

Mix-Seeded Soybean as an Integrated Weed Management Tool in Roundup Ready Soybean

Jason Norsworthy
Dept. of Crop and Soil Environmental Science

Charlie Curtis
Dept. of Agricultural and Applied Economics

Problem Addressed

Weeds are the number one pests in South Carolina soybeans as perceived by growers. The introduction of Roundup Ready soybean has allowed producers the option of a total-postemergence weed control program using a single, broad-spectrum herbicide. However, the lack of residual control with glyphosate requires multiple applications or the use of a residual herbicide for season-long weed control. In 1999, multiple herbicide applications were applied to two-thirds of the South Carolina soybeans, resulting in a considerable weed control investment. Because early-season canopy closure gives soybean a competitive advantage over late-emerging weeds and increases herbicide effectiveness, soybean population may be increased, resulting in a more competitive crop with potential to reduce weed interference and glyphosate applications. This research looked at using an innovative, integrated weed management system that makes use of conventional and Roundup Ready soybean mixtures for enhanced weed suppression and soybean yield.

Objectives

1. To determine the feasibility of utilizing a drill-seeded conventional/Roundup Ready soybean seed mix for improved weed suppression, yield, and economic return.
2. To determine the critical time for removal of the conventional cultivar from Roundup Ready soybean.

Methodology

'Northrup King' 73-Z5, a Roundup Ready soybean, was mixed with 'Motte', a conventional soybean, at six different ratios and then planted in field plots at the Edisto Research and Education Center in 2001 and 2002 under overhead irrigation. In 2001, the test area contained a natural infestation of Florida pusley (*Richardia scabra*), yellow nutsedge (*Cyperus esculentus*), large crabgrass (*Digitaria sanguinalis*), and Palmer amaranth (*Amaranthus palmeri*). In 2002, Florida pusley, pitted morningglory (*Ipomoea lacunosa*), sicklepod (*Senna obtusifolia*), and Palmer amaranth infested the test area, of which Florida pusley was the predominant weed. Glyphosate at 1.0 lb ai/acre was applied at 2, 3, 4, 5, and 6 weeks after soybean emergence to control emerged weeds and the conventional soybean, which served solely for early-season weed suppression. On the same day glyphosate was applied, weed and soybean density and biomass were determined in a 10-ft² quadrat in each plot. Weed control was visually rated at this time and again at the R2 stage of soybean development. At crop maturity, plots were machine harvested, and grain yields were adjusted to 13% moisture.

Results and Discussion

Soybean populations were similar between years, ranging from 166,000 to 470,000 plants/acre for the lowest and highest seeding rates of 200,000 and 1,000,000 total seed/acre (glyphosate-resistant plus conventional). Percentage emergence generally declined with increasing seeding rate, ranging from 46 to 84%.

Glyphosate applied at 2 to 6 weeks after soybean emergence was effective in removing the conventional soybean, but application timing affected weed control which generally diminished with application delays. Weed control was often less at 5 and 6 weeks after soybean emergence compared to earlier timings because

of larger weed sizes and the inability to achieve adequate glyphosate spray coverage of weeds beneath the soybean canopy. However, control of those weeds exhibiting an upright growth habit, such as Palmer amaranth and sicklepod, was less dependent on application timing than were some of the lower growing or more glyphosate-tolerant weeds such as pitted morningglory and yellow nutsedge which were ineffectively controlled at these later timings.

Total weed biomass declined with increasing soybean density from 2 through 6 weeks after emergence. Weed biomass suppression within each week was maximized by 200,000 glyphosate-resistant plus 400,000 conventional seed/acre. In 2002, Florida pusley density declined with increasing soybean population at 4, 5, and 6 weeks after soybean emergence because of the dense soybean canopy. Visual weed suppression prior to glyphosate varied among species, indicating some species were more sensitive to shading than others. Suppression of all weeds prior to glyphosate increased exponentially with soybean groundcover (Figures 1 & 2) and was greatest in week six because of the denser soybean canopy. The increased control was attributed to reduced weed emergence as a result of shading of the soil surface along with greater competitiveness of soybean with emerged weeds beneath the soybean canopy. Because early-season weed suppression is highly contingent upon soybean groundcover, weeks after soybean emergence and soybean plant population were used to model development of soybean groundcover (Figure 3). This knowledge would be useful in determining when in the growing season a particular soybean population would reach a critical level of groundcover sufficient to effectively suppress weed emergence and growth.

Yield data were similar both years and only conventional soybean seeding rate affected seed yield. Yields were similar when 0; 100,000; or 200,000 conventional soybeans/acre were seeded with 200,000 glyphosate-resistant soybean/acre (Figure 4). Numerically, the greatest seed yield was at 100,000 conventional plus 200,000 glyphosate-resistant soybean seed per acre. At total seeding rates higher than 400,000 seed/acre, soybean yields were reduced, indicative of early-season interference from the conventional cultivar. There was no economical advantage to mixing conventional and glyphosate-resistant soybean because of the lack of a substantial improvement in yield and the added expense of using the conventional soybean for weed suppression. However, it is important to note that soybean yields following a single glyphosate application similar to sequential applications, an indication that producers could reduce herbicide expenditures by using a single glyphosate treatment when drill-seeding soybean. Furthermore, research suggests management strategies that promote rapid canopy closure such as increasing seeding rates, narrowing row widths, or preventing early-season moisture stress through irrigation will diminish emergence of shade intolerant species.

Figure 1. Florida pusley suppression as influenced by soybean groundcover from 2 to 6 weeks after soybean emergence. Control was recorded prior to glyphosate treatment and was pooled from 2001 and 2002.

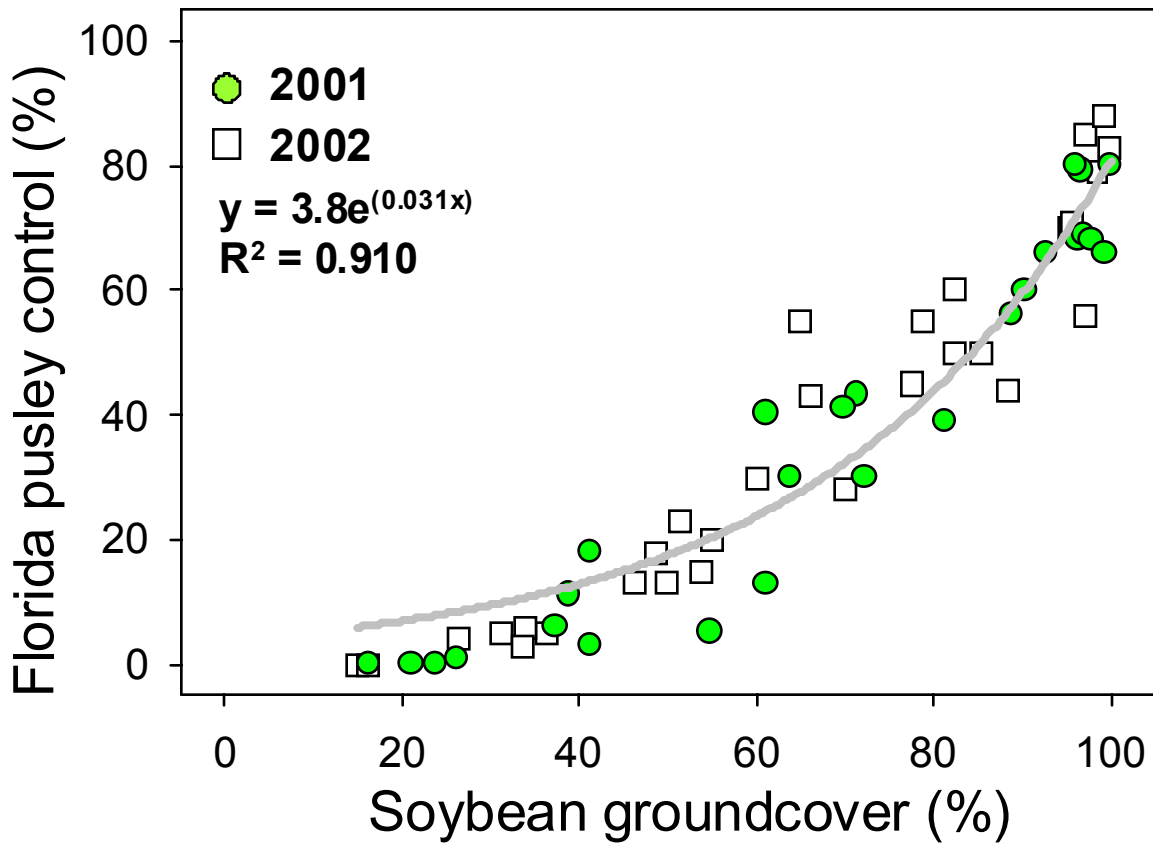


Figure 2. Florida pusley suppression as influenced by soybean groundcover from 2 to 6 weeks after soybean emergence. Control was recorded prior to glyphosate treatment and was pooled from 2001 and 2002.

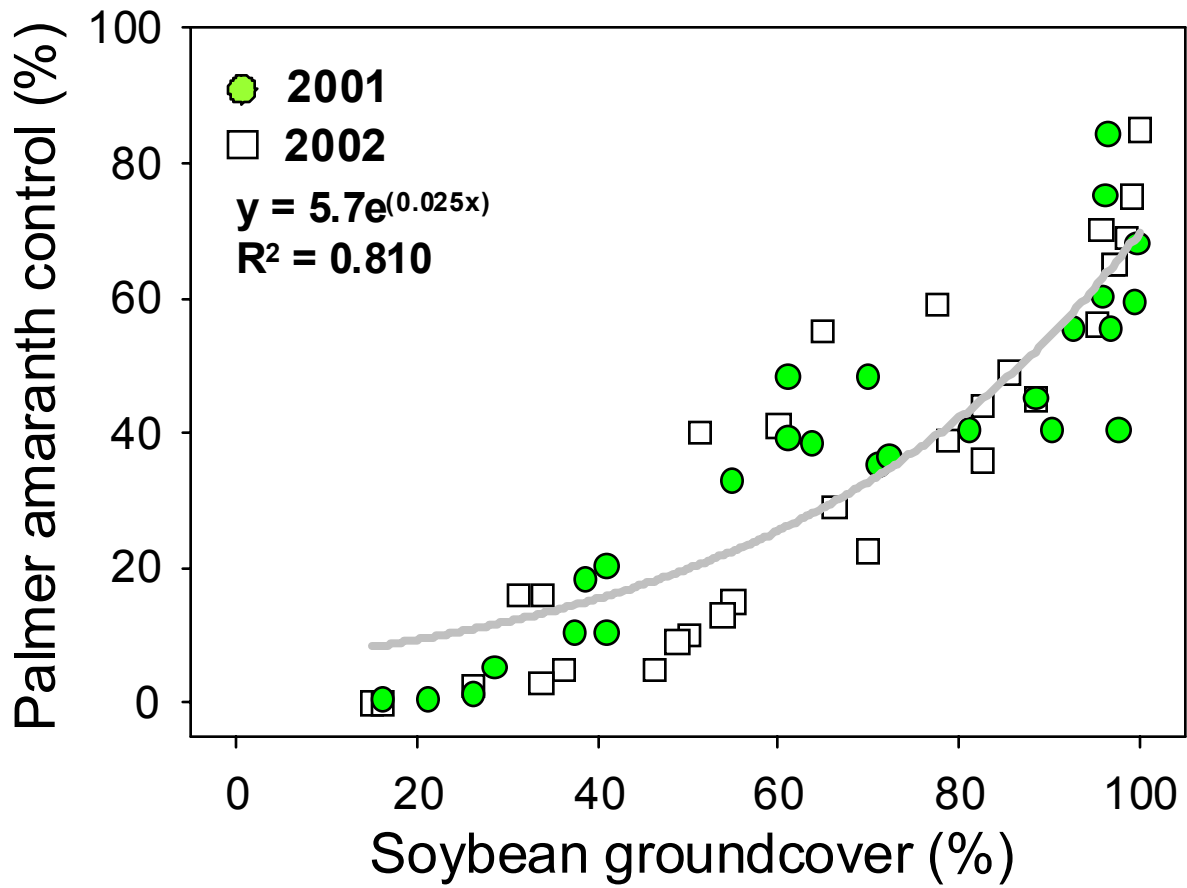


Figure 3. Soybean groundcover as a function of weeks after soybean emergence and early-season soybean population.

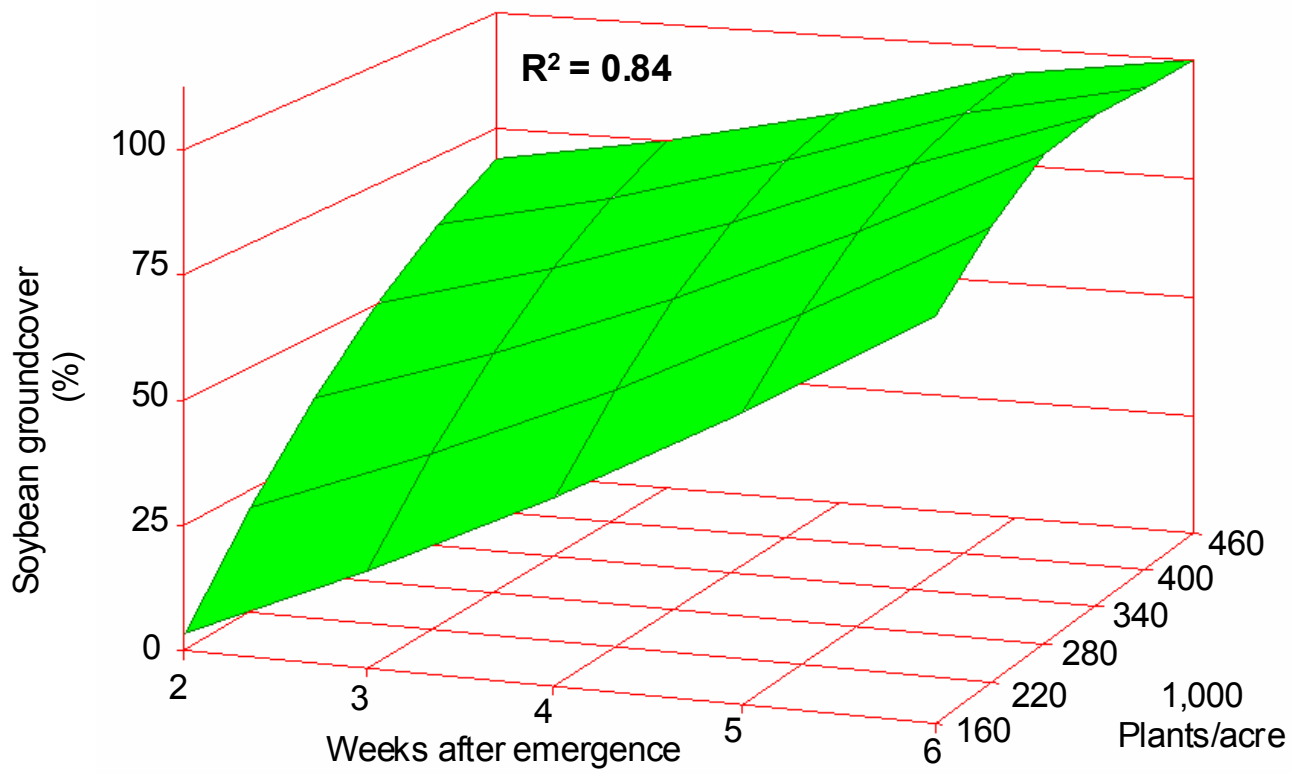


Figure 4. Soybean seed yield as affected by the addition of conventional soybean to 200,000 Roundup Ready soybean/acre, pooled over conventional soybean removal timings and two growing seasons.

