k-state extension AGRONOMY e-Updates

Number 229
February 5, 2010

1. Kochia: Biology and growth habit

One of the most troublesome broadleaf summer annual weeds in western Kansas is kochia, also known as fireweed. Kochia is native to southern and eastern Russia. It was actually introduced to North America as an ornamental and then escaped into areas where it was adapted. It is not just a Kansas problem. Kochia has been reported in 42 of the lower 48 states and in the seven Canadian Provinces neighboring the U.S. border. During the Dirty 30's, when forage was short, kochia was often put up for hay for livestock.

Kochia germinates early in the spring, and is quite frost tolerant. It is reported to survive temperatures as low as 9 degrees F. It thrives in hot weather, too, and can continue to germinate throughout the summer growing season. Lab experiments have shown kochia to germinate at temperatures from 39 to 106 degrees F.

In the absence of competition, kochia can be very bushy in appearance and achieve heights of greater than 7 feet. Kochia can have an extensive root system. Kochia roots grew to a depth of 16 ft in a sorghum field during a drought in Kansas in 1956. A single plant has been reported to have a root system 22 feet wide. Kochia is daylength sensitive and begins to flower sometime in mid-July to into August in Kansas. A critical light period triggering flowering ranges from 13 to 15 hours among kochia accessions.

Kochia in wheat stubble, showing the pattern of emergence after these "tumbleweeds" have blown across the field in waves.

Kochia seedlings are quite pubescent. Kochia is susceptible to several broadleaf herbicides when young. Photos by Curtis Thompson, K-State Research and Extension.

Kochia is self-fertile, although it can outcross. Kochia seed are brown, oval and flattened with a star shaped hull enclosing the seed. It has been reported that a single plant can produce as much as 14,600 seed. In a seed burial experiment in Nebraska, kochia seed viability was 5% after 1 year and zero after 2 years. However, seed burial experiments in Colorado indicate that a low percentage of both a dormant and a non-dormant kochia seed remained viable even after 3 years. Seed viability declined more rapidly when seed was buried 4 inches or less.

As the kochia plant matures, an abscission layer develops in the stem near the soil surface. In the presence of wind, this weakened area allows the dried plant to sever from the root system and tumble across the landscape spreading viable seed where ever it rolls. Thus some people call kochia tumbleweed.

In addition to reducing yield, kochia can cause significant harvest complications. Kochia has also become a problem from an herbicide-resistance aspect. Biotypes have been found that are

resistant to ALS inhibitors (such as Spirit, Peak and Steadfast), photosystem II inhibitors (such as atrazine), synthetic auxins (such as Banvel or 2,4-D), and glyphosate. Herbicide-resistant kochia has been identified in 19 states.

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2. Control of kochia in corn

Controlling kochia in corn should always begin by controlling any plants that have emerged early before the corn is planted. This can either be done with tillage or with a burndown treatment using both glyphosate and dicamba. Producers should not plant corn into a seedbed with actively growing kochia.

To control kochia through the season, producers can choose to try a one-pass program or use a two-pass program.

One-pass programs

One-pass programs in general have lower costs, but higher risks of failure, than two-pass programs. That said, one-pass preemergence programs have a lower risk of failure than one-pass postemergence programs. That's because if a preemergence treatment fails, it can be backed up with a postemergence treatment. If a one-time postemergence application either fails or can't be made on time and weeds continue growing, the result is often a train wreck.

If the kochia is susceptible to triazine herbicides, then any of the acetamide-atrazine herbicide combinations applied preemergence can potentially give good control of kochia for up to a month after application. Examples include Bicep II Magnum, Cinch ATZ, Guardsman Max, Propel ATZ, Bullet, Harness Xtra, Keystone, Volley ATZ, FulTime, and several generic versions. These products can run out before the kochia stop emerging during the summer under irrigation or high rainfall conditions. They all require moisture for activation, and will not give good control if they are not activated.

If the kochia is resistant to triazine herbicides, kochia will emerged through the previously discussed products thus producers can use Balance Flexx or Corvus either preemergence or up through the 2-leaf stage of corn. These products can do an excellent job of controlling kochia throughout the season if they are tankmixed with at least 1 lb/acre of atrazine. These products also require moisture for soil activation but do have foliar activity.

Lumax and Lexar, which are premixes of Callisto, Dual II Magnum, and atrazine, will also do an excellent job of controlling kochia preemergence. They can be used as a one-pass program if the corn was planted into weed-free ground. They are best applied preemergence; however, they can also be applied postemergence up to 12-inch corn. For adequate grass control, these products must be applied preemergence to the grass. Lexar contains twice as much atrazine as Lumax. In western areas, or on lighter-textured soils, producers will normally want to use Lumax because of its lower atrazine content. In central and eastern Kansas, or on heavy-textured soils, producers may want to use Lexar to get more atrazine applied, and longer residual control

Where Roundup Ready corn is used, producers can also get excellent one-pass kochia control by using an early postemergence application of Halex GT + atrazine. Halex GT is a premix consisting of a high rate of glyphosate, Dual II Magnum, and Callisto. Atrazine should be added to this product to get the best season-long control of kochia. Glyphosate + Status can also be effective on kochia, although this combination will not provide much residual control and often a second herbicide application is required to control later-emerged weeds.

Two-pass programs

Producers will usually get more consistent full-season control of kochia by planning to use a two-pass program. This would start with a clean seedbed by using tillage or a good burndown application followed by a preemergence application of an acetamide-atrazine product (as described above). If triazine-resistant kochia is present, then Balance Flexx, Corvus, Lumax, or Lexar should be used as the preemergence herbicide. A low-cost preemergence option in a two-pass system is Prequel, which is a premix of Resolve and Balance, which must be applied preemergence to corn.

For the postemergence application, producers can use Laudis, Callisto, Impact, Capreno, glyphosate (on Roundup Ready hybrids, and only if the kochia is susceptible to glyphosate), or Ignite (on Liberty Link hybrids).

Note: Balance Flexx, Corvus, and Prequel cannot be applied in certain counties in Kansas. Always consult the labels for details.

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3. Soybean seed treatments in Kansas

Soybean seed is increasingly costly, which makes getting a good stand the first time more valuable than ever. Seed rot and seedling diseases can reduce germination, emergence, and seedling survival of soybeans.

Pythium, *Phytophthora*, *Rhizoctonia*, and *Fusarium* are soil-borne diseases that can infect soybean seed or seedlings. *Phomopsis* is a seed-borne disease.

Pythium and *Fusarium* are more prevalent in cooler soils, while *Phytophthora* and *Rhizoctonia* are more prevalent in warmer soils. Early in the season, *Pythium* is the more common problem in Kansas and later on *Rhizoctonia* becomes more important. *Fusarium* and *Phytophthora* are usually only problems in heavy clay soils and under irrigation. All of these fungi can cause seed rot and seedling diseases such as damping off. All four can result in death of soybean seedlings. Even if infected seedlings survive, yields may be reduced.

A good insurance policy for protecting stands and yields is to use a planting time fungicide seed treatment. K-State fungicide seed treatment evaluations have shown an average yield increase of 2.5 bushels per acre when a seed treatment was routinely used over the past six years.

Year	Untreated Bu/a	Treated Bu/a	Difference Bu/a
2003	25.3	28.4	+3.1
2004	53.9	58.0	+4.1
2005	38.4	38.7	+0.5
2006	24.8	27.2	+2.4
2007	37.9	38.0	+0.1
2008	41.9	45.1	+3.2
2009	63.3	67.8	+4.5
Average			+2.5

Locations: Scandia (irrigated), Ottawa, Parsons, Rossville, Silver Lake

K-State recommendations are based on more than 20 years of field research:

* All soybean seed planted before May 15 in eastern and central Kansas should be treated with a fungicide seed treatment. Where soybeans are being planted before May 15, it is especially beneficial to include products containing metalaxyl or mefenoxam for *Pythium* control.
* No-till fields planted before May 31 should also be treated.
* There is no K-State data on the effect of seed treatments in western Kansas, but irrigated soybeans in that region should also probably be treated with a fungicide seed treatment if planted before May 15.
* For soybeans planted in June or later, fungicide seed treatments only occasionally pay off.

There are two basic types of fungicide seed treatments: contacts and systemics. The contact products do not penetrate the seed coat and have a shorter residual life (7 to 10 days). Systemic products are absorbed by the emerging seedling and translocated throughout the developing seedling and can provide protection for 14-21 days. Contact fungicides used for soybean seed treatment include: captan, PCNB, and thiram. Systemic fungicides used for soybean seed treatment include: azoxystrobin, carboxin, fludioxonil, ipconazole, mefanoxam, metalaxyl, thiabendazole, and trifloxystrobin.

Mefenoxam and metalaxyl are effective against *Pythium* and *Phytophthora*. These two chemicals are very closely related, and are marketed under trade names such as Apron XL and Allegiance. The other products mentioned above are effective against *Fusarium* and *Rhizoctonia*.

Since it is difficult to know or predict what seedling diseases may be a problem in any particular field, it is usually best to select a product(s) that will give a broad spectrum of disease control, somewhat similar to tank mixing herbicides.

Examples of products that have a combination of ingredients to provide broad-spectrum control include:

* Apron Maxx: mefenoxam, fludioxonil
* Bean Guard/Allegiance: captan, carboxin, metalaxyl
* Protector-L/Allegiance: thiram, metalaxyl
* Rancona Summit: ipconazole, metalaxyl

* SoyGard: azoxystrobin, metalaxyl
* Stiletto: carboxin, thiram, metalaxyl
* Trilex AL/Trilex + Allegiance: trifloxystrobin, metalaxyl
* Warden RTA: mefenoxam, fludioxonil

Examples of soybean seed treatments that combine fungicides and insecticides include:

* Cruiser Maxx: mefenoxam, fludioxonil, thiamethoxam
* Trilex AL+ Gaucho: trifloxystrobin, metalaxyl, imidacloprid
* Warden CZ: mefenoxam, fludioxonil, thiamethoxam

Monsanto's new Genuity Roundup Ready 2 Yield soybeans come with a seed treatment called Acceleron Soybean. The active ingredient in Acceleron is Harpin Alpha Beta Protein. This is not a fungicide, and has no direct activity on diseases, but works instead by enhancing the plants own natural immune system.

Some companies have efficacy charts for these various products, rating them in effectiveness against pythium, phytophthora, rhizoctonia, fusarium, and other soil-borne or seed-borne diseases. There are some minor differences, but as long as you use a product that combines one fungicide from each of the two major groups of systemic products, as mentioned above, your soybean seed will be protected.

Seed treatments can either be applied commercially or as a hopper-box or planter-box treatment. The product label will specify how they are to be applied. The benefits of commercially applied seed treatments are they are cheaper and the seed is more uniformly covered. One of the most important factors in getting good results from seed treatments is to make sure to get good seed coverage. The negative is that companies will generally not take back treated seed if for some reason it does not get planted.

Growers who have not taken delivery of their seed may still be able to get it custom applied by their seed dealer. If seed has already been received, there is still the availability of on-farm applied, "hopper-box" treatments. In selecting a hopper-box seed treatment, it is best to use one of the newer generation systemic products rather than a contact material alone such as captan. Hopper box formulations have the advantage of treating only what you will plant, but they are more expensive and coverage on the seed may not be as good as it should be.

If a rhizobial inoculant is to be used, check the product label for compatibility and specific instructions on usage. Not all seed treatment fungicides are compatible, particularly some of the older materials.

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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