CSU Agronomy Agent's Corner #5

Integrated Pest Management

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Integrated pest management (IPM) is a commonly used term in agronomy. IPM implies the use of multiple tools to control pests in your fields. While the name lends itself to control of unwanted animals, IPM is used as a strategy to control any unwanted organism. Let us look at some of the tools; why they work and why adaptation to current conditions is necessary to keep as many tools viable as possible.

Tool 1

Crop rotation has been used for centuries to avoid pests. Insects will lay their eggs in areas where they expect the host plant to be present upon the eggs hatching. Wild plants will drop their seeds close to the mother plant or be carried by wind and water downstream of the mother plant. Insects would lay their eggs accordingly. Agriculture changes that tendency. Breeding to domesticate plants has in most cases increased seed size to the point of wind not carrying seeds away. Shattering of crops has also been decreased greatly. While volunteer crops certainly occur, the volunteers are nowhere near the population density of an intentionally cultivated crop. Rotating away from the prior year's crop has interfered with the insect's tendency to lay their eggs where the host is currently growing. Insects have adapted to this change through at least two techniques: extended diapause (Levine et. al, 1992) and laying eggs in fields with crops other than the host (U of IL, 2020). For crop rotation to continue to be effective the diversity of crops in a rotation should be increased.

Tool 2

Natural enemies are commonly promoted by organic producers. They should also be part of the IPM strategy of conventional producers. Lady beetles eat many pests including aphids, mites, white flies, and scales. If scouting finds lady beetles in your field, consider delaying insecticide application to see if they can control your insect problems. Parasitoids exists for many insects. Releasing parasitoids has been successful in controlling some pests including the sugarcane stem borer. In other cases, the reproductive rate of the pests far outpaces the ability of the parasitoids to control them. This is the case with the wheat stem sawfly. Amphibians and lizards also play a role in the control of insect pests. Rodent pest populations can be reduced by the presence of owls. Consider adding barn owl boxes close to your fields to promote their presence. Barn owl boxes bring another beneficial organism to your fields as well. They are attractive homes for honeybees to start hives.

Tool 3

Making the habitat inhospitable to pests by changing a cultural practice contributes to IPM as well. The water level in rice fields is manipulated throughout the growing season to control two major pests. Rice water weevil will not lay their eggs in shallow water. They have developed this aversion due to the risk of shallow fields drying out before the eggs hatch. Early in rice growing season when water weevils are the greatest threat to young stems, the fields are kept shallow. Later in the season when stinkbugs chewing on developing seed heads is a problem, the opposite management technique is used. Stinkbugs avoid water over four inches deep, so the water depth in rice patties is raised to discourage their presence. A bordering buffer crop can be used as a cultural practice to decrease wheat stem sawfly

damage. The flies being carried in by wind will be caught by taller stemmed thickly populated triticale planted around the border of wheat fields. This filter will decrease the number of flies entering your field.

Tool 4

Genetic resistance to pests is perhaps the most sought-after approach by producers. In 2013 grain sorghum crops in Texas were devastated by the sugarcane aphid. Growers throughout the sorghum belt became concerned of the cost of controlling this insect. Seed companies quickly discovered a gene to make new hybrids resistant to sugarcane aphid. Since the gene is a dominant trait, it was easy to identify parents which contained the gene. By 2015 many sugarcane aphid resistant grain sorghum hybrids were available. Similar approaches are taken by breeders with respect to disease. Corn smut is uncommon due to resistant hybrids. Rusts of many crops have been reduced by the development of resistant varieties. Unfortunately, the proliferation of previously uncommon biotypes of both insects and pathogens will break down the resistance to these pests causing the need for further breeding efforts. Agriculture will always be changing to adapt to the evolutionary tools that it created selection pressure to promote.

Tool 5

Finally, pesticides are effective in many pest management situations. Pesticides are quick and they do less long-term damage than mechanical practices such as tillage. In many cases, they are the cheapest route. Much like genetic resistance built into varieties, using the same pesticide repetitively will promote the proliferation of resistant biotypes. To delay or ideally prevent a buildup of pesticide resistance, the pesticide used should be rotated. A Johnsongrass control plan during fallow may look like glyphosate applied in the spring followed a group 1 herbicide after it recovers from injury, the final application before returning to glyphosate application would be a group 18 herbicide. Using all three of these modes of action to control a perennial grass decreases the chance of any given specimen being resistant to the entire management strategy.

Stewardship for pesticides goes beyond managing the buildup of resistant populations. These chemicals must be handled with respect to prevent the damage they will cause if misused. Harm to the handlers can include chemical burns, short term toxicity, and lifelong health risks. Harm to the environment can include biomagnification and interruptions in the food web. To avoid these risks always read the chemical label before applying. Chemical handlers need to be trained in the worker protection standards. Their supervisors need to be licensed applicators to minimize the risk to both the handlers and the environment.

Combining all these tools into IPM will provide the most sustainable suppression of pests' damage. To seek advice on implementing a plan for IPM on your farm feel free to contact CSU extension.

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