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1. Vertical tillage: What is it and how does it work?

One of the most recent trends in tillage equipment is "vertical tillage." What is vertical tillage and how does it work?

There are several manufacturers of vertical tillage equipment, and none of the implements is exactly the same. But there are some common features. From a distance, many vertical tillage tools look very similar to disks in that there are a series of round blades in a gang on a toolbar. However, some models have blades individually mounted on springs, similar to a field cultivator. Offset disks are primarily used as primary tillage tools and tandem disks are usually used as a finishing tool. In contrast, most vertical tillage implements are being used as a one-pass operation directly on crop residues prior to planting.

One of the physical differences between the two types of implements is that tandem disk blades are more curved, go a little deeper into the soil profile, and turn up some soil as they go across the field. Vertical tillage blades are generally straighter, more like coulters, and are often fluted. In fact, many manufacturers refer to the blades on vertical tillage implements as coulters. The degree of curvature and amount of fluting on the coulters varies by manufacturer, as does the angle of the gangs.

The blades on vertical tillage implements typically go only a few inches (2-3") into the soil, and do not move much soil as the implement goes across the field. Vertical tillage implements will have a slight to moderate smoothing effect, which is usually enhanced with smoothing bars, harrow tines, or rolling baskets behind the disks. Again, the features available vary by manufacturer.

Tandem disks create more draft and have a somewhat higher power requirement than vertical tillage equipment. Producers using a vertical tillage implement can usually go faster across the field, up to 6 to 7 mph, than when using a tandem disk.

Vertical tillage equipment is used to lightly till the soil and cut up residue, mixing and anchoring a portion of the residue into the upper few inches of soil while still leaving large quantities of residue on the soil surface. This action helps speed up residue decomposition. The best description for vertical tillage is to call it a form of mulch-till, as it generally leaves greater than 30 percent residue on the soil surface, yet creates nearly full-width disturbance on the soil surface.

The main objective of using vertical tillage is to break up surface soil compaction, or smooth out areas in a field with shallow (2-3”) rills from water erosion or ruts and tire tracks from tractors, combines, grain carts, trucks, and other equipment. It is also used to help improve rainfall penetration by breaking up crusts. However, if a hard rainfall occurs after the vertical tillage operation on a low-residue environment, it could have the opposite effect. Vertical tillage should only be used when the soil is dry enough to shatter; otherwise, it may create shallow compaction. This type of equipment tends to leave the soil somewhat fluffy, but not quite to the extent that a tandem disk will.

At K-State, we have begun to evaluate the effect that vertical tillage on corn stalks will have on subsequent soybean yield, soil bulk density, soil aggregate stability, and water infiltration on various soil types in northeast Kansas. We have just one year’s preliminary data, working with David Hallauer, Meadowlark District Extension agent. We need more data, from different types of soils and conditions, and on different initial residue levels, before drawing any conclusions. We also note that we only tested one model in 2009. In the future we would like to test other models/types of vertical tillage implements.

The following photos and mention of manufacturers are for product identification purposes only, and to show just a few examples of what some vertical tillage equipment looks like. The photos of equipment were taken at the 2009 Husker Harvest Days in Nebraska. No endorsement is intended, nor is criticism implied of similar products not mentioned or shown in photos.

Figure 1. One example of a vertical tillage implement, the Case True Tandem 330. Photo taken at Husker Harvest Days in fall 2009.

Figure 2. An 8-wave fluted blade on a vertical tillage implement manufactured by Salford. Note that the blades are spring-mounted and that this implement has harrow tines.

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Figure 3. A side-by-side comparison between no-till and vertical tillage, taken on May 21, 2009 from the K-State research project in northeast Kansas. The vertical tillage operation was performed on approximately 120-bushel corn residue with the vertical tillage implement pictured in Figure 1. Notice the effect on weeds, and the amount/form of crop residue on soil surface. Soybeans were planted into these strips later that day.

All photos by DeAnn Presley, K-State Research and Extension.

-- DeAnn Presley, Soil Management Specialist
deann@ksu.edu

2. Potential for wheat die-out during the winter

During the week of December 7-11, the northern half and western half of Kansas had some record-low temperatures of zero or significantly below zero. South central and southeast Kansas did not get as cold. The northern half of Kansas had good snow cover to protect the wheat. But southwest Kansas had little or no snow cover, with temperatures below zero in many areas. Will the wheat be damaged in those situations?

The following are some of the questions to consider when evaluating the potential for winterkill:

* How well has the wheat hardened off?
When temperatures through fall and early winter gradually get colder, that helps wheat plants develop good winterhardiness. When temperatures remain unusually warm late into the fall then suddenly drop into the low teens, plants are less likely to have had time to harden properly and will be more susceptible to winterkill. This fall, temperatures have been cool, and have fallen off gradually. As a result, the wheat crop should be adequately hardened in most cases.

* How well developed is the root system?
Poor root development is a concern where wheat was planted later than the ideal range of planting dates. Where wheat plants have a good crown root system and two or more tillers, they will have better winterhardiness. If plants are poorly developed going into winter, with very few secondary roots and no tillers, they will be more susceptible to winterkill or desiccation. Poor development of secondary roots may not be readily apparent unless the plants are pulled up and examined. If plants are poorly developed, it may be due to poor seed-to-soil contact, dry soils, very low pH, insect damage, or other causes

* How cold did the soil get at the crown level?
This depends on snow cover and moisture levels in the soil. Winterkill is possible if soil temperatures at the crown level (about one inch deep) get down into the single digits. If there is at least an inch of snow on the ground, the wheat will be protected and soil temperatures will usually remain above the critical level. Also, if the soil has good moisture, it’s possible that soil temperatures at the crown level may not reach the critical level even in the absence of snow cover. But if the soil is dry and there is no snow cover, there may be the potential for winterkill, especially on exposed slopes or in low-lying areas, depending on the condition of the plants. Air temperatures below -10 degrees can certainly reduce soil temperatures below critical levels when the soil is dry and there is no snow cover.

* Is the crown well protected by soil?
If wheat is planted at the correct depth, about 1.5 to 2 inches deep, and in good contact with the soil, the crown should be well protected by the soil from the effects of cold temperatures. If the wheat seed was planted too shallowly, then the crown will have developed too close to the soil surface and will be more susceptible to winterkill. Also, if the seed was planted into loose soil or into surface residue, the crown will be more susceptible to cold temperatures and desiccation.

* Is there any insect or disease damage to the plants?
Damage from winter grain mites, brown wheat mites, fall armyworm, and crown and root rot diseases can weaken wheat plants and make them somewhat more susceptible to injury from cold weather stress or desiccation.

Plants may also die during the winter not from winterkill, but from the direct effects of a fall infestation of Hessian fly. Many people are familiar with the lodging that Hessian fly can cause to wheat in the spring, but fewer recognize the damage that can be caused by fall infestations of Hessian fly.

Wheat infested in the fall often remains green until the winter when the infested tillers gradually die. Depending on the stage of wheat when the larvae begin their feeding, individual tillers or whole plants can die. If the infestation occurs before multiple tillers are well established then whole plants can die. If the plants have multiple tillers before the plants are infested then often only individual tillers that are infested by the fly larvae will die.

The key to being able to confirm that the Hessian fly is the cause of the dead tillers is to carefully inspect the dead plants or tillers for Hessian fly larvae or pupae. This can be done by carefully removing the plant from the soil and pulling back the leaf material to expose the base of the plant. By late winter all of the larvae should have pupated and thus the pupae should be easily detected as elongated brown structures pressed against the base of the plant. The pupae are fairly resilient and will remain at the base of the plant well into the spring.

If significant levels of Hessian fly are detected then the producer will potentially need to be concerned about spring infestation levels. But more importantly, the producer should begin planning for future management decisions, beginning mainly with next year's crop. The important management practices to adopt include: destruction of volunteer wheat, delayed planting, and avoiding planting wheat back into infested wheat stubble.

Dying tiller from Hessian fly infestation.

Hessian fly pupae at base of plant.
Photos by Phil Sloderbeck, K-State Research and Extension

If plants are killed outright by cold temperatures, they won't green up next spring. But if they are only damaged, it might take them a while to die. They will green up and then slowly go "backwards" and eventually die. There are enough nutrients in the crown to allow the plants to green up, but the winter injury causes vascular damage so that the nutrients that are left cannot move, or root rot diseases move in and kill the plants. This slow death is probably the most common result of winter injury on wheat.

Direct cold injury is not the only source of winter injury. Under dry conditions, wheat plants may suffer from desiccation. This can kill or weaken plants, and is actually a more common problem than direct cold injury.

-- Jim Shroyer, Extension Agronomy State Leader
jshroyer@ksu.edu

-- Phil Sloderbeck, Southwest Area Extension Entomologist
psloderb@ksu.edu

3. Blackleg found in winter canola fields

An aggressive strain of the fungal disease blackleg (*Leptosphaeria maculans*), has been observed and confirmed in canola fields along the Kansas-Oklahoma border and further south in central Oklahoma. In the past, blackleg has not been verified in Oklahoma. As a result, it is not known how canola yields will be impacted this summer by the disease.

Because of the widespread outbreak, blackleg may have been present at low levels prior to this year or brought in on infested seed. It is nearly impossible to determine where the infestations first started. The damp and cool weather this fall was ideal for its spread. The blackleg fungus of canola is not the same pathogen that causes blackleg in cattle.

Blackleg survives on infected seeds, stubble, and on many mustard-related weeds. Blackleg can spread over long distances when over-summering spores, known as ascospores, are released from diseased stubble. Ascospores can travel by wind for many miles.

Fall symptoms of blackleg begin as beige lesions on the leaves. Black, pepper-like structures known as pycnidia can often be observed within the leaf lesions. On infected plants, a second spore type known as conidia are released from the pycnidia. These spores are responsible for infecting neighboring plants and infection of the plant stems near the soil surface. Stem infections become most noticeable in the spring and can cause deep cankers, stem girdling, premature ripening, lodging, and death of the plant.

At the current rosette stage of the growing season, producers are encouraged to take no action beyond surveying their fields for blackleg lesions. Typical plant leaf loss from cold temperatures should not be confused with blackleg. If blackleg is observed, concerned producers should contact their local county Extension agent or crop consultant to have samples submitted to the appropriate plant diagnostics lab. Producers should use caution if they spot blackleg in a field. The disease can be spread by spores that attach to shoes, clothing, or equipment, and these should be cleaned before entering any uninfected fields.

Genetic resistance to blackleg is the main method of preventing crop loss. Overall, winter canola has fair to good resistance to blackleg. Popular varieties grown in the southern Great Plains have a range of resistance to the blackleg fungus. Varieties from the National Winter Canola Variety Trial are evaluated each year in Georgia in nurseries planted in proximity to fields infected with blackleg. Results from 2008 are published in Table 38 of the *2008 National Winter Canola Variety Trial,* SRP-1009.

For more information about the blackleg lifecycle and management methods, consult the *Great Plains Canola Production Handbook,* MF-2734.

To familiarize producers with information on the symptoms and management of blackleg, the following link will direct you to an OSU E-Pest Alert: http://entoplp.okstate.edu/pddl/2009/PA8-33.pdf

Blackleg leaf lesions with black pycnidia fruiting bodies.

Yellowing of lower, older leaves caused by blackleg lesions.
Photos by Mike Stamm, K-State Research and Extension.

-- Mike Stamm, Canola Breeder, K-State and Oklahoma State University
mjstamm@ksu.edu

-- Doug Jardine, Extension Plant Pathology State Leader
jardine@ksu.edu

These e-Updates are a regular weekly item from K-State Extension Agronomy and Steve Watson, Agronomy e-Update Editor. All of the Research and Extension faculty in Agronomy will be involved as sources from time to time. If you have any questions or suggestions for topics you'd like to have us address in this weekly update, contact Steve Watson, 785-532-7105 swatson@ksu.edu, or Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader 785-532-0397 jshroyer@ksu.edu