Issue 771

K-STATE
Research and Extension

Extension Agronomy

# eUpdate

10/25/2019

These e-Updates are a regular weekly item from K-State Extension Agronomy and Kathy Gehl, Agronomy eUpdate 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 Kathy Gehl, 785-532-3354 kgehl@ksu.edu, or Dalas Peterson, Extension Agronomy State Leader and Weed Management Specialist 785-532-0405 dpeterso@ksu.edu.

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## 1. Fall soil testing of hay fields and pasture

Soil testing can be done in either spring or fall on hay fields and pasture. Given a choice, fall would be the preferred time because it allows more time for any needed lime applications to have an effect before the main growing season begins, and it gives the producer some flexibility for planning nutrient applications.

**Figure 1. Grazing pasture in the fall. Photo by Doo-Hong Min, K-State Research and Extension.**

Soil sampling on a regular basis (every 3 – 4 years) can keep you from applying excessive and unnecessary amounts of fertilizer or manure, and can increase yields by revealing exactly which soil nutrients are too low for optimum productivity. By doing this practice properly, producers can save money and reduce the environmental impacts.

**Tips for collecting a representative soil sample**

To take accurate soil samples, it is best to use a soil probe. You can borrow a probe from many county extension or NRCS offices. A shovel or spade can be used, but make sure to dig a hole first and then take a nice even slice to the correct depth. A shovel or spade that angles to a point at the bottom can easily result in misleading soil test results because the sample is biased by having more soil from the surface and less from lower depths.

When taking soil samples, it is important to have a representative composite soil sample from the field by combining several soil cores and mixing thoroughly. The ideal sampling technique is to take at least one composite soil sample every 10 acres. On these 10-acre areas, take 15 to 20 cores or subsamples to make up your representative composite sample. If the field has areas where different forages or crops have been grown, or has different soil types, then soil sampling from these areas should be done separately.

Sampling depth for pastures and hayfields should be 3 to 4 inches for pH evaluation. For phosphorus and potassium, a 6-inch depth is preferred when submitting samples to the K-State Soil Testing Laboratory since that is the depth we have used to calibrate recommendations.

**Soil pH is important**

One key soil property for forage production, especially with legumes, is soil pH. The optimal pH level is 6 to 7, depending on the forage species. Grasses such as brome or fescue do well at a lower pH. But legumes, especially alfalfa, require a near-neutral pH (~pH 7). If the soil pH is too low or too high, nutrient uptake of macro- and micronutrients can be reduced. Especially important for legumes such as alfalfa and clover is the impact of pH on nodulation and nitrogen fixation. At low soil pH, aluminum toxicity can also be an issue.

When you lime a new pasture, it is important to apply the lime 6 to 12 months before planting legumes. If you want to get a more rapid response from liming, use fine-ground liming materials with a high effective calcium carbonate (ECC). Fields that will be planted to alfalfa next spring should also be evaluated for phosphorus and potassium levels and make corrections before planting.

For more information on soil sampling and submitting samples to the K-State Soil Testing Laboratory, visit their website at http://www.agronomy.k-state.edu/services/soiltesting/. You can also access two previous eUpdate articles discussing fall soil sampling and collecting a representative soil sample in Issue 767, September 27, 2019.

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## 2. New research on strategic tillage in dryland no-till systems

No-tillage (NT) systems provide several benefits to dryland crop production in the semiarid central Great Plains (CGP). These include improvements to soil health, reduced wind erosion, fewer energy inputs, increased retention of soil moisture, and improved crop yields. Despite these benefits, maintaining continuous NT and the associated soil conservation benefits are at risk due to a lack of effective control of herbicide-resistant (HR) weeds, as well as issues of compaction and stratification (abrupt changes by soil depth) of soil pH and nutrients (Figure 1). Stratification of soil nutrients and soil acidity could reduce nutrient availability and uptake by crops and increase the chances of nitrogen and phosphorus losses in surface runoff.

**Figure 1. Grasses in the long-term no-tillage plots. Photos by Augustine Obour, K-State Research and Extension.**

**What is strategic tillage?**

Strategic tillage (ST) with a sweep plow, timed when soil erosion risk is low in an otherwise NT cropping system, could help manage HR weed populations and reduce stratification of soil properties. After the one-time tillage operation, the field goes back to NT production.

This ST approach could increase productivity and profitability of dryland cropping systems in the region. However, the soil health impacts of ST are unclear, particularly in water-limited environments of the CGP where susceptibility to wind erosion can be high. Few studies have investigated the effects of ST on soils that have been in continuous NT (> 40 years) in dryland conditions in the CGP.

**The objectives of this study were to determine the effects of strategic tillage in long-term NT systems on:**

1. Soil water content at winter wheat planting
2. Winter wheat and grain sorghum yields
3. Effectiveness of ST to redistribute soil nutrients, reduce soil acidity, and control perennial grass and herbicide-resistant weeds
4. Determine soil quality following tillage of an otherwise long-term NT soil

This strategic tillage study was conducted using long-term tillage and crop rotation experiment plots established in 1976 at the K-State Agricultural Research Center near Hays. Since their creation, these plots had five crop rotation treatments with two tillage treatments. The five crop rotations were continuous winter wheat (WW), wheat-fallow (WF), wheat-sorghum-fallow (WSF), continuous sorghum (SS), and sorghum-fallow (SF). The tillage treatments were reduced tillage (RT) and NT.

This long-term study was modified in 2016 to include a strategic tillage component. The three tillage treatments were: RT, continuous NT, and strategic tillage (ST) of the long-term NT plots. To create the ST plots, the long-term NT plots were split into two equal plots of 20-ft wide by 80-ft long. One half was left in continuous NT and the other half was tilled. The ST plots were tilled twice with a sweep plow at depths between 3 and 6". All tillage operations in the wheat rotations were performed in July prior to wheat planting in October. For crop rotations involving sorghum, tillage operations were done in May before sorghum planting in June. Tillage in the RT treatments were accomplished with the same tillage implement to 6- to 8-in. depth. Two to three tillage operations were usually done in the RT plots over the fallow period.

Soil water content at wheat planting was measured down to 4 ft, in 6-in. depth increments in 2016 and 2017. Wheat and sorghum grain yields were determined using a small plot combine. Soil samples were collected in increments down to 1 foot after tillage operations in 2017. The soil was analyzed for changes in bulk density, soil organic carbon (converted to a soil organic matter value), dry aggregate size distribution, and soil nutrients.

**Summary of strategic tillage study**

**Weed control.** In general, broadleaf and grass weeds were significantly less with RT and ST compared to the NT treatments (Figure 2).



**Figure 2. Comparison of the continuous wheat (WW) plots with strategic tillage (ST) and the**

**continuous no-tillage (NT) wheat plots containing abundant cheatgrass. Photos by Augustine Obour, K-State Research and Extension.**

**Soil water content.** Irrespective of crop rotation, soil water content at wheat planting was significantly less with RT treatments compared to NT or ST (Figure 3). Soil water content with NT was not different from that of ST under cropping systems with fallow (WF or WSF). Tillage (ST or RT) reduced soil water content at wheat planting in WW system.


**Figure 3. Soil water content at winter wheat planting as affected by tillage in each crop rotation system. Data averaged across two years and three replications (n=6). Graph from KAESRR: Vol. 5: Iss. 4. [https://doi.org/10.4148/2378-5977.7756](https://doi.org/10.4148/2378-5977.7756)**

**Wheat yield.** Winter wheat grain yields decreased with increasing cropping intensity, WF (26-48 bu/a) > WSF (22-33 bu/a) > WW (15-19 bu/a) (Figure 4). Averaged across years and crop rotations, wheat yield with ST was 30 bu/a, which was greater than the NT (23 bu/a) or RT (28 bu/a) systems, mostly due to better weed control and increased nutrient availability.

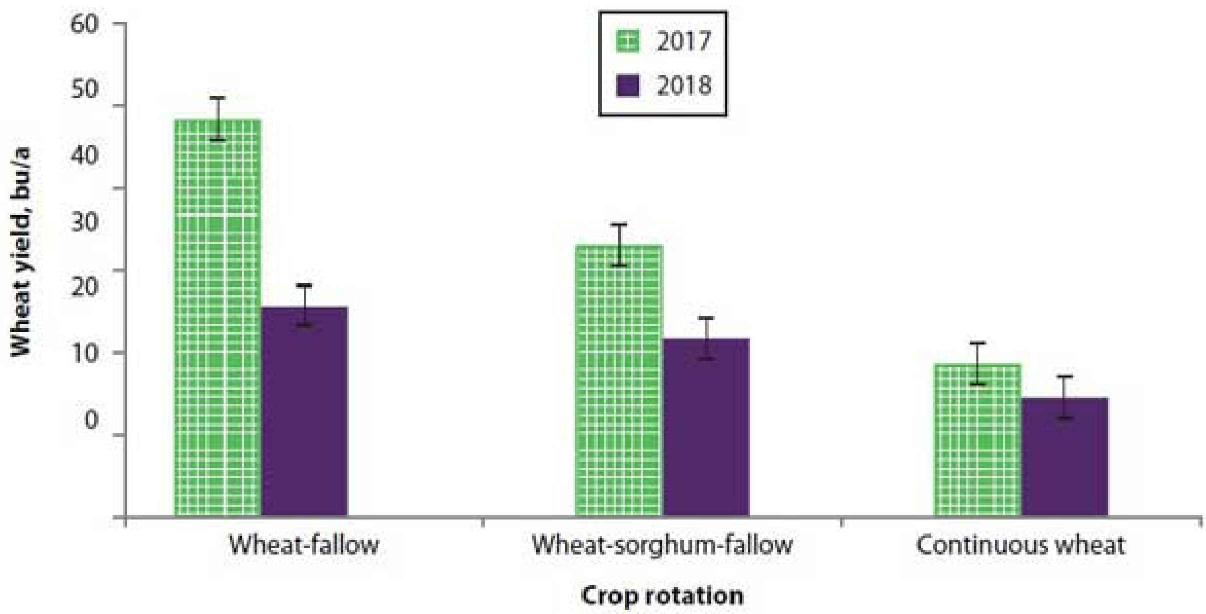


**Figure 4. Winter wheat grain yield as affected by crop rotation system in 2017 and 2018 growing seasons at Hays, KS. Data are averaged across three tillage systems and three replications (n=9). Graph from KAESRR: Vol. 5: Iss. 4. [https://doi.org/10.4148/2378-5977.7756](https://doi.org/10.4148/2378-5977.7756)**

**Sorghum yield.** Sorghum grain yield over the 2 years with ST (63 bu/a) was not different from that of NT (61 bu/a), but were both greater than RT (54 bu/a). Increasing cropping intensity reduced sorghum grain yield, average grain yield with SF was 73 bu/a, similar to WSF (68 bu/a), but greater than SS (38 bu/a).

**Soil properties.** Tillage had no effect on soil bulk density. However, increasing cropping intensity lowered the bulk density measured in the upper 0 to 2 in. of the soil. Tillage and crop rotation effects on soil organic matter (SOM), pH, and nutrient concentrations occurred only in the top 0- to 2-in. depth. The SOM, iron (Fe), and manganese (MN) concentrations were greater in soils under WW compared to WF or WSF. Soil pH and potassium (K) were least in soils under WW. The SOM concentration in the top 0 to 2 in. with NT was 3.34%, which was similar to that of soil under ST (3.02%) but both were greater than RT (2.65%). Nitrate-N concentration increased with ST but ammonium-N concentration was greatest in soils under NT.

## Take-home message

These results suggest strategic tillage could provide a mitigation option for herbicide-resistant weeds in no-till crop production with little impact on crop yields and soil chemical properties. Currently, research studies at Garden City, Hays, and Tribune are evaluating occasional tillage (one or two tillage operations every three years in a wheat-sorghum-fallow rotation compared to NT) to determine the effect of low-frequency tillage in the cropping system.

For more detailed information on this study, please refer to: "Strategic Tillage in Dryland No-tillage Crop Production Systems," Kansas Agricultural Experiment Station Research Reports: Vol. 5: Iss. 4.

https://doi.org/10.4148/2378-5977.7756

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## 3. Insect activity update - Alfalfa, soybeans, and wheat

**Alfalfa and Soybeans**

Green cloverworm adults (Figure 1) have been very common in soybean and alfalfa fields the last couple of weeks, and this has caused concern about potential green cloverworm infestations next year. However, green cloverworm adults are, or have been, migrating to the southern U.S. for overwintering. Thus, since they do not overwinter in Kansas, infestations next year will depend on wherever the adults come back to, so predicting future infestations after overwintering adults return from the southern U.S. are not possible.

**Figure 1. Adult green cloverworm. Photo by K-State Extension Entomology.**

**Alfalfa update – aphids and potato leafhoppers**

Pea aphids are and have been returning, or at least increasing in numbers, to many alfalfa fields throughout north central Kansas (Figure 2). These are primarily cool weather aphids and are usually the last ones still feeding in the fall on alfalfa and the first ones in the spring.  However, with the onset of cool/cold weather, this late-fall feeding should be negligible. Potato leafhoppers (Figure 3), for the most part, have emigrated, or at least are not present in easily detectable numbers, so "hopper burn" (Figure 4) and its consequences, should not be problematic this fall/winter.

**Figure 2. Pea aphids. Photo by K-State Extension Entomology.**

**Figure 3. Pea aphids. Photo by K-State Extension Entomology.**

**Figure 4. Example of "hopper burn". Photo by K-State Extension Entomology.**

**Wheat update – armyworms and grasshoppers**

Some fields have already established good stands of wheat this fall. However, there are also some pretty well established fields of volunteer wheat (Figure 5). There have been reports of armyworms and grasshoppers causing concern in some wheat fields that are struggling because of lack of moisture, but the recent cold weather should control both armyworm and grasshopper feeding.


**Figure 5. Volunteer wheat stand. Photo by Jay Wisby, K-State Research and Extension.**

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## 4. Retirement reception for longtime Extension Weed Science Specialist Dallas Peterson

The Department of Agronomy at K-State is hosting a retirement reception for Dr. Dallas Peterson, Extension Weed Science Specialist. The reception is scheduled for Wednesday, October 30, from 4:30 p.m. to 6:00 p.m. It will be held at the new Agronomy Education Center located on the grounds of the Agronomy North Farm (across from Bill Snyder Family Stadium) in Manhattan.

All are invited to attend this casual gathering to celebrate the exceptional career of Dr. Peterson. Light refreshments will be served. Interim Agronomy Department Head, Dr. Mickey Ransom, will offer remarks at 5:00 p.m., with plenty of time afterwards to visit with Dallas.

A full retirement announcement detailing Dr. Peterson's background and career will be featured in an upcoming eUpdate article.

Join us in celebrating Dallas's many contributions to Kansas agriculture throughout his 30 years of professional service at Kansas State University.

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