

# **Managing Insect Pests of Wheat Under Changing Production Conditions**

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The increased wheat acreage grown in Nebraska in 2007 was largely driven by the potential for increased market price. While increased price is one change that has occurred in wheat production in the last few years, there are other changes that have and are continuing to occur in wheat production in Nebraska that require producer attention. Through the last several years, Nebraska wheat growers endured considerable drought that made wheat production extremely challenging. Significant rainfall in 2007 provided relief for some growing areas of the state, but others remained firmly in the grip of this drought. In addition to the drought, changes in weather patterns are affecting production and how we manage wheat pests. One response has been the increase in reduced and no-till wheat production. The impact of these changes has altered the pattern of risk for some pests, but also, has altered how these pest problems may need to be managed.

Higher wheat prices impact pest management by altering thresholds for insect damage. The increased value of the crop reduces the amount of damage from a pest that can be tolerated before control action should be taken. Some insect pests in wheat do not have established thresholds, but for those that do a doubling in the value of the crop would cut the treatment threshold in half. For example, the previous threshold for army cutworm presence in wheat shortly after spring regrowth was 4 cutworms per row foot. With dramatically increased wheat prices, the threshold should be lowered to 2 or three cutworms per row foot. Thresholds for other pests with calculated thresholds need to be modified as well (e.g. Russian wheat aphid).

Reduced and no-tillage have been increasing as a response to the need for more efficient use of soil moisture. While these tillage changes are necessary to improve water use efficiency, it is important to realize that these changes also affect the ability of insects to survive impact the wheat crop. In western Nebraska the best example of this is the increased incidence of the wheat stem sawfly in areas where no-till is being used. This insect has moved from southeastern Wyoming into the western Panhandle through the last ten years, but in 2007, it jumped from a limited range to encompass several production areas in Scotts Bluff, Box Butte and Banner counties. Once established this insect can be very difficult to manage. Its range is currently limited in these counties, but growers must become aware of the signs of this insect's presence. Hessian fly is another insect that can have an increased risk in reduced tillage situations. It over winters and over summers in the flaxseed stage and tillage can impact this stage of the insect. A secondary effect that may occur from reduced tillage is an increase in pest problems associated with volunteer wheat (e.g. wheat streak mosaic, Hessian fly, cereal aphids); however, these problems can be reduced with good volunteer wheat control.

A final change affecting wheat pest management is the impact of the long term weather. Certainly, the recent drought has had major impact on wheat production but also on the rotations that wheat is grown under. Changes in rotation can impact pest incidence, but the greatest impact on pests is through the change in weather itself. We have seen a string of very long falls followed in

most cases by mild winters. These conditions increase the potential for some pests including the wheat curl mite and its vectored virus wheat streak mosaic virus. The mild fall and winter conditions can also increase the risk from cutworms, the Russian wheat aphid, and other cereal aphids that can transmit barely yellow dwarf. Mild winters may allow some of these pests to overwinter in Nebraska and increase their risk to wheat.

As with all aspects of managing wheat production, changes need to be considered in the details of how we manage several of these wheat pests. The following sections go into more detail on the management of some of these pest situations.

### **Cereal Aphids / Barley Yellow Dwarf**

Four aphid species are common invaders of Nebraska wheat fields. These are greenbug, bird-cherry oat aphid, English grain aphid, and the Russian wheat aphid. The Russian wheat aphid is limited to western Nebraska and it is not able to transmit barley yellow dwarf virus (BYDV). The remaining three species can transmit BYDV. Identification life cycles of these species can be found in 'Cereal Aphids' (NebGuide G1284).

Spread of BYDV depends entirely on aphid movement, but the biology and behavior of these aphid vectors in Nebraska are not well known. In the past they were thought to over-winter further south under milder winter conditions. However, these species have been found to over-winter in parts of Nebraska during our recent mild winters. The effects of a warming climate that allows these insects to regularly over-winter are not known, but will likely increase the incidence of BYD in Nebraska.

#### *Managing Cereal Aphids / BYDV*

In the fall, early planted winter wheat and barley have a greater risk of BYDV infection. Aphid vectors actively move throughout the agroecosystem during the early fall as summer crops and grasses mature. Delaying fall seeding of cereals until aphid populations decline will minimize BYDV risks. In the spring, early seeding allows plants time to develop past the seedling stage before aphids become active.

Cultural methods of managing BYD include controlling grassy weeds, including volunteer cereals, within and near cereal production fields. In addition, small grains should not be planted in midsummer as cover or companion crops in cereal-producing areas. These practices reduce virus and vector reservoir in surrounding areas.

Winter wheat seed treatments of imidacloprid (Gaucho and other products) or thiamethoxam (Cruiser) will reduce aphid presence through the fall, and therefore, reduce primary infections from BYDV. However, the sporadic nature of aphid infestations in the fall limits the economic value of this practice unless planting in high risk situations (e.g. early planting).

Insecticide treatment to control aphid vectors in the spring needs to be based on incidence and infestation estimates obtained from scouting. Threshold levels are available from your local UNL extension office or the website: <http://highplainsipm.org>. It is important to only treat cereal aphids if necessary because they are often well controlled by natural enemies (lady beetles and other

predators and parasites). Unnecessary controls can eliminate natural enemies and allow aphids and other pest species to develop unchecked.

### **Wheat Curl Mite / Wheat Streak Mosaic**

The wheat curl mite is a major pest of winter wheat in the Great Plains from Texas to Canada. Its major impact results from its ability to vector wheat streak mosaic (WSMV) and high plains viruses.

Wheat curl mites are found on winter wheat from the time they infest the plants in the fall until wheat maturity the following summer. To survive from the time of wheat maturity until emergence of the fall wheat crop, they must find 'green bridge' hosts. The most important green bridge results when hail occurs prior to wheat harvest, and the shattered wheat heads and kernels fall to the ground, germinate rapidly and volunteer wheat begins to grow. Wheat curl mites readily infest and transmit viruses to this pre-harvest volunteer. The buildup of mite populations during the green bridge period is determined by the available bridge hosts, the environmental conditions during this time, and the length of the bridge period.

#### *Managing Wheat Curl Mite and WSMV*

The most effective management practice is to control green bridge hosts to break the bridge for the mites. High risk bridge hosts should be controlled completely before the emergence of the fall wheat crop. If mite-infested bridge hosts are not completely destroyed before the next wheat crop emerges in the fall, the mites will move from the volunteer to the new wheat crop and transmit virus.

Pre-harvest volunteer arising from hail has, by far, the greatest risk of serious mite and virus presence. Volunteer wheat growing in summer crops (e.g. sunflower, corn, millet) that emerges before wheat harvest can also be a threat if left uncontrolled. After harvest, mite activity drops to very low levels and post-harvest volunteer will be infested slowly. The risk from post-harvest volunteer will be greater in the southern plains because the green bridge period is much longer than in the north because there is more time for mites and virus to build to significant levels.

Corn can also serve as a green bridge host, but corn is not nearly as good a host as wheat. Mites move into corn after the flush of mites moving off wheat just prior to wheat harvest. They build up in corn as the ears develop, and they move off corn as the ears are drying down. Dryland corn often dries down before wheat planting in the fall and carries a lower risk for virus problems. Irrigated corn will stay green longer, and if wheat emergence overlaps with green corn, the risk of developing virus problems is increased.

Other potential green bridge hosts include several other grass hosts for the mites. The ability of mites to reproduce on these hosts is much less than wheat; therefore, the risk from their presence is much lower than that for volunteer wheat.

An important practice that reduces the potential for disease development is to avoid early planting of winter wheat. Early planting allows for a shorter green bridge period, and allows a longer period of time for mites and virus to build up in the winter wheat in the fall. Later planting

will reduce the risk levels of developing WSMV in high risk situations (i.e. next to pre-harvest volunteer) or low-moderate risk situations (e.g. next to growing irrigated corn).

Commercial wheat varieties have been developed that show resistance to the wheat curl mite (e.g. TAM 107). However, mite biotypes have developed in the region that can overcome this resistance. The use of miticides to control the wheat curl mite has never been highly effective nor economical.

### **Wheat Stem Sawfly**

Over the last two decades serious infestations of the wheat stem sawfly have begun to occur and spread in southeastern Wyoming and into adjoining counties in the Nebraska panhandle. In 2007 reports of serious sawfly infestations occurred in a wider infestation than previously reported. Serious infestations are most often associated with no-till wheat production.

The adult wheat stem sawfly is a wasp-like insect about  $\frac{3}{4}$  inch long. The most serious problems often occur at the field margins closest to the adult emergence site which is the previous year's wheat field. In western Nebraska, adults begin to emerge in May and can still be present in early June. Sawfly larvae feed within the stem after hatching and gradually move down the stem, feeding as they move for about 30 days. The larvae are cream colored and  $\frac{1}{2}$  to  $\frac{3}{4}$  inches long and have a broad head. When mature the larvae move to the area in the stem near the soil line and cut a V-shaped notch around the stem, weakening it at that point. The larvae then plug the stem at the notch and move down to near the crown where it remains until it pupates the next spring. It produces a clear protective covering around it that protects it from excess moisture or moisture loss.

The most dramatic impact of the wheat stem sawfly is the lodging of damaged stems and the subsequent losses from not being able to completely harvest these stems. This damage is very apparent at harvest time and will be easily observed by the combine operator. However, not all infested stems will break off and lodge. In addition to losses from lodging, sawfly larvae cause physiological damage of 10 to 15 percent to the infested stems.

#### *Managing Wheat Stem Sawfly*

Tillage will reduce wheat stem sawfly larval survival through the winter and spring. The objective of summer and fall tillage is to bring the stubs containing the larvae to the surface so they will be maximally exposed to the dry conditions in the late summer and the cold through the winter. Blading after harvest and/or before winter will accomplish this by lifting the crowns and loosening or removing the soil around them. Studies in Nebraska have shown this to result in about a 50 percent reduction in sawfly emergence the following year. In contrast, spring tillage should bury the stubble so that the adult sawflies will have a problem emerging from deeper soil levels.

The use of a trap crop (barley, oats, rye or solid stem wheat) along the edge of winter wheat strips may be effective especially when populations are low to moderate. These trap crops will be attractive to the sawflies for oviposition, but the larvae will not be able to complete development. However, if sawfly populations are heavy, trap crops may not be enough to satisfactorily reduce damage because significant numbers of sawfly adults will move past the trap crops to infest the wheat.

Another cultural practice that will reduce sawfly potential is the use of larger acreages in block plantings rather than planting in narrow strips. Strip planting maximizes the ability of the sawfly to move from the old stubble into the wheat crop. Reducing the amount of border in the fields reduces the potential for damage throughout the field. Soil erosion issues come into play when considering this option, but it may be feasible in a no-till cropping system.

Solid stem varieties of spring wheat have been successful at reducing the amount of damage from the wheat stem sawfly. However, the effectiveness of this resistance is influenced by environmental conditions. No winter wheat varieties adapted to the central High Plains region have solid stems; however, Montana has developed two winter wheat varieties (Rampart and Vanguard) that are solid-stemmed. Yield data from eastern Wyoming indicates Rampart is close to being competitive in yield with commonly used adapted varieties (see Table 1), but its yields are perhaps 10-15% lower than the best competing varieties.

Several natural enemies to the wheat stem sawfly have been noted in the northern plains, but in most years none of these is identified as a major factor in reducing the population. Insecticide control has proven to be an ineffective option, because of the extended period that the adults are present and control is needed.

Table 1. Wheat variety yields for Wyoming and western Nebraska winter wheat comparisons that included Rampart, a solid stem winter wheat variety effective at reducing infestations of the wheat stem sawfly (data from Univ. Wyoming and Univ. Nebraska Winter Wheat Variety Test Reports).

Variety	1999 #1	1999 #2	1999 #3	2000 #1	2000 #2	2001 #1	2001 #2	2001 #3	Avg. Yield
Alliance	30.4	55.4	56.9	32.0	29.0	29.0	47.6	56.4	42.1
Pronghorn	19.2	47.2	53.5	32.0	28.0	31.0	40.7	57.8	38.7
Buckskin	22.7	47.0	52.3	31.0	27.0	29.5	38.3	--	35.4
Rampart	21.4	55.5	46.6	26.0	25.0	23.7	38.6	56.5	36.7
Avg.	23.4	51.3	52.3	30.2	27.2	28.3	41.3	56.9	