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1. Dryland strip-till research – Southeast and East Central Kansas

Early planting is beneficial for corn production in southeast and east central Kansas. Dryland corn in this region must be planted early (mid-March to early April) in order to reach the critical tassel-silk-pollination stage before hot and dry conditions occur, usually by mid- to late-July. At the same time, conservation tillage practices with subsurface nutrient placement are being encouraged to reduce soil erosion and nutrient runoff losses. These two factors can be at odds, since heavier amounts of surface residue and less tillage often means colder and wetter soils in early spring, which creates a poor seedbed for corn.

Strip-till is sometimes considered a better tillage system than no-till for dryland corn production on poorly-drained, heavier or claypan soils, which are prevalent in southeast and east central Kansas, since strip-till creates a narrow zone of tillage in the seed rows, with a loosened raised seedbed, while leaving crop residue in the row middles. This usually creates a warmer, drier seedbed for corn than no-till.

Two K-State research projects in eastern Kansas have studied the potential for dryland strip-till in that region. Strip-till has been tested by K-State agronomists in southeast and east central Kansas, but not northeast Kansas, where soil conditions are different.

A. Southeast Kansas. K-State research at the Southeast Agricultural Research Center in Parsons has compared strip-till to no-till and reduced tillage for dryland corn production on thin, poorly drained soils. A short-season corn hybrid was used. The variables were:

Tillage:
* Strip-till in late fall

* Strip-till in early spring
* No-till
* Reduced till (disk in fall and spring)

Fertilizer placement:
* Dribble
* Knife

Fertilizer timing:
* Late fall
* Spring

In this area, crops grown on claypan soils have usually performed better with some tillage. In two of the three years, corn yields under reduced-till were about 20-30 bushels per acre higher than strip-till and no-till. In one year, tillage had no significant effect on yields. There was no significant difference in yields between fall strip-till, spring strip-till, and no-till averaged over the three years. Corn yields were slightly higher under strip-till than no-till, but the difference was not statistically significant.

All plots were fertilized with 120 lbs/acre N and 40 lbs/acre $P_2O_5$. Regarding fertilizer placement and timing, corn yields were 12 bushels per acre higher with the knifed fertilizer than dribble when averaged over the three years. Corn yields were 11 bushels higher with spring than fall applications of fertilizer.

B. East Central Kansas. K-State research at the East Central Kansas Experiment Field has compared strip-till and no-till with different fertilizer treatments in 2003-2005 on dryland corn:

Treatments
* Fall strip-till, all fertilizer banded 5 inches deep in fall
* Fall strip-till, fertilizer split between fall and planting-time (120 lb/a N rate treatment only)
* Fall strip-till, all fertilizer applied at planting time in band
* No-till, all fertilizer applied at planting time in band
* No-till, fertilizer deep-banded on 15-inch centers preplant (120 lb/a N rate treatment only)

Nitrogen rates were 40, 80, and 120 lbs/acre. The planting-time fertilizer was banded 2 x 2 inches in 2003 and changed to 2.5 x 2.5 inches in 2004 and 2005 for improved seed safety. The P-K-S treatments were constant at 30-5-5. The corn hybrid used was Pioneer 35P12.

Plant populations overall tended to be about 7 to 15 percent better and emergence was more uniform for corn planted strip-till than no-till. Tillage had a much greater effect on plant populations than N rate or timing and placement of the N-P-K-S fertilizers. The positive effects of a loosened, raised seedbed in strip-till also generally improved early season (V6) plant growth.

Strip-till generally produced higher grain yields than no-till, by about 9 to 12 bushels per acre. Overall, the standard strip-till system, with all of the fertilizer applied at one time, either in the fall or preplant in the spring, proved to be the most effective conservation tillage system.

In addition to the tests at the East Central Kansas Experiment Field, there were tests on farmer fields in Allen, Crawford, Franklin, and Montgomery counties comparing strip-till, no-till, and conventional tillage. Several of these tests have had some confounding factors that prevent many conclusions from being made, but overall, corn yields have been roughly the same with conventional-till and strip-till. No-till yields have been a little lower.

Strip-till has generally resulted in higher dryland corn yields than no-till in east central Kansas. Yields with strip-till have not been consistently increased compared to conventional or reduced tillage, however. Deep-banding the fertilizer in conventional tillage helped corn yields in the on-farm studies, compared to broadcasting it.

At the Kansas River Valley Experiment Field in Shawnee County, a test was done in 2004 comparing fall and spring fertilizer application timing and N rates in strip-till. Corn yields were about the same with fall and spring applications.

Many of the environmental benefits of no-till can be matched with strip-till.

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## 2. Application for emergency exemption for Lumax in grain sorghum

One of the more common weed control problems in grain sorghum is that currently registered residual preplant and preemerge herbicides are not especially strong on large-seeded broadleaf weeds such as velvetleaf, kochia, sunflower, and morningglory. As new flushes of these weeds emerge during the growing season, producers must either use postemerge herbicides or cultivation to control them.

Another problem is the presence of ALS- and triazine-resistant Palmer amaranth and waterhemp. These resistant weed populations are not adequately controlled by currently registered residual preplant and preemerge herbicides for grain sorghum.

Both of these problems could be at least partially solved if the EPA approves a section 18 emergency exemption proposed by the Kansas Department of Agriculture for the use of Lumax herbicide in grain sorghum. Research in Kansas documented the effectiveness and crop safety of Lumax herbicide on grain sorghum.

Lumax is a herbicide used in field corn since 2002, but not yet labeled for use in grain sorghum. We now have 16 site-years of research testing Lumax on grain sorghum at full and double rates. The data show excellent sorghum tolerance for Lumax applied 10 to 20 days ahead of planting.

Until this emergency exemption is approved by the EPA, however, Lumax must not be applied to grain sorghum.

Lumax is a premix of the active ingredient in Callisto and Dual Magnum, along with a low rate of atrazine. It is manufactured by Syngenta Crop Protection.

Along with controlling certain hard-to-control broadleaf weeds in grain sorghum, this herbicide option would also help reduce the amount of atrazine applied in grain sorghum. Atrazine rates are lower in Lumax than in the preemerge herbicides presently being used. This would be especially helpful in atrazine mitigation areas, such as the Solomon River watershed, which provides water for the city of Beloit.

If the emergency exemption is approved, growers can expect the following directions for the use of Lumax on grain sorghum:

* Application rate: 2.5 qt/acre.

* Application method: 7 to 14 days preplant; no mechanical incorporation.

* Crop restrictions: Concep-treated grain sorghum seed only; no forage sorghums or sudangrasses.

* Soil restrictions: Do not use on coarse-textured soils.

* Tank mixtures with herbicides such as atrazine, glyphosate, paraquat, and 2,4-D are allowed for burndown.

* End users and/or growers will agree to accept full responsibility for failure to perform and for crop damage from use of Lumax on grain sorghum.

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3. Soil salinity problems in Kansas

Of all the soil-related problems for crop production in Kansas, one of the most potentially damaging for crops is high salinity. Fortunately, salinity problems affect a relatively small percentage of the total acres. The Arkansas River floodplain has the greatest concentration of salt-affected soils in Kansas.

In some cases, salinity problems occur because of a shallow water table and poor quality of the river water, as is the case with the Arkansas River floodplain. Other causes include soil formation from parent material high in soluble salts, poor quality irrigation water, excessive application rates of manure or other waste products, and spillage of brine water associated with oil production.

Some degree of salinity in the soil is normal, and even necessary because essential nutrients exist in the soil as part of the soluble salts. If soluble salt levels are too high, however, salt can reduce seed germination and plant growth. At this point, the soil is termed a "saline soil." This is sometimes confused with "sodic" soils. Sodic soils are those with excessive levels of exchangeable sodium, but low levels of total salts. Saline-sodic soils have both high salt levels and high exchangeable sodium.

Saline and saline-sodic soils often have a white crust on the soil surface. Sodic soils usually have a brownish-black crust from the dispersion of organic matter.

When salt levels in the soil become too high, the osmotic pressure within the soil is increased to the point that soil water is held too tightly for plant roots to be able to absorb it. Most plants become stressed or die from lack of water uptake in a saline soil. Plant species vary markedly in their tolerance to salinity levels. Some species are quite tolerant, such as salt marsh grasses. Unfortunately, the major agronomic crops grown in Kansas are only moderately tolerant to salinity. Soybeans are slightly more sensitive than sorghum, corn, and wheat to salinity.

Measurement of soluble salt concentrations is normally made on a saturation paste by mixing just enough distilled water with the soil to totally saturate it. The specific conductance is then measured on the mixture directly or on a vacuum extraction of the mixture. A specific conductance of 4 millimhos per centimeter (mmhos/cm) or greater is defined as saline or saline-sodic. You also may see results reported as deciseimens per meter (ds/m). One mmhos/cm is equal to one ds/m, so these numeric values are equivalent.

Soil testing labs typically evaluate EC (electrical conductivity) as part of a routine analysis. Because saturation pastes are labor intensive to prepare and hard to duplicate among technicians without considerable experience, many soil test laboratories use an alternative method of sample preparation, which yields excellent results. An equal amount of distilled water and soil are mixed as a slurry and the specific conductance is determined on the mix. This is the same slurry mix used by the lab for determination of soil water pH. Results obtained by this alternative method cannot be interpreted using published salinity levels in most soils textbooks or handbooks which reference the saturated paste method. Conductivity values for this mix will be roughly half those found for a saturation paste on a medium-textured soil.

Reclamation of salt-affected soils is possible. The first step is to assess the situation through a salt-alkali soil test to verify that a salinity problem exists. Find out whether it is only a salinity problem, or if excess exchangeable sodium also is present.

The second step is to identify the source of the excess soluble salts and, if possible, eliminate the source. This may be a simple as stopping the manure application, or correcting drainage problems. In some cases, such as where the water table is high, it may not be possible to eliminate the source of the problem.

If excess sodium is found by the salt-alkali test, then a chemical amendment, such as gypsum, needs to be applied.

The final step is to leach out the excess salt from the root zone. Under natural rainfall conditions, leaching may be relatively slow. Practices that improve water retention and movement into the soil, such as enhanced residue cover, will be beneficial.

For more detailed information on saline and sodic soils, see K-State Extension publication MF-1022.

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4. Prescribed burns: backfires vs. headfires and other burning methods

There are several methods used in prescribed burning of grazinglands, CRP, and crop stubble fields. How the burn is conducted will affect smoke behavior, effect on vegetation, and safety concerns.

Some managers use a total backfire system rather than using headfires. In a total backfire system, the burn is started along the borders of the field that are down wind. In this method, if the wind were from the south, the fire would be started along the northern edges of the field and allowed to slowly work its way south, into the wind.

The backfire method results in a slower-moving burn than headfires. Usually, slower-moving fires result in higher temperatures at the soil surface. Backfires can be easier to control (as long as a good fireguard is established) and reduce the amount of smoke. But they also may result in more injury to bunch grasses, such as little bluestem, especially if the soil surface is dry at the time of the burn. Late-spring backfires in the tallgrass prairie have been shown to reduce tallgrass production and increase forb production compared to using a headfire. Using the backfire technique can also be more labor-intensive if the fire is set in a series of small strips leading into the direction of the wind rather than in one continuous line along the downwind perimeter of the field.

In a more traditional headfire method, the fire would started along the upwind edge of the field and would have the wind "at its back" as it moves through the field. In other words, if the wind is from the south, the headfire would be lit along the southern edges of the field. The only backfire used in this system would be whatever might be set to create burned fireguards downwind before the headfire is ignited.

The most commonly used burning method is the ring fire technique, which uses a headfire. A ring fire requires a firebreak along the borders of the field downwind that provides adequate width to prevent the escape of the fire. On level to gently rolling ground, the firebreak should be at least 150 feet wide at the point where the headfire will have the longest run.

Once the firebreak is secure, the remaining sides of the burn area are lit as rapidly as possible. The resulting headfire will move in the direction of the prevailing wind and sweep rapidly across the area. As the headfire builds in heat and size, a draft is created from the front and will draw the backing fires of the firebreak into the head fire. A strong convection column develops in the center of the ring, increasing the speed of the fire, heat intensity, and lifting smoke from the burned area. Once the convection column develops, the fires are drawn rapidly to the middle of the burn area, resulting in a rapid burn. At 18 inches or more above ground level, headfires are hotter than backfires and more effective for taller brush control. Once the ring is closed and the perimeter fires are extinguished, there is little chance for the fire to escape.

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These e-Updates are a regular weekly item from K-State Extension Agronomy. 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 Jim Shroyer, Research and Extension Crop Production Specialist and State Extension Agronomy Leader
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