

# Evaluation of summer cover crops for suppression of sting, lesion, and root-knot nematodes on strawberry in Florida

Tristan Watson and Johan Desaeager

## Summary

Plant-parasitic nematodes present a significant barrier to the establishment of productive strawberry fields. Cover crops have shown the capacity to reduce populations of plant-parasitic nematodes, and have other benefits including the potential to increase soil nutrition and suppress weeds. In this study, host susceptibility of summer cover crops to sting, root-knot, and root-lesion nematodes was evaluated in a series of growth room and small-plot field experiments. In the growth room experiments, sting nematode reproduced well on nine, root-knot nematode on one, and root-lesion nematode on three of the 14 cover crops. In the small-plot field trial, sting nematode was present in soil at moderate population densities prior to planting the cover crop mixes. All cover crop mixes had greater ground coverage relative to that of the weedy fallow. The Southern Pea + Marigold cover crop mix reduced the number of Purple Nutsedge shoots in plots relative to that of the weedy fallow. Sting nematode population densities and soil nutrition will be determined one month after tilling the cover crops into the soil.

## Methods

### Cover Crop Host Effect on Nematodes

A series of growth chamber experiments were performed from 2018 - 2019 to determine the host range of sting, root-knot, and root-lesion nematodes on 14 summer cover crop species.

Steam-sterilized field soil was inoculated with one of three different nematodes: (1) sting nematode (20

*Belonolaimus longicaudatus* per 200 mL soil), (2) root-knot nematode (250 *Meloidogyne hapla* per 200 mL soil), or (3) root-lesion nematode (100 *Pratylenchus penetrans* per 200 mL soil). For each nematode, six replicate 5-inch plastic pots were filled with nematode-infested soil and planted with one of the following prospective cover crops: buckwheat, goat's rue, marigold, mexican sunflower, millet, pearl millet, radish, sesame, sorghum sudangrass AS6201, sorghum sudangrass AS6401, southern pea, sunflower, or sunnhemp. A fallow (no crop) treatment as well as pots planted with strawberry were included as controls.



**Figure 1** – Fourteen prospective summer cover crops growing in soil infested with root-knot nematode.

The cover crops were grown in a growth chamber at 72 °F for 12 weeks prior to analysis. At harvest, the nematode reproductive factor was calculated (final population density/initial population density). The entire experiment was performed twice.

### Small-Plot Field Trial

In Spring 2019, a small-plot field trial was conducted at the Gulf Coast Research and Education Center to identify a summer cover crop mix to suppress plant-parasitic nematodes and enhance soil health. The trial was conducted at a site with a history of sting nematode infestation and severe weed pressure.



**Figure 2** – Strawberry field at the Gulf Coast Research and Education Center showing severe sting nematode damage.

In early April 2019, the previous season’s strawberry field was tilled and flattened. Plots (6 by 4 feet) were marked off using wooden stakes. Six replicate plots were planted in a randomized complete block design with one of the following cover crop mixes:

1. Sunnhemp (50 lb/A)
2. Sunnhemp (25 lb/A) + Marigold (2.5 lb/A)
3. Southern Pea (15 lb/A)
4. Southern Pea (7.5 lb/A) + Marigold (2.5 lb/A)
5. Sunnhemp (25 lb/A) + Southern Pea (7.5 lb/A)
6. Sunnhemp (16.7 lb/A) + Southern Pea (5 lb/A) + Marigold (1.7 lb/A)
7. Sorghum Sudangrass (30 lb/A)
8. Weedy fallow

In late June 2019, the cover crop was chopped down and tilled into the soil to a depth of 6 inches.

Ground cover was measured weekly using a handheld GreenSeeker™ during the first four weeks of crop establishment. Soil populations of sting nematodes were determined prior to planting the cover crops,

prior to tilling the cover crops, and one month after the cover crops were tilled into the soil. Soil nutrient analyses were performed prior to planting the cover crops as well as one month after the cover crops were tilled into the soil. Weed species growing within plots were quantified prior to tilling the cover crops.

## Results

### Cover Crop Host Status to Nematodes

Cover crops that were good hosts (i.e. reproductive factor >1) for sting nematode included buckwheat, mexican sunflower, millet, pearl millet, radish, sorghum sudangrass AS6201, sorghum sudangrass AS6401, southern pea, and sunflower (Table 1).

Cover crops that were good hosts for root-knot nematode included southern pea.

Cover crops that were good hosts for root-lesion nematode included mexican sunflower, radish, and sunflower.

### Small-Plot Field Trial

All cover crop mixes increased ground coverage relative to that of the weedy fallow (Table 2); however, coverage was greatest in the Sorghum Sudangrass treatment.



**Figure 3** – Small-plot field trial at the Gulf Coast Research and Education Center with different cover crop mixes growing in sting-nematode infested soil.

At the time of planting, sting nematode populations did not differ among plots (Table 3), with population densities ranging from 2 to 6 nematodes per 200 mL

of soil. Soil population densities prior to tilling the cover crop as well as one month after tilling the cover crop will be determined in the next month.

At the time of planting, soil organic matter content and total nitrogen content did not differ among the plots (Table 4). Soil nutrition one month after tilling the cover crops will be determined in the next month.

Prior to tilling the cover crops into the soil, the abundance of purple nutsedge shoots was significantly lower in the Southern Pea + Marigold treatment relative to that of the Weedy Fallow (Table 5).

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## **Contact**

Dr. Johan Desaegeer  
UF/IFAS Gulf Coast Research and Education Center  
P: 813-419-6592  
E: [jad@ufl.edu](mailto:jad@ufl.edu)

**Table 1** - Host status of 14 prospective summer cover crops to sting, root-knot, and root-lesion nematodes.

Crop	Nematode Reproductive Factor		
	Sting Nematode	Root-Knot Nematode	Root-Lesion Nematode
Fallow	0.10 b	<0.01 d	0.06 c
Buckwheat	3.34 b	0.72 b	0.71 c
Goat's Rue	0.09 b	<0.01 d	0.20 c
Marigold	0.52 b	0.17 cd	0.04 c
Mexican Sunflower	3.67 b	0.33 bcd	4.70 a
Millet	8.48 ab	<0.01 d	0.20 c
Pearl Millet	5.92 b	<0.01 d	0.21 c
Radish	6.51 b	0.57 bc	2.05 b
Sesame	0.14 b	0.19 cd	0.58 c
Sorghum Sudangrass (AS6201)	18.71 a	<0.01 d	0.54 c
Sorghum Sudangrass (AS6401)	9.70 ab	<0.01 d	0.55 c
Southern Pea	5.48 b	2.24 a	0.01 c
Sugar Beet	0.21 b	0.05 cd	0.26 c
Sunflower	2.24 b	<0.01 d	2.33 b
Sunnhemp	0.04 b	<0.01 d	0.72 c
Strawberry	2.03 b	2.68 a	2.56 b
<b>P-value</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>

**Table 2** - Ground cover by prospective summer cover crop mixes. NDVI = normalized difference vegetation index and WAP = weeks after planting.

Cover Crop Mix	Ground Cover (NDVI value)			
	1 WAP	2 WAP	3 WAP	4 WAP
Sunnhemp	0.23 ab	0.50 ab	0.60 b	0.63 a
Sunnhemp + Marigold	0.20 bc	0.43 bc	0.58 b	0.62 a
Southern Pea	0.15 de	0.32 d	0.61 b	0.66 a
Southern Pea + Marigold	0.15 e	0.36 cd	0.63 ab	0.67 a
Sunnhemp + Southern Pea	0.20 bc	0.44 bc	0.60 b	0.63 a
Sunnhemp + Southern Pea + Marigold	0.18 cd	0.44 bc	0.63 ab	0.68 a
Sorghum Sudan	0.24 a	0.55 a	0.70 a	0.75 a
Weedy Fallow	0.13 e	0.27 d	0.44 c	0.52 b
<b>P-value</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.031</b>

**Table 3** - Impact of prospective summer cover crop mixes on sting nematode population densities.

Cover Crop Mix	Sting Nematode per 200 mL soil		
	At Plant	Pre-Till	Post-Till
Sunnhemp	3		
Sunnhemp + Marigold	2		
Southern Pea	3		
Southern Pea + Marigold	6		
Sunnhemp + Southern Pea	5		
Sunnhemp + Southern Pea + Marigold	3		
Sorghum Sudan	2		
Weedy Fallow	3		
<b>P-value</b>	<b>0.219</b>		

**Table 4** - Impact of prospective summer cover crop mixes on soil nutrition.

Cover Crop Mix	Organic Matter (%)		Total Nitrogen (%)	
	At Plant	Post-Till	At Plant	Post-Till
Sunnhemp	0.80		0.03	
Sunnhemp + Marigold	0.80		0.02	
Southern Pea	0.80		0.02	
Southern Pea + Marigold	0.90		0.03	
Sunnhemp + Southern Pea	0.90		0.03	
Sunnhemp + Southern Pea + Marigold	0.80		0.02	
Sorghum Sudan	0.80		0.03	
Weedy Fallow	0.90		0.03	
<b>P-value</b>	<b>0.130</b>		<b>0.572</b>	

**Table 5** - Impact of prospective summer cover crop mixes on common weeds.

Cover Crop Mix	Weeds (# per plot)			
	Purple Nutsedge	Crab Grass	Pigweed	Pusley
Sunnhemp	53 ab	25	3	3
Sunnhemp + Marigold	79 ab	16	3	10
Southern Pea	58 ab	24	6	7
Southern Pea + Marigold	17 b	26	10	10
Sunnhemp + Southern Pea	56 ab	16	4	8
Sunnhemp + Southern Pea + Marigold	46 ab	41	6	9
Sorghum Sudan	54 ab	10	7	13
Weedy Fallow	122 a	31	4	10
<b>P-value</b>	<b>0.027</b>	<b>0.075</b>	<b>0.682</b>	<b>0.463</b>