More and better biological control of insect and mite pests on the farm

Paul Jepson, Integrated Plant Protection Center, Cordley Hall, Oregon State University, Corvallis, OR 97331 jepsonp@science.oregonstate.edu

With the benefit of hindsight, we can now see that some time in the 1940's we so reduced our investment in biological control in universities around the world that we set the subject back by a generation (for a brief summary of what biological control is, see side bar 1). The number and success rate of biological control programs plummeted internationally through the 1940's and 50's and we are still recovering towards the rate of natural introductions that occurred in the first half of the last century. So, although the overall number of natural enemy introductions shown in side bar 1 may seem high, this number does not measure up to the need that exists (i.e. the large number of pests and commodities needing attention), and the success rate is disappointing.

Throughout this century of change in world of pest control, which of course included the introduction of modern synthetic pesticides, biological control was largely considered to be the importation and release of natural enemies from overseas, to attack and suppress exotic pests that were having a field day in our crops. Termed classical biological control, this approach still offers enormous potential for region-wide limitation of pests and weeds. In Oregon we have some particularly successful examples of this practice (see side bar 2).

Side Bar 1

Biological control of arthropod pests: classical methods and the record in Oregon

Biological control, exploiting the natural enemies and pathogens of pests, diseases and weeds, provides a potentially effective control technique, an alternative to chemical pesticides, and an ecological foundation for pest control strategies. Where there are no effective indigenous natural enemies, or the effectiveness of indigenous species is limited, IPM programs for indigenous and exotic pest, disease and weed species should include the use of exotic biological control agents (classical biological control). Although the concept of introducing biological control agents is a simple one, such factors as the logistics of release and colonization, and differences between the origin, or collection site of the exotic species, and the establishment site, make the task difficult to accomplish. In addition, great care must be taken in the selection of biological control agents, to ensure that they bring a low risk of achieving noxious pest or pathogen status in their own right, and to ensure that they do not cause unintended suppression of non-target species.

Classical biological control through the introduction and establishment of natural enemies of arthropod pests has been practiced in the Western United States for at least 100 years. More recently, between 1964 and 1989, we have records of sixteen species of natural enemy being introduced in Oregon, against eight species of arthropod pest (Table 1). The high numbers of introductions in California reflect the number of high value perennial crops where problems such

a pest resistance to insecticides has necessitated biological control. It also reflects the high pest pressure and diverse cropping systems in that state, and the presence of a biological pest control organizational infrastructure. Oregon, by contrast, has a large number of minor crops, where the scale of production is less suited to classical biological control. The record of introduction and success is however, somewhat limited in Oregon, and there would seem to be scope for biological control against a wider range of target arthropod pests. Several projects are now underway (see first issue of the Oregon IPM Newsletter at http://oregonipm.ippc.orst.edu).

Table1: Summary of the introduction and establishment of natural enemies for biological control of arthropod pests. Data from Western Regional Project W-84, 1964-1989. Western States, excluding Nevada.

State	Pest species	Number of natural enemy introductions	Natural enemies established (from introductions elsewhere)
Arizona	7	16	3
California	35	140	44
Colorado	1	3	2
Idaho	3	17	2
Kansas	2	3	0
Montana	1	6	0
New Mexico	7	8	6
Oregon	**8**	**17**	**1**
Utah	8	23	2
Washington	7	29	2
Wyoming	2	4	0
Totals	81	267	63

Side Bar 2

Biological control in hazelnut (Dr. M. AliNiazee, OSU)

Dr. AliNiazee's program established biological control of the filbert aphid *Myzocalis coryli*, by importation of a hymenopteran (wasp) parasitoid, *Trioxys pallidus* from Europe. This program has reduced pesticide chemical and application costs, reduced crop damage, limited development of pesticide resistance, reduced environmental contamination and residue burdens on fruit and helped promulgate sustainable pest management practices within the state. In 1980, all growers applied insecticides to control filbert pests, 57% applying insecticides against filbert aphids using broad spectrum, organophosphate and carbamate insecticides. By 1997, the proportion applying sprays against filbert aphid had fallen to 6.25%, and there was emphasis upon the use of reduced risk pesticides, including Neem seed extract (Azadirachtin) and *Bacillus thuringiensis* for control of other pests. Pesticide application fell from 88,000 pounds of active ingredient in 1981, to 3,200 pounds in 1997, and the proportion of growers applying organophoshate insecticides fell from 24% of growers, over 27% of the

acreage, to 5% of growers, over 0.21% of the acreage, over the same period. It has been estimated that this program will have saved the hazlenut industry more than $10,000,000 by the year 2000.

A number of other biological control programs also have been demonstrably successful in the state. These include fruit tree spider mite biological control in Oregon and Washington where selective pesticide programs that preserve indigenous predatory mites have reduced pesticide use dramatically. For example, in Washington, it has been estimated that the mass of active ingredient applied, fell from over 500,000 pounds in the 1960's to just over 20,000 pounds by the early 1990's. This reduced environmental contamination and residue burdens on fruit, and set the stage for the successful area-wide codling moth IPM program. Economic benefits also included a reduction in pesticide costs of between 7 and 8 million dollars per annum.

This is an extreme example of what is now termed Conservation Biological Control. We now know that broad spectrum insecticides are highly toxic to natural enemies, and that when spray applications cease, natural enemy communities recover, if gradually in some cases, to offer a level of pest suppression. Reduction or removal of broad spectrum pesticides may be the best thing that many growers can do to restore natural enemy populations. Organic growers start however from a profoundly different place. The challenge they face is how to maximize the contribution that natural enemies make to pest limitation, knowing that they are unlikely to hinder this by the use of toxic sprays. This is where a new program at OSU is hoping to make a contribution.

The IPPC is developing a partnership with Oregon Tilth to establish a community-based program in conservation biological control. If you want to gain a quick insight into the kind of biological control methods that we are going to focus on, have a look at the superb publication "Farmscaping to Enhance Biological Control" by Rex Dufour, which can be viewed and printed from the ATTRA web site at http://www.attra.org. In this you will find reference to insectary plantings, hedgerows, and bird and bat housing, among other approaches. All of these methods have excellent potential in Oregon. But, which methods should you select for your farm?, how much will it cost?, are there potential risks as well as benefits?, and how will you know it is working anyway?

These questions have prompted us to start thinking about the best ways to support growers in their efforts to enhance biological control on their farms. Our goal is to support grower-led activities that build knowledge of conservation biological control (CBC) in the various cropping systems of Oregon. To work, these methods and approaches have to fit within your farming system, they have to be economic, and they have to be effective! The only way to develop these approaches is through a partnership between growers, researchers and educators, and we will be initiating this program with some events in the Willamette Valley this summer and fall.

We will be having a combination of farm walks and workshops to get the CBC ball rolling, and we will be approaching a number of growers this summer, to interest them in this project. If you wish to know more then please do not hesitate to contact me at jepsonp@science.oregonstate.edu.

The initial development team consists of myself, Mario Ambrosino (an OSU graduate student), Gwendolyn Ellen (Owner manager of an Oregon Tilth Certified Organic Farm, who will also be working at OSU), and Nick Andrews from Oregon Tilth. We hope to add a substantial number of growers to this team through the year, and we look forward to your participation.