



## WEED COMPETITION WITH SOYBEAN

### What You'll Learn...

- Weeds can reduce soybean yield by 1% per day if left uncontrolled after the V2 to V3 stage of soybean growth.<sup>2</sup>
- University research shows that weeds emerging with the crop should be removed by the V2 or V3 stage of soybean development, when weeds are less than 4 inches tall, to minimize yield loss due to weed competition.
- Using pre-emergence residual herbicides with a planned POST application is the best approach to avoid losses from early season weeds.

### The Critical Period for Weed Control

Successful integrated weed management systems require an understanding of crop and weed interactions. Weeds impact soybean yield potential by competing for limited light, water, and nutrient resources. Weeds and soybean can coexist during the early season without compromising yield potential, but once plants begin to increase in size, competition for resources begins.

The critical period for weed control (CPWC) is the time interval where it is necessary to maintain weed-free conditions to prevent an unacceptable reduction in yield potential. The CPWC represents the critical timing of weed removal and the minimum weed-free period after planting. The CPWC is influenced by weed morphology, emergence timing and duration of emergence, weed density, environmental conditions, the competitive characteristics of the crop, and system management. The critical period can range from the V1 to V6 stage of soybean growth, depending on row spacing, production area, and environmental conditions.<sup>1</sup>

Weeds emerging with the crop can cause the greatest reduction in yield potential (Table 1). Broadleaf weeds such as giant ragweed, sunflower, and cocklebur are more competitive with soybean than grass weeds (Table 2). University research shows that weeds emerging with the crop should be removed by the V2 or V3 stage of soybean development, when weeds are less than 4 inches tall, to minimize yield loss. Weeds can reduce soybean yield by 1% per day if left

uncontrolled after the V2 to V3 stage of soybean growth.<sup>2</sup>

### Factors That Affect Competition

Management practices and environmental conditions affect crop and weed competition. Early planting is recognized as a good practice but it may increase the CPWC because significant weed emergence may occur after planting.<sup>1</sup> However, very early planting, combined with reduced or no tillage, allows for greater weed competition, as well as for different species of weeds to be present. Weeds that are established at the time of crop emergence begin to compete with the crop earlier than weeds that emerge only after the crop emerges.<sup>3</sup>

Higher planting density and narrow row spacing can improve yield potential, crop competitiveness, and help reduce weed competition.<sup>4,5</sup> Later maturity soybean products with high yield potential for a production area can reduce losses due to weeds, particularly in narrow row, high plant density systems.<sup>6</sup>

Predicting the precise time of the CPWC is difficult and misinterpretation can lead to delayed post-emergence (POST) herbicide applications.<sup>7</sup> Using pre-emergence (PRE) residual herbicides plus a planned POST application is the best approach to avoid losses from early season weeds and help protect soybean yield potential.

**Table 1. Relative emergence sequence of selected weeds.**

Winter annuals	Prior to planting	Around planting	After planting
Marestail	Kochia	C. ragweed	Waterhemp spp.
Biennial thistles	Russian thistle	Wild buckwheat	Palmer amaranth
Field pennycress	Common lambsquarters	Velvetleaf	Black nightshade
Shepherd's purse	Giant ragweed	Foxtail spp.	Large crabgrass
White cockle	Smartweed spp.	Pigweed spp.	Wild proso millet
Downy brome	Sunflower	Cocklebur	Fall panicum
Wild carrot	Hairy nightshade	Field sandbur	Morningglories
Dandelion (seed)	Dandelion	Canada thistle	Jerusalem artichoke
	Foxtail barley	Yellow nutsedge	

Source: Buhler, D.D., Hartzler, R.G., Forcella, F., Gunsolus, J.L. 1997. Relative emergence sequence for weeds of corn and soybeans. PM 9. Iowa State University.



## WEED COMPETITION WITH SOYBEAN (CONTINUED)

PRE herbicides can provide control of resistant weeds and allow for more flexible POST application timing.<sup>8</sup> Including soil residual herbicides in POST tank mixtures can help control late emerging weeds such as waterhemp or Palmer amaranth.

Weed competition with soybean can cause substantial reductions in yield potential (Table 3). Knowledge of the weed species in a field and the competitiveness, emergence pattern, and density of the weed community can be used to develop effective herbicide programs and other management practices to minimize yield potential losses, herbicide resistance, and contain aggressive weed species. Visit [www.roundupreadyPLUS.com](http://www.roundupreadyPLUS.com) for solutions and recommendations.

Weeds that germinate and emerge with soybeans usually compete well with soybeans. Nearly complete weed

control is needed during the first weeks after soybean emergence to avoid yield potential losses due to early emerging weeds. Soybeans are susceptible to shading by weeds and weeds compete with soybeans for nutrients and water. Soybeans are especially sensitive to moisture deficiencies in late summer and even a few large weeds left in the field can severely reduce yield potential.<sup>9</sup>

Sources: <sup>1</sup> Knezevic, S.Z., Evans, S.P., Blankenship, E.E., Van Acker, R.C., and Lindquist, J.L. 2002. Critical period for weed control: The concept and data analysis. <sup>2</sup> Hartzler, R. 2003. Is your weed management program reducing your economic return? Iowa State University. <sup>3</sup> Hager, A., and Wax, L. 1998. Weed/Crop competition: Factors to consider. The Bulletin. University of Illinois. <sup>4</sup> Harder, D.B., Sprague, C.L., and Renner, K.A. 2007. Effect of soybean row width and population on weeds, crop yield, and economic return. Weed Technology, 21(3):744-752. <sup>5</sup> Hock, S.M., Knezevic, S.Z., Martin, A.R., and Lindquist, J. L. 2006. Soybean row spacing and weed emergence time influence weed competitiveness and competitive indices. Weed Science, 54(1):38-46. <sup>6</sup> Nordby, D.E. Alderks, D.L., and Nafziger, E.D. 2007. Competitiveness with weeds of soybean cultivars with different maturity and canopy width characteristics. Weed Technology 2007 21:1082-1088. <sup>7</sup> Fickett, N.D., Boerboom, C.M., and Stollenberg, D.E. 2013. Soybean yield loss potential associated with early-season weed competition across 64 site-years. Weed Science, 61(3):500-507. <sup>8</sup> Hartzler, R.G. 2006. Role of preemergence herbicides in Roundup Ready® crops. Part I and II. Iowa State University. <sup>9</sup> Gunzulus, J.L. Weed control in soybeans. University of Minnesota.

**Table 2. Competitive indices of weed species in Missouri.**

Weed	Competitive index
Giant foxtail	3.0
Fall panicum	1.5
Shattercane	3.5
Common cocklebur	5.5
Hemp dogbane	1.0
Morningglories	5.5
Common ragweed	1.5
Giant ragweed	8.0
Common sunflower	10.0
Velvetleaf	4.2
Waterhemp	2.5

Adapted from Practical weed science for the field scout: Corn and soybean. University of Missouri.

**Table 3. Approximate yield loss from annual weed competition with soybean in the unifoliate stage of growth with a yield potential of 50 bu/acre.**

Weed Species (height in inches)	Weed density category and % yield loss potential					
	Very low 0 to 1%	Low 1 to 2.5%	Moderate 2.5 to 5%	Intermediate 5 to 10%	High 10 to 20%	Very high 20 to 30%
	Weed density per 100 square feet					
Giant foxtail (2-4)	2	5	10	20	40	60
Shattercane (< 6)	1	2	3	7	15	22
Waterhemp (2-4)	1	2	4	8	16	25
Velvetleaf (2-4)	1	1.5	2	4	10	15
Morningglory (1-2)	1	1.5	2	4	10	14
Cocklebur (2-4)	1.5	1	2	4	8	11
Approximate yield loss by 1 species	0.5 bu/acre	2 bu/acre	3 bu/acre	6 bu/acre	13 bu/acre	18 bu/acre
Approximate yield loss by all species	6 bu/acre	11 bu/acre	17 bu/acre	25 bu/acre	32 bu/acre	34 bu/acre

Adapted from Practical weed science for the field scout: Corn and soybean. University of Missouri.

This document is intended to provide information about this weed and guidelines for control. As a tough-to-control weed, knowledge about the biology and weed control programs will help in their management. For additional information, contact your local seed representative. Developed in partnership with Technology Development & Agronomy by Monsanto.

**Individual results may vary**, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

**ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Tank mixtures:** The applicable labeling for each product must be in the possession of the user at the time of application. Follow applicable use instructions, including application rates, precautions and restrictions of each product used in the tank mixture. Monsanto has not tested all tank mix product formulations for compatibility or performance other than specifically listed by brand name. Always predetermine the compatibility of tank mixtures by mixing small proportional quantities in advance. Roundup Ready PLUS® is a registered trademark of Monsanto Technology LLC. All other trademarks are the property of their respective owners. ©2017 Monsanto Company. 140829140352 102417AMH