SDSU Extension

iGrow Soybean

BEST MANAGEMENT PRACTICES

Chapter 34:
Management of Problem Weeds in Soybean Production

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The widespread adoption of Roundup Ready® soybeans has greatly simplified soybean herbicide The widespread adoption of Roundup Ready® soybeans has greatly simplified soybean herbicide programs ThThe widespread adoption of Roundup Ready® soybeans has greatly simplified soybean herbicide The widespread adoption of Roundup Ready® soybeans has greatly simplified soybean herbicide programs but excessive dependence on glyphosate has resulted in glyphosate-resistant weed species in several fields. Other weeds continue to be a problem in soybean production systems, regardless of the herbicide management system. These problems result from late emergence or partial or near complete tolerance to glyphosate. The purpose of this chapter is to discuss management of problem weeds in soybean production systems (Table 34.1). As always, it is important to read and follow herbicide label instructions.

Soybeans in cropping systems for weed management

Including soybeans in crop rotations provides many benefits for managing several soil and pest problems, including weed control. Prior to the introduction of Roundup Ready® crops, including soybeans in a corn-soybean crop rotation was important for managing annual grass weed species in the soil seed bank as herbicide options for grass control were limited in corn, and broadleaf control in corn was much easier than in soybeans.

The widespread adoption of Roundup Ready® technology has greatly simplified weed control in corn and soybeans, but excessive dependence on glyphosate has resulted in glyphosate-resistant weed species in several fields. In recent years, soybean has been an important rotational crop because it is planted at a later time than corn enabling control of several weeds prior to soybean emergence. In addition, soybeans allow the use of different herbicide sites of action to control glyphosate resistant weeds resulting in more consistent weed control and avoiding selection of resistance to additional herbicides. Therefore, it is still important to include at least two crop species in a crop rotation to manage weed seed banks and minimize future weed management challenges.

Soybeans are generally less competitive with weeds than other common crop species (Colquhoun et al., 2001), which may be one potential limitation associated with including soybeans in a crop rotation. Narrower rows (less than 30 inches apart) and higher plant populations can increase soybean's competitive ability (Harder et al., 2007), but the response is inconsistent and can increase the risk of diseases and soybean lodging (Chapter 10).

Table 34.1. Problem weeds, possible control options, and notes. Tolerant weeds were never susceptible to glyphosate and resistant weeds are those that have become less susceptible after several years of herbicide use. (Source: Michael Moechnig, SDSU)

Problem Weed	Possible Weed Control Options	Notes
Annual grass weed species	Clethodim, quizalofop, sethoxydim, glyphosate	Generally easy to control.
Wild buckwheat	Post-emergence Pursuit®+glyphosate or Extreme®	Approximately 60% control by glyphosate alone.
Velvetleaf	Post-emergence Cadet®, Resource®, or glyphosate. Pre-emergence Sonic®, Authority First® or Gangster®	May emerge later than soybean and still be competitive.
Waterhemp	Post-emergence Flexstar® or Cobra®. Residual soil active herbicides to control late emerging plants	May emerge late (see Chapter 33 for discussion on glyphosate-resistant biotypes).
Common lambsquarter	Post-emergence Harmony®, Cadet®, Resource®. Several effective pre-emergence herbicides.	Cool temps can decrease its susceptibility to glyphosate as it ages.
Biennial wormwood	Early glyphosate application or tank mix 2,4-D prior to planting soybeans. Several pre-emergence herbicides to control late emerging plants. Post-emergence herbicide options are very limited.	Most problemactic in wet no-tillage fields. Becomes tolerant to glyphosate at it ages.
Evening primrose	Pre-plant 2,4-D for suppression.	Most problematic in wet no-tillage fields. Near complete tolerance to glyphosate.
Elm	Fall glyphosate + 2,4-D ester if leaves still green. Herbicides generally provide suppression only.	Only a problem in some no-tillage fields.
Scouring rush	MCPA desiccates top growth. Permit and Python may provide suppression.	Persistent in wet no-tillage fields. Glyphosate not effective.
Field horsetail	Treat similarly as for scouring rush. Herbicides may only provide suppression.	Most common in wet no-tillage fields. Glyphosate not effective.

The exceptional efficacy of glyphosate in Roundup Ready® soybeans negated the drawback associated with weed competition with soybeans, but as tolerant or resistant weeds become more common, it will become increasingly important to rely on more diverse herbicide programs and controlling weeds in crop rotations to minimize the weed seed bank.

Standard weed management programs

Currently, weeds are mostly controlled with post-emergence herbicide applications, but it is becoming increasingly important to apply pre-emergence and post-emergence herbicides to ensure consistent weed control. Glyphosate alone may control the weeds that have emerged prior to the application, but will not have soil activity to control weeds emerging after the application.

SDSU research indicates that weeds may emerge at an average rate of five weeds/ft² per day from mid-May to mid-June (Nyamusamba, 2009). Therefore, additional weeds may quickly replace weeds controlled on the day of a glyphosate application if soil residual herbicides are not used. This is particularly important for controlling late emerging weeds, such as waterhemp, that may emerge after the last glyphosate application and produce seed that may replenish the weed seed bank. Some soil residual herbicides may be applied early post-emergence, but herbicide options are more limited than for pre-emergence applications and efficacy may be less consistent as rainfall may be more erratic at that time of year.

Although soybeans may tolerate early-season weed competition more than corn, it may be important to control weeds prior to the V3-V4 growth stage (three to four weeks after emergence (Chapter 3) to avoid yield reduction. Figure 34.1 illustrates the results from a study conducted at the Brookings Agronomy

Farm in 2007 where soybeans were weed-free for zero to five weeks after soybean emergence or weeds were allowed to grow for two to six weeks after soybean emergence. The results indicated that late emerging weeds (up to three weeks after soybean emergence) could reduce soybean yield. In addition, weeds allowed to grow in soybeans for more than three to four weeks after emergence could cause yield loss even if they were controlled after that time.

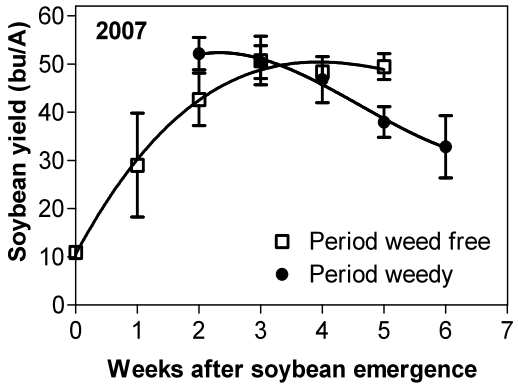

Figure 34.1. Effect of weed removal time on soybean yield. Open squares (□) indicate treatments where weeds were controlled for different periods of time and then allowed to grow thereafter whereas the solid circles (●) indicate treatments where weeds were allowed to grow for different periods of time and then controlled thereafter.
(Source: http://www.sdstate.edu/ps/weed-mgmt/weed-mgmt-crops.cfm)

In this study, weed populations were high as the weeds in the untreated treatments caused approximately 80% yield loss. Low to moderate weed densities would likely not cause as much yield loss if controlled late (after the V4 growth stage). Consequently, pre-emergence herbicide applications would likely reduce weed densities enough to prevent yield loss associated with early-season weed competition and enable greater flexibility in post-emergence herbicide application time.

Difficult weeds in South Dakota soybeans

Annual grass weed species can be controlled with ACCase-inhibiting herbicides (WSSA Group 1 herbicides) such as clethodim, quizalofop, sethoxydim, and others. Broadleaf weeds species, on the other hand, are the primary challenge associated with most herbicide programs in soybeans (Fig. 34.2).

Since nearly 98% of soybean acres in South Dakota are herbicide tolerant (NASS 2012), the most challenging weeds are generally those that are not highly susceptible to glyphosate or glufosinate (Liberty®). Some of these weed species may be considered glyphosate tolerant, which means they were never highly susceptible to glyphosate. Glyphosate-resistant weed species are those that were once susceptible, but biotypes have become less susceptible due to selection for plants that are biologically different than the original susceptible population.

Wild buckwheat

Wild buckwheat *(Polygonum convolvulus)* (Fig. 34.2) is a common annual weed throughout South Dakota. Glyphosate often only suppresses populations (about 60% control). It may be controlled with post-emergence herbicide applications by tank mixing imazethapyr (Pursuit®) with glyphosate or using premixed products (e.g., Extreme®). Several pre-emergence herbicides also provide suppression. Seed banks can be managed with aggressive control in rotational crops such corn or wheat.

Figure 34.2. Wild buckwheat a problem weed found in many production fields. (Photo courtesy of Michael Moechnig, SDSU)

Velvetleaf

Velvetleaf *(Abutilon theophrasti)* (Fig. 34.3) is a common annual weed around the eastern edge of South Dakota, with populations less common in central South Dakota (e.g., west of Hwy 281). However, areas of velvetleaf infestation continue to expand. Although glyphosate often severely injures velvetleaf, some plants may eventually grow out of the injury symptoms. In addition, velvetleaf's large seed size results in large seedlings that can emerge later than soybeans but still eventually grow taller than the soybean canopy.

Figure 34.3. Velvetleaf a problem weed found on the eastern edge of South Dakota. (Photo, Michael Moechnig, SDSU)

Velvetleaf may be controlled with post-emergence applications of fluthiacet (Cadet®), flumiclorac (Resource®), and other herbicides. Pre-emergence herbicides containing cloransulam (Sonic®, Authority First®, Gangster®, etc.) are generally very effective for controlling emerged seedlings and provide soil residual activity to control later emerging plants.

Waterhemp

Waterhemp *(Amaranthus tuberculatus)* (Fig. 34.4) is common throughout much of eastern South Dakota, but is less common in the north central part of the state. This weed is problematic in soybeans because its duration of emergence may extend later than many other weed species enabling many plants to emerge after a late post-emergence herbicide application, produce seed, and replenish the seed bank. Consequently, using soil active residual herbicides is one way to deplete moderate to high waterhemp densities.

Figure 34.4. Waterhemp common through much of eastern South Dakota. (Photo, Michael Moechnig, SDSU)

SDSU research indicates that early emerging waterhemp can grow above the soybean canopy and produce more than 1 million seeds/plant whereas late emerging plants are kept in control by the dense soybean canopy, producing fewer than 100 seeds/plant (Uscanga-Mortera, 2004). Waterhemp plants may be male (pollen producing) or female (seed producing), so plants must cross with other plants to reproduce. This creates much genetic diversity within waterhemp populations allowing waterhemp to adapt to herbicides more quickly than other weed species.

Common lambsquarters

A common annual weed throughout South Dakota, common lambsquarters *(Chenopodium album)* (Fig. 34.5) can be challenging to control in soybeans because adverse growing conditions, such as cool temperatures or night time herbicide applications, can decrease its susceptibility to glyphosate. In addition, it can become less sensitive to glyphosate as it grows taller (greater than six inches). Common lambsquarters can be very persistent in the weed seed bank due to its relatively hard seed coat that increases dormancy rates and its prolific seed production (Colquhoun et al., 2001).

Figure 34.5. Common lambsquarters is a common weed throughout South Dakota. (Photo, Michael Moechnig, SDSU)

Biennial wormwood

Biennial wormwood *(Artemisia biennis)* is an annual or biennial weed present throughout eastern South Dakota. It is most problematic in wet no-till fields (Fig. 34.6, left photo). As a young plant, it can be easily confused with common ragweed (see Fig. 34.6, right photo). It is challenging to control in soybeans because it becomes more tolerant to glyphosate as it becomes taller (greater than 5-10 inches). It must be adequately controlled prior to soybean emergence because there are few effective alternative herbicide options.

Figure 34.6. Mature biennial wormwood plant (above left). Young common ragweed (above right, left image) and biennial wormwood (above right, right image). (Photos, Michael Moechnig, SDSU)

Growth regulator herbicides, such as 2,4-D, may be effective if applied prior to soybean planting. Read the label, as planting soybean may require a pre-seeding interval. Some biennial wormwood plants may emerge during or after soybean emergence, so soil active residual herbicides may also improve control. Biennial wormwood is a very prolific seed producer so populations can increase rapidly if it is not adequately controlled.

Evening primrose

Evening primrose *(Oenothera biennis)* is a biennial weed that is found mostly in no-till fields (Fig. 34.7). It is nearly completely tolerant to glyphosate and there are few post-emergence herbicide options in soybeans. Pre-plant applications of growth regulator herbicides, such as 2,4-D, may provide some suppression or control. Fortunately, populations of this weed rarely increase so it is generally not a problematic weed. However, survivors after glyphosate applications often cause concern.

Figure 34.7. Evening primrose is a problem weed in no-tillage fields. (Photos, Michael Moechnig, SDSU)

American elm

Elm trees *(Ulmus americana)* (Fig. 34.8) are often not considered a weed, but they can persist in no-till fields and are generally very difficult to control with herbicides. Effective control options are not well known. Perhaps early fall applications of glyphosate + 2,4-D ester may provide suppression if the leaves are still green at the time of application, but this has not been verified in SDSU trials.

Figure 34.8. Elm can persist in no-tillage fields. (Photo, Michael Moechnig, SDSU)

Scouring rush

Scouring rush *(Equisetum hyemale)* (Fig. 34.9) is a perennial weed that can spread by roots and spores. It is very persistent in wet areas that are not tilled. Scouring rush accumulates high concentrations of silica on its surface making it nearly completely tolerant to glyphosate. Effective herbicide options are not known.

MCPA may defoliate shoot growth, but new shoots will eventually grow from the roots. Halosulfuron (Permit®) and flumetsulam (Python®) have seemed to inhibit new growth in some SDSU trials, but more verification is needed. Scouring rush patches often become so dense that crops may not be planted into them. Perhaps tillage of infested areas during dry periods in the fall or spring may be the most practical control option.

Figure 34.9. Scouring rush is persistent weed in wet areas that are not tilled. (Photo, Michael Moechnig, SDSU)

Field horsetail

Field horsetail *(Equisetum arvense)* (Fig. 34.10) is a perennial weed that is most common in wet areas of no-till fields. It is similar to scouring rush, but it has whorls of leaf-like structures at the nodes and is often much shorter. Like scouring rush, field horsetail is nearly completely tolerant to glyphosate. Effective herbicide options are not well known. Crops with dense canopies, such as wheat, may suppress field horsetail, but this has not yet been verified.

Figure 34.10. Field horsetail is a perennial weed common in wet no-tillage fields. (Photo, Michael Moechnig, SDSU)

Summary

The diverse growth characteristics among the several weed species in any field may enable weeds to quickly adapt to management practices. Using only one method of weed control will quickly select for the weed species best adapted to that management method resulting in inconsistent control and increases in the weed seed bank. Multiple methods of weed control, including more than one herbicide site of action and good agronomic practices that optimize crop competitiveness and crop rotations that disrupt weed life cycles, and will contribute to effective and consistent weed control. In addition, fields must be closely monitored to identify changes in weed species composition so that management adjustments may be made before the weed seed bank increases.

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