# NO-TILLAGE RESEARCH UPDATE - NORTH CAROLINA[1]

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## EFFECTS OF TILLAGE SYSTEMS AND CROP ROTATION ON CROP PRODUCTION

Long-term experiments were established in 1984 at one Coastal Plain location and one Piedmont location to evaluate the effects of tillage system and crop rotation on certain soil chemical and physical properties and their relationship to crop growth and development. The 1985 growing season marks the completion of one cycle of each rotation (10). The first experiment consisted of two rotations (continuous corn and corn-soybeans) and three tillage systems (continuous conventional tillage, continuous no-tillage, and annually alternating conventional tillage and no-tillage). A second experiment consisted of a corn-wheat-soybean rotation with four tillage systems: 1) no-tillage for all crops, 2) conventional tillage for all crops, 3) no-tillage for soybeans only, and 4) no-tillage for corn and soybeans. All tillage and rotational sequences were fully established in 1985, consequently, only 1985 results will be discussed. Corn yield was significantly increased by no-tillage at the Piedmont location but was unaffected by tillage at the Coastal Plain location (Table 1). Full-season soybean yields were also unaffected by tillage at both locations. Both corn and soybeans showed no response to tillage in the previous year. Although data are not presented, corn yields were not influenced by the previous crop as well. Grain yield results for the three-crop rotation at the Piedmont location are shown in Table 2. As with the two-crop rotation, the corn yield response was highly significant in favor of no-till (9.1 vs 5.6 Mg $ha^{-1}$). Double-cropped soybean yields were also increased by no-tillage. In contrast, the only significant decline in grain yield due to no-tillage was with the wheat crop in the rotation (7.5 vs 4.0 Mg $ha^{-1}$). Tillage in the previous crop did not appear to have any effect on 1985 grain yield results. The effect of tillage system on soil compaction was also monitored in selected treatments and some of these results are presented in Table 3. After two years of maintaining various tillage systems and controlled traffic patterns, soil in the untrafficked interrow area was compacted to a greater degree in the no-till system compared to conventional tillage at both locations. However, on the basis of

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equal. or superior yield results in the no-till systems, it is not likely that these increased bulk density values were much of a limiting factor to crop performance and overall grain yields. It is of great interest to continue monitoring this particular aspect of these studies (10).

Table 1. Effect of tillage *on* corn and soybean yields.

| 1985 | 1984 | Location | | Location | |
|---|---|---|---|---|---|
| Tillage | Tillage | Coastal Plain | Piedmont | Coastal Plain | Piedmont |
| | | ----------Corn---------- | Mg $ha^{-1}$ | ---------Soybeans--------- | |
| NT | NT | 9.7 | 7.4 | 1.7 | 2.5 |
| NT | CT | 9.9 | 7.1 | 1.8 | 2.5 |
| CT | NT | 10.1 | 5.2 | 2.0 | 2.4 |
| CT | CT | 10.1 | 4.6 | 1.8 | 2.4 |
| | | ...................... | sig. level | ---------------------- | |
| NT vs. CT | | NS | 0.05 | NS | NS |

Table 2. Effect of tillage on grain yields in the three crop rotation.

| Tillage Sequence | Corn | Wheat | Soybeans |
|---|---|---|---|
| | ------------------ | Mg $ha^{-1}$ | ------------------ |
| NT Corn–NT Wheat–NT Soybeans | 9.0 | 3.5 | 2.9 |
| NT Corn–CT Wheat–NT Soybeans | 9.2 | 4.1 | 2.9 |
| CT Corn–CT Wheat–NT Soybeans | 5.6 | 4.0 | 2.9 |
| CT Corn–CT Wheat–CT Soybeans | 5.5 | 3.8 | 1.9 |
| | ---------------- | sig. level | ---------------- |
| NT vs. CT | 0.01 | 0.05 | 0.01 |

Table 3. Soil compaction as affected by tillage system and row position.

| 1995 | 1984 | Interrow Area | | Interrow Area | |
|---|---|---|---|---|---|
| Tillage | Tillage | Trafficked | Untrafficked | Trafficked | Untrafficked |
| | | ---------------------- | $D_b$, Mg $m^{-3}$* | ---------------------- | |
| | | Coastal Plain | | Piedmont | |
| NT | NT | 1.64 | 1.47 | 1.62 | 1.52 |
| NT | CT | 1.66 | 1.76 | 1.67 | 1.44 |
| CT | NT | 1.57 | 1.24 | 1.51 | 1.22 |
| CT | CT | 1.58 | 1.25 | 1.46 | 1.70 |

* Sample area represents the surface 2-10 cm of soil

SUBSOILING AND COVER CROP INTERACTIONS IN CORN

In the Southeastern Coastal Plain, subsoiling is done to increase the access of plant roots to available subsoil water. Winter cover crops can also aid in conserving soil water during the growing season. This experiment examined the interaction of subsoiling and cover crops on water use, growth, and yield of corn. Three cover conditions at planting (bare, wheat, or crimson clover) were tested with and without subsoiling (4). During early spring the cover crops depleted surface moisture substantially, and corn planted into cover grew more slowly. However, by the onset of tasseling (day 59), dry matter accumulation in cover crop plots which were subsoiled was nearly that of the bare plots, and tasseling was delayed only 2 days as compared to 4 days for nonsubsoiled cover cover plots. Final yields were not affected by cover in the subsoiled plots, but were substantially reduced by cover in nonsubsoiled plots. Data are summarized in Table 4 (4).

Table 4. Soil water at planting, above-ground plant dry weights, and grain yield.

| Cover Condition | Sub-Soiling | Soil water* at planting kg/kg | Plant dry weight, g/plant ---days after planting--- 31 | 59 | 102 | Grain yield Mg/ha |
|---|---|---|---|---|---|---|
| Bare | Yes | 0.107a | 8.0a | 86.7a | 258.6a | 6.5a |
| Bare | no | 0.107a | 9.1a | 80.1a | 264.0a | 5.7b |
| Wheat | Yes | 0.076c | 3.3c | 64.6b | 264.5a | 6.4a |
| Wheat | no | 0.076c | 2.7c | 57.8b | 207.4b | 4.5c |
| Clover | yes | 0.081b | 4.2b | 79.0a | 304.9a | 6.4a |
| Clover | no | 0.081b | 4.0b | 58.9b | 209.4b | 4.3c |

* Represents soil water content in the upper 90 cm of soil.

## WINTER-ANNUAL LEGUMES AND FERTILIZER PLACEMENT METHODS IN NO-TILLAGE CORN

Since 1982, efforts have been made to evaluate the potential of winter-annual legumes as nitrogen sources and mulches for no-tillage corn production systems in the North Carolina Coastal Plain. In six experiments, hairy vetch, Cahaba White vetch, Austrian winter pea and Tibbee clover produced adequate dry matter and top growth nitrogen to function successfully as mulches for no-tillage corn in comparison to fallow systems supplied with fertilizer nitrogen. Hairy vetch consistently produced the highest corn yields; fifty pounds per acre of fertilizer N was the optimum fertilizer nitrogen rate for legume systems. Incorporation of a hairy vetch cover crop prior to corn planting produced yields equivalent to the corn planted without tillage into undisturbed vetch (in a two-year study where soil moisture was plentiful during grainfilling periods). In-row subsoiling for corn was required for maximum yields in the winter-annual/corn rotation. Removal of the vetch for forage reduced corn yield unless additional fertilizer nitrogen was supplied. Planting of corn into killed strips of the hairy vetch cover crop reduced corn yields whether the remaining cover crop was killed at two or four weeks after corn planting or allowed to mature in the row middles. Three years of experimentation indicated that starter fertilizers may improve no-tillage corn yields in some seasons. Placement of UAN solutions in dribbled surface bands close to the corn row (approximately 6" to one side) produced higher corn yields than surface bands placed in the row middle (on 36" row spacings). This effect may be offset, in some situations, by use of a starter fertilizer in 2 x 2 placement. Many N.C. corn growers have adapted the no-tillage plus subsoiling implements to their corn production systems and wish to place a starter fertilizer in the subsoiler track. In 1985, a device was developed that uniformly distributes fluid fertilizers in the subsoiler track. Preliminary experiments indicate that uniform distribution of fertilizer in the subsoiler track produces a "starter" response equivalent to that observed with 2 x 2 placement (1).

## SOIL STUDIES OF TILLAGE SYSTEMS FOR CORN PRODUCTION

Nine tillage systems for corn production have been tested for two years at two Piedmont locations (3). The tillage systems are fall moldboard plow-spring disk, spring moldboard plow-spring disk, fall chisel plow-spring disk,

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spring chisel plow–spring disk, spring disk only, fall chisel plow only, spring chisel plow only, no–till, and no–till with in–row chiseling. In 1984, a wet year, there were no yield differences between systems at one location. At the other location, poor stands and serious weed problems resulted in lower yields in no–till than in conventionally tilled treatments. In 1985, a drier year, no–till and chisel plowing without disking resulted in higher yields than the conventionally tilled systems at both locations. Bulk density measurements indicated no compaction problems in any system in untrafficked areas. All systems had high bulk densities (1.60 - 1.55 $g/cm^3$) in trafficked areas, indicating a possible compaction problem in continuous no–till if traffic is not controlled (3).

## ROLF OF LEGUME COVER CROPS IN NO-TILL CORN

The use of legumes in conservation tillage production systems may provide significant quantities of fixed nitrogen while conserving soil and water resources. Research has been conducted the past two years to determine the influence of winter cover crops in a conservation tillage corn system with regard to: 1) N cycling and 2) soil–plant–water relationship (8). Another objective was to evaluate the adaptability of various legumes to North Carolina soil and climatic conditions. In this study, the experimental design consisted of four cover crop treatments (no cover, rye, crimson clover, and hairy vetch), three cover crop-corn/time of burndown–planting combinations (early kill–early plant, early kill–late plant, and late kill–late plant), and three rates of fertilizer N (0, 100, and 200 kg $ha^{-1}$). There was approximately a 2–week interval between the early and late corn planting dates. Grain yield results (2 yr. avg.) are shown in Table 5 and represent mean values averaged across all burndown–plant combinations. The soil water status in the no–cover treatment appeared to limit the yield response to fertilizer N, as grain yield only increased up to the first 100 kg of N In contrast, with rye as cover crop, grain yield increased with increasing N rate. The wide C:N ratio of this cover crop and associated N immobilization potential was most likely a contributing factor in this response pattern. even with no fertilizer N applied, grain yields for the legume cover crop treatments were comparable to yields obtained with the no cover and rye cover treatments receiving 180 kg N(8).

Table 5. Effects of cover crop and N rate on corn grain yield, 1984-85.

| | N Rate (kg $ha^{-1}$) | | |
|---|---|---|---|
| Cover Crop | 0 | 100 | 200 |
| | Yield, Mg $ha^{-1}$ | | |
| No cover | 5.9 | 7.6 | 7.9 |
| Rye | 4.4 | 7.1 | 7.9 |
| Crimson clover | 7.6 | 8.3 | 8.6 |
| Hairy vetch | 8.1 | 8.6 | 8.6 |

## TILLAGE-CROP ROTATION INTERACTIONS ON WEEDS, NEMATODES AND NUTRIENTS

A long-term. tillage–crop rotation study involving corn, soybeans and wheat was established at the Tidewater Research Station on a high organic: soil (14). Tn the fifth year of the experiment, 1955, all plots were planted to soybeans. Tillaqe treatments on corn and wheat in 1984 previously af fected lesion and stunt nematode population levels. Lesion populations tended to be greatest in plots continuously tilled, whereas their numbers were lowest if corn was planted no-till in 1984. The fewest of these nematodes occurred in plots planted no-till to corn but plowed, disked and planted to wheat. This latter treatment also gave low population densities of the stunt nematode. Tn contrast to the lesion nematodes, greatest population densities of the stunt nematode were found after continuous no-till. In 1985, each plot was subdivided, half treated with aldicarb and half left untreated. The stunt and lesion nematode populations were lower in aldicarb treated subplots than in untreated ones at 74 and 69 days after planting. The number of plots with detectable populations of the soybean cyst nematode increased from planting of soybeans in 1985 to 69 days later. Increases in incidence of various life stages were: juveniles -from 5% to 65%, cysts - from 45% to 50%, and eggs - from 40% to 50%. Late-season data will be needed to determine the impact of aldicarb on population resurgence. Weeds were still not a major problem in any of the treatments. The herbicide program for soybeans in 1985 was: linuron + paraquat was used preemergence and aciflurofen + crop oil concentrate was used as an early-post-emergence treatment for broadleaf weeds. There was more morning glory in the tilled plots as compared to the no-till. All plots were relatively clean in late-season. Grass control was not a problem. In 1985, there were no differences in stratification of P and K with regard to tillage. P and K were higher at the surface in all treatments. According to the P and K index, P was about 80% higher in the surface and K was 65 to 75% higher at the surface than lower depths. Nutrient cycling is probably responsible for no more changes in stratification than this. Differences in soil pH were very small. There were no differences in plots that were bottom plowed. pH in chiseled and disked plots was 0.13 lower in the surface as compared to deeper and pH in no-till plots was 0.1 lower in the surface as compared to deeper (14).

## NEMATODE CONTROL IN CONVENTIONAL AND NO-TILL DOUBLE-CROPPED SOYBEANS

Efficacy of nematicides to control selected nematodes, with emphasis on Heterodera glycines, was determined in no-till and conventional-till planted soybeans over a 3-year period from 1981-87 (8). Greatest numbers of H. glycines eggs were recovered in conventionally-tilled plots. Population of Tylenchorhynchus claytoni were lowest in in-row subsoiled no-till treatments and highest in no-till, nonsubsoiled treatments. Nematicide effects were not consistent across years as mensured by population densities. Yields were greatest in in-row subsoiled no-till plots treated with EDB. The soil characteristics which influence water movement seem to be important for nematicide performance (8).

## CONSERVATION TILLAGE FOR VEGETABLES AND TOBACCO

Conservation-tillage research involving vegetables and tobacco have mainly focused on the use of various cover crops as residue in a strip-til1 system (5). Experiments with the various commodities have shown that cover crop residues do influence growth parameters and yields (Table 6). The strip-till tobacco production system yields well when rye and Austrian winter peas have been used. The various vegetable crops, however, seem to yield better when legume cover crops are used than when grass cover crops are utilized. All commodities were produced under optimum conditions (including fertilizer) except for irrigation. Various tillage systems have also been established to measure the yield potential and constraints of conservation tillage on seeded and transplanted vegetable and tobacco crops. Yield results indicate that production under conservation tillage can compete competitively with conventional culture (6). Conventional tillage does appear to yield better when early season varieties or commodities are grown, but full-season or "normal" season crops yield similarly regardless of tillage methods (Table 7).

Table 6. The effect of cover crop on tobacco and vegetable yields.

| Cover Croe | Tobacco lbs/A | | Cabbage T/A | Broccoli T/A | Tomato T/A | Potatoes T/A |
|---|---|---|---|---|---|---|
| | Brevard Soil | Dyke Soil | | | | |
| Bare | | 1988 | 29.4 | 6.2 | 78.3 | 19.3 |
| Cultivated | 2605 | | 31.1 | | | |
| Rye | 2921 | 2207 | 26.9 | 6.6 | 34.4 | 17.8 |
| Barley | 2680 | 1989 | 25.7 | | | 16.9 |
| Ryegrass | | | 24.6 | | | |
| Wheat | 2646 | | 25.0 | | | |
| Crimson clover | | 2046 | 28.9 | 6.5 | 38.9 | 18.0 |
| Vetch | | 1950 | 29.7 | 6.9 | 79.1 | 17.8 |
| Peas | 2918 | | | | | |

Mean yields from two years data.

Table 7. The effect of tillage on various vegetables and tobacco yield.

| | Marketable Yield by Commodity, Ton/A | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Squash | Broccoli | | Sweetcorn | Tobacco |
| | Tomatoes | Cabbage | Snap Beans | Acorn | Spring | Fall | ears/A | lbs/A |
| Conventional | 46.1 | '54.0 | 18.6 | 18.8 | 6.6 | 4.8 | 22172 | 2425 |
| Strip-till | 50.8 | 33.4 | 15.5 | 15.2 | 5.5 | 4.1 | 22058 | 2225 |
| No-till | 49.4 | | 15.5 | 20.9 | 5.4 | 3.9 | 19970 | 2244 |
| LSD(.05) | NS | NS | | | .9 | .6 | NS | NS |

## SOIL CONSERVATION AND TILLAGE SYSTEMS FOR TOBACCO

In 1984, a year characterized by intense storms and greater than normal precipitation (170 mm during July through Sept.) runoff and erosion losses from tobacco planted on Cecil soil with a 6% slope were 42.1 mm and 16768 kg/ha from conventional tillage (CT) (fall moldboard plow, spring disc and ridge, cultivation), 40.7 mm and 18615 kg/ha for conventional tillage without cultivation (NC), and 35.9 mm and 1757 kg/ha from reduced tillage (RT) (fall moldboard plow, disc and ridge, and a cover crop) (2). A higher percentage of fines, though lower in actual mount, were eroded from the RT treatment. Tobacco yields were reduced 10% by NC (2360 kg/ha) and 14% by RT (2274 kg/ha) treatments compared to CT (2630 kg/ha). In 1985, a year characterized by less intense storms and near normal precipitation levels (202 mm from May to Sept.), runoff and erosion losses from tobacco on Appling soil with a 5.5% slope were 29.0 mm and 9361 kg/ha for CT, 36.1 mm and 9629 kg/ha for NC, and 35.5 mm and 1502 kg/ha for RT, respectively. As in 1984, a greater percentage, but less in actual amount, of fines were eroded from the RT plots. The erosion event characteristics changed markedly as the growing season progressed, with very large storms near the end of August producing large amounts of runoff but very little soil loss, with the RT treatments producing the least soil loss. Texture of the sediments varied between treatments and varied across time, with the NC and CT plots producing coarser sediments than the RT plots. The NC treatment reduced tobacco yield 7% (2634 kg/ha) compared to the RT (2807 kg/ha) and CT (2818 kg/ha) treatments. Detailed analysis of soil physical properties and plant characteristics of these and 9 more treatments are being done at this tine (2).

## NO-TILL TOBACCO WEED CONTROL RESEARCH

Weed control in no-till tobacco was variable in 1985 (I3, 15). Plots with good weed control yielded well. No-till tobacco in one test on a clay soil yielded 38% less than conventional, one test on a sandy loam soil, 32% less and in another test, 20% less. No-till burley tobacco yielded as much as conventional. Over the last 4 years, no-till burley yeild has been equal to conventional yields. In a variety test in no-till flue-cured tobacco, higher yields (7015 and 3085 Ib/A, respectively), were obtained with K-326 and NF-28 over C-319, NF-22, 5-70 and NC-82 (averaging 2502 lb/A). Most no-till plots where registered herbicides were used had to have some hand weeding to attain acceptable weed control. A fertility test site was infested with morningglory and control was poor. All conventional tobacco out-yielded the no-till and had a higher price per lb., although grade index was not different. In the conventional and no-till tobacco, the higher rates of fertilizer tended to increase yields. This resulted in lower quality in the conventional but not in no-till. Two on-farm no-till tests in flue-cured tobacco were heavily affected by drought and all no-till treatments yielded about 400 lb/A less than conventionally tilled and fertilized tobacco. In general, the no-till tobacco seemed to be more adversely affected by drought than conventionally tilled tobacco. This might have been caused by the water shedding effect of the firm, untilled soil plus the funneling of water by the raised row ridges and early depletion of soil moisture by the cover crop of rye. Tillage and fertility treatments in the on-farm tests which included: in-row subsoiling, injected fertilizer, and surface applied fertilizer to no-till tobacco did not result in mensurable differences in cured leaf yield or quality and all treatments yielded less than conventionally grown tobacco (13, 15).

## CONTROL OF BARD-TO-CONTROL WEEDS IN NO-TILL CORN AND SOYBEANS

Field studies were initiated in 1985 to evaluate the combined tankmix interactions of several broad spectrurn contact and systemic herbicides relative to individual burndown treatments alone for hard-to-control weeds (12). Results in corn indicated paraquat plus 2,4-D gave better control of horseweed and Virginia pepperweed than paraquat alone. Glyphosate or glyphosate plus 2,4-D) gave better control of the weeds studied than paraquat or paraquat plus 2,4-D. Glyphosate or paraquat plus 2,4-D gave significantly better yields than either glyphosate or paraquat alone. Results in soybeans indicated that glyphosate, paraquat plus linuron, glyphosate plus 2,4-D, glyphosate plus dicamba and glyphosate plus alachlor were excellent on common lambsquarters and horseweed. The addition of 2,4-D to paraquat improved control of all weeds over paraquat alone, although 2,4-D rates may need to be higher than 0.56 kg/ha to obtain better control. The addition of dicamba to paraquat or glyphosate improved control, but caused crop injury. Subsequent studies revealed that soybeans planted two weeks after dicamba applications of 0.15 or 0.28 kg/ha were not injured. Paraquat plus linuron, glyphosate plus 2,4-D, glyphosate plus alachlor gave significantly better yields than all other treatments (12).

## CONTROL OF LEGUME COVER CROPS IN NO-TILL AND ALLELOPATHIC EFFECTS

Field studies were initiated in 1985 to investigate different herbicide combinations and rates of application to improve initial kill of legume cover crops prior to planting corn and cotton (11). Consistent with other legume cover crop studies, corn and cotton planted into hairy vetch outyielded that which was planted into crimson clover (by 926 kg/ha and 149 kg/ha, respectively). Plots treated with combinations such as glyphosate or paraquat/2,4-D or dicamba generally produced greater yields than plots treated with the former two separately (612 kg/ha more for corn and 256 kg/ha more for cotton); plots treated with paraquat usually had higher yields than those treated with slower-killing herbicides. Overall, hairy vetch was more easily killed than crimson clover. Throughout the growing season, corn and cotton plants were taller in the vetch whole plots. Nitrogen differences and allelopathy were suspected. Although vetch had 187 kg/ha total N in the above-ground biomass versus 136 kg/ha N for clover, crop tissue analysis for N, however, did not reveal higher N levels in plants from the vetch plots. Differences in yield of corn between vetch and clover were correlated to differences in stand, with poorer corn stand in clover. Differences in yield of cotton between vetch and clover are not explained. To investigate possible allelopathic interactions, germination studies using water extracts of each legume at full (5g dry wt./150 ml water) one-half and one-third strength concentration levels were conducted; corn, cotton, wild mustard, morningglory and goosegrass were used as bioassay test species. Reductions of 25-90% in germination rates and seedling dry weights were found. Debris studies also revealed significant inhibition of emergence and growth of corn and cotton planted in pots in which 4 levels of legume dry matter (0, 1.67, 3.77 and 6.67 mg/g soil) were incorporated. Plants grown in pots with legume remaining on top of soil showed no reductions in seedling emergence, plant height, or dry weight. Future studies will examine possible allelopathic interactions between legume roots and the test species. It is planned to repeat the field studies in 1986 (11).

## WEED CONTROL IN NO-TILL STAKED TOMATOES

Preemergence and postsmergence herbicides were evaluated in no-till and strip-till plantings of tomatoes in a rye cover crop which had been killed with paraquat (7). Diphenamid, napropanide and cinmethylin provided excellent control of goosegrass (*Eleusine indica*) and common lambsquarters (*Chenopodium album*) in both the no-till and striptill systems. The same was true for tank-mix combinations used in both systems. Trifluralin at 1 lb/A applied prior to tillage in the strip-till planting did not provide adequate weed control. Chloramben followed by either sethoxydim or fluazifop a month later provided good weed control in the no-till system. However, chloramben csused significant injury initially. Two months following application no injury was apparent. However, chloramben treated plants were delayed in maturing fruit. Overall, none of the herbicide treatments reduced yield in either system. ?he weedy check in the no-tillage planting yielded in the same range of all other treatments, whereas the weedy check in the strip-tillage planting did not. The rye mulch in the no-tillage weedy check provided approximately 50% weed control perhaps accounting for the better yield obtained. In general, a trend towards higher yields was observed with the strip-tillage planting compared to the no-tillage planting *(7)*.

## HERBICIDE AND TILLAGE EFFECTS ON SOIL ARTHROPODS

Studies have been initiated to elucidate the effects of two commonly used herbicides, glyphosate and paraquat, on soil arthropod number and activity in nc-tillage systems and to quantify the impact of conventional and no tillage practices on the soil arthropod community (5). For the first gear tillage had a greater impact on soil microarthropod numbers than herbicides. Treatments without tillage, regardless of the kind of herbicides applied, supported higher numbers of microarthropods (e.g., Collembola and mites) than tilled treatments. Length of time without tillage had a significant ($p<0.05$) effect on microarthropod density. Soil microarthropod numbers were 10-fold higher in treatments two years without tillage than in those one year without tillage. In no-tillage systems, differences between herbicide treatments were detected for surface crop residue-dwelling microarthropods. On two sampling dates, higher microarthropod numbers were collected from the surface crop residue of nonherbicide than herbicide treated no-tillage plots, probably as a consequence of a more moist litter layer due to the dense weed and crop canopy. However, in the soil surface *(0-3* cm depth), similar numbers of microarthropods were col.-lected from both herbicide and nonherbicide treated plots. Soil macroarthropods (e.g., spiders, ground beetles) were most abundant under weedy, no-tillage conditions. Clean (i.e., herbicide-treated) no-tillage treatments often sup ported fewer arthropods than nonherbicide no-till age treatments. Indirect effects of herbicides on habitat modification, especially floral diversity, are implicated. Decomposition (weight loss) of nonherbicide surface crop residues may be more rapid than herbicide-treated as a consequence of different microclimatic effects within the treated soil-litter subsystem (5).

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