DEPARTMENT OF AGRONOMY

Weed Control in Dryland Cropping Systems

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Moisture is the most limiting factor to dryland crop production in western Kansas. As cropping intensity is increased from a wheat-fallow rotation to a wheat-summer crop-fallow rotation, moisture efficiency becomes the most critical factor that leads to a successful cropping system. For these reasons, there is very little tolerance for weed development and growth in the more intensive cropping systems in western Kansas.

In the wheat-fallow system, the 24-month cycle consists of 9 months of crop and 15 months of fallow. Producers who do not control weeds during the first summer after wheat harvest can often harvest at close to a normal wheat yield, which is 30 to 40 bushels. This indicates the wheat-fallow system is not intensive enough to efficiently utilize the moisture received.

Common weed species in the wheat-fallow system are winter-annual broadleaf weeds such as tansy mustard, flixweed, shepherdspurse, field pennycress, and purple mustard; spring-annual broadleaf weeds such as kochia, Russian thistle, common sunflower, pigweed species, and common lambsquarters; and winter-annual grasses such as jointed goatgrass, downy brome, Japanese brome, cheat, and weedy rye.

Intensifying the cropping system

Intensifying a rotation to wheat-summer crop-fallow results in approximately 14 months cropping in a 36-month planting cycle and provides two crops in three years (Figure 1). Planting a summer crop after a fallow period can decrease populations of winter-annual grasses. A single fallow period does not eliminate jointed goatgrass, because the seed life is longer than the fallow period and has a longer seed life than rye or brome weed species (Anderson 1994). Wheat-fallow may not eliminate rye or brome species.

The 36-month cycle shown in Figure 1 includes a summer crop and two fallow periods, which control winter-annual weeds by eliminating seed production for two consecutive years. In Nebraska, it was found that rye, jointed goatgrass, and the brome species became serious problems in continuous wheat and including a summer crop in the rotation greatly reduced the winter-annual grass populations (Lyon and Baltensperger 1995).

Weed control in wheat (Phase I)

Producers need to understand weeds utilize both moisture and nutrients. As the wheat crop matures, it utilizes less moisture and nutrients than it uses during stages of vegetative and early reproductive growth. Thus late spring rains can replenish soil-profile moisture if weeds have been controlled. In essence, the fallow period begins prior to wheat harvest. Weeds allowed to grow in a wheat crop, utilize moisture and nutrients that would otherwise be available for a

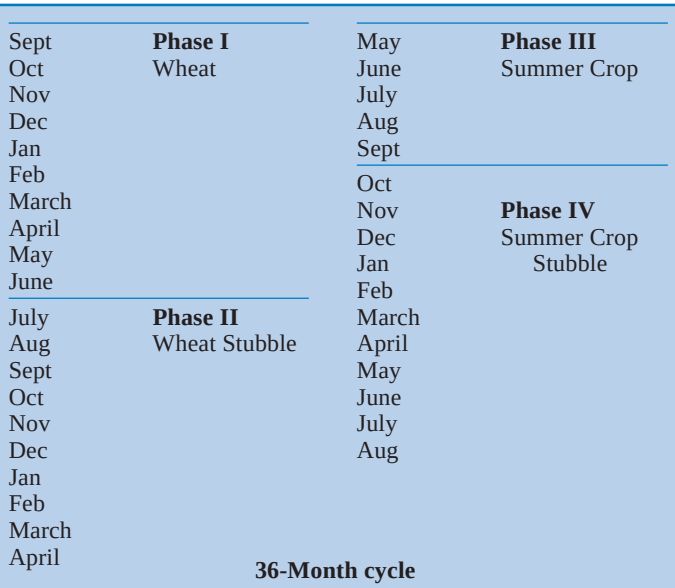

Figure 1. *Four phases in a 36-month wheat- summer crop- fallow system in western Kansas.*

following crop. In addition, the weeds in a wheat crop will produce seed and may reduce wheat yields. **Weed control in the wheat crop is essential to the success of the system.**

Whether or not weeds are controlled in the wheat crop will affect how and when they are controlled in the post-harvest fallow period. Weeds in fallow will generally be smaller and more easily controlled if weed control measures were made in the growing wheat. Consequences of not controlling weeds in the wheat crop include potential yield loss, increased dockage and harvest costs, and moisture and nutrient depletion.

Weeds that emerge in spring may become so large that harvesting problems occur, thus, requiring a preharvest herbicide application that will often cost as much or more than an in-crop treatment. The success of preharvest weed control is often marginal at best.

The summer crop planted after wheat will affect herbicide selection for weed control in the wheat crop. If a rotation to sunflowers is planned, a non-residual herbicide such as Buctril, Bronate, Banvel, 2,4-D Harmony Extra, or Express must be used to control the weeds in wheat. Glean, Finesse, Amber, Peak, and Ally are used in wheat and are sulfonylurea products that can carry over and possibly injure a susceptible crop like sunflowers. Several of these herbicides may be used ahead of corn or sorghum. However, soil pH, soil texture, and precipitation greatly affect the duration of the herbicide residual. Of the residual sulfonylurea herbicides, Ally and Peak pose the least risk to corn and sorghum. Corn has less tolerance than sorghum to the sulfonylurea herbicides unless an IR (imidazolinone [Pursuit] resistant) corn hybrid is used. The use of an IR corn hybrid will increase crop tolerance. Always read and follow the herbicide label.

Weed control in fallow (Phase II)

Fallow allows for soil moisture storage, increased nutrient availability through mineralization of organic matter, and weed control. A producer can add fertilizers to the system and control weeds, but a producer can not influence the amount of precipitation received. Thus, management that affects moisture storage is the most critical factor in this phase.

Fallow is a moisture-storing phase of the system. Weeds must be controlled in fallow to avoid moisture depletion from the profile during this period and maximize moisture storage. Research suggests that a no-till (leave stubble standing and do not undercut or till) system may be the most beneficial system during this time period. This means herbicides must be used to control weeds. Usually some method of weed control will be required in July.

The subsequent crop will affect which herbicides are utilized to control weeds during this phase of the rotation. Nonselective, nonresidual herbicides should be used when retaining all cropping options including the option of continuous wheat. Herbicides such as Roundup Ultra, Landmaster BW, Fallow Master, Cyclone, or Touchdown leave all options open because there is very little residual following application of these herbicides.

However, repetitive use of the Roundup-type (glyphosate) herbicides over time can increase populations of glyphosate-tolerant weed species including an annual grass such as prairie cupgrass, perennial grasses such as tumble windmillgrass and sand dropseed, and a sedge such as yellow nutsedge. Application of glyphosate at the boot stage of growth of prairie cupgrass may prevent seed development and reduce the population of prairie cupgrass.

Yellow nutsedge can be controlled with the herbicide, Permit, applied in the postemergence stage in corn or sorghum (Doll, 1997). Preplant incorporated herbicides such as Eradicane, Lasso, Dual, Frontier, Surpass, and Harness can suppress yellow nutsedge. Basagran and Classic applied postemergence also can suppress yellow nutsedge. Often Roundup-tolerant weeds can be found in patches. In this case, tillage may be the most effective and economical method of control.

Atrazine, is a relatively inexpensive herbicide, with pre-emergence or postemergence activity that provides excellent control of susceptible species. However, residual atrazine restricts what subsequent crop can be planted. There are several strategies on how atrazine fits into an ecofallow system. Weed species, precipitation, soil pH, soil texture, and farming practices will determine when and how much atrazine should be used in the system.

In some situations, atrazine is applied immediately after wheat harvest. This should control volunteer wheat and other weeds that germinate after wheat harvest, reducing the number of herbicide applications or tillages required during the fallow period. However, if hot dry conditions prevail after this treatment, the atrazine may be lost and ineffective for weed control. Late June or early July applications will have more atrazine breakdown during the fallow period than if applied later in the season resulting in less atrazine carryover into the spring.

Another strategy is to wait until volunteer wheat and weeds have emerged. Then, apply atrazine and crop oil concentrate to burn down the new growth and provide residual control for the remainder of the summer. This application will usually be made sometime during July. Wheat must be small, having little or no crown root development, to be controlled by atrazine. It is almost always best to add an additional burndown herbicide to the atrazine since it often will not control emerged grassy weeds.

A third strategy is to control weeds after wheat harvest with a nonselective, nonresidual herbicide and then apply the atrazine during the last half of August or early September. This strategy will control any fall-emerging weeds or volunteer wheat and should provide adequate atrazine residual to control weeds up to planting of the subsequent corn or sorghum crop. Winter-annual weeds should be controlled in this system.

Use of atrazine reduces the number of times that the field will have to be sprayed for weeds, unless, atrazine-tolerant or resistant weeds are present. For corn or sorghum, a nonselective herbicide or additional atrazine may have to be used in the following spring to control spring weeds that emerge. It is important that winter-annual weeds do not produce seed.

It is important to remember sorghum is less tolerant to atrazine than corn. Low rates of atrazine will do an adequate job of weed control on most soils in areas of western Kansas because of less annual precipitation and slower rate of breakdown. Atrazine at 1.0 to 1.5 pounds active ingredient per acre can provide good weed control on dryland in western Kansas. The atrazine label allows up to 3.0 pounds atrazine to be used in wheat stubble after wheat harvest. That rate is excessive for most dryland in western Kansas. The maximum amount of atrazine that may be applied in the subsequent year (summer crop year) is 2.5 pounds per acre. (pre-emergence+postemergence). If the land is highly erodible and has less than 30 percent residue cover, a maximum of 1.6 pounds per acre atrazine may be used pre-emergence to the crop. Atrazine rates will have to be adjusted for annual rainfall and soil pH.

Weed control in the summer crop (Phase III)

Seedbed preparation for the summer crop must be timely to prevent winter-annual grasses from heading and producing seed.

Winter-annual grasses that are allowed to head likely will produce some viable seed, thus defeating one of the purposes of this 36-month cycle to reduce and eliminate winter-annual grasses for following wheat crop. It is likely a burndown herbicide will be required prior to or at planting of the summer crop in a no-till system. Nonselective and nonresidual herbicides such as Roundup, Touchdown (corn and sorghum), or Cyclone may be used in this situation. Atrazine and crop oil concentrate may provide sufficient control if weeds are very small and are primarily broadleaves. Susceptible grasses must be small, with one to two leaves, to be controlled with atrazine.

Depending on the summer crop to be grown, weed control options will vary. Pre-emergence atrazine is an essential component in a herbicide program for dryland corn or sorghum. It provides an excellent spectrum of weed control at a reasonable cost. The exception would be if sorghum is planted on sandy soils. Atrazine pre-emergence can cause significant sorghum injury on sandy soils and should not be used. Atrazine can be used postemergence to provide broadleaf and limited grass control or suppression in sandy soils.

Several other options exist for weed control in corn and sorghum. If grass pressure is expected, a pre-emergence chloracetamide herbicide such as Lasso, Dual, or Frontier can be used in sorghum and corn. Harness and Surpass are additional options for corn. More expense will be incurred when these herbicides are used. When prairie cupgrass is a problem, early preplant applications of the pre-emergence grass herbicides may be required before the prairie cupgrass germinates. Combinations of grass herbicides plus atrazine have provided the best general weed control in dryland corn and sorghum experiments at Tribune, KS.

If sunflowers are grown, herbicides for weed control are limited. Dinitroanalines (Treflan and other generic trifluralin, Prowl, or Sonolan) are some of the preplant incorporated herbicide options. Prowl can be applied pre-emergence if adequate moisture is received for activation within a 7-day period following treatment. Poast or Poast Plus are herbicides for postemergence grass control in sunflower. Generally the options for weed control in sunflowers are limited especially in a no-till situation where herbicides cannot be mechanically incorporated. Broadleaf weed control is a problem in sunflowers, thus, relatively clean fields should be selected for sunflower production. Refer to the current Chemical Weed Control publication from K-State Research and Extension for specific details of herbicide treatments available in summer crops.

Weed control in the summer crop stubble (Phase IV)

Weeds need to be controlled during the spring and summer prior to fall-planted wheat. This allows for moisture storage for the subsequent wheat crop. In this phase, tillage or nonselective-nonresidual herbicides can be used. During this phase, costs of chemical fallow are higher than tillage costs and wheat yields have not been increased with no-till compared to conventional till. Utilizing a residual sulfonylurea herbicide during this phase can provide excellent control of broadleaf weeds. However, it can eliminate the option of planting a second consecutive summer crop if moisture conditions turn favorable. It also can increase greatly the risk of developing weed populations resistant to sulfonylurea herbicides. Tillage during this phase of the rotation can help reduce resistant weed populations and Roundup-tolerant weed problems that increase during a previous no-till fallow period.

Summary

A high level of management, especially in the area of weed control, will be required of those who adopt a wheat-summer crop-fallow system. Moisture is the key. Weed growth and development must be avoided in the more intensive cropping systems than in wheat-fallow. Timely applications of herbicides are required for successful weed control. Herbicide rotational restrictions must be considered as crop rotations are planned. Grasses become a greater problem in the wheat-summer crop-fallow system when herbicides are used for weed control during the fallow periods. Prairie cupgrass, tumble windmillgrass, sand dropseed, and yellow nutsedge are some of the grass and sedge species that survive and tend to increase in a Roundup-intensive fallow system. Weed management systems have to be adjusted to fit the situation.

Key points regarding weed control that will make the more intensive systems most likely to succeed:

1. Control weeds in the wheat crop.
2. Control weeds during fallow with herbicides, **do not till stubble** after wheat harvest.
3. Use atrazine during fallow period to reduce herbicide cost of fallow prior to planting corn or sorghum.
4. Do **not** let winter-annual weeds produce seed in the spring prior to planting a summer crop.
5. Plant summer crop into standing wheat stubble utilizing herbicides for weed control.
6. Weed control in fallow following summer crop can be attained with cultivation or herbicides without affecting wheat yields.

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