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The strip/border cropping applied at different sites in Ledger, Valier, Choteau and Pendroy. Rows of wheat plants were bordered by pea plants at standard seeding rate to check the association and movement of wireworms.

Trap crops for cereal crops in Montana: where are we heading?

By Anamika Sharma and Gadi V.P. Reddy, Montana State University, Western Triangle Agricultural Research Center, Conrad, MT

Cereal crops are a major part of Montana agriculture and in 2017, we produced about USD 1.3 billion worth of cereal crops. Cereal crops deal with several economically important insect pests such as wheat stem sawfly, wheat midge, and wireworms in Montana. These insect pests can cause more than 30–70% damage to cereal crops. To deal with these insect pests the major management strategy include the use of conventional insecticides which are expensive and may not be effective since most of these insects have perplexing behavior either in the soil or plant itself. To combat this problem, we integrate biological control and cultural methods as part of integrated pest management.

Application of trap crops is considered to be an excellent cultural management strategy as an integral part of integrated pest management. Trap crops are plants grown with the main crop to attract insect pests that would otherwise attack the main crop. Trap crops can be an inexpensive way to reduce crop damage and the need for conventional pesticide application. Other than direct pest management, trap crops also preserve natural enemies by providing habitat and help to preserve the soil and hence support the broader ecosystem. To imply trap crops, a crop which can distract the pest away from the main crop and towards the trap crop

is planted around the main crop. The trap crops can be planted in various designs and patterns such as in strips and borders. Sometimes trap crops can also serve as a barrier between the insect pests and main crop and may trap the majority of the insect population.

In Montana use of trap crops has been applied to manage wheat stem sawfly and wireworms in cereal crops. For wheat stem sawfly (*Cephus cinctus*), other than limited chemical control options, growers mainly rely on crop rotation and use of solid stem varieties. Naturally occurring parasitic wasp species (*Bracon cephi*, *Bracon lissogaster*) are also found to be effective. Nevertheless, Montana growers every year face the attack of wheat stem sawfly which causes huge damage to the wheat crop especially if solid stem varieties are not used. Some earlier studies done in Canada indicated that two members of the grass family, Poaceae [Rye grass (*Lolium perenne*) and brome grass (*Bromus inermis*)] can function as a trap crop to attract wheat stem sawfly away from wheat. However, these trap crops are not been tested extensively in Montana, specifically in terms of their practicality for this landscape and growing practices. In Montana wheat is grown in monoculture, where both crop and fallow fields are adjacent to each other and get yearly alternation between crop and

no-till fallow. A study done in Montana pointed out that these farming conditions can be used in our favor and an edge effect can be created to attract wheat stem sawfly by using different susceptible wheat varieties as trap crops. In the 2009 study by Weaver and his coworkers. 2009. *J. Econ. Entomol.* 102: 1009-1017), 'Reeder' spring wheat variety was found to be preferred for oviposition by wheat stem sawfly compared to the variety Conan. This indicated that use of susceptible wheat variety can be planted as border crop to trap wheat stem sawfly. However, more exploration about the practical aspect of this is required.

Similarly, one more insect pest, wireworms on wheat has been targeted to be managed by trap crops. Wireworms are larvae of click beetles and in Montana, we

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Trap crops for cereal crops in Montana: where are we heading?

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have several species of wireworms (such as *Limonius californicus*, *Aeolus mellillus* and *Hypnoidius bicolor*). The soil dwelling behavior and vertical movement below ground during unfavorable weather conditions, make their management difficult. Imidacloprid seed treatment is the only option growers have at present. Although some entomopathogenic fungus (insect killing fungi) and predatory nematodes are being tested on wireworms and are found to be effective as biological control agents, however, more research is needed in this direction. In 2017, a study was done at Western Triangle Agricultural Research Center (WTARC) (Adhikari and Reddy 2017. Arthropod Plant Interact. 11:755-766), showed that legumes (peas, and lentils) can function as a trap crop to attract wireworms in spring wheat fields. Wheat intercropped with pea and lentil showed significantly less damage. Further following up on the same study, we have found that pea crop can function more efficiently at the seeding density of 8 seeds/sq. ft. which is a standard seeding rate for peas in Montana. At this seeding rate, higher numbers of wireworms were found to be attracted to the pea crop, resulting in higher yield of spring wheat plant stands. Nonetheless, more experiments are needed since intercropping might not be a feasible farming practice for Montana growers. To develop an effective trap crop strategy, the possible pea-wheat spatial patterns (border/perimeter or row/strip) need to be assessed in further field trials. At WTARC we are establishing more experiments to finalize the proper trap crops scheme which can work with growing practices in Montana. In the future, more experiments to study the movement of wireworms will be needed. Chemical compounds responsible for attracting wireworms from the roots of trap crops can be identified and further used in the baiting method to trap wireworms by attracting and retaining the wireworm in a confined area of a field. Also, the attractive compound can also be used along with any killing agent (such as entomopathogenic fungus) to create an 'attract and kill' mechanism to cause the required mortality of wireworms below ground.

Overall for cereal crops in Montana, the major task needed in terms of testing the field efficacy of trap crops which can work with the farming practices of this region. Furthermore, the most important objective should be to test the cost-effectiveness of trap crops as a part of an integrated pest management program for targeted insect pests of this region.

A Bountiful Thanksgiving

Tucked between the two monster sized holidays of Halloween and Christmas, Thanksgiving receives far less attention. But Thanksgiving is a very important holiday, especially in the busy lives of Americans. It is a time to kick back and relax, watch a football game or go to a movie, and enjoy a huge feast. It's also time for us to give thanks to our God, for the things he has bestowed upon us and upon this great nation. There is no nation in the world that has more to be thankful for than us.



Thanksgiving History:

The first Thanksgiving was celebrated between the Pilgrims and the Indians in 1621. That first feast was a three day affair. Life for the early settlers was difficult. The fall harvest was time for celebration. It was also a time of prayer, thanking God for a good crop. The Pilgrims and the Indians created a huge feast including a wide variety of animals and fowl, as well as fruits and vegetables from the fall harvest. This early celebration was the start of today's holiday celebration. Like then, we celebrate with a huge feast.

Today, most of us enjoy Turkey with "all the trimming". The "trimming" include a wide variety of foods that are a tradition for your family. Those traditional foods often replicate the foods at the first Thanksgiving feast. While others, are traditional ethnic or religious groups recipe, or a special food item that your family always serves at Thanksgiving dinner. Then, to top it off, pumpkin pies, apple pies, an even mince meat pies are bountiful around the table.

American Thanksgiving traditions revolve around a huge and lavish meal, usually with Turkey as the centerpiece. For those who do not like Turkey, a Roast or Prime Rib is common. As tradition has it in most families, a special prayer of thanks precedes the meal. In many homes, family members will each mention something they are very thankful for.

Did you know? Potatoes were not part of the first Thanksgiving. Irish immigrants had not yet brought them to North America.

After the first Thanksgiving, the observance was sporadic and almost forgotten until the early 1800's. It was usually celebrated in late September or October. In 1941, Congress made it a national holiday and set the date as the fourth Thursday in November.

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