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1. Managing weeds in glyphosate-tolerant (GT) corn

When planting glyphosate-tolerant (GT) corn, the least expensive herbicide strategy is often to rely entirely on one or two postemerge applications of glyphosate for weed control. But that is not generally the best strategy to use.

As appealing as it may be, a total glyphosate program on GT corn has some important disadvantages. For one, it strongly selects for GT weed biotypes. GT horseweed (marestail) discovered in Delaware and now common in Tennessee and other states closer to Kansas, and GT waterhemp discovered just across the Missouri River, developed under a total glyphosate program.

Another disadvantage of this program is that glyphosate will not completely control dense weed infestations, even when sprayed at the appropriate weed size. The problem is that taller weeds can shelter smaller weeds from adequate glyphosate coverage. Death of the taller weeds releases the smaller ones to grow more actively.

Young corn does not tolerate weed pressure well. In a total glyphosate program, it’s tempting to wait just a bit longer to give more weeds time to emerge. Windy or wet weather may then cause further delays. If weed infestations are high, loss of corn yield potential can happen very quickly.

Several herbicides can nicely complement glyphosate in GT corn. For example, Balance Pro (in areas where its use is permitted) and atrazine, applied before corn emerges, can give excellent burndown of chickweed, henbit, and many other broadleaf winter annuals, and also provide good residual activity on pigweeds, kochia, velvetleaf, smartweeds, and others. If winter annual grasses are present, adding some glyphosate to the Balance-atrazine mixture would be economical and effective.

Where heavy summer annual grass pressure is expected, adding even a third- to half-rate of a residual grass herbicide (acetochlor, alachlor, dimethenamid, metolachlor, flufenacet) can give partial control for several weeks. This can greatly improve the effectiveness of a postemerge glyphosate application, and give the producer more leeway on application timing.

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2. Starter fertilizer use on corn

Many producers in Kansas could benefit by using a starter fertilizer on corn. Starter fertilizer is simply a relatively low rate of fertilizer placed near the seed (traditionally 2 inches beside and 2 inches below the seed), which "jump starts" growth in the spring. But getting an economic yield response to starter is not a sure thing in Kansas. The response of corn to starter fertilizer depends on soil fertility levels, tillage system, nitrogen (N) placement method, yield environment, and possibly the hybrid being used.

* Soil fertility levels. The most important consideration is soil fertility levels. The lower the fertility level, the greater the chance of economic responses to starter fertilizers. A routine soil test will reveal available phosphorus (P) and potassium (K) levels. With corn in high-yield environments, it’s also a good idea to test for sulfur (S) and zinc (Zn). A soil test analysis from K-State will include a fertilizer recommendation, but it will not specify how or when those nutrients should be applied.

If soils test low or very low in P, below 20 ppm, there is a very good chance that producers will get an economic yield response by using a starter fertilizer containing P, even in some low-yield environments. If the soil test shows a medium level of P, 20-30 ppm, it’s still possible to get a yield response to P fertilizer. But the yield resonse will not occur as frequently, and may not be large enough to cover the full cost of the practice. The chances of an economic return at higher soil test levels are greatest when planting corn early in cold, wet soils. If the soil test is high, above 30 ppm, economic responses to starter P fertilizers are rare. In general, the same principles apply with K. If soil tests are low, below 130 ppm, the chances of a response to K in starter are good, and the lower the soil test level, the greater the odds of a response.

Starter fertilizers are an excellent way to apply S and Zn. If the soil test indicates that S or Zn levels are low or very low, these nutrients can be added to the starter fertilizer. With the low rates of these nutrients needed, mixing them with N or N-P starters is an easy and efficient means of applying both.

* Tillage system. No-till corn will almost always respond to a starter fertilizer that includes N – along with other needed nutrients – regardless of soil fertility levels or yield environment, especially when preplant N was applied as deep-banded anhydrous ammonia or where most of the N is sidedressed in-season. That's because no-till soils are almost always colder and wetter at corn planting time than soils that have been tilled, and N mineralization from organic matter tends to be slower at the start of the season in no-till environments.

In reduced-till systems, the situation regarding the likelihood of response to starter fertilizer containing N becomes less clear. The planting/germination zone in strip-till or ridge-till corn is typically not as cold and wet as no-till, despite the high levels of crop residue in the row middles. Still, P and K starter fertilizer is often beneficial for corn planted in reduced-till, especially where soil test levels of those nutrients are very low, or low, and where the yield environment is high. Conventional-till corn is unlikely to give an economic response to an N starter.

In general, corn is much less likely to respond to an N starter if the N was broadcast and incorporated, or surface-applied preplant or preemerge, as opposed to deep-banded preplant.

* Starter fertilizer placement method. Producers should be very cautious about applying starter fertilizer that includes N and/or K, or some micronutrients such as boron, in direct seed contact. It is best to have some soil separation between the starter fertilizer and the seed. The best/safest placement methods for starter fertilizer are banded 2 to 3 inches to the side and 2 to 3 inches below the seed. Another effective method is to band the starter on the soil surface to the side of the seed row at planting time. If producers apply starter fertilizer with the corn seed, they run an increased risk of seed injury when applying more than 6 to 8 pounds per acre of N and K combined in direct seed contact. K-State's recommended maximum limit is 10 pounds per acre N and K placed in direct seed contact, but the less N and K you apply in this manner, the better.

* Hybrid. Research at the Irrigation Experiment Field near Scandia has shown that some corn hybrids respond to starter fertilizer more readily than others. Unfortunately, there is very limited research on this. Seed company representatives may be able to provide guidance to producers on whether a given hybrid is more or less likely to respond to starters than other hybrids.

* What rates of starter fertilizer should a producer use? With adequate separation of seed and fertilizer, there is no real limit to the amount of nutrients that can be applied at planting. However there can be some advantages, especially at very low fertility levels, to applying a combination of starter and broadcast applications. Research has shown that there is a limit to the amount of nutrient a root can absorb. Having all of the nutrients in the starter band can actually limit nutrient uptake. As a general rule, applying 25 to 50% of the P as starter and broadcasting the remainder works well at very low fertility levels. Plus it limits the amount of time spent filling starter boxes or tanks.

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3. Recommended corn populations in different parts of Kansas

Corn yield response to seeding rates and plant populations often varies from one year to the next. This is especially true for dryland corn in central and western Kansas. Populations somewhat lower than those listed in the table below may, in fact, result in more consistent dryland yields in western Kansas. But if lower populations are used, producers will miss out on a potentially nice payday if growing conditions are good.

Optimal seeding rates for irrigated corn don't vary much from year to year, as long as water application rates stay about the same. But if fertilizer rates are sharply increased or decreased, optimal seeding rates for irrigated corn may need to be adjusted. For example, research at the Irrigation Experiment Field near Scandia has shown that if fertilizer rates are increased, seeding rates also have to be increased in order to realize maximum yield benefit.

	Dryland	
Area	**Environment**	**Final Plant Population**
Northeast	100- to 150-bushel potential	22,000-25,000 per acre
	150+ bushel potential	24,000-28,000
Southeast	Short-season, upland shallow soils	20,000-22,000
	Full-season, bottomground	24,000-26,000
Northcentral	All dryland environments	20,000-22,500
Southcentral	All dryland environments	18,000-20,000
Northwest	All dryland environments	16,000-20,000
Southwest	All dryland environments	16,000-20,000
	Irrigated	
Environment	**Hybrid maturity**	**Final Plant Population**
Full irrigation	Full-season hybrids	30,000-34,000
	Shorter-season hybrids	30,000-36,000
Limited irrigations	All hybrids	24,000-28,000

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4. Dryland corn populations, hybrid maturity, and planting dates in SC Kansas

There have been many corn population studies throughout Kansas in previous years. A current study underway at the Harvey County Experiment Field is conducted under no-till conditions. This research has focused on dryland corn response to plant populations since 2001. Planting date and hybrid maturity components were added in 2004 and 2005.

In an outstandingly good corn year, such as 2004, the highest yield of 137 bu/acre (averaged over planting dates and hybrids) was at the highest population of 22,000. In 2005, another relatively good year, top average yields of 110 bushels per acre were also reached at the 22,000 population. In poor corn years, such as 2001 and 2003, with yield environments of 50 bushels or less per acre, the highest average yields were at the lowest population of 14,000. However, under unfavorable conditions, yields with 18,000 plants per acre generally were not significantly different.

Overall, the research to date indicates that the optimal population for dryland corn at this location would be about 18,000 in poor to average yield environments, and 22,000 in years with above average conditions. The effect of planting date has varied considerably over the past two years, with optimums ranging from mid-March to mid-April. Additional years of research are needed to confirm planting dates most likely to favor top yields under other conditions. The past two years have resulted in best yield performance by corn hybrid maturity of 111 days, with declining production as maturity decreased to 105 and 97 days.

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5. The challenge of collecting a representative soil sample

At first glance, soil sampling would seem to be a relatively easy task. However, when you consider the tremendous variability that likely exists within a field because of inherent soil formation factors and past production practices (such as banded fertilization), the collection of a representative soil sample becomes more of a challenge.

Before heading to the field to take the sample, be sure to have your objective clearly in mind. If all you want to learn is the average fertility level of the field, then the sampling approach would be different than sampling for a variable rate fertilizer application program.

In some cases, sampling procedures are predetermined and simply must be followed. For example, soil test results may be required for compliance with a nutrient management plan or environmental regulations associated with confined animal feeding operations. Sampling procedures for regulatory compliance are set by the regulatory agency and their sampling instructions must be followed. Likewise, site-specific, variable-rate application programs have established a soil sampling system for their service, and their sampling plan should be followed.

Regardless of the sampling objectives or requirements, there are some sampling practices that should be followed:

* The soil sample should be a composite of many cores to minimize soil variability effects. A minimum of 8 to 10 cores should be taken from a relatively small area (two to four acres). A greater number of cores should be taken on larger fields than smaller fields, but not necessarily in direct proportion to the greater acreage. A single core is not an acceptable sample.

* A consistent sampling depth for all cores should be used because pH, organic matter, and nutrient levels often change with depth. Sampling depth should be matched to sampling objectives. For example, K-State recommendations call for a sampling depth of two feet for the mobile nutrients – nitrogen, sulfur, and chloride. A six-inch depth is suggested for routine tests for pH, phosphorus (P), potassium (K), zinc (Zn), iron (Fe), and boron (B).

* A zigzag pattern across the field is better than following planting/tillage pattern to minimize any past non-uniform fertilizer application/tillage effects. With GPS system available, georeferencing of core locations is possible. This allows future samples to be taken from the same locations in the field.

* Unusual spots obvious by plant growth or visual soil color/texture differences should be avoided. If information on these unusual areas is wanted, then a separate composite sample should be taken from these spots.

* If banded fertilizer has been used on the previous crop and the old rows are still identifiable, the area where the band was applied should be avoided in taking cores. If old bands are not identifiable, then the number of cores taken should be increased to minimize the effect of an individual core on the composite sample results.

* On ridge-till fields where ridges still exist, cores should be taken from the side of the ridge to represent the original soil elevation.

* For permanent sod or long-term no-till fields where nitrogen fertilizer has been broadcast on the surface, a three- or four-inch sampling depth would be advisable to monitor surface soil pH. A two-increment sampling plan of 0-3 and 3-6 inches on the no-till fields also would allow for assessing stratification of P and K, as well as pH.

Soil test results for organic matter, pH, and non-mobile nutrients (P, K, Zn, and Fe) change relatively slowly over time, making it possible to monitor changes if soil samples are collected from the same field following the same sampling procedures. There can be some seasonal variability and previous crop effects, however. Therefore, soil samples should be collected at the same time of year and after the same crop. For example, in a corn-soybean rotation, sampling after soybean harvest in the fall would be an excellent sampling system.

Soil sampling has much to offer if done properly, but it all starts with the proper soil sample collection procedure – one that meets your objectives.

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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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