EFFECT OF PLANT POPULATION ON YIELD, DISEASE, AND OTHER PARAMETERS OF SOYBEANS PLANTED NO-TILL AND CONVENTIONALLY

D. L. Wright, F. M. Shokes and W. B. Tappan[1]

No-till and reduced tillage farming are being widely accepted by growers with a minimal amount of information on management of crops grown under these conditions. Labor, fuel, equipment savings and timely plantings with multiple-cropping are major advantages of these systems. Little is known about the long-term effects of no-till farming on populations of insects, weeds, nematodes, and plant pathogenic fungi. Florida has high levels of certain pests and serious problems could result from continuous no-till planting. A 5-10% loss of stand can occur with no-till planting due to insect problems, cooler soil, slower seed germination, improper seed placement in sods and bird damage. Slower seedling emergence and cooler soils as well as a build-up of inoculum in soil residues, could also contribute to a higher incidence of seedling disease.

Planting a winter cover crop of a small grain followed by soybeans is becoming popular, but research is needed to determine whether such a crop is sufficient to prevent the build-up of pest populations.

Current Research

With consideration of the above factors, research on soybean no-till systems was begun at the Agricultural Research and Education Center at Quincy, Florida, in 1977-78. In one study the 'Centennial' soybean was grown under the following cultural systems: 1) soybeans after rye-ryegrass winter cover no-till planted into stubble; 2) soybeans no-till planted into soybean stubble; 3) soybeans after rye-ryegrass winter cover, conventional plow-plant; 4) soybeans planted into soybean stubble, conventional plow-plant. Three nematicides, Temik 15G (18 lbs/A), Soilbrom 90EC (1.5 gal/A) and sodium azide 2C (50 lbs/A), were tested using these cultural systems. The foliar fungicide, Benlate was also compared to an unsgrayed check using these cultural practices.

In a second study seven different soybean plant populations were compared under no-till and conventional plow-plant cultural regimes. Populations of 8, 6, 4, 3, 2, 1, and 0.5 plants per foot of row were used. Seedling disease, foliar disease, yields and morphological parameters (plant height and stem diameter) were measured.

Kesults and Discussion of 1979 Data

Soybeans under the four cultural systems showed no significant differences in yields due to the cultural systems or the nematicides. Only the spiral nematode was present in sufficient numbers to be of importance. Table 1 shows that there was a two-fold increase in numbers of this nematode in no-till plots. Spiral nematode is not known to be a major problem in soybeans.

D. L. Wright, Extension Agronomist, F. M. Shokes, Plant Pathologist, and W. B. Tappan, Professor of Entomology, AREC, University of Florida, Route 3, Box 638, Quincy, Florida 32351.

The fungicide, Benlate, decreased overall foliar disease but had no effect on yield in this study as is often the case with the Centennial variety of soybeans.

Soybean yields at different plant populations in 36 inch rows are shown in Table 2. Yields were similar for both no-till and conventional plantings from 3-8 plants per foot of row. As plant numbers decreased below three plants per foot of row, yields were sharply reduced and weed populations increased with both methods of planting. Stem diameters increased with a decrease in plant height resulting in a low bushy growth as compared to plants in higher populations. Plants were taller under no-till conditions than with conventional planting (Table 3). This might be attributed to increased moisture under the stubble mulch. The hundred seed weight increased as population decreased (Table 4). Seed weights were consistently higher for soybeans in the conventional plow-plant system but differences were not statistically significant.

The incidence of seedling diseases, as evidenced by root rot and stem lesions was 12% greater on seedlings from no-till plots than on seedlings from conventional plow-plant plots. Plant population had only a nominal effect pn overall foliar disease ratings (Table 5), but pod and stem blight increased as population increased. Anthracnose ratings were significantly different in relation to tillage practices and were higher in the lower populations and lower in the no-till plots.

Further research is needed on no-till systems in relation to effects on yields and disease. Optimal management systems need to be developed to permit maximum yields and minimize losses when available land for rotations is limited, More data is needed to determine if the short rotation with a winter crop of small grains is sufficient to permit continuous no-tillage planting of soybeans. Insufficient data is available at this time to project any long-term effects of such plantings on diseases or other pests in no-till systems in North Florida.

References

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2. Doupnik, B., Jr. and M. G. Boosalis. 1980. Ecofallow - a reduced tillage system and plant diseases. Plant Disease 64: 31-35.

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Table 1. Effect of Nematicides on Spiral Nematode Numbers and Yield of Soybeans (Quincy 1979).

Treatment	Nematode Counts/100 cc Soil		Yield
	Conventional	No-Ti[1]	Bu/A
Soilbrom	309	734	32.7
Temik	350	905	33.1
Sodium azide	578	857	37.3
Check	612	1171	34.5

[1]Yields were not significantly different across cultural practices or in relation to treatments.

Table 2. Effect of Plant Population on Soybean Yields Under No-Till and Conventional Planting - 1979.*

P1ants/row ,ft.	No-Till	Conventional
	bu/A	
8	58.2 a	57.2 a
6	59.2 a	56.5 a
4	55.5 a	55.3 a
3	54.5 a	50.8 a
2	40.6 b	43.3 b
1	27.5 c	30.5 c
0.5	16.6 d	24.7 d

* Means in a column followed by the same letter are not significantly different DMRT p = .05). There were no significant differences between cultural practices.

Table 3. Plant Height and Stem Diameter at Maturity - 1979 Soybean Plant Population Study.

Plants/row ft.	Plant Ht. (an) No-Till[1]	Conventional	Stem Diameter (cn)*
8	113.8 a	99.0 ab	0.96 cd
6	110.9 ab	105.2 a	0.92 d
4	108.2 ab	102.2 ab	1.00 cd
3	107.7 ab	99.6 ab	1.04 c
2	102.3 b	95.3 bc	1.14 b
1	93.4 c	88.0 cd	1.45 a
0.5	87.7 c	82.4 d	1.38 a

1 Numbers in a column with the same letter are not significantly different (DMRT p = .01). Each number represents a mean of at least 80 measurements.

2 Numbers in this column represent a mean of no-till and conventional plow-plant stem diameters for a given population. Tillage practices had no significant effect on stem diameters.

Table 4. Weight of 100 Soybean Seed in Relation in Plant Populations with No-Till and Conventional Management - 1979.*

Plants/row ft.	No-Till	Conventional
8	14.0 ab	14.7 c
6	13.6 b	14.7 c
4	14.2 ab	14.5 c
3	14.5 ab	15.0 bc
2	15.1 a	15.6 abc
1	15.2 a	16.1 ab
0.5	14.9 ab	16.6 a

*Means in a column followed by the same letter are not significantly different (DMRT p = .05). There was no statistically significant difference between cultural practices.

Table 5. 1979 Soybean Plant Population Study Disease Ratings.[1]

Plants/row ft.	Overall[2] Foliar Disease	Pod & Stem[2] Blight	Anthracnose[3]	
			No-Till	Conventional Plow-Plant
8	4.6 a	3.0 a	1.9 a	3.4 ab
6	5.0 a	2.6 a	3.2 ab	3.2 ab
4	5.2 a	2.6 a	1.9 a	2.8 a
3	4.7 a	2.4 ab	2.1 a	3.9 abc
2	4.6 a	1.0 b	2.5 a	4.5 bc
1	4.0 b	1.1 b	4.1 bc	3.9 abc
0.5	4.1 b	0.9 bc	4.7 c	5.4 c

1 Numbers in a column with the same letter are not significantly different (DMRT p = .05). Each number represents a mean rating for four replications. All disease ratings were on a scale from 1-10 with one representing plants free from disease and 10 representing plants killed by disease.

2 Numbers in these columns represent combined means of no-till and conventional plow-plant for a given population. Tillage practices had no significant effect on disease.

3 Anthracnose ratings were significantly different in relation to tillage practices (DMRT p =