ROUNDUP READY PLUS®
WEED MANAGEMENT SOLUTIONS

Burndown and Early Season Weed Control

What You'll Learn...

- Early emerging weeds cause potentially significant yield loss, averaging 3 bu/acre/day in corn and 1% per day in soybean
- Burndown herbicide applications are an essential part of weed management in corn and soybean
- Environmental conditions affect herbicide performance, weed susceptibility to herbicides, and crop development
- Sequential herbicide applications combining different modes of action, foliar, and residual activity provide the most effective weed management plans

Importance of Early Weed Control

Weeds emerging prior to or at planting are the most competitive with corn and soybean. A significant portion of yield is at risk if early emerging weeds are allowed to compete with corn and soybean crops during the first 4 weeks after planting. The timing and intensity of weed emergence determines which species will be the most competitive with the crop. The emergence patterns of different species remain relatively consistent between species, but weed emergence profiles may vary from year to year depending upon environmental conditions, crop planting dates, and other management practices (Table 1). The unique emergence profile for each weed species is defined by the initial emergence date, the duration of emergence, and the distribution of emergence within this time period. The presence of early emerging weeds generates several questions pivotal to good weed management:

- Will a burndown application need multiple herbicides including a residual?
- Will the residual persist long enough before a post-emergence application can be made?
- What herbicide modes of action and residual activity will be needed to control weed escapes and late emerging weeds?

The emergence profiles of weeds in a field significantly affect the performance of weed management programs and should be a major consideration for planning.

In addition to starting with a clean field, removing weeds after planting when weeds are less than 4 inches tall is necessary to preserve yield potential. Research at the Universities of Minnesota and Wisconsin shows an average of 3 bushel per day of yield potential is at risk for every day 3 to 4 inch weeds are left uncontrolled after V3 to V4 stage corn.[1] University research shows that weeds emerging with the crop should be removed by the V2 or V3 stage of soybean development, when weeds are typically 3 to 6 inches tall, to help prevent yield loss. Weeds can reduce soybean yield by 1% per day if left uncontrolled after the V2 to V3 stage of soybean development.[2]

Table 1. Relative emergence sequence of weeds

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

Source: Buhler, D. D. et. al. 1997. Relative Emergence Sequence for Weeds of Corn and Soybeans. Pest Management Fact Sheet 9. Iowa State University.

Burndown Applications

Starting with clean fields at planting is an essential step for proper weed management in corn and soybean. Preplant burndown tank mixtures remove early weed infestations and provide broad spectrum foliar and residual weed control. Dicamba or 2, 4 - D may be required in burndown tank mixtures for tough to control weeds. Both products have planting interval restrictions of a week or more between application and the planting of corn or soybean. Dry soil may limit herbicide degradation and require a longer waiting period. Consult individual product labels for precise instructions.

A burndown plus residual herbicide tank mix, or tillage, may be required to remove early weed infestations. Be aware that the residual herbicide component of the burndown tank mix, applied several weeks prior to planting, may not last long enough to provide adequate weed control. An earlier than normal early post herbicide application may be required. The early post application may need a residual

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component to control late emerging weeds that impact yield potential.

Residual herbicides have planting interval or crop rotation restrictions and precautions that need consideration if conditions warrant a change in planting intentions. Consult individual product labels for precise instructions.

Tank mixed herbicides, with different modes of action, may cause antagonism that affects performance. For example, a fast acting contact herbicide can interfere with the uptake and translocation of a systemic herbicide by quickly shutting down weed growth. Higher use rates, ammonium sulfate, or adjuvants can help overcome antagonism. Fertilizer components and higher preplant spray volumes may also reduce herbicide activity, requiring higher herbicide use rates.

Environmental Factors

Environmental conditions affect the rate of weed growth, crop development, crop tolerance to herbicides, and herbicide performance. Fluctuating day and night temperatures are typical in the spring. The efficacy of a burndown herbicide application can be reduced by cold temperatures. It is recommended to wait on applying herbicides until nighttime temperatures are above 40°F and daytime temperatures are in the high 50's to low 60's.[1] Weed control may be even more effective if there are several days of warmer weather prior to herbicide applications rather than applying on the first warm day of the season.

Low overnight temperatures and slow warming during the day can reduce the rate of weed development. Seedling weeds tend to be more susceptible to soil-applied herbicides under cool conditions because plant emergence is delayed and metabolism is slowed. Slower weed growth caused by heat, drought, or cold also affects herbicide uptake, translocation, and metabolism that may reduce performance of post applied herbicides. Most herbicide labels contain statements regarding environmental influences on herbicide performance. Ammonium sulfate (AMS) has been shown to be an effective additive to condition hard water by deactivating antagonist salts (iron, zinc, calcium, magnesium, sodium, potassium[4]), prevent the binding of herbicides to soil particles on leaf surfaces, and improve foliar uptake. The best way to limit problems related to warm, dry, or adverse conditions is timely application to small weeds rather than equipment adjustments.[3] Usually, postponing herbicide application is risky because changing weather conditions may delay application until weeds exceed optimum size for good herbicide performance.

Treatment Recommendations

Scout fields and control weeds throughout the season. Proper application timing that helps protect yield potential, ensures correct use rate for weed size, and considers the impact of environmental conditions on performance.

Weed management tactics for tough - to- control weeds such as marestail, giant ragweed, kochia, lambsquarters, *Amaranthus* species, and others can be found at http://www.roundupreadyPLUS.com.

Table 2. Recommendations for Roundup WeatherMAX® or Roundup PowerMAX® tank mixtures in corn and soybean.

Practice	Products[3]
Corn Burndown	dicamba or 2,4-D
Corn Preplant or PRE[1]	Harness® Brands, Degree Xtra®, or TripleFLEX® Herbicide
Corn POST 1 or 2	Impact® or other POST herbicides
Soybean Burndown	dicamba or 2,4-D
Soybean Preplant or PRE	Warrant® Herbicide, Fierce®, Valor®, Valor® XLT, Gangster®, Authority® Assist, Authority® First, Authority® MAXX, Authority® MTZ, or Authority® XL
Soybean POST 1[2]	Warrant® Herbicide
Soybean POST 2	Warrant® Herbicide + Cobra® or fomesafen

Always refer to product labels for use rates, application guidelines, and rotational crop restrictions.
[1] PRE herbicides may also include other herbicides based on local weeds and preferences.
[2] Tank mix Select® or Select Max® if volunteer corn is present.
[3] Crop and weed specific recommendations http://www.roundupreadyPLUS.com.

Sources: [1] Pocock, J. 2011. 5 Tips For Corn Weed Management | Start With a Clean Field – Then Control Weeds Early as They Reach 4 Inches. Corn and Soybean Digest. [2] Hartzler, R. 2003. Is Your Weed Management Program Reducing Your Economic Return? Iowa State University Weed Science online www.weeds.iastate.edu (verified 12/09/2013). [3] Hartzler, R. 2006. Understanding Glyphosate to Increase Performance. www.ces.purdue.edu (verified 12/09/2013). [4] Nalewaja, J.D. and R. Matysiak. 1991. Salt antagonism of glyphosate. Weed Science 39: 622-629.