Reprinted with permission from: Agricultural Research Magazine. March 2000. p. 2.
Published by: United State Department of Agriculture, Agriculture Research Service.

Biological control: Important tool for managing invasive species

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The U.S. Department of Agriculture has long worked to exclude and manage invasive species. But globalization of trade and travel has allowed unprecedented spread of foreign plants and animals. The damage caused by these invasive pests costs an estimated $122 billion annually in control, loss of resources, and damage to property.

At least 14 federal laws and other actions have been passed during the last century to deal with invasive weeds, insects, and other pests. The latest and most comprehensive, Executive Order 13112, was signed by President Clinton in February 1999.

Since 1881, biological control – the deliberate use of one living organism to control another – has been one of the tools used to stem the spread of introduced pests. Properly conducted biological control works because it uses carefully selected and tested natural enemies (for example, insects, mites, or pathogens) of the target pest.

Leafy spurge, for example, is not a problematic weed in its Eurasian homeland. But once in the United States, free of the hundreds of insects and diseases that naturally limit its growth, it has spread over millions of acres. By introducing some of the weed's natural enemies, scientists help reestablish controls on the weed. The key is to be selective in choosing these natural enemies – introducing only those that are acceptably specific and damage a susceptible stage or part of the weed.

Concern about introducing any species, potentially beneficial or otherwise, is warranted. That's why for over 120 years, biological control ecologists have developed and modified a series of tests that take several years to complete before a biological control agent is proposed for release.

First a weed is selected as a target for biological control because it is perceived as a significant domestic problem. Then scientists study the plant in its homeland to identify the weed's natural enemies.

Once a promising candidate is identified, many "host specificity tests" are conducted to determine whether the agent will significantly damage the weed and whether it might also damage crops or native plants. The goal is to find an organism that feeds and reproduces entirely or primarily on the target weed, significantly damaging it and reducing its ability to compete with other vegetation.

If an agent passes these tests, the findings are submitted to the Technical Advisory Group for Biological Control Agents of Weeds, an independent group that advises USDA's Animal and Plant Health Inspection Service on whether to approve the release of the agent. If an agent is approved, it is first imported to quarantine facilities. There, scientists confirm that the correct agent was imported and that no unwanted parasites or diseases have come along for the ride.

Dozens of researchers both here and abroad – in ARS and other state and federal agencies and universities – participate to identify, test, and import each biological control agent for each weed. The first two stories in this issue of *Agricultural Research* demonstrate the cooperation necessary between overseas and U.S. laboratories to bring biological control projects to fruition.

Despite the extensive precautions, biological control, like all integrated pest management strategies, is not a panacea and is not risk-free. But that doesn't mean we should not proceed. The consequences of inaction are far greater than the risks, as million of acres of rangeland, cropland, and wildlife habitat are affected each year.

The very few examples of nontarget damage from weed biological control agents receive widespread attention. However, the most recent catalog of biological weed control projects notes that there are only eight examples worldwide of agent damage to nontarget plants, "none of which has caused serious economic or environmental damage and the majority of which were anticipated by routine testing before release."

This catalog contains data on more than 350 biological control agents released against 133 weeds in more than 70 countries in the last 120 years.

Further, the vast majority of this nontarget damage is short term and insignificant. For example, an agent may nibble on a nontarget plant but can't complete its life cycle on the plant and dies off without reproducing.

To further improve the practice of weed biological control projects, ARS recently revised its policy. Now, each project is considered to last at least 20 years, even though individual components may take only 3 to 5.

Biologically based integrated weed management (biological control with cultural control/revegetation) is the basis of our programs. Chemical and mechanical strategies are still vital in many instances and may be used in combination with biological control.

ARS is also committed to long-term monitoring of the effects of agents on target weeds and on potential nontarget species closely related to target weeds.

Finally, ARS continues to lead in fostering partnerships with other federal and state agencies, universities, overseas groups, private organizations, and landowners. The invasive species problem is too vast for anyone to tackle alone.

Biological control takes many years to succeed. But it is often the best, safest, and most cost-effective approach to long-term management of widespread, invasive weeds. Sometimes it is the *only* practical approach.