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Influence of Cover Crop Rotation and Conventional Management Practices on Strawberry Plant Growth and Weed Growth

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Abstract
The traditional cover crops, perennial ryegrass (*Lolium perenne* L.) and sorghum sudangrass (*Sorghum bicolor* L. Moench), are used in rotation with strawberry (*Fragaria* × *ananassa* Duch.) in the Midwest to improve soil quality and suppress pests. Use of cover crops in rotation with strawberry may provide an alternative to chemical pesticides and may maintain or improve soil quality. The objective of this study was to investigate how cover crops affect weed and nematode populations as well as the physical and chemical properties of soil when used in rotation with strawberry.

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Introduction

The traditional cover crops, perennial ryegrass (*Lolium perenne* L.) and sorghum sudangrass (*Sorghum bicolor* L. Moench), are used in rotation with strawberry (*Fragaria* × *ananassa* Duch.) in the Midwest to improve soil quality and suppress pests. Use of cover crops in rotation with strawberry may provide an alternative to chemical pesticides and may maintain or improve soil quality. The objective of this study was to investigate how cover crops affect weed and nematode populations as well as the physical and chemical properties of soil when used in rotation with strawberry.

Materials and Methods

The long-term experiment was established in 1996 at the Iowa State University Horticulture Station, Ames, Iowa. Treatments were cover crops of *Rudbeckia hirta* L. [black-eyed Susan], *Panicum virgatum* L. [switchgrass], *Sorghastrum avenaceum* Michx. Nash. [Indiangrass], *Andropogon gerardii* Vitm. [big bluestem], *Tagetes erecta* L. Crackerjack [marigold], *L. perenne* [perennial ryegrass], *S. bicolor* L. Moench [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 to establish matted rows. Weed growth was evaluated by estimating visual percentage, numbers and types of weeds present, and biomass (dry weight) of weeds. Strawberry plant growth and development were evaluated by percentage of fill of the matted rows and runner formation. Soil quality will be determined by measuring macroaggregate mass (wet aggregate stability), bulk density, water infiltration, percentage of organic carbon, total nitrogen, and pH. Nematodes were enumerated from soil and plant roots by sugar and shaker extraction.

Results and Discusssion

Weed growth. *R. hirta* treatment plots were similar to *T. erecta* plots and had the highest grass germination in June 2005, the year of plant establishment, and after the tilling of all treatment plots (Table 1). Weed growth was higher in June than in August (Tables 1 and 2).

Strawberry growth. The continuous strawberry and *L. perenne* treatment plots had fewer established strawberry plants and a lower percentage of the matted rows filled (Table 3). *P. virgatum, A. gerardii, S. avenaceum, T. erecta,* and *S. bicolor* treatment plots had similar plant-establishment results and were similar to the cultivated treatment plot.

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

The study will be continued in the 2006 growing season to determine plant growth and yield of strawberries planted on 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 on sites with previous cover crop or control treatments, June 2005.[z] [y]

Treatments	Weed cover percent	Grasses no.	Broadleaves no.	Grasses dry weight (g)	Broadleaves dry weight (g)
R. hirta	37.2 a[x]	324 a	20 abc	7.6 a	1.7 bc
P. virgatum	28.3 ab	28 d	27 ab	1.5 de	3.5 a
S. avenaceum	27.2 ab	171 bc	36 a	4.1 bc	1.3 bc
A. gerardii	26.1 ab	104 cd	18 abc	3.7 bcd	1.4 bc
T. erecta	26.1 ab	231 ab	32 a	3.8 bcd	1.5 bc
L. perenne	21.7 bc	179 bc	8 bc	5.2 ab	1.3 bc
S. bicolor	13.3 cd	170 bc	8 bc	2.7 cde	0.3 c
Strawberry	26.1 ab	159 bc	26 abc	3.2 bcde	2.7 ab
Cultivated	8.3 d	52 d	6 c	1.1 e	0.4 c
LSD P≤0.05	12.5	94	20	2.4	1.7

[z]Means of three replications.
[y]Data presented are averages of three samples, 0.5 meter^2/plot, June 2005.
[x]Means within a column with the same superscript do not differ (P<.05).

Table 2. Incidence of weed growth in Honeoye strawberry matted rows grown on sites with previous cover crop or control treatments, August, 2005.[z] [y]

Treatments	Percent weed cover	No. grasses	No. broadleaves	Grass weight (g)	Broadleaf weight (g)
R. hirta	30.0 bcd[x]	9 ab	2 c	15.6 a	3.8 c
P. virgatum	15.0 de	1 d	4 bc	0.1 b	4.7 c
S. avenaceum	36.1 bc	2 d	4 bc	3.0 b	18.2 ab
A. gerardii	20.6 cde	1 d	3 bc	3.3 b	2.9 bc
T. erecta	22.2 cde	7 bc	2 c	10.3 ab	1.7 c
L. perenne	44.4 b	4 cd	6 ab	2.2 b	20.2 a
S. bicolor	16.8 de	8 abc	2 c	5.5 ab	2.2 c
Strawberry	73.3 a	11 a	8 a	14.6 a	22.7 a
Cultivated	6.2 e	1 d	1 c	2.8 b	0.8 c
LSD P≤0.05	17.2	4	3	11.3	10.9

[z]Means of three replications.
[y]Data presented are averages of three samples, 0.5 meter^2/plot.
[x]Means within a column with the same superscript do not differ (P<.05).

Table 3. Honeoye strawberry plant growth and development in the year of establishment.[z] [y]

Treatments	2005 No. runners formed[x]	2005 No. plants in quadrat[w]	Percentage of matted row filled
R. hirta	5 bcd[v]	9 b	82.7 b
P. virgatum	6 abc	14 a	97.7 a
S. avenaceum	7 a	13 a	92.3 ab
A. gerardii	7 a	13 a	93.7 ab
T. erecta	6 abc	14 a	97.7 a
L. perenne	3 d	4 c	41.7 c
S. bicolor	5 abcd	14 a	92.8 ab
Strawberry	4 cd	7 b	53.3 c
Cultivated	6 ab	14 a	98.9 a
LSD P≤0.05	2	3	12.5

[z]Means of three replications.
[y]Data presented are averages of three samples/plot.
[x]Runners formed/mother plant.
[w]Quadrat=0.5 meter^2.
[v]Means within a column with the same superscript do not differ (P<.05).