
Palmer Amaranth Control in Soybean: 2009 Efficacy Experiments

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Palmer amaranth (*Amaranthus palmeri* S. Wats.) is a member of the Amaranthaceae or pigweed family. It is also known as carelessnessweed or palmer pigweed. It is an erect, branched summer annual that can grow to over seven feet tall and emerge throughout the growing season. Four palmer amaranth plants per 100 ft² can reduce yields by 12 to 15%, making it the most competitive of pigweeds found in row crops. Plants have either male flowers that shed pollen or female flowers that can produce up to 600,000 seed per plant.

In Virginia, Palmer amaranth has only been documented in 13 counties, but will likely enlarge its territory. Its spread can be rapid because of custom harvesting, failing to clean vehicles and equipment after exiting infested fields, and failing to hand remove escapes. More troublesome is that extensive use of herbicides has led to resistance to glyphosate and ALS-inhibiting herbicides. In Virginia, populations of ALS-inhibiting herbicide resistant Palmer amaranth have been confirmed and glyphosate-resistant Palmer amaranth is suspected. Because of the weed's rapid spread and its tendency to develop resistance to herbicides, experiments were conducted to evaluate the efficacy of herbicides and herbicide programs in a Greensville County field where glyphosate did not give adequate control in 2008. This publication summarizes those experiments.

Site Description and Experimental Methods

Experiments were established in Greensville County, VA in a Palmer amaranth infested field where control with glyphosate was poor in 2008. Half of the field was planted to Roundup-Ready® soybean (Southern States variety RT 5760N) and the other half was planted to Liberty-Link® soybean (Southern States variety LL 499N) (Fig. 1). Roundup-Ready® soybean have been genetically engineered to tolerate glyphosate herbicide and Liberty-Link® soybean have been genetically engineered to tolerate glufosinate herbicide. The entire field received an application of glyphosate at 32 oz per acre in early May to control emerged weeds. Soybean was planted on May 27 in 15-inch rows. Herbicide treatments were applied with a CO² unicycle sprayer traveling at 3 miles per hour and using 80015 flat fan spray tips at 15 gallons per acre and 32 pounds per square inch of operating pressure. Application timings and dates are shown on Figures 1 through 5. The first postemergence (POST) herbicide application was made to 0.5 to 3.0 inch tall Palmer amaranth plants. Several weed species were present, but only Palmer amaranth control ratings are presented.

Control in Roundup-Ready® Soybean

The 1 and 3 weeks after planting (WAP), glyphosate (Roundup WeatherMAX®) applications did not control all Palmer amaranth plants (Fig. 1). Therefore at 5 weeks after planting (WAP), an additional 44 oz/acre of Roundup WeatherMAX® was applied to those plots. Even after a total of 88 oz/A of Roundup WeatherMAX® were applied, Palmer amaranth control only approached 80% (Fig. 2a).

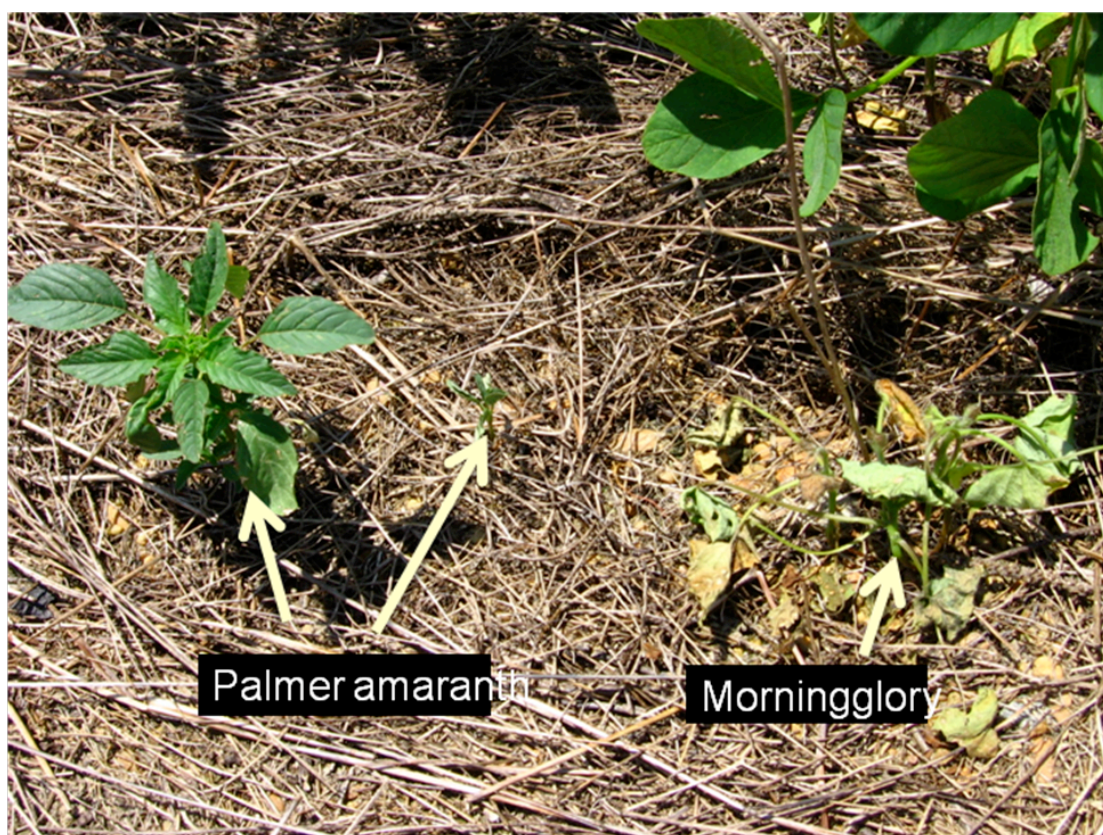


FIGURE 1. Weed control after two glyphosate applications. Plots were sprayed with 22 oz of Roundup Weathermax® herbicide at 1 and 3 WAP, Greensville County, 2009.

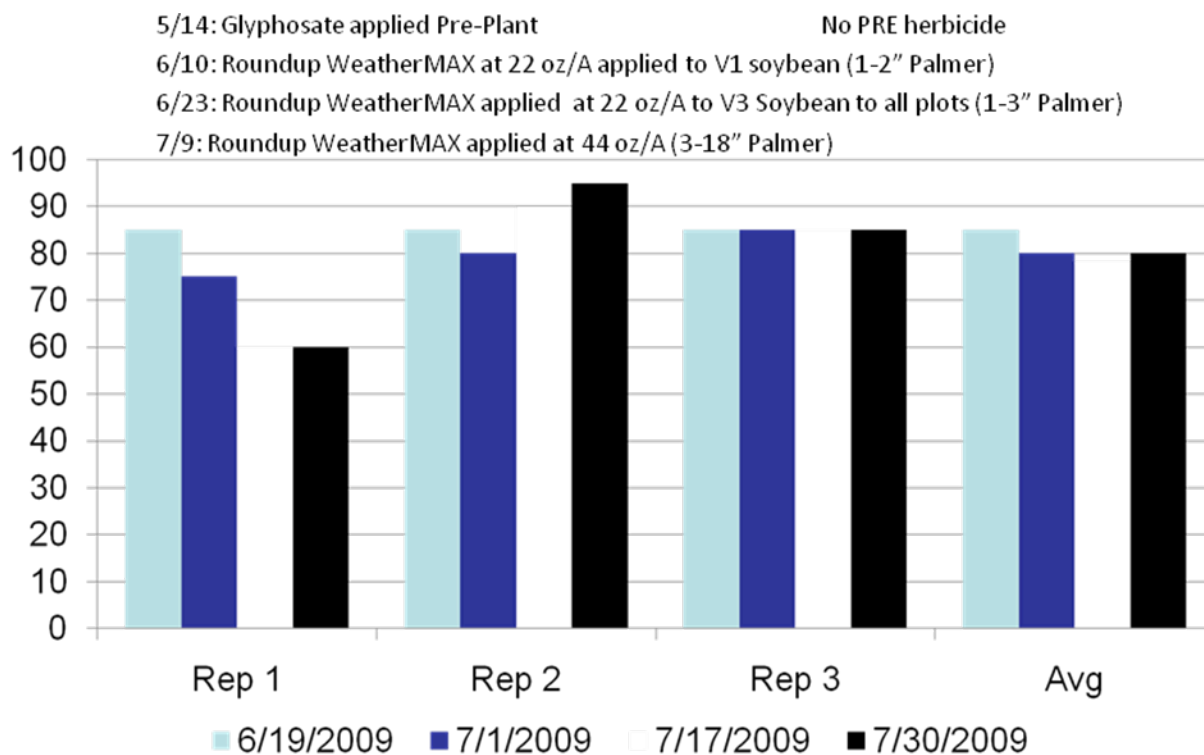
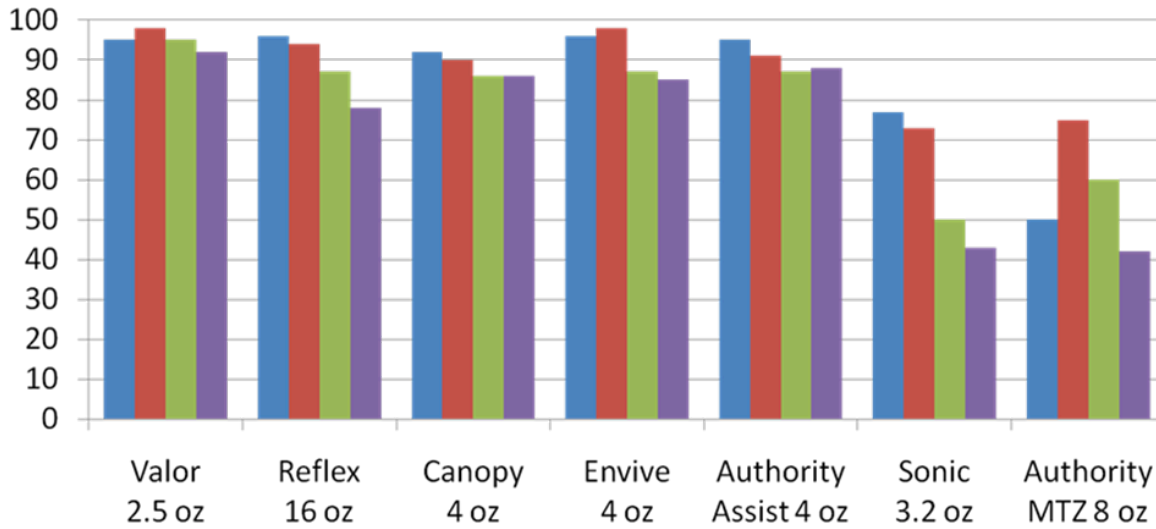
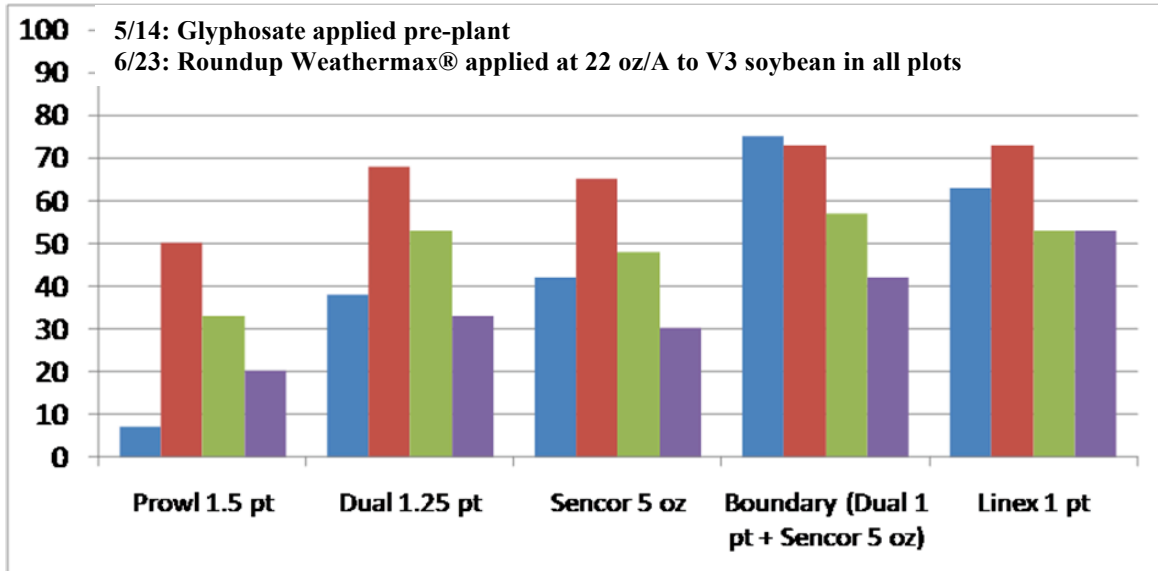


FIGURE 2a. Percent Palmer amaranth control in Roundup-Ready Soybean, Greenville County, 2009. Photos were taken 1 week after second Roundup WeatherMAX® application.

The inclusion of preemergence (PRE) herbicides improved control with glyphosate (Fig. 2b). Initial control of Palmer amaranth exceeded 90% when the following PRE herbicides were used in combination with a POST glyphosate application: Valor, Reflex, Canopy, Envive, and Authority Assist. However, control declined over time for most treatments. Only the treatment including Valor was able to maintain season-long control above 90%.



Rating Date: ■ 6/19/2009 ■ 7/1/2009 ■ 7/17/2009 ■ 7/30/2009

FIGURE 2b. Effect of preemergence herbicides on control with glyphosate on percent Palmer amaranth control in Roundup-Ready® soybean, Greenville County, 2009. All preemergence herbicides included Gramoxone Inteon for burndown.

Of the early POST glyphosate combinations, only Extreme (glyphosate + imazethapyr) applied 3 WAP provided greater than 90% control throughout the season; but was no better than 4 oz/A of Pursuit (Fig. 2c). The addition of 12 oz/A of Reflex provided over 80% season-long control and the addition of 0.375 oz/A of Synchrony provided greater than 70% control. An additional POST application may have improved control, but the objective of this experiment was to determine any residual effects of the POST herbicide treatments.

5/14: Glyphosate applied Pre-Plant

6/10: Roundup WeatherMAX applied to V3 Soybean in tank-mix with below treatments (1-2" Palmer)

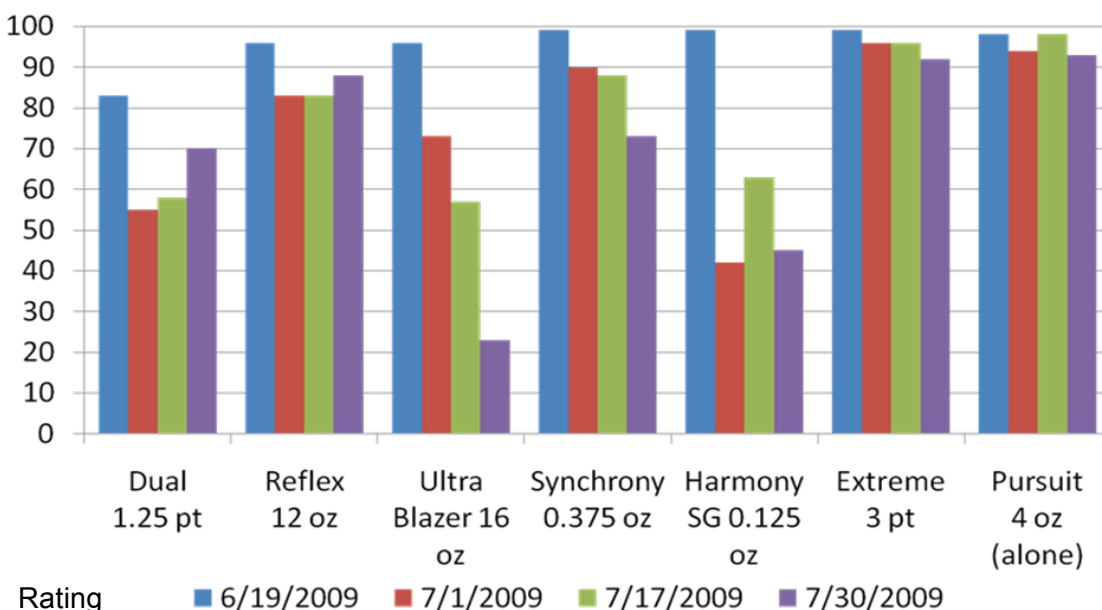


FIGURE 2C. Percent control of palmer amaranth with postemergence glyphosate tank-mixes in Roundup-Ready[®] soybean. Greenville County, 2009.

Control with Sharpen[®] Herbicide in Roundup-Ready[®] Soybean

Sharpen[®] is a new pre-plant herbicide that provides fast burndown of broadleaf weeds in a wide range of crops. Sharpen[®] applied PRE provided greater than 85% control of Palmer amaranth (Fig. 3). However, the addition of Scepter, Prowl, or Pursuit was required to maintain this control throughout the growing season

Control in Conventional Soybean

Conventional weed control programs giving greater than 90% season-long control included: Dual PRE followed by Reflex POST, Authority MTZ PRE followed by Reflex, Dual + Authority MTZ followed by Reflex, and Valor PRE followed by Synchrony POST (Fig. 4a and 4b). PRE combinations of Dual + Sencor or Linex, when followed by Reflex POST, gave greater than 80% control. The POST only approach (Reflex + Basagran + Fusion) did not provide adequate season-long control.

Control in Liberty-Link[®] Soybean

In Liberty-Link systems, excellent control of Palmer pigweed was obtained when glufosinate (Ignite 280[®]) was applied to 1-3" weeds (Fig. 5). Two applications of Ignite 280[®] at 22 oz/A at 1 and 5 WAP gave 95% or more control of Palmer amaranth. When a PRE herbicide was used, a 3 WAP application controlled all weeds present. The 5 WAP application added very little control to treatments that included a PRE herbicide and Ignite 280[®] at 3 WAP. One application of Ignite at 36 oz/A at 3 WAP provided only 80-90% control; Valor added little the season-long control with this treatment.

5/29: PRE's + Roundup PM 22 oz

6/23: Mid-POST (V3, 1-3" Palmer)

7/9: Late-POST (V7 soybean, 3-8" Palmer)

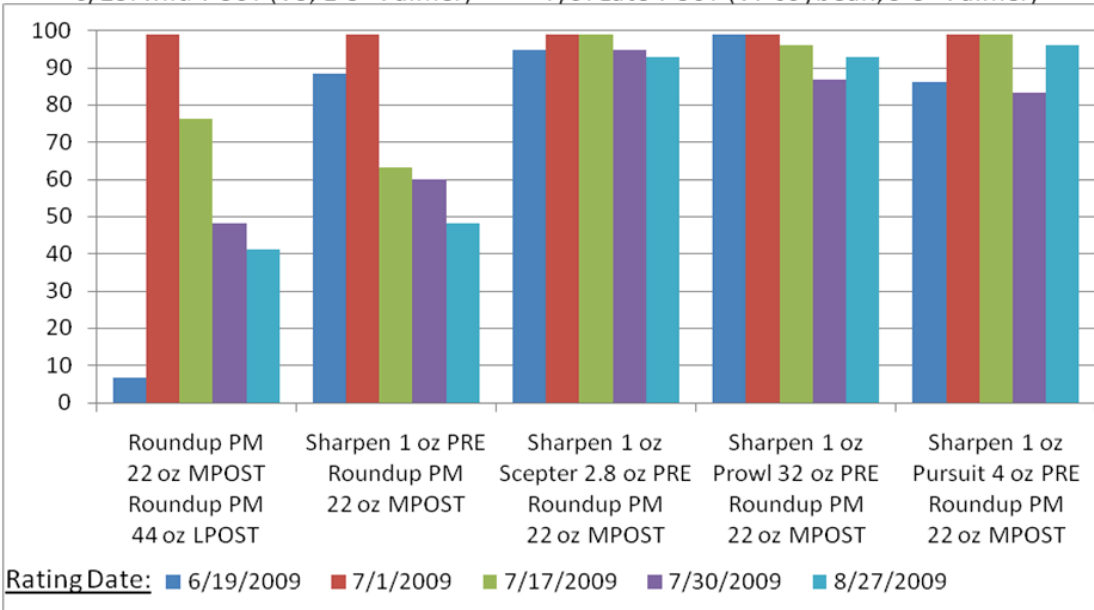


FIGURE 3. Percent control of Palmer amaranth in Roundup-Ready® soybean with preemergence Sharpen combinations, Greenville County, 2009. Photo taken 1 week after glyphosate application.

5/14: Roundup applied Pre-Plant 5/29: PRE's, including Gramoxone Inteon
 6/23: Postemergence herbicides applied to V3 Soybean (1-3" Palmer)

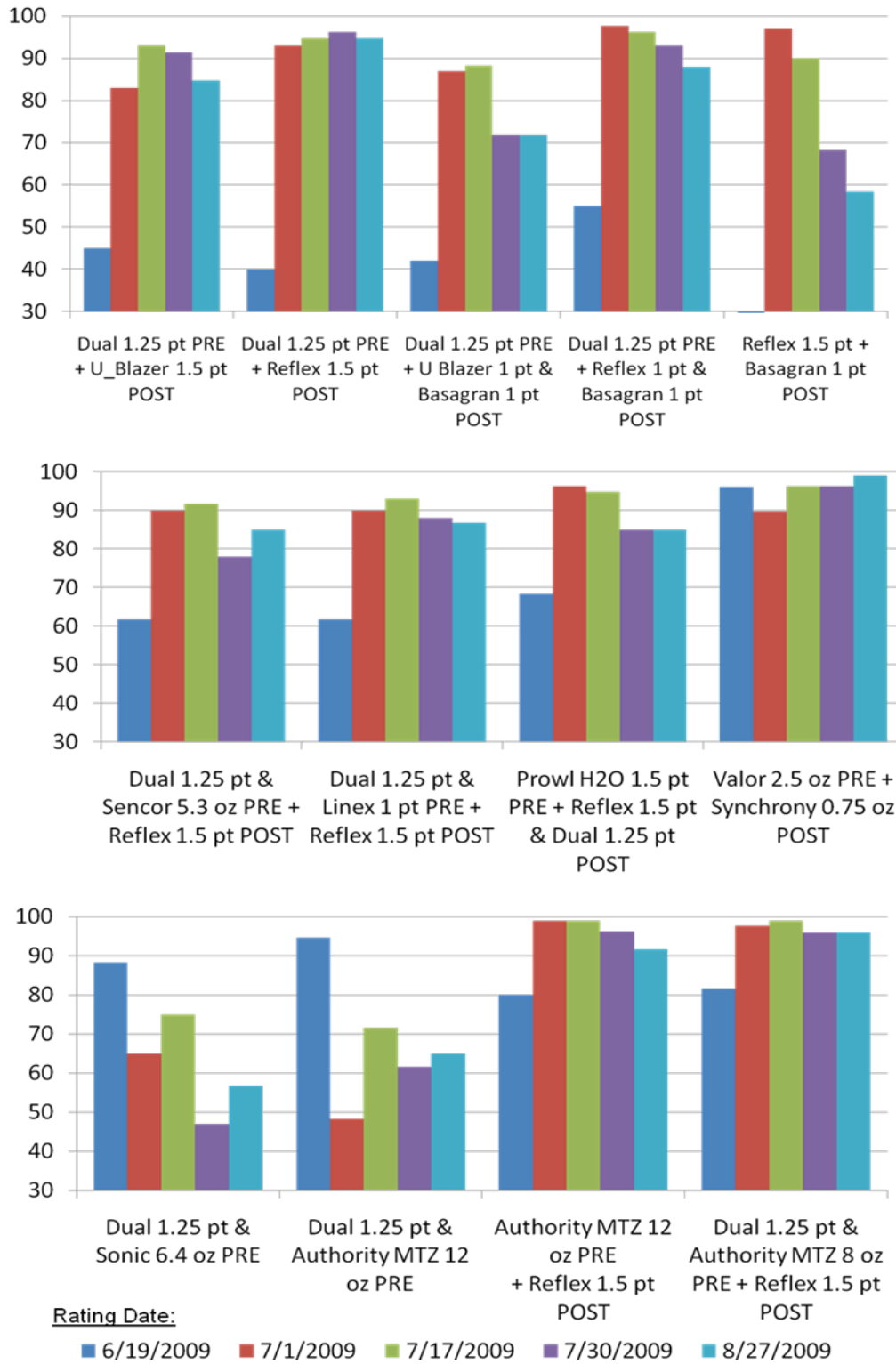


FIGURE 4a. Percent Palmer amaranth control in conventional soybean, Greenville County, 2009.

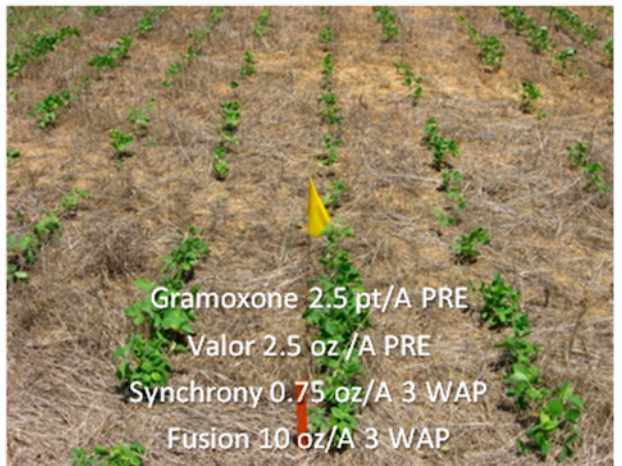
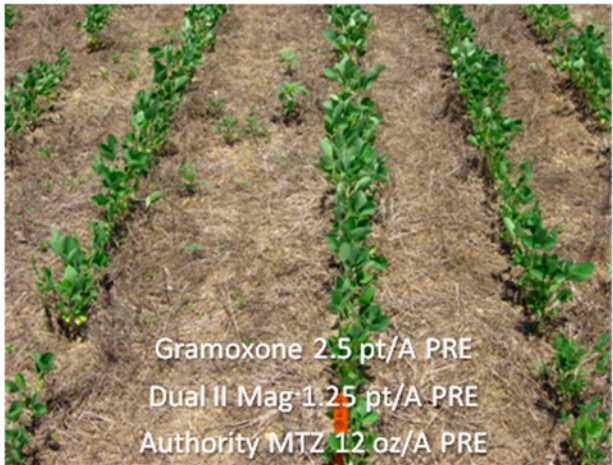


FIGURE 4b. Palmer amaranth control in conventional soybean. Photos were taken 1 week after postemergence application.

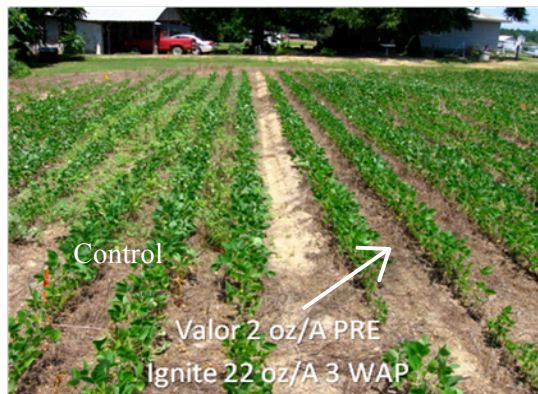
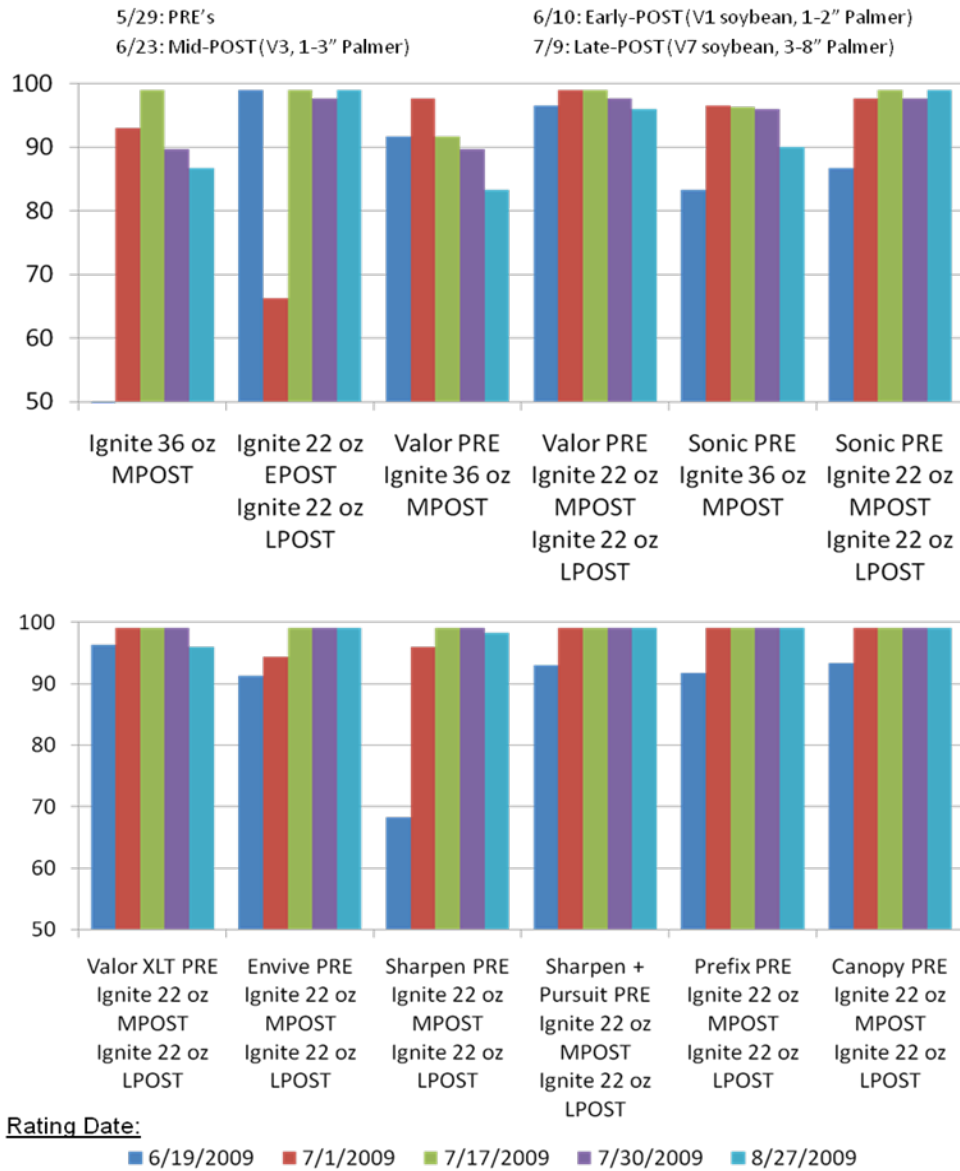


FIGURE 5. Percent Palmer amaranth control in Liberty-Link[®] soybean, Greenville County, 2009. Glyphosate was applied preplant for burndown. Photographs were taken 1 week after Ignite 280[®] herbicide application

Summary

At this location, glyphosate-resistant Palmer amaranth has developed and rendered a exclusively POST glyphosate weed control program ineffective. This scenario will likely be typical for most of Virginia where Roundup-Ready® soybean and cotton are the primary weed control system. Only with the inclusion of PRE herbicides will growers be able to continue to effectively control this weed in Roundup-Ready® systems. Several conventional soybean herbicide programs should be considered if faced with glyphosate resistant weeds. In this experiment, programs that included PRE herbicides followed by POST herbicides controlled over 90% of the weeds present. It must be emphasized that conventional POST herbicides must be applied to small weeds, 1 to 3 inches in height, to obtain acceptable control.

At this location, Liberty-Link® weed control programs gave the best control. The photograph on page 1 of this publication best illustrates these results. Glyphosate weed control programs were used in the left half of that photograph, while glufosinate-based programs were used in the right half. Using either a PRE herbicide followed by Ignite 280® or two postemergence applications of Ignite 280 were usually required for season-long control. Like conventional programs, it is necessary to apply Ignite 280® when the weeds are small (3 inches or less) to obtain the best control.

Acknowledgements

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