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How Pretreatment Cover Crop and Conventional Management Practices Affect Strawberry Plant Growth and Yield, Pest Populations, and Soil Characteristics

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Abstract
The benefits of rotating cover crops within a cropping system include improved soil quality and suppression of pests,such as weeds and nematodes. Few studies compare native plants as rotation cover crops in cropping systems to more conventional cover crops. The use of cover crops in rotation with strawberry may provide an alternative to chemical pesticides, reduce the degradation of soil structure, and provide a potential cash crop of seeds and biomass. The objective of this study was to investigate how different cover crops affect pest populations and soil properties when used in rotation with strawberry compared with conventional tillage.

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How Pretreatment Cover Crop and Conventional Management Practices Affect Strawberry Plant Growth and Yield, Pest Populations, and Soil Characteristics

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Introduction

The benefits of rotating cover crops within a cropping system include improved soil quality and suppression of pests, such as weeds and nematodes. Few studies compare native plants as rotation cover crops in cropping systems to more conventional cover crops. The use of cover crops in rotation with strawberry may provide an alternative to chemical pesticides, reduce the degradation of soil structure, and provide a potential cash crop of seeds and biomass. The objective of this study was to investigate how different cover crops affect pest populations and soil properties when used in rotation with strawberry compared with conventional tillage.

Materials and Methods

The long-term experiment was established in 1996 at the Iowa State University Horticulture Station, Ames, IA. Nine treatments were established: *Rudbeckia hirta* L. (blackeyed Susan), *Panicum virgatum* L. (switchgrass), *Sorghastrum avenaceum* (Michx.) Nash. (Indiangrass), *Andropogon gerardii* Vitm. (big bluestem), *Tagetes erecta* L. Crackerjack (marigold), *L. perenne* (perennial ryegrass), *Sorghum bicolor* (sorghum sudangrass), *F. ×ananassa* Duch. Honeoye (strawberry), and cultivated-bare soil. A randomized complete block design with three replications was used for the experimental design. In spring 2005, all treatments were tilled and *F. ×ananassa* Duch. Honeoye were planted. In 2006, berries were harvested and the plants were renovated to reestablish the matted rows. Weed growth was evaluated by estimating visual percentage, numbers, types, and biomass (dry weight). Strawberry plant growth and development were evaluated by percent row fill and plants established. Strawberry yield was collected from three, five-foot linear rows per plot. Soil quality was determined by measuring macroaggregate mass (wet aggregate stability), bulk density, water infiltration, percentage organic carbon and nitrogen, pH, and nitrogen and carbon utilization. Nematodes will be enumerated from soil and plant roots by sugar and shaker extraction.

Results and Discussion

Weed growth. R. hirta treatment plots were similar to *T. erecta* plots and had greater grass weed germination in June 2005. Weed growth was greater in June than August 2005 (Table 1).

In 2006, weed presence and dry weed biomass was greater in *R. hirta* and *L. perenne* cover crop plots and were similar to the continuous strawberry plots (Table 2). The number of weeds was generally less, but biomass was greater in 2006 than 2005.

Strawberry growth. In 2005, the continuous strawberry, *R. hirta,* and *L. perenne* treatment plots had fewer established strawberry plants (Table 3). *P. virgatum, A. gerardii, S. avenaceum, T. erecta,* and *S. bicolor* treatment plots had the best plant establishment results and were similar to the cultivated-treatment plot.

Overall, plant establishment was greater in the second year of growth (2006). *L. perenne* and continuous strawberry treatment plots had fewer numbers of established plants and lower percent row fill than all other treatments. Percent row

fill was greatest in *P. virgatum*, *A. gerardii*, *S. bicolor,* and cultivated treatments.

Stawberry yield. In 2006, *P. virgatum* treatment plots had greater yields than *S. avenaceum*, *L. perenne*, and continuous strawberry. The *P. virgatum* treatment had greater yields than all other treatments, but was similar to the cultivated, *A. gerardii*, *T. erecta*, *S. bicolor* treatments.

Water infiltration. There was no difference in water infiltration found between treatments in 2005 or 2006 (data not presented).

The study will be continued in 2007 to obtain data from an additional growing season. Variables will determine weed growth and plant growth and yield of strawberries planted into sites that were previously in the cover crop, conventional or control treatments. In addition, soil and nematode analyses will be completed.

Table 1. Incidence of weed growth in Honeoye strawberry matted rows grown in sites with previous cover crop or control treatments, 2005.[z y]

Treatments	Weed cover (%)		Grasses (no.)		Broadleaves (no.)		Grasses dry wgt (g.)		Broadleaves dry wgt (g.)	
	June	Aug.	June	Aug.	June	Aug.	June	Aug.	June	Aug.
R. hirta	37.2 a	30.0 bcd	324 a	9 ab	20 abc	2 c	7.6 a	15.6 a	1.7 bc	3.8 c
P. virgatum	28.3 ab	15.0 de	28 d	1 d	27 ab	4 bc	1.5 de	0.1 b	3.5 a	4.7 c
S. avenaceum	27.2 ab	36.1 bc	171 bc	2 d	36 a	4 bc	4.1 bc	3.0 b	1.3 bc	18.2 ab
A. gerardii	26.1 ab	20.6 cde	104 cd	1 d	18 abc	3 bc	3.7 bcd	3.3 b	1.4 bc	2.9 bc
T. erecta	26.1 ab	22.2 cde	231 ab	7 bc	32 a	2 c	3.8 bcd	10.3 ab	1.5 bc	1.7 c
L. perenne	21.7 bc	44.4 b	179 bc	4 cd	8 bc	6 ab	5.2 ab	2.2 b	1.3 bc	20.2 a
S. bicolor	13.3 cd	16.8 de	170 bc	8 abc	8 bc	2 c	2.7 cde	5.5 ab	0.3 c	2.2 c
Strawberry	26.1 ab	73.3 a	159 bc	11 a	26 abc	8 a	3.2 bcde	14.6 a	2.7 ab	22.7 a
Cultivated	8.3 d	6.2 e	52 d	1 d	6 c	1 c	1.1 e	2.8 b	0.4 c	0.8 c
LSD P≤0.05	12.5	17.2	94	4	20	3	2.4	11.3	1.7	10.9

[z]Means of three replications. Means within columns followed by the same letter are not different.
[y]Data presented are averages of three samples (.5 meter^2) per plot.

Table 2. Incidence of weed growth in Honeoye strawberry matted rows grown in sites with previous cover crop or control treatments, 2006.[z y]

	Weed cover (%)		Grasses (no.)		Broadleaves (no.)		Grasses dry wgt (g.)		Broadleaves dry wgt (g.)	
Treatments	May	Aug.	May	Aug.	May	Aug.	May	Aug.	May	Aug.
R. hirta	37.8 b	25.1 bc	10 a	24 a	9 b	4 bc	10.3 b	7.8 bc	30.8 a	4.2 bc
P. virgatum	4.1 c	7.7 cd	2 b	4 c	3 b	3 bc	0.1 c	0.4 c	1.2 c	6.3 bc
S. avenaceum	19.0 c	12.6 cd	3 ab	8 bc	4 b	2 c	0.8 c	4.9 bc	11.2 bc	4.1 bc
A. gerardii	7.1 c	7.6 cd	3 ab	7 bc	3 b	2 bc	1.8 c	1.9 bc	4.0 bc	1.1 c
T. erecta	13.3 c	17.9 cd	3 ab	7 bc	5 b	4 bc	0.5 c	1.6 bc	7.1 bc	9.5 abc
L. perenne	65.3 a	43.6 ab	11 a	24 a	30 a	7 b	21.7 a	13.9 ab	20.7 ab	12.3 ab
S. bicolor	4.2 c	8.6 cd	1 b	12 bc	5 b	2 c	0.6 c	1.4 c	0.2 c	2.8 c
Strawberry	38.6 b	46.8 a	10 a	16 ab	12 b	12 a	3.7 bc	26.0 a	20.4 ab	12.6 a
Cultivated	5.8 c	5.4 d	1 b	6 bc	7 b	1 c	0.6 c	1.2 c	2.4 bc	0.1 c
LSD P≤0.05	16.9	19.7	8	11	12	4	7.7	12.5	19.2	10.8

[z]Means of three replications. Means within columns followed by the same letter are not different.
[y]Data presented are averages of three samples (.5 meter^2) per plot.

Table 3. Honeoye strawberry plant growth, development and yield in 2005 and 2006.[z y]

	Runners formed*	No. plants in quadrat**		Percent row filled		Total yield***
Treatments	2005	2005	2006	2005	2006	2006
R. hirta	5 bcd	9 b	22 a	82.7 b	80.0 bc	1221.8 c
P. virgatum	6 abc	14 a	26 a	97.7 a	90.7 abc	2299.8 a
S. avenaceum	7 a	13 a	21 a	92.3 ab	79.5 c	1582.5 bc
A. gerardii	7 a	13 a	22 a	93.7 ab	91.1 abc	1991.5 ab
T. erecta	6 abc	14 a	21 a	97.7 a	81.4 bc	1968.3 ab
L. perenne	3 d	4 c	10 b	41.7 c	61.5 d	580.0 d
S. bicolor	5 abcd	14 a	22 a	92.8 ab	93.8 ab	2001.4 ab
Strawberry	4 cd	7 b	11 b	53.3 c	47.2 e	625.8 d
Cultivated	6 ab	14 a	22 a	98.9 a	95.6 a	1987.9 ab
LSD P≤0.05	2	3	7	12.5	13.8	587.7

[z]Means of three replications. Means within columns followed by the same letter are not different.
[y]Data presented are averages of three samples per plot.
*Runners formed per mother plant in year of establishment.
**Quadrat = .5 meter^2
***Total yield = average grams of three, five-foot linear rows.