the article may be obtained from:

Farm Show
20088 Kenwood Trail
P.O. Box 1029
Lakeville, MN 55044
800-834-9665


## Internet resources

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Alberta Agriculture, Food and Rural Development

## Suppliers of *Nosema locustae*

Planet Natural (formerly Bozeman Bio-Tech)
1612 Gold Ave
Bozeman, MT 59715
800-289-6656
Fax: 406-587-0223

Harmony Farm Supply & Nursery
3244 Hwy. 116
N. Sebastopol, CA 95472
707-823-9125; FAX: 707-823-1734

IFM
1422 N. Miller Street Ste. 8
Wenatchee, WA 98801
800-332-3179; FAX 509-662-6594

M&R Durango, Inc.
P.O. Box 886
Bayfield, CO 81122
800-526-4075; FAX 970-259-3857

Gardens Alive
5100 Schenley Place
Lawrenceburg, IN 47025
812-537-8650; FAX 812-537-5108

## Suppliers of *Beauveria bassiana*

Troy Biosciences, Inc.
2620 N., 37th Drive
Phoenix. AZ 85009
800-448-2843, 602-233-9047; FAX 602-254-7989

Hydro-Gardens, Inc.
P.O. Box 25845
Colorado Springs, CO 80936
719-495-2266 or 888-693-0578; FAX 719-495-2266 or 800-694-6362

The Green Spot, Ltd.
Dept. of Bio-Ingenuity
93 Priest Road
Nottingham, NH 03290
603-942-8925

## Row covers

American Agrifabrics
1282 Old Alpharetta Road
Alpharetta, GA 30202
800-565-5151; 803-772-3222

Gardens Alive
5100 Schenley Place
Lawrenceburg, IN 47025
812-537-8650; FAX 812-537-5108

Harmony Farm Supply & Nursery
3244 Hwy. 116
N. Sebastopol, CA 95472
707-823-9125; FAX: 707-823-1734

Peaceful Valley Farm Supply
PO Box 2209
125 Springhill Blvd.
Grass Valley, CA 95945
530-272-4769; 1-888-784-1722

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