Field Reference Guide

Roundup Ready®
SUGARBEETS

Roundup Ready® Sugarbeet

varieties contain in-plant tolerance to Roundup® agricultural herbicides for unsurpassed broad-spectrum weed control and excellent crop safety at all growth stages. Roundup WeatherMAX® and Roundup PowerMAX™ can be applied from planting up to 30 days prior to harvest. In addition to the wide application window, Roundup agricultural herbicides have no carryover or crop rotation restrictions and work without soil incorporation. Roundup agricultural herbicide formulations are manufactured to exact standards and tested over the top of Roundup Ready sugarbeets to ensure crop safety.

Weed competition can dramatically reduce sugarbeet root yield, and yield loss thresholds for competitive weeds can be surprisingly low, as shown in the chart below.

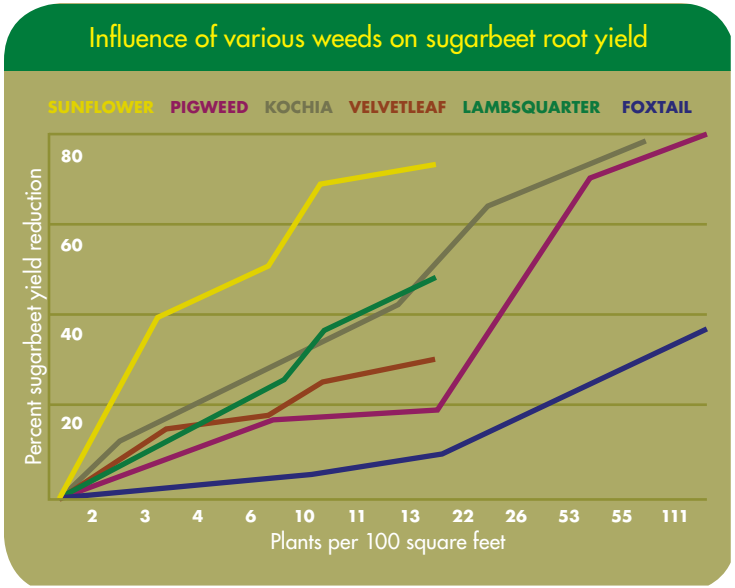


Figure 1. Wilson, Robert G., Stephen D. Miller, and Scott J. Nissen. "Influence of various weeds on sugarbeet root yield." Chart. Sugarbeet Production Guide. Lincoln: University of Nebraska, 2007.

Even a few weeds left in the field can reduce sugarbeet yield. Weeds compete with sugarbeets for resources — water, nutrients and light — and, by outcompeting young seedlings, may lead to stunted plants and thinner stands.

Weed size and height

Weeds that grow larger than the crop are typically more competitive. By robbing sugarbeets of light and nutrients, these weeds can severely impact sugarbeet yield and sugar content.

Density of the weed infestation

As seen in Figure 1, common weeds can impact sugarbeet productivity at different densities.

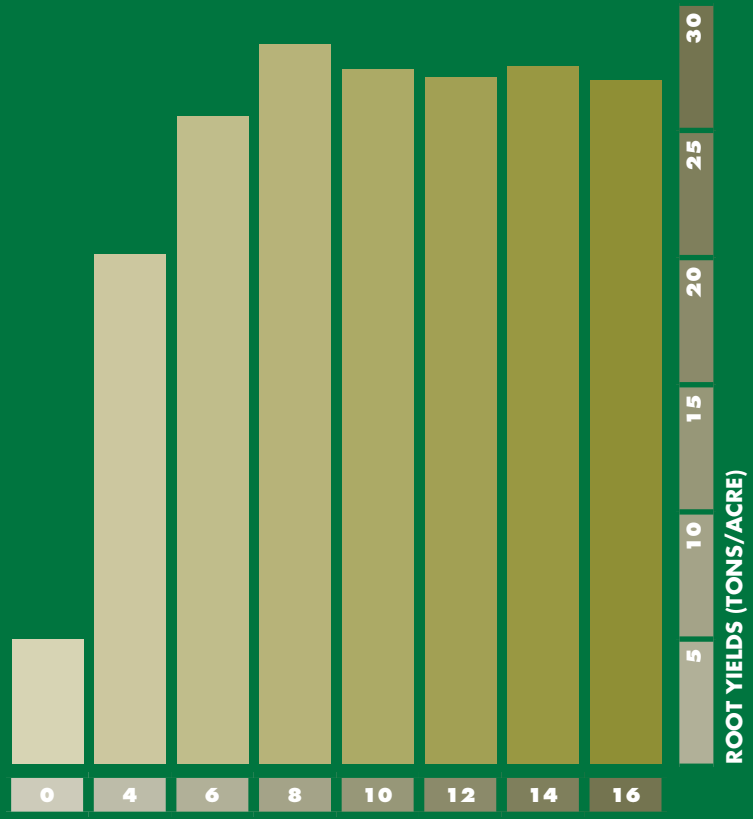
Duration of weed competition

The longer weeds remain in the field, the greater the impact on sugarbeet yields (see Figure 2). Therefore, it is vital to maintain a weed-free period after emergence to preserve yield potential.

Time of weed emergence vs. crop emergence

Weeds that emerge prior to or with sugarbeets cause greater yield losses than those emerging after the crop is established and better able to compete with weeds.

Impact of weed-free weeks after planting on sugarbeet root yields



Research indicates weeds have the greatest impact on sugarbeet yield in the six weeks following planting.

Figure 2. Wilson, Robert G., Stephen D. Miller, and Scott J. Nissen. "Influence of various time periods on sugarbeet root yield." Chart. Sugarbeet Production Guide. Lincoln: University of Nebraska, 2007

Sugarbeet seedlings are extremely vulnerable to weed competition during stand establishment. As a general rule, remember:

To limit weed competition, it is critical to control weeds when they are small, never permitting them to exceed the height of the sugarbeet crop. To get your Roundup Ready sugarbeet crop off to the best start – **just remember 2·2·22.** When you see either 2-inch weeds OR 2-leaf sugarbeets, it's time for a broadcast application of a minimum of 22 oz. per acre of Roundup WeatherMAX® or Roundup PowerMAX™. However, when timely applications cannot be made and weeds become large and/or weed populations are severe, the application rate of Roundup agricultural herbicide can be increased to 32 oz./acre. **Subsequent applications should be made before weeds reach 4 inches in height.** The following two charts illustrate the recommended rates and timings for applications:

Label Rates and Application Timings	
Application Timing	**Maximum Rate**
Combined total for all application timings	**5.3** Qt./Acre
Preplant, at planting, preemergence applications	**3.3** Qt./Acre
Emergence to 8-leaf — up to 32 oz./acre application	**56** Oz./Acre
Between 8-leaf and canopy closure — 22 oz./acre per application	**44** Oz./Acre

Figure 3. Total in-crop applications cannot exceed 3 quarts (96 oz.)/acre. Always read and follow pesticide label directions.

Key Recommendations

Sprayer preparation

- Sprayers can contain pesticide residue from previous applications.
- Thoroughly clean all equipment – including tanks, lines and screens – prior to use.
- For specific information on proper sprayer cleaning, refer to the appropriate pesticide labels.
- You may also consider dedicating a sprayer solely for Roundup agricultural herbicides if spraying 2,4-D or dicamba on your farm.

Sprayer setup and nozzle selection

With Roundup agricultural herbicides, the goal is to deliver the maximum amount of spray solution to the weed target. The following guidelines will help you

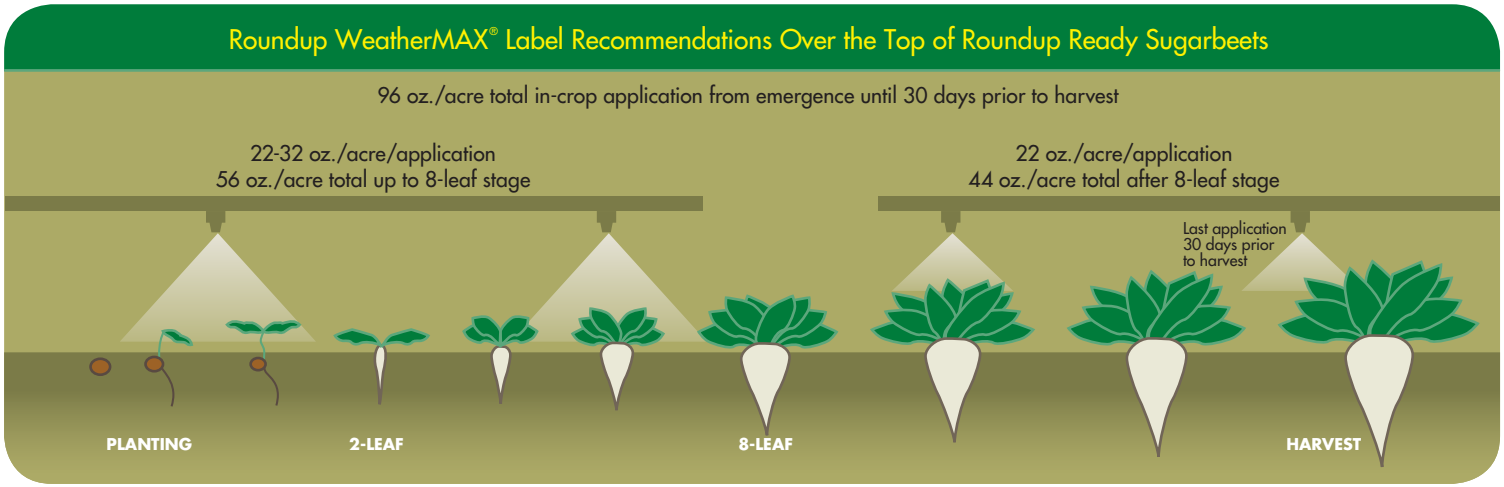


Figure 4. Label rates and recommendations apply to Roundup WeatherMAX and Roundup PowerMAX. Always read and follow pesticide label directions.

achieve that goal when selecting spray nozzles, applicator speed, boom height and nozzle spacing.

- For best coverage and minimized drift, select nozzle configurations that deliver 10 to 15 gallons/acre with medium to coarse droplets at pressures between 25 and 40 psi at speeds below 12 mph.
- Consider low-drift, flat-fan nozzles for Roundup agricultural herbicide applications.
- Avoid flood-type nozzles, as their spray pattern can be inconsistent and result in weeds not receiving adequate spray coverage.
- Avoid applicator speeds in excess of 12 mph, as higher speeds can create a "vortex effect" and may disturb the spray pattern.
- Adjust nozzle spacing and sprayer boom height to provide maximum coverage with minimal overlap and to minimize the potential for drift and aerial spray droplet evaporation.

Tank mixtures

Improper or unlabeled tank mixtures of fertilizers and pesticides with Roundup agricultural herbicides can negatively impact weed control, cause crop injury or reduce pest control in Roundup Ready sugarbeets. Use the following recommendations to achieve the best results, and consult Roundup herbicide labels for more information on tank mixtures with other herbicides.

- Tank mixtures of Roundup agricultural herbicides with fungicides, insecticides, micronutrients or other foliar fertilizers are not recommended and not supported on product labels.
- Roundup agricultural herbicides do not require additional surfactants, buffering or pH adjusting agents – although additional surfactant may be added to Roundup PowerMAX.
- Where hard water and stressful growing conditions are encountered, ammonium sulfate (17 lbs./100 gallons) should be added to the water before the addition of the Roundup brand herbicide. AMS may enhance the performance of Roundup agricultural herbicides in such conditions.
- Glyphosate, the active ingredient in Roundup agricultural herbicides, can be bound by positively charged cations, such as iron and calcium, dissolved in hard water, making less herbicide available in the spray solution. If less herbicide is available in the spray solution, weed control can be adversely impacted.

Broadcast versus banded applications

Broadcast applications are recommended over banded applications because they target weeds within and between rows in a single pass. Weeds left between rows can compete with sugarbeets until cultivation or furrow establishment operations are performed. Although weeds between rows can be removed by cultivation, this approach requires an additional equipment trip and disturbs the soil, bringing weed seed to the surface and often resulting in subsequent weed flushes.

Managing tough conditions

Whether from mechanical operations, dust storms or weather, dust settling on weeds can compromise the effectiveness of weed-control products like Roundup agricultural herbicides.

- Ground applications made shortly after irrigation may reduce airborne dust.
- Slower ground application speed can help reduce dust kicked up by the applicator.
- For subsequent applications, consider shifting applicator travel path to target weeds remaining in the wheel path from prior application passes.

Drought and cold weather

Roundup brand agricultural herbicides perform best on actively growing weeds. Weeds under conditions of stress like drought are not actively growing. Also, drought stress can cause weeds to increase their cuticular or waxy layer, which can slow or reduce the amount of herbicide absorbed by the weed.

- Weed growth is typically slowed when temperatures are less than 55° Fahrenheit.
- Cooler temperatures can reduce the amount of herbicide absorbed by the weeds.
- Cooler temperatures can slow the translocation of herbicide throughout the weed's vascular tissues.

When tough conditions exist, it is critical to consider:

- Proper use rate – application up to 32 oz./acre through the 8-leaf stage.
- The addition of AMS where hard-water conditions exist.
- The addition of non-ionic surfactant may improve the performance of Roundup PowerMAX.
- Taking measures to improve coverage like choosing the proper spray nozzles and a slower applicator speed.

Managing wind and drift

Non-target crop protection chemical drift is never desirable. The potential for drift is reduced at lower wind speed and applicator speeds.

- Applications should be made when wind speeds are lowest. These times are typically the early morning and evening hours.
- Applicator speed should be kept between 2 and 10 mph.

Special note on temperature inversions

Temperature inversions occur when air temperatures near the ground are lower than the air above, typically in the morning or late evening. Applications should be avoided during such events or when wind speeds are less than 2 mph, due to the potential for variable direction in wind movement and increased drift.

Managing your cultivation schedule

Disturbing the soil surface by cultivation or other tillage methods can promote new weed flushes as buried seed is brought to the surface. If you plan to cultivate, consider the following before making your last planned herbicide application.

- Cultivation should be delayed a minimum of three days after applying Roundup agricultural herbicides to allow the herbicide to be translocated throughout the treated weeds.
- Injured weeds may not absorb and translocate Roundup agricultural herbicides as effectively.

Allow weeds to recover after cultivation before applying Roundup agricultural herbicides.

- If there are plans to cultivate to define rows for harvest or create irrigation ditches, consider conducting these tillage operations prior to making your last herbicide application. This will allow weeds to germinate before the last planned herbicide application.

Managing temperature and humidity

Higher temperature and low humidity can reduce weed-control efficacy or cause non-target drift. To maximize performance, consider these practices:

- Spray-droplet evaporation may be reduced by spraying early in the morning when humidity is higher.
- You can also set the sprayer to produce larger droplets to reduce the potential for evaporation and drift to non-target plants.
- Air temperatures should be 85° F or lower.
- Spraying after sunset should be avoided because of the potential for reduced efficacy.

Managing the risk of developing glyphosate-resistant weeds

Follow the guidelines below to minimize the risk of developing glyphosate-resistant weed populations in a Roundup Ready sugarbeet system.

- Start clean with tillage and follow up with a burndown herbicide, such as Roundup® agricultural herbicides, if needed prior to planting.
- Early-season weed control is critical to protect sugarbeet yield potential. Apply the first in-crop application of Roundup WeatherMAX® at a minimum of 22 oz./acre while weeds are less than 2 inches in height.
- Follow with an additional postemergence in-crop application of Roundup WeatherMAX at a minimum of 22 oz./acre for additional weed flushes before they exceed 4 inches in height.
- Add spray grade ammonium sulfate at a rate of 17 lbs./100 gallons of spray solution with Roundup agricultural herbicides to maximize product performance.
- Use mechanical weed control/cultivation and/or residual herbicides where appropriate in your Roundup Ready sugarbeets.
- Use additional herbicide modes of action/ residual herbicides and/or mechanical weed control in other Roundup Ready crops you rotate with Roundup Ready sugarbeets.

Help prevent glyphosate resistance. Contact Monsanto or your local retailer if you experience repeated non-performance.

Additional Resources

Sugar Industry Biotech Council
www.sugarindustrybiotechcouncil.org

Sugarbeet Weed Resistance Education Module
www.sugarindustrybiotechcouncil.org/learning-module

Weed Resistance Web Site
www.weedscience.org

Beet Sugar Development Foundation
www.bsdf-assbt.org

Sugarbeet Research and Education Board of North Dakota and Minnesota
www.sbreb.org

Michigan State Bean and Beet Web Site
http://www.maes.msu.edu/ressta/saginawvalley/beet1.html

University of Nebraska Sugarbeet Resources
www.panhandle.unl.edu/sugarbeets/sugarbeets.htm

Weed Resistance Management
www.weedresistancemanagement.com