

WEED CONTROL AND NET RETURN IN GLYPHOSATE-RESISTANT AND NON-RESISTANT SOYBEAN GROWN CONTINUOUSLY AND IN ROTATION



K.N. Reddy*, L.G. Heatherly, S.R. Spurlock, and C.H. Koger

USDA-ARS: SWSRU and CGPRU, Stoneville, MS; and Dept. of Agric. Econ., Mississippi State University



INTRODUCTION

The early soybean production system (ESPS) uses early-maturing cultivars that are planted from late March to late April in the midsouthern US. ESPS produces maximum yields in this area. Glyphosate-resistant (GR) cultivars have been rapidly adapted (>90% acreage). Glyphosate is the predominate and often only herbicide used for managing weeds in this system. The continued and increased use of glyphosate in crop production is being associated with weed resistance to glyphosate. Alternative strategies to minimize selection pressure for development of resistance and to control GR weeds is needed in production systems where they commonly occur, such as rotation with non-GR crops and herbicides. Inputs used for weed management in soybean represent a significant financial cost. Cost and yield differences among weed management systems can mean significant differences in net returns. Weed management in GR and non-GR soybean generally involves two basic approaches: use of soil-applied preemergent followed by foliar-applied postemergent herbicides, and use of postemergent-only herbicides. Both approaches can be used effectively to control weeds. Economically feasible weed control strategies using these two approaches in rotated GR and non-GR soybean cultivars have not been determined.

OBJECTIVE

To study weed control, soybean yield, and net returns from continuous and rotated GR and non-GR soybean production systems.

MATERIALS AND METHODS

Location: Stoneville, MS.

Soil: Tunica silty clay soil.

Years: 2000, 2001, 2002, and 2003.

Non-irrigated environment.

Row spacing: 50 cm, 16 rows/plot.

Plot size: 30.5 m long and 8.1 m wide.

Treatments:

Eight management systems, each containing a MG IV or MG V GR and non-GR cultivar grown continuously or in rotation with each other, and two weed management treatments (PRE+POST and POST-only (Table 1).

Design: Split-plot arrangement in a randomized complete block with 4 replications.

Data:

Weed population and control

Soybean grain yield (13% moisture).

Net returns calculated using Mississippi State Budget Generator.

Table 1. Description of treatments used in 2000-2003.

| Rotation system | Weed management treatment |
|----------------------------|---|
| 1. Continuous MG IV GR | 1. PRE non-glyphosate + POST glyphosate 2. POST glyphosate |
| 2. Continuous MG IV Non-GR | 1. PRE + POST non-glyphosate 2. POST non-glyphosate |
| 3. Continuous MG V GR | 1. PRE non-glyphosate + POST glyphosate 2. POST glyphosate |
| 4. Continuous MG V Non-GR | 1. PRE + POST non-glyphosate 2. POST non-glyphosate |
| 5. Rotated MG IV GR/non-GR | 1. Respective PRE + POST 2. Respective POST |
| 6. Rotated MG IV Non-GR/GR | 1. Respective PRE + POST 2. Respective POST |
| 7. Rotated MG V GR/non-GR | 1. Respective PRE + POST 2. Respective POST |
| 8. Rotated MG V Non-GR/GR | 1. Respective PRE + POST 2. Respective POST |

MG, maturity group; GR, glyphosate-resistant; non-GR, non-glyphosate-resistant.
GR MG IV, Asgrow 4702RR; GR MG V, Asgrow 5701RR;
non-GR MG IV, Agripro 4882; non-GR MG V, Pioneer P3594.

RESULTS

Table 2. Weed control at harvest in 2003 as affected by 4-yr of GR and non-GR soybean rotation, Stoneville, MS.

| Treatment | Hyssop spurge | Johnsongrass | Pitted morningglory | Prickly sida | Redvine | Trumpet creeper | Yellow nutsedge |
|----------------------------------|---------------|--------------|---------------------|--------------|---------|-----------------|-----------------|
| | ----- % ----- | | | | | | |
| Rotation system | | | | | | | |
| Continuous MG IV GR | 93 ab | 99 a | 94 ab | 96 a | 81 a | 94 a | 98 a |
| Continuous MG IV non-GR | 89 b | 99 a | 96 ab | 91 a | 74 a | 93 a | 78 b |
| Continuous MG V GR | 100 a | 99 a | 100 a | 100 a | 90 a | 99 a | 100 a |
| Continuous MG V non-GR | 100 a | 99 a | 100 a | 100 a | 94 a | 96 a | 100 a |
| Rotated MG IV GR | 96 ab | 95 b | 93 b | 96 a | 84 a | 96 a | 96 a |
| Rotated MG IV non-GR | 94 ab | 100 a | 93 b | 94 a | 73 a | 86 a | 95 a |
| Rotated MG V GR | 100 a | 99 a | 100 a | 100 a | 90 a | 98 a | 100 a |
| Rotated MG V non-GR | 100 a | 100 a | 100 a | 100 a | 80 a | 98 a | 100 a |
| Weed management treatment | | | | | | | |
| PRE + POST | 99 a | 98 a | 93 a | 100 a | 83 a | 95 a | 98 a |
| POST-only | 93 b | 99 a | 93 a | 95 b | 83 a | 95 a | 93 b |

Note: Means within a column and within rotation system or weed management treatment followed by the same letter are not significantly different at the 5% level using Fisher's protected LSD test.

Table 3. Soybean yield and net return from GR and non-GR soybean cultivars grown using two weed management treatments in continuous and rotated systems, Stoneville, MS, 2000-2003.

| Treatment | Soybean yield | | | | Net return | | | |
|----------------------------------|-------------------|--------|--------|---------|-------------------|-------|---------|-------|
| | 2000 | 2001 | 2002 | 2003 | 2000 | 2001 | 2002 | 2003 |
| | ----- kg/ha ----- | | | | ----- \$/ha ----- | | | |
| Rotation system | | | | | | | | |
| Continuous MG IV GR | 3761 a | 2122 b | 3641 a | 3358 ab | 479 a | 181 b | 467 a | 422 a |
| Continuous MG IV non-GR | 2970 c | 2142 b | 3452 a | 3240 ab | 304 c | 166 b | 356 c | 350 b |
| Continuous MG V GR | 2138 d | 3302 a | 3720 a | 3059 b | 148 d | 422 a | 482 a | 361 b |
| Continuous MG V non-GR | 2156 d | 3516 a | 3551 a | 3227 ab | 141 d | 443 a | 373 bc | 346 b |
| Rotated MG IV GR | 3457 ab | 2038 b | 3781 a | 3350 ab | 417 ab | 164 b | 496 a | 421 a |
| Rotated MG IV non-GR | 3327 bc | 2089 b | 3793 a | 3246 ab | 378 bc | 169 b | 426 abc | 351 b |
| Rotated MG V GR | 2146 d | 3506 a | 3564 a | 3444 ab | 149 d | 464 a | 450 ab | 439 a |
| Rotated MG V non-GR | 2259 d | 3447 a | 3525 a | 3614 a | 162 d | 442 a | 368 bc | 425 a |
| Weed management treatment | | | | | | | | |
| PRE + POST | 2819 a | 2769 a | 3582 a | 3396 a | 268 a | 305 a | 397 b | 396 a |
| POST-only | 2734 a | 2772 a | 3675 a | 3239 b | 276 a | 307 a | 457 a | 383 a |

Note: Means within a column and within rotation system or weed management treatment followed by the same letter are not significantly different at the 5% level using Fisher's protected LSD test.

CONCLUSIONS

- Densities of hyssop spurge, johnsongrass, and yellow nutsedge were slightly higher in non-GR cultivars compared to GR cultivars.
- Overall, control of weed species was sufficient to support soybean production regardless of cultivar and rotation.
- Cost of weed management: POST < PRE +POST in GR cultivars and POST ≈ PRE+POST in non-GR cultivars.
- Overall, cost of weed management treatments in GR cultivars was lower than non-GR cultivars.
- GR cultivars using POST-only glyphosate was the most economical system each year.
- GR cultivars produced net returns that were equal to or greater than those from using non-GR cultivars.
- Rotating GR and non-GR cultivars had no significant effect on weed populations, weed control, soybean seed yield, and net return in this 4-yr study.
- These results indicate that use of PRE+POST vs. POST-only weed management is not necessary for achieving highest yields and net returns with either non-GR or GR cultivars grown either continuously or in rotation.

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