PEST MANAGEMENT USING BIOLOGICAL CONTROL

Ecological considerations

- Ecological Pest Management relies on **preventive** rather than **reactive** strategies. your cropping program should focus primarily on preventive practices above and below ground to build your farm's natural defenses. Reactive management is reserved for problems not solved by the preventive or planned strategies
- These broad strategies and the individual practices that follow result in systems that are:
- self-regulating — keeping populations of pests within acceptable boundaries
- self-sufficient — with minimal need for "reactive" interventions
- Resistant to stresses such as drought, soil compaction, pest invasions
- Resilient -- with the ability to bounce back from stresses

- **1) Crop management: above ground habitat conservation and enhancement of biodiversity within and surrounding crop fields.** Use a variety of practices or strategies to maintain biodiversity, stress pests and/or enhance beneficial organisms.
- Select appropriate crops for your climate and soil
- Choose pest resistant, local varieties and well adapted cultivars
- Use legume-based crop rotations, alternating botanically unrelated crops
- Use cover crops intensively
- Manage field boundaries and in-field habitats (ecological islands) to attract beneficials, and trap or confuse insect pests
- Use proper sanitation management
- Consider intercropping and agroforestry systems

- **2) soil management: below ground habitat conservation and enhancement.** Build healthy soil and maintain below ground biodiversity to stress pests, enhance beneficials and/or provide the best possible chemical, physical, and biological soil habitat for crops.
- Build and maintain soil organic matter with crop residues, manures and composts
- Reduce soil disturbance (tillage)
- Keep soil covered with crop residue or living plants
- Use cover crops routinely
- Use longer crop rotations to enhance soil microbial populations and break disease, insect and weed cycles
- Maintain nutrient levels that are sufficient for crops but do not cause imbalances in the plant, which can increase susceptibility to insects and diseases
- Maintain appropriate ph
- Control soil erosion and nutrient losses
- Avoid practices that cause soil compaction

- **3) Planned supplemental pest management practices.** The following practices can be used if research and farmer experience indicate that -- despite the use of comprehensive preventive management as outlined above -- some additional specific pest management practices will still be needed:
- Release beneficial insects or apply least environmentally harmful biopesticides
- Prune to reduce humidity in the canopy and deter fungal infections
- Cultivate for weed control based on knowledge of critical competition period
- **4) Planned supplemental soil practices to reduce crop stress and/or optimize yield and quality**
- Maintain adequate soil water content (i.e., with careful irrigation scheduling)
- Mow rather than incorporate orchard cover crops, leaving a mulch cover
- Undersow legumes in cereals
- **5) Reactive inputs for pest management**
- If, after following preventive and planned management practices (#1, 2, 3, and 4), pests are above threshold levels and beneficials populations are low, release beneficials or apply selected biopesticides with low environmental impact.
- **6) Reactive inputs to reduce plant stress**
- Use chisel plow or subsoiler to alleviate soil compaction
- Apply nutrients to soil or foliage in response to plant deficiency symptoms

Biological control of insects

- **Biological control** or **biocontrol** is a method of controlling pests, such as insects, mites, weeds, and plant diseases, using other organisms.[1] It relies on predation, parasitism, herbivory, or other natural mechanisms, but typically also involves an active human management role. It can be an important component of integrated pest management (IPM) programs.
- There are three basic strategies for biological pest control: classical (importation), where a natural enemy of a pest is introduced in the hope of achieving control; inductive (augmentation), in which a large population of natural enemies are administered for quick pest control; and inoculative (conservation), in which measures are taken to maintain natural enemies through regular reestablishment.
- Natural enemies of insect pests, also known as biological control agents, include predators, parasitoids, pathogens, and competitors. Biological control agents of plant diseases are most often referred to as antagonists. Biological control agents of weeds include seed predators, herbivores, and plant pathogens.
- Biological control can have side-effects on biodiversity through attacks on non-target species by any of the above mechanisms, especially when a species is introduced without a thorough understanding of the possible consequences.

- Predators
- Predators catch and eat their prey. Some common predatory arthropods include ladybird beetles, carabid (ground) beetles, staphylinid (rove) beetles, syrphid (hover) flies, lacewings, minute pirate bugs, nabid bugs, big-eyed bugs, and spiders.

- Parasitoids
- Parasitoids (sometimes called parasites) do not usually eat their hosts directly. Adult parasitoids lay their eggs in, on, or near their host insect. When the eggs hatch, the immature parasitoids use the host as food. Many parasitoids are very small wasps and are not easily noticed. Tachinid flies are another group of parasitoids. They look like large houseflies and deposit their white, oval eggs on the backs of caterpillars and other pests. The eggs hatch, enter the host, and kill it. Parasitoids often require a source of food in addition to their host insect, such as nectar or pollen.
- Pathogens
- Pathogens are disease-causing organisms. Just as many other organisms get sick, so do insects. The main groups of insect disease-causing organisms are insect-parasitic bacteria, fungi, protozoa, viruses, and nematodes. Biological control using pathogens is often called microbial control. One very well-known microbial control agent that is available commercially is the bacterium *Bacillus thuringiensis* (Bt).

- Microbial Control
- Microbial control of insects is achieved through the inundative application of allowable formulations of insect-pathogenic bacteria (e.g., *Bacillus thuringiensis*), insect-pathogenic fungi (e.g., *Beauveria bassiana)*, or insect viruses.
- Information about rates and timing of release are available from suppliers of beneficial organisms. The quality of commercially available biocontrol agents is an important consideration. Biological and microbial control agents are living organisms, and must not be mishandled during shipping, storage, or application.

. Biological control of plant disease.

- Plant diseases need to be controlled to maintain the quality and abundance of food, feed, and fiber produced by growers around the world. Different approaches may be used to prevent, mitigate or control plant diseases. Beyond good agronomic and horticultural practices, growers often rely heavily on chemical fertilizers and pesticides. Such inputs to agriculture have contributed significantly to the spectacular improvements in crop productivity and quality over the past 100 years. However, the environmental pollution caused by excessive use and misuse of agrochemicals, as well as fear-mongering by some opponents of pesticides, has led to considerable changes in people's attitudes towards the use of pesticides in agriculture. Today, there are strict regulations on chemical pesticide use, and there is political pressure to remove the most hazardous chemicals from the market. Additionally, the spread of plant diseases in natural ecosystems may preclude successful application of chemicals, because of the scale to which such applications might have to be applied. Consequently, some pest management researchers have focused their efforts on developing alternative inputs to synthetic chemicals for controlling pests and diseases. Among these alternatives are those referred to as biological controls.

Biological control of weeds.

- Biological control uses a living agent to control weeds. The biocontrol agent can be an insect species, a fungus, or grazing animals.
- A good biocontrol insect, or "bug," reduces the target weed population but never completely eliminates it. Some bugs work better than others.
- During some years, conditions can be very hard on the bugs' ability to thrive and reproduce. Factors include the weather and the population of the weed host.
- Bug populations rise and fall in cycles because they lag behind growth of the host weed. When a lot of weeds build up, the next year there will be a lot of bugs. Those bugs will eat the weeds, so the following year there will be fewer weeds to support bugs, and the bug population will crash.

- The section on Biological Control in the PNW Weed Management Handbook provides details on various biocontrol methods.
- The Oregon Department of Agriculture's Noxious Weed Control website lists many types of insects and fungi that control the noxious weeds found in Oregon. The history of weed species and release of biocontrol agents is included.
- Most of the important biocontrol agents against weeds are already populating the noxious weeds in Oregon. If you don't find biocontrol bugs on your weeds, you can collect them from other sites and release them on your weeds.

THANK YOU