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# Weed Population Changes in No-till Soybeans

W. E. Stevens, J. R. Johnson, and H. R. Hurst

No-tillage has been suggested as a means of reducing soil losses from highly erodable soybean fields in Mississippi. Research at the MAFES North Mississippi Branch on a Grenada silt loam soil with a 5% slope showed that 8 tons of soil per year can be conserved by planting soybeans no-till (6).

The reluctance of many farmers to accept no-tillage soybean production has been partially due to its high frequency of weed control failures. Experiments conducted in soybean fields with heavy weed infestations have shown that not using preplant tillage increases the likelihood for poor weed control (1, 3). Farmers trying no-till soybeans for the first time are usually advised to choose fields with low weed infestations. Information on what types of weeds they should expect after several years of no-tillage in these fields is not available. Most no-tillage weed control experiments have been conducted in fields already heavily infested with weeds.

Eliminating tillage in corn has been shown to cause shifts in weed species. In Ohio research, no-till corn fields became infested with perennial weeds that are usually controlled with tillage. These included such weeds as Canada thistle, horsenettle, hemp dogbane, and common dandelion (7).

A 12-year experiment at the North Mississippi Branch at Holly Springs was begun in 1981 to determine whether weed control can be maintained in no-till soybeans in a field initially low in weed infestations. The effects of herbicides and cultivation on weed species are being studied. This preliminary report contains results through April 1987.

## Materials and Methods

The experiment was established on a Grenada silt loam soil (fine silty, mixed, thermic Glossic Fragiudalf) with 1-5% slope. Analysis of soil samples collected from 0 to 6 inches deep in 1983 showed a pH of 6.2 and an organic matter level of 0.7%. The site, which had been used for soybean variety trials, had been kept weed-free for 5 years prior to beginning this study.

The experimental design was a split plot with herbicide treatment as main plots. Main plots were 26.7 feet (8 rows) wide and 30 feet in length. Each sub-plot contained four rows, which were either cultivated or not cultivated. All treatments were replicated four times. Individual plots were located on the same site each year.

Soybean varieties and planting dates were Forrest, June 10, 1981; Forrest, May 19, 1982; Essex, June 3, 1983; Forrest, June 1, 1984; Centennial, June 25, 1985; and Asgrow 5980, May 9, 1986. Fertilizer (300 pounds of 0-20-20 per acre) was drilled 2 inches to the side of the row at planting each year. Soybeans were planted with a John Deere 7000® planter equipped with ripple coulters from 1981 to 1985. A Cole® planter with fluted coulters was used in 1986. Soybeans were planted in 40-inch rows in 1981, 1982, 1983, and 1986. Rows were narrowed to 36 inches in 1984 and 1985.

A decision had to be made early in the study as to whether herbicide treatments would remain constant or be upgraded when superior herbicides became available. Not changing herbicides would have allowed more definitive statements on herbicide efficacy. However, at the end of 12 years, the results might have shown that it is not possible to maintain weed control in no-till soybeans when, in fact, farmers could do so by using new herbicides as they are released. Since evaluating herbicide efficacy was secondary to the broader objective of determining whether weed control can be maintained, herbicides were upgraded as warranted.

Table 1 lists the herbicides that were applied preplant to existing weed foilage (PPF), preplant incorporated (PPI), or preemergence (PRE) to main plots each year. Treatment No. 6 was a conventionally tilled control. Treatments 1-5 were all no-till planted. The conventionally tilled control plots were chiseled and disked before the PPI herbicides were applied. Incorporation was performed immediately afterwards with two passes by a finishing harrow in the row direction, followed by planting.

PPF herbicides (glyphosate, paraquat, glufosinate) were applied 10 days prior to planting in 1986 instead of tank mixing them

## Table 1. Preplant and preemergence herbicide applications to no-till (Treatments 1-5) and conventionally tilled (Treatment 6) mailn plots in 1981-86.

| Trt. No. | Herbicides (1981-84) | Rate/Acre | Applied[1] | Herbicides (1985) | Rate/Acre | Applied | Herbicides (1986) | Rate/Acre | Applied |
|---|---|---|---|---|---|---|---|---|---|
| | | (lb a.i.) | | | (lb a.i.) | | | (lb a.i.) | |
| 1 | Roundup® 4L (glyphosate)<br>+ Sencor® 4L (metribuzin) | 1.0<br>0.375 | PPF-(AP) | Unchanged | Unchanged | Unchanged | Roundup 4E<br>Sencor 4L | 1.0<br>0.375 | PPF-(BP)<br>PPF-(AP) |
| 2 | Paraquat® CL 2E (paraquat)<br>+ X-77® Spreader<br>+ Surflan® 4AS (oryzalin) | 0.25<br>0.5%<br>1.0 | PPF-(AP) | Unchanged | Unchanged | Unchanged | Paraquat CL 2E<br>+ X-77<br>Canopy® 75 DG[3] | 0.25<br>0.5%<br>0.375 | PPF-(BP)<br><br>PPF-(AP) |
| 3 | Paraquat CL 2E<br>+ X-77 Spreader<br>+ Dual® 8E (metolachlor) | 0.25<br>0.5%<br>2.0 | PPF-(AP) | Unchanged | Unchanged | Unchanged | Paraquat CL 2E<br>+ X-77<br>Turbo® 8E[4] | 0.25<br>0.5%<br>2.0 | PPF-(BP)<br><br>PPF-(AP) |
| 4 | Paraquat CL 2E<br>+ X-77 Spreader<br>+ Lasso® 4E (alachlor) | 0.25<br>0.5%<br>2.0 | PPF-(AP) | Unchanged | Unchanged | Unchanged | Paraquat CL 2E<br>+ X-77<br>Lasso ME 4E | 0.25<br>0.5%<br>2.0 | PPF-(BP)<br><br>PPF-(AP) |
| 5 | Paraquat CL 2E<br>+ X-77 Spreader<br>+ Lasso 4E | 0.25<br>0.5%<br>3.0 | PPF-(AP) | Ignite® 1.67E[2]<br>+ X-77<br>+ Lasso 4E | 0.75<br>0.5%<br>2.0 | PPF-(AP) | Ignite 1.67E<br>+ X-77<br>Lasso ME 4E | 0.75<br>0.5%<br>2.0 | PPF-(BP)<br><br>PPF-(AP) |
| 6 | Treflan® 4E (trifluralin)<br>Sencor 4L | 0.75<br>0.375 | PPI<br>PRE | Unchanged | Unchanged | Unchanged | Unchanged | Unchanged | Unchanged |

[1] PPF = preplant to existing weed foliage (AP) = applied at planting, (BP) = applied 10 days before planting; PPI = preplant soil incorporated 2 inches with a finishing harrow; PRE = preemergence.
[2] Ignite 1.67E was tested as HOE 39866. Glufosinate is its common name.
[3] Canopy 75DG is 64.3% metribuzin and 10.7% chlorimuron.
[4] Turbo 8E is 6.55/1.45 ppg mixture of metolachlor/metribuzin.



## Table 2. Postemergence herbicide applications to no-till (Treatments 1-5) and conventionally tilled (Treatment 6) main plots in 1981-86.

| Trt. No. | Herbicides[1] (1981) | Rate/Acre | Applied[4] | Herbicides (1982-84) | Rate/Acre | Applied | Herbicides (1985) | Rate/Acre | Applied | Herbicides (1986) | Rate/Acre | Applied |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (lb a.i.) | | | (lb a.i.) | | | (lb a.i.) | | | (lb a.i.) | |
| 1 | Paraquat CL 2E<br>+ X-77 Spreader | 0.125<br>0.5% | Dir. | Unchanged | Unchanged | Unchanged | Scepter® 1.5AS (imazaquin)<br>+ X-77 | 0.1875<br>0.5% | OT | Scepter 1.5AS<br>+ X-77 | 0.1875 | OT |
| 2 | Lorox® 50W (linuron)<br>+ X-77 Spreader | 0.75<br>0.5 | Dir. | Unchnaged | Unchanged | Unchanged | Unchanged | Unchanged | Unchanged | Butyrac® 175 (2,4-DB)<br>Gemini® 60DG[6]<br>+ X-77 Spreader | 0.2<br>0.75<br>0.5% | Dir.<br>Dir. |
| 3 | Assure® 0.8E (quizalofop)[2] | 0.15 | OT | Verdict® 2E (haloxyfop)[5]<br>+ X-77 Spreader | 0.125<br>0.125% | OT | Unchanged | Unchanged | Unchanged | None | | |
| 4 | Poast® 1.53E (sethoxydim)<br>+ Atplus® 411F[3] | 0.375<br>1.25% | OT | Poast 1.53E<br>+ Atplus 411F | 0.2<br>1.25% | OT | Poast 1.53E<br>+ Agri-Dex® Crop Oil | 0.2<br>1.25% | OT | Unchanged | Unchanged | Unchanged |
| 5 | Poast 1.53E<br>PL Atplus 411F | 0.375<br>0.125% | OT | Fusilade® 4E (fluazifop)<br>+ X-77 Spreader | 0.20<br>0.125% | OT | Fusilade 2000 1E (fluazifop)<br>+ X-77 Spreader | 0.1875<br>0.125% | OT | Unchanged | Unchanged | Unchanged |
| 6 | None | – | – | None | – | – | None | – | – | None | – | – |

[1] Basagran® 4E (bentazon) + Blazer® 2S (acifluorfen) was applied over-the-top 8-inch soybeans at 0.5 + 0.375 lb ai/A, respectively, on the entire area in 1981-1985. In 1986, the mixture was only applied to Treatments 3-6.
[2] Assure 0.8E was tested as NCI 96683 which was later changed to DPX-F 6202.
[3] Atplus 411F is a crop oil concentrate (83% oil, 17% surfactant).
[4] Dir. = directed spray (20-inch band) to 8-inch soybeans, OT = over-the-top of soybeans. Except for Scepter which was applied OT to 8-inch soybeans, all other OT herbicides were applied when johnsongrass reached 15 inches or when other grasses reached 2 inches whichever came first.
[5] Verdict 2E was tested as XRM 4570.
[6] Gemini 60 DG is a 12:1 mixture of linuron and chlorimuron.

with the PRE herbicides as was done in 1981-85. The postemergence herbicides used are listed in Table 2.

All herbicides were applied with a $CO_2$-pressurized backpack sprayer calibrated to deliver 20 gallons of solution per acre on a broadcast basis. Post-directed herbicides were applied in a 20-inch band centered on each row with two off-center flat fan nozzles per row when soybeans were 8 inches tall.

Cultivation was performed on designated sub-plots 3 to 5 weeks after planting. A cultivator with three plows per row middle was used in 1981-84. A Glencoe® cultivator with three coulters followed by a sweep plow was used in 1985 and 1986.

Weeds in plots were identified and measured March 15, 1984 and April 30, 1987. Their distributions in the field were visually described as very abundant (VA), abundant (A), moderate (M), scattered (S), or very scattered (VS).

Plots were visually rated for percent weed control (0 = no control, 100 = complete control) on Sept. 8, 1982 and July 22, 1985. An evaluation of the infestation of perennial grasses was made at soybean maturity Oct. 24, 1983 and Oct. 2, 1986.

A scale map of each plot was constructed and perennial grass boundaries were recorded on the map by field inspection. The infested areas on the map were darkened and the percentage of these areas relative to the total plot area was determined with an image analyzer. Mapping was not suitable for perennial broadleaf weeds because they did not form distinct boundaries. Annual grass and and all broadleaf weed populations were visually estimated as either present in numbers sufficient to affect yields, present in low numbers, or absent. These were subjective ratings, based on the opinions of the authors making the observations. It should be borne in mind that several weed species with low numbers may have had a cumulative affect on soybean competition. All weed notations were made from the center two rows of each sub-plot. Botanical nomenclature for common weed names used hereafter in this text is shown in the Appendix.

Soybeans were harvested from the center two rows with a plot combine. Yields were converted to bushels per acre.

## Results

When field observations were made on March 15, 1984, 17 early season weed species were identified in the experimental area (Table 3). A slightly larger variety of weeds was found on April 30, 1987 (Table 4). However, the 1987 observation was made later in the spring and several warm season weeds such as johnsongrass had emerged. No consistent relationship between treatments and the types of weeds in plots was found in either year. Little barley was a dominant cool season weed in all plots each spring (Figure 1).

In 1987, weeds other than little barley were not as abundant in three replications of the conventionally tilled main plots (Treatment 6) as in the no-till plots. However, one replication of the conventionally tilled treatment was indistinguishable from no-till plots in either abundance or diversity of early season weeds. No explanation other than field variability is available.

Narrowleaf vetch, pokeweed, and Carolina horsenettle increased in abundance from 1984 to 1987. Horseweed (Figure 2) declined from being rated as very abundant in March 1984 to very scattered in April 1987. One possible explanation for this may be more competition from winter weeds. Several early maturing cool season weeds, such as henbit, were observed to be more abundant earlier in the spring than the April 30, 1987 rating date indicated.

Weed infestation levels were low in all plots in 1981-83 and soybean yields did not differ significantly

**Table 3. Size, distribution, and growth stages of early season weeds in plots on March 15, 1984.**

| Weed Name | Distribution[1] | Growth Stage | Size Ht. or Dia.[2] (in.) |
|---|---|---|---|
| Little barley | VA | Vegetative | 1-4 ht. |
| Annual bluegrass | VA | See ding | 1-2 ht. |
| Mousetail | VA | Flowering | 1 ht. |
| Horseweed | VA | Vegetative | 1 ht. |
| Carolina geranium | VA | Vegetative | 6 dia. |
| Bittercress | VA | Flowering | > 4 ht. |
| Henbit | A | Flowering | > 4 ht. |
| Virginia pepperweed | A | Vegetative | 2-4 dia. |
| Shepherdspurse | M | Flowering | 6 ht. |
| Mouseear chickweed | M | Vegetative | 1 ht. |
| Wild garlic | M | Vegetative | 6 ht. |
| Buttercup | M | Vegetative | 4 dia. |
| Cutleaf eveningprimrose | S | Vegetative | 2-6 dia. |
| Hop clover | S | Vegetative | 1 ht. |
| Narrowleaf vetch | S | Vegetative | 1-2 ht. |
| Common chickweed | VS | Vegetative | 1 ht. |
| Whitlowort | VS | Vegetative | 1 ht. |

[1] Infestation was uniform over the entire area. Distributions were described as very abundant (VA), abundant (A), moderate (M), scattered (S), or very scattered (VS).

[2] Ht. = Height; Dia. = Diameter

**Table 4. Size, distribution, and growth stages of weeds before burndown on April 30, 1987.**

| Weed Name | Distribution[1] | Growth Stage | Heigth (in.) |
|---|---|---|---|
| Narrowleaf vetch | M-VA | Flowering | 10-23 |
| Little barley | VA | Seedheads present | 10-14 |
| Carolina geranium | M | Flowering | 9-12 |
| Mouseear chickweed | M | Flowering | 8-10 |
| Hop clover | M | Flowering | 5-10 |
| Johnsongrass | S-A | Vegetative | 10-15 |
| Carolina horsenettle | S-M | Vegetative | 3-10 |
| Bermudagrass | S-M | Vegetative | 1-2 |
| Common chickweed | S | Flowering | 15 |
| Virginia pepperweed | S | Seed present | 12 |
| Buttercup | S | Seed present | 5-8 |
| Pokeberry | S | Vegetative | 5-25 |
| Wild lettuce | S | Vegetative | 8-12 |
| Curly dock | S | Seed present | 25-30 |
| Wild garlic | S | Vegetative | 15 |
| Chervil | S | Flowering | 12-18 |
| Horseweed | VS | Vegetative | 8-10 |
| Bracted plantain | VS | Seed present | 10 |
| Red sorrell | VS | Flowering | 8-10 |
| Wild oats | VS | Seed present | 20 |

[1] Infestation was not uniform over the area, but there was not a consistent pattern of infestations relative to main or sub-plot treatments. Distributions were described as very abundant (VA), abundant (A), moderate (M), scattered (S), or very scattered (VS).

**Table 5. Effects of herbicides and cultivation on soybean yields in 1981-86.**

| Number | Cultivated | 1981 | 1982 | 1983 | 1984[2] | 1985 | 1986 |
|---|---|---|---|---|---|---|---|
| | | Soybean yields[1] (bu/A) | | | | | |
| 1 | Yes | 28.4 | 32.1 | 13.9 | 24.2 | 29.9 | 21.4 |
| | No | 29.7 | 36.8 | 12.6 | 17.9 | 26.6 | 19.3 |
| 2 | Yes | 33.0 | 38.4 | 14.7 | 19.4 | 22.5 | 25.4 |
| | No | 31.4 | 36.8 | 13.0 | 8.9 | 20.2 | 26.1 |
| 3 | Yes | 35.3 | 35.7 | 14.7 | 18.5 | 31.6 | 25.0 |
| | No | 30.9 | 35.1 | 11.1 | 11.8 | 25.5 | 16.5 |
| 4 | Yes | 35.4 | 38.2 | 15.9 | 18.3 | 34.5 | 32.2 |
| | No | 36.7 | 37.9 | 12.1 | 10.1 | 29.6 | 25.1 |
| 5 | Yes | 37.3 | 32.1 | 17.3 | 14.5 | 37.3 | 30.1 |
| | No | 34.9 | 36.5 | 14.5 | 14.9 | 30.8 | 26.6 |
| 6 | Yes | 33.0 | 35.5 | 13.5 | 26.5 | 46.8 | 30.5 |
| | No | 33.7 | 38.5 | 12.1 | 24.8 | 39.5 | 27.0 |
| LSD 0.05[3] | | NS | NS | NS | 4.0 | 8.7 | 4.3 |
| LSD 0.05[4] | | NS | NS | NS | 2.0 | 3.4 | 2.3 |
| CV (%) | | 20.8 | 13.9 | 20.7 | 21.5 | 22.0 | 15.6 |

[1] Average of four replications.
[2] Damage to some plots during cultivations affected 1984 yield results.
[3] LSD 0.05 values for comparing two herbicide means. Statistical analysis of 1984 yields showed a cultivation x herbicide interaction. NS = not significant.
[4] LSD 0.05 values for comparing cultivated and not cultivated means.

with main or sub-plot treatments (Table 5). Weed control was recorded as nearly perfect for all treatments in field notes made in 1981. Visual ratings for weed control on Sept. 8, 1982 showed that grasses were absent from all plots and broadleaf weed control averaged greater than 85 percent for all treatments. Although 26 weed species were observed and recorded from the experimental area on Oct. 24, 1983, no single species was judged abundant enough to lower soybean yield (Table 6). Bermudagrass, broomsedge, and johnsongrass had begun to invade some plots, but were only present in small areas.

Soybean rows were narrowed from 40 to 36 inches in 1984 and 1985 because of research showing yield increases from narrower rows (2). However, unusually high weed infestation levels developed in the 52-inch row middle between plots during 1984 and 1985. To alleviate this problem, rows were returned to 40-inch widths in 1986.

Soybean yield differences in main plots and sub-plots were first observed in 1984 (Table 5). As mentioned, soybean rows were narrowed to 36 inches in 1984. By error, a cultivator adjusted for 40-inch rows was used that year, resulting in damage to some rows. Statistical analysis of 1984 soybean yields showed an interaction between main plots and sub-plots. Considering the problems with the cultivation and that no interaction was found in 1985 or 1986, the 1984 yield results are viewed with some skepticism.

Horseweed was a dominant weed in no-till plots, which were burned down with paraquat in 1984. It was less abundant in plots receiving Roundup® or preplant tillage, which probably contributed to the numerically lower yields in other no-till plots in 1984. Tennessee researchers observed greater horseweed control from Roundup than from paraquat

(5). The systemic activity of Roundup as contrasted to the contact activity of paraquat was cited as the reason for the difference. In the Tennessee study, excellent horseweed control was achieved when 2,4-D was applied 9 days before planting, followed by paraquat and residual herbicides.

Soybean yields varied widely between main plots in 1985. The lowest yielding treatment was Treatment 2, which had Surflan® applied preemergence (Table 5). The directed spray of Lorox to 8-inch soybeans in Treatment 2 was not highly effective on weeds such as horsenettle that were not previously controlled by paraquat. By the time soybeans reached a height of 8 inches, these weeds were also 8 inches tall or taller. Yields from conventionally tilled plots (Treatment 6) were high relative to other treatments. This cannot be explained completely by weed control because the no-till Treatment 5 had higher weed control ratings but yielded less (ratings not shown).

The weedy vegetation, primarily little barley and narrowleaf vetch, was so dense at planting in 1985, that identifying the tops of seedbeds from 1984 was nearly impossible. This resulted in poor seed placement with the planter because the planter depth control wheels sometimes rode the shoulders of the beds. Plot areas with poor stands were hand planted with a hoe shortly after planter-planted soybeans emerged. Killing the weeds 10 days prior to planting in 1986 provided much better planting conditions.

Erect spurge was rated as being present in high enough numbers to reduce soybean yields in many plots in 1986 (Table 7). Canopy®, which was substituted for Surflan in Treatment 2, resulted in the best spurge control of the herbicide treatments evaluated. Carolina horsenettle was rated as abundant enough to affect soybean yields in Treatments 2-5. Preplant tillage probably controlled most horsenettle plants in Treatment 6. Roundup (Treatment 1) gave better PPF horsenettle control than paraquat or Ignite® (Figure 3).

Pokeweed may pose a special problem for no-till farmers. As Table 7 shows, pokeweed plants did not occur in high numbers in any plots in 1986, but they caused considerable soybean staining when the purple berries went through the combine (Figure 4). Grain elevators would probably dock soybeans with such stain. Pokeweed plants measuring 25 inches tall were observed April 29, 1987 (Figure 5). The burndown herbicides used in this study did not control large pokeweed plants. In many plots, regrowth was

**Figure 1. Little barley, a naturally occurring cool season grass, was easily killed with PPF herbicides.**

**Figure 2. Competition from cool season weeds may have contributed to the decline of horseweed in non-till plots in 1985 and 1986. Horseweed germinates in the fall and lives through the winter in the rosette stage.**

observed within a week of burndown applications (Figure 6). The only herbicide main plots in which it was completely absent were Treatment 2. As this study is continued, attention will focus on this weed to see whether by coincidence pokeweed has not yet invaded these plots or if one of the herbicides in Treatment 2 is effectively controlling it.

Generally, treatments which included over-the-top grass herbicides provided good grass control, as evidenced by ratings and plot area infestation percentages shown in Table 7. Treatment 1 main plots produced a low yield in 1986, despite better horsenettle control from Roundup. This was because southern crabgrass was not controlled.

After the third year of the study, no-till and conventionally tilled plots showed significant annual yield increases from cultivation (Table 5). Only three weed species were observed in cultivated conventionally tilled plots in 1986 as compared to 10 species in noncultivated conventionally tilled plcts (Table 7). This indicates that even with conventional tillage, cultivation was required to maintain the original low infestation status of the field. Plant residue accumulations on the soil surface of no-till plots caused frequent clogging of cultivator sweeps in 1984. This necessitated the use of a cultivator with coulters in 1985 and 1986. Cultivation usually did not rid plots of such weeds as pale smartweed, but it usually reduced their numbers (Table 7). In a few cases, cultivation resulted in higher perennial grass infestation percentages than no cultivation. Cultivator sweeps possibly carried bermudagrass and johnsongrass rootstocks to other parts of plots where they started new plants. Cultivation may have enhanced soybean yields by providing more favorable soil conditions for soybean growth. A review article on cultivation research in *Crops and Soils* magazine cited several studies in which soybean yields were increased with early season

**Table 6. Weed population ratings for broadleaf weeds, sedge, and annual grasses and the percentage of plot areas infested with perennial grasses for no-till (Treatments 1-5) and conventionally tilled (Treatment 6) soybeans on Oct. 24, 1983.**

| | | Weed population ratings[2] | | | | | | | | | | | | | | | | | | | | | | | Percentage of plot areas infested with perennial grass[2] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment number | Cultivated | Spiny amaranth | Carpetweed | Cocklebur | Virginia copperleaf | Curly dock | Carolina horsenettle | Horseweed | Honeyvine milkweed | Entireleaf morningglory | Pitted morningglory | Redroot pigweed | Poison ivy | Pokeweed | Prickly sida | Common ragweed | Red sorrel | Erect spurge | Nutsedge | Goosegrass | Southern crabgrass | Foxtail | Fall panicum | Broadleaf signalgrass | Bermudagrass | Broomsedge | Johnsongrass |
| 1 | Yes | + | – | + | – | – | + | – | – | – | – | + | – | – | + | – | – | + | – | – | + | – | – | + | 6 | 0 | 6 |
| | No | – | – | – | – | – | + | – | – | – | + | + | – | – | + | – | – | + | – | + | + | – | – | + | 1 | 2 | 1 |
| 2 | Yes | – | – | + | – | + | + | + | – | – | + | + | – | – | + | – | – | + | – | + | + | + | – | – | 9 | 1 | 2 |
| | No | + | – | + | – | – | + | + | + | – | + | + | – | – | – | + | – | + | – | + | + | + | – | + | 0 | 5 | 0 |
| 3 | Yes | + | – | + | – | – | + | + | – | – | – | + | – | – | + | – | + | + | – | – | + | + | – | + | 0 | 1 | 0 |
| | No | + | – | + | – | – | + | + | – | + | + | + | – | + | + | – | + | + | + | – | + | + | – | + | 0 | 1 | 1 |
| 4 | Yes | + | – | + | – | – | + | – | + | – | + | + | – | – | + | – | – | + | – | + | + | + | – | + | 1 | 1 | 0 |
| | No | + | + | + | – | + | + | – | – | + | – | + | + | + | + | – | + | + | – | + | + | – | – | + | 1 | 1 | 7 |
| 5 | Yes | + | – | + | – | – | + | + | – | + | – | + | – | – | + | – | – | + | – | – | + | + | – | – | 0 | 1 | 2 |
| | No | – | – | + | – | – | + | + | – | + | + | + | – | + | + | – | – | + | – | + | + | – | + | + | 0 | 1 | 0 |
| 6 | Yes | – | – | – | – | – | + | – | – | + | – | + | – | – | + | – | – | + | – | – | – | – | – | – | 1 | 1 | 0 |
| | No | – | + | + | – | – | + | – | – | + | – | + | – | – | + | – | – | + | – | – | – | – | + | – | 0 | 0 | 0 |

[1] Weed population ratings are summarized as follows: (–) species absent from plots in all replications; (+) species present in low numbers in at least one replication; and (x) species present in high enough numbers in at least one replication to affect soybean yields. No single weed was judged to be abundant enough to affect soybean yields on this date.

[2] Differences between percentages of plot areas infested with perennial grasses were not significant at the 5% level for herbicides or cultivation.

Figure 3. Paraquat applied PPF killed all existing weeds except horsenettle.

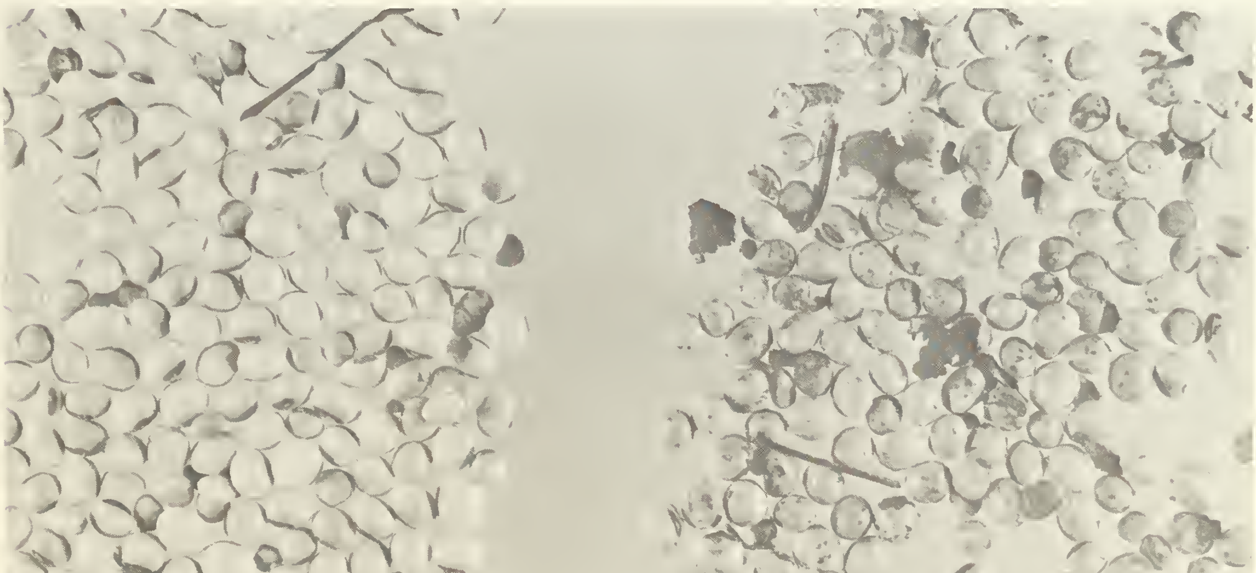

Figure 4. Soybean quality from harvested plots with pokeweed (right) was lower than plots without the weed (left). Soybeans on the right were stained by pokeweed.

cultivation even though there were not enough weeds to justify cultivation (4). Increased water infiltration rates due to breaking up soil surface crusts and creating small water storage areas was believed to be the reason for the increased yields in most cases. In an Illinois study on fields with 3 to 5 percent slope, soil loss was reduced with cultivation.

## Conclusion

No-till soybeans were grown with low weed competition for 3 years (1981-83). No significant yield differences in main plots with different herbicides and sub-plots cultivated and non-cultivated were obtained during that period. Weeds, though they were mostly absent when the study began, gradually invaded and increased in number in some no-till plots each year.

PPF herbicides played an important role in the control of certain weeds. Roundup controlled horseweed better than paraquat resulting in lower yield with treatments using the latter herbicide in 1984. Control of Carolina horsenettle in 1986 followed a similar pattern.

Applications of over-the-top grass herbicides were required in main plots for good control of grasses in 1986.

Pokeweed plants were not considered abundant enough to affect soybean yields in 1986. However, the staining on soybeans during combining would likely cause dockage.

Cultivation was no substitute for good herbicide treatments, but it usually lowered the infestation level of weeds. Significant yield increases from cultivation were shown in 1984-86.

## References


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**Table 7. Weed population ratings for broadleaf weeds and annual grasses and the percentage of plot areas infested with perennial grasses for no-till (Treatments 1-5) and conventionally tilled (Treatment 6) soybeans on Oct. 2, 1986.**

| | | Weed Population Ratings [2] | | | | | | | | | | | | | | | Percentage of plot areas infested with perennial grass[2] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Treatment number | Culti-vated | Cocklebur | Virginia copperleaf | Groundcherry | Carolina horsenettle | Horseweed | Entireleaf morningglory | Pokeweed | Prickly side | Pale smartweed | Erect spurge | Barnyardgrass | Southern crabgrass | Foxtail | Fall panicum | Broadleaf signalgrass | Bermudagrass | Broomsedge | Johnsongrass | Purpletop |
| 1 | Yes | + | – | + | + | – | – | + | + | + | x | + | x | + | – | + | 4 | 0 | 7 | 1 |
| | No | – | – | – | + | – | + | – | + | + | x | – | x | + | – | – | 0 | 0 | 7 | 1 |
| 2 | Yes | x | – | – | x | – | + | – | + | + | + | – | x | + | – | x | 2 | 1 | 14 | 0 |
| | No | – | – | – | + | + | – | – | – | + | – | – | x | + | – | + | 0 | 3 | 1 | 0 |
| 3 | Yes | + | – | + | + | + | – | + | – | + | x | – | + | + | – | + | 0 | 0 | 3 | 0 |
| | No | – | – | – | x | – | + | + | – | x | x | – | x | + | – | – | 0 | 0 | 13 | 0 |
| 4 | Yes | + | – | – | x | + | – | + | – | + | x | – | – | – | – | – | 0 | 0 | 2 | 0 |
| | No | + | + | – | x | – | – | + | – | x | x | – | – | – | – | – | 0 | 2 | 7 | 0 |
| 5 | Yes | + | – | – | + | – | + | + | – | + | x | – | – | – | – | – | 1 | 0 | 0 | 0 |
| | No | + | – | – | x | – | – | + | – | x | x | – | – | – | – | – | 0 | 0 | 0 | 0 |
| 6 | Yes | – | – | – | + | – | – | – | – | – | + | – | + | – | – | – | 0 | 0 | 1 | 0 |
| | No | – | – | + | + | + | + | + | – | + | x | – | + | – | + | x | 2 | 0 | 2 | 0 |

[1] Weed populations are summarized as follows: (–)species absent from plots in all replications; (+) species present in low numbers in at least one replication; and (x) species present in high numbers in at least one replication.

[2] Differences between percentages of plot areas infested with perennial grasses were not significant at the 5% level for herbicides or cultivation.

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**Figure 5. Pokeweed is a perennial weed which can grow quickly after emerging in early spring.**

**Figure 6. Regrowth was visible on this pokeweed in less than a week after receiving paraquat (PPF).**

# Appendix

***Botanical nomenclature for common weed names used in the text.***

| Common name | Botanical name |
|---|---|
| Amaranth, spiny | *Amarantus spinosus* |
| Barley, little | *Hordeum pusillum* |
| Bermudagrass | *Cynodon dactylon* |
| Bittercress | *Cardamine hirsuta* |
| Bluegrass, annual | *Poa annua* |
| Broomsedge | *Andropogan virginicus* |
| Buttercup | *Ranunculus abortivus* |
| Carpetweed | *Mollugo verticillata* |
| Chervil | *Chaerophyllum tainturieri* |
| Chickweed, common | *Stellaria media* |
| Chickweed, mouseear | *Cerostium vulgatum* |
| Clover, hop | *Trifolium procumbens* |
| Cocklebur | *Xanthium penslyvanicum* |
| Copperleaf, Virginia | *Acalyha virginica* |
| Crabgrass, southern | *Digitaria sanguinalis* |
| Dock, curly | *Rumex crispus* |
| Eveningprimrose, cutleaf | *Oenothera laciniata* |
| Foxtail, yellow | *Setaria glauca* |
| Garlic, wild | *Allium vineale* |
| Geranium, Carolina | *Geranium carolinianum* |
| Goosegrass | *Eleusine indica* |
| Groundcherry | *Physalis heterophylla* |
| Henbit | *Lamium amplexicaule* |
| Horsenettle, Carolina | *Solanum carolinense* |
| Horseweed | *Erigeron canadensis* |
| Johnsongrass | *Sorghum halepense* |
| Lettuce, wild | *Lactuca scariola* |
| Milkweed, honeyvine | *Ampelamus albidus* |
| Mousetail | *Myosurus minimus* |
| Morningglory, entireleaf | *Ipomaea hederacea var. Integriuscula* |
| Morningglory, pitted | *Ipomoea lacunosa* |
| Nutsedge, purple | *Cyperus rotundus* |
| Panicum, fall | *Panicum dichotomiflorum* |
| Pepperweed, Virginia | *Lepidium virginicum* |
| Plantain, bracted | *Plantago aristata* |
| Poison ivy | *Rhus radicans* |
| Pokeweed | *Phytolacca americana* |
| Ragweed, common | *Ambrosia artemisiifolia* |
| Shepherdspurse | *Capsella bursa-pastoris* |
| Sida, prickly | *Sida spinosa* |
| Signalgrass, broadleaf | *Brachiaria platyphylla* |
| Smartweed, pale | *Polygonum lapathisolium* |
| Sorrel, red | *Rumex acetosella* |
| Spurge, erect | *Euphorbia maculata* |
| Vetch, narrowleaf | *Vicia angustifolia* |
| Whitlowort | *Draba verna* |

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