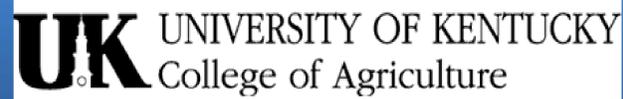


Weed Control in No-Till Organic Soybean.

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Introduction

Tillage is often used as weed-suppression method in organic soybean production. However, this destroys soil structure, increases soil temperature, and increases potential for soil loss through erosion. This method of weed removal is also receiving increased criticism with concerns of CO₂ loss to the atmosphere.

In response to these concerns, this research approaches the problem of weed control in organic soybeans by coupling no-till agriculture with cover-crop management. Previous studies have shown that the optimal weed-free period for soybeans is 4 weeks, however this study finds that it is 2 weeks for no-till rye and 6 weeks for tilled vetch treatments.

Objectives

The purpose of this study is to compare the effective weed management of coupling no-till organic soybean production with cover cropping systems.

Materials and Methods

Organic soybeans (Glycine Max) were planted using a no-till rear-mounted planter accompanied by a front-loaded roller over rye. Additionally, soybeans were planted in adjacent repetitions of conventionally planted soybeans with a moldboard plow and disk over tilled vetch. All surface weeds were removed via hand-hoeing from 3.0 m wide by 6.1 m long plots of four rows spaced 0.75 m apart.



Picture 1. The no-till planter and front-loaded roller planting soybeans and crimping a rye cover crop. (Photo: John D. McMaine, 2009)

Five treatments were performed on each repetition consisting of: control (no hand-hoeing), 2 WAP (weed-free through 2 weeks), 4 WAP (weed-free through 4 weeks), 6 WAP (weed-free through 6 weeks), and 8 WAP (weed-free through 8 weeks).

At physiological maturity, biomass samples were taken from a 0.38m² area with soybeans, broad-leaved weeds and grasses sampled. Yield was taken from the center two rows of an approximately 5.2 m length section of each treatment.



Picture 2. Conventional tilled soybeans with weeding treatments.



Picture 3. No-till soybeans with weeding treatments

Results and Discussion (See Top Right Panel)

Response	Units	Cover Crop Treatment		Sig. at 0.05 level?
		No-till rye	Conv. Till vetch	
Stand	Plants m ⁻²	41.8	30.8	Yes
Broadleaf weed mass	g m ⁻²	19	151	Yes
Grassy weed mass	g m ⁻²	13	59	No
Canopy closure at R1	percent	94	76	Yes
Plant height	cm	109	119	Yes
Lodging	1-5 scale	2.6	3.1	Yes
Soybean yield	Mg ha ⁻¹	4.39	3.13	Yes

Table 1. Responses to Cover Crop Treatments



Picture 4. Harvesting soybeans with a small-plot Hege combine. (Photo: John D. McMaine, 2009)

Cover Crop Treatment Analysis (Table 1): A higher proportion of soybeans germinated two weeks after planting in the no-till rye treatment than with conventional tillage. Broadleaf weed mass was significantly greater in the no-till rye than the conventional till vetch. Unlike broadleaf's, the presence of grassy weed was not significantly different between no-till rye and conventional till at the 0.05 level. The greater presence of tall broadleaf plants may have caused soybeans to grow taller in the conventional tilled plots resulting in greater lodging. Finally, soybean yield was significantly greater in the no-till rye treatment than in the conventional till vetch. This data reveals that the no-till treatment outperformed conventionally tilled treatments in weed suppression and yield.

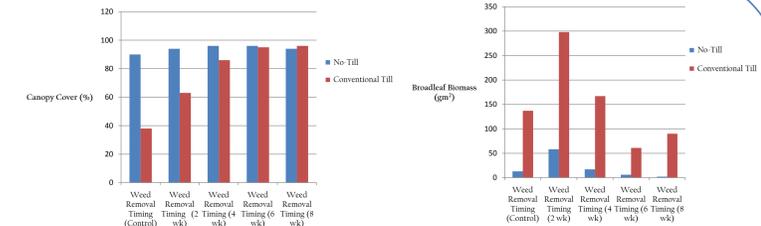


Table 2. Canopy cover for different weed treatments using no-till and conventional till planting.

Table 3. Broadleaf Biomass for different weed treatments using no-till and conventional tillage planting.

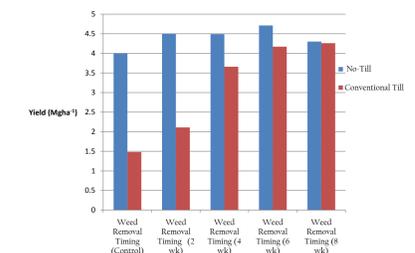


Table 4. Soybean yield for different weed treatments using no-till and conventional till planting

Cover crop treatments and weed removal timing (Tables 2-4):

Canopy cover was high (above 80%) for all weed removal timings in the no-till treatment. However, for the weed removal timings in conventionally tilled land, a notable increase from 2, 4 and 6 week weeding timings occurred. Furthermore, while the broadleaf biomass did not demonstrate a significant trend between the weed removal timings, there was a greater biomass among the conventionally tilled vetch treatments than the no-till rye treatments. Finally, the yield for all weed removal timings in the no-till treatment was high, while the peak yield in the weed removal timings in the conventional till didn't occur until the sixth week timings. This data suggests that rolled rye no-till treatments achieve comparable yields with no weeding as conventional tillage treatments do with up to six weeks of weeding.

Conclusion

In summation, the no-till rye treatment outperformed the conventional till vetch in most aspects of study. The amount of manual weed control needed to achieve, on average up to six weeks, to match the no-till treatments in weed suppression and yield is tremendous. Upon further research and consultation, organic farmers may find considerable utility in combining no-till agriculture with weed suppressing winter cover-crops.