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Preliminary evaluation of nematode community responses to ground covers in jute leaf cultivation

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Abstract: Jute leaf (*Corchorus olitorius*) is an emerging ethnic crop in the Mid-Atlantic United States. No information is available on nematode associations and nematode community responses to jute leaf grown with ground cover. We conducted a preliminary field study in the summer of 2023 in Beltsville, Maryland to evaluate the responses of endemic nematode communities to three cultivars of jute leaf (Firebird, Molokhia, and USDA PI 404029) and four ground cover treatments (compost, compost and landscape fabric, compost and straw mulch, and compost and wood mulch). We extracted nematodes from soil samples collected before planting, at midseason, and at harvest. By the end of the season, plots with straw had higher counts of *Prismatolaimus, Mononchus* and total plant-parasites and plots with wood chips had higher counts of *Helicotylenchus*. Structure index and maturity index 2-5 were also higher in plots with straw at the end of the season. Cultivar had a relatively small impact on the nematode community with USDA PI 404029 plots having the highest *Plectus* counts and Firebird plots having the highest predator counts at midseason only. The channel and enrichment indexes showed a shift occurred with all four treatments: the soil environment became dominated by bacterial decomposition pathways with nutrient enriched conditions. However, plant biomass was not different between treatments. These results suggest ground covers can influence soil nematode communities in jute leaf production.

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Ground cover treatments
Wood chips + compost
Fabric + compost
Straw + compost
Compost only

Cultivars
A = Firebird
B = Molokhia
C = USDA PI 404029

C	A	A	C
B	B	C	B
A	C	B	A
C	C	B	A
A	B	C	B
B	A	A	C
A	B	B	A
B	A	C	C
C	C	A	B
C	B	B	B
A	A	C	C
B	C	A	A

Fig. 1S - Treatment layout in experimental plots. Each ground cover treatment plot was 8.1 m^2 and each cultivar plot was 2.7 m^2.

Fig. 2S - Experimental site and layout of plots planted with jute leaf.

Table 1S - Means (±standard error of the mean) of nematode relative abundance and ecological indexes across four ground cover treatments and three sampling periods in a jute leaf experiment in Beltsville, MD, USA. Genera found in less than 1% of samples were omitted from the table

Nematode group/ecological index	Sampling period											
	Pre-plant treatment				Midseason treatment				Final treatment			
	C†	F	S	W	C	F	S	W	C	F	S	W
Plant-parasites	56 (±9)	149 (±40)	126 (±26)	177 (±33)	46 (±10)	62 (±23)	54 (±13)	78 (±17)	25 (±10)	45 (±14)	72 (±18)	67 (±21)
Helicotylenchus	55 (±9)	142 (±41)	120 (±27)	172 (±33)	42 (±9)	59 (±23)	51 (±13)	77 (±17)	24 (±10)	43 (±15)	44 (±14)	55 (±15)
Hoplolaimus	0 (±0)	0 (±(±0)	1 (±(±0.4)	0 (±0)	1 (±0.7)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	3 (±3.3)
Paratylenchus	1 (±0.4)	7 (±1.9)	4 (±1.8)	5 (±1.8)	2 (±1.5)	2 (±1.7)	3 (±1.5)	0 (±0.4)	1 (±1.2)	2 (±1.3)	26 (±15)	5 (±3.3)
Pratylenchus	0 (±0)	0 (±0)	1 (±0.5)	0 (±0.5)	0 (±0)	0 (±0)	0 (±0)	0 (±0.5)	0 (±0)	0 (±0)	2 (±1.6)	3 (±3.3)
Bacterivores	117 (±18)	206 (±39)	156 (±40)	172 (±30)	732 (±144)	1085 (±191)	962 (±235)	915 (±157)	737 (±107)	1052 (±193)	1066 (±333)	1043 (±158)
Acrobeles	1 (±0.5)	0 (±0)	1 (±1.1)	2 (±1.6)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Alaimus	1 (±0.8)	0 (±0)	6 (±3.8)	1 (±0.7)	1 (±1.2)	1 (±0.6)	2 (±1.8)	0 (±0)	2 (±1.1)	0 (±0)	9 (±5.1)	4 (±2.2)
Butlerius	0 (±0)	0 (±0)	0 (±0)	0 (±0)	17 (±5.1)	15 (±7.2)	18 (±4.7)	29 (±9.2)	19 (±5)	14 (±4.8)	17 (±5.8)	18 (±6.1)
Cephalobus	12 (±3.4)	7 (±1.7)	12 (±4.1)	5 (±2.8)	8 (±3.1)	1 (±0.8)	9 (±4)	3 (±1.6)	8 (±3.6)	10 (±8.9)	3 (±1.1)	6 (±3.3)
Diploscapter	0 (±0.3)	0 (±0)	0 (±0.4)	0 (±0)	0 (±0)	1 (±1.4)	2 (±1.9)	0 (±0)	1 (±0.9)	4 (±2.9)	6 (±3.3)	1 (±1.2)
Eucephalobus	30 (±5.3)	31 (±10)	22 (±6.4)	19 (±3.2)	20 (±4.6)	10 (±2.5)	13 (±3.8)	29 (±9.5)	15 (±4.2)	14 (±4.3)	22 (±5.8)	12 (±4.7)
Panagrolaimus	0 (±0)	0 (±0)	0 (±0)	0 (±0)	1 (±1.2)	1 (±0.6)	2 (±1.8)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Plectus	4 (±3)	5 (±1.9)	2 (±0.8)	5 (±2.7)	2 (±1)	2 (±1.5)	1 (±0.6)	0 (±0.4)	2 (±1.4)	1 (±1)	3 (±1.6)	4 (±2)
Prismatolaimus	13 (±3.1)	13 (±4.5)	15 (±4.6)	5 (±2.5)	13 (±7)	11 (±5.2)	6 (±2.5)	8 (±2.6)	8 (±1.8)	3 (±1.4)	16 (±3.7)	12 (±2.8)
Rhabditis	55 (±10)	150 (±37)	98 (±30)	134 (±24)	671 (±145)	1044 (±191)	911 (±241)	845 (±150)	682 (±111)	1004 (±187)	991 (±334)	986 (±162)
Fungivores	264 (±36)	380 (±33)	333 (±50)	389 (±46)	252 (±34)	318 (±34)	345 (±49)	338 (±33)	231 (±32)	260 (±37)	316 (±31)	305 (±61)
Aphelenchoides	4 (±1.5)	5 (±2.7)	4 (±1.6)	2 (±0.9)	0 (±0)	1 (±0.7)	1 (±1)	7 (±3.8)	0 (±0)	6 (±4.5)	1 (±0.8)	5 (±4.2)
Aphelenchus	15 (±3.5)	22 (±5.4)	17 (±5.3)	34 (±10.4)	17 (±5)	16 (±3.1)	21 (±6.6)	31 (±9)	16 (±7.4)	22 (±8)	7 (±2.7)	33 (±12)
Diphtherophora	1 (±0.4)	2 (±1.2)	1 (±1)	1 (±0.6)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Ditylenchus	0 (±0)	0 (±0)	0 (±0)	0 (±0)	37 (±16)	49 (±12)	31 (±9)	20 (±10)	23 (±9.2)	10 (±5.4)	35 (±13)	15 (±5.6)
Tylenchus	244 (±34)	350 (±30)	311 (±48)	352 (±42)	198 (±25)	253 (±36)	293 (±42)	280 (±27)	192 (±25)	222 (±27)	272 (±34)	252 (±58)
Omnivores	1 (±0.9)	4 (±2.5)	1 (±0.5)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	1 (±0.7)	0 (±0)
Aporcelaimus	1 (±0.9)	4 (±2.5)	0 (±0.4)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	1 (±0.7)	0 (±0)
Dorylaimoides	0 (±0)	0 (±0)	0 (±0)	1 (±0.9)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Prodorylaimus	0 (±0.1)	0 (±0)	0 (±0.2)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	1 (±1.5)	0 (±0)	0 (±0)
Predators	3 (±1)	7 (±2)	4 (±1.3)	3 (±1)	2 (±1.3)	0 (±0)	2 (±1.2)	3 (±1.4)	5 (±3.5)	6 (±2)	8 (±2.6)	0 (±0)
Ironus	1 (±0.6)	5 (±1.7)	2 (±1.2)	0 (±0.4)	0 (±0)	0 (±0)	0 (±0)	0 (±0.4)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Mononchus	2 (±0.7)	2 (±1.1)	1 (±0.9)	2 (±0.8)	2 (±1.3)	0 (±0)	2 (±1.2)	2 (±1.4)	5 (±3.5)	4 (±1.7)	8 (±2.6)	0 (±0)
cp 1	55 (±10)	150 (±37)	99 (±30)	134 (±24)	689 (±146)	1061 (±192)	932 (±239)	874 (±155)	702 (±111)	1023 (±189)	1015 (±332)	1005 (±164)
cp 2	311 (±42)	421 (±38)	368 (±55)	420 (±46)	281 (±32)	331 (±34)	367 (±52)	370 (±38)	255 (±30)	285 (±42)	343 (±34)	327 (±60)
cp 3	14 (±3.3)	15 (±4.6)	16 (±5.2)	6 (±2.6)	13 (±7)	11 (±5.2)	6 (±2.5)	8 (±2.6)	8 (±1.8)	3 (±1.4)	16 (±3.7)	12 (±2.8)
cp 4	4 (±1.1)	7 (±2)	10 (±4)	5 (±1.1)	4 (±2.3)	1 (±0.6)	3 (±2)	3 (±1.4)	7 (±3.5)	6 (±2)	17 (±4.5)	4 (±2.2)
cp 5	1 (±0.9)	4 (±2.5)	1 (±0.5)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	1 (±0.7)	0 (±0)
MI	2 (±0)	2 (±0)	2 (±0)	2 (±0)	1 (±0)	1 (±0.1)	1 (±0.1)	1 (±0.1)	1 (±0)	1 (±0.1)	1 (±0.1)	1 (±0.1)
MI2-5	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)
BI	36 (±1.5)	31 (±2.4)	34 (±1.6)	32 (±1.2)	10 (±1.4)	9 (±2.1)	12 (±2.3)	11 (±1.8)	9 (±1.2)	8 (±1.7)	13 (±2.4)	10 (±2.2)
CI	55 (±3.5)	46 (±4.9)	54 (±4)	45 (±3.3)	11 (±1.8)	11 (±2.8)	14 (±2.9)	13 (±2.8)	9 (±1.4)	9 (±2.1)	15 (±3.2)	11 (±2.6)
EI	61 (±1.6)	67 (±2.5)	63 (±1.7)	68 (±1.3)	89 (±1.4)	91 (±2.2)	88 (±2.4)	89 (±2)	91 (±1.3)	91 (±1.8)	87 (±2.5)	90 (±2.3)
SI	16 (±2)	15 (±2.5)	16 (±2)	7 (±1.6)	11 (±5.2)	6 (±2.6)	5 (±1.5)	8 (±2.4)	14 (±3.5)	10 (±2.5)	23 (±3)	12 (±3)

C = compost only; F = compost + fabric; S = compost + straw; W = compost + wood chips;
cp 1 = colonizer-persister group 1; cp 2 = colonizer-persister group 2; cp 3 = colonizer-persister group 3; cp 4 = colonizer-persister group 4; cp 5 = colonizer-persister group 5; MI = maturity index; MI2-5 = maturity index cp 2-5; BI = basal index; CI = channel index; EI = enrichment index; SI = structure index.

Table 2S - Means (±standard error of the mean) of nematode relative abundance and ecological indexes across three cultivars of jute leaf and three sampling periods in a jute leaf experiment in Beltsville, MD, USA. Genera found in less than 1% of samples were omitted from the table

Nematode group/ecological index	Sampling period								
	Pre-plant			Midseason			Final		
	Cultivar			Cultivar			Cultivar		
	F†	M	U	F	M	U	F	M	U
Plant-parasites	142 (±21)	112 (±32)	128 (±28)	61 (±9.6)	59 (±17)	59 (±16)	47 (±17)	58 (±13)	52 (±13)
Helicotylenchus	139 (±21)	108 (±33)	120 (±28)	58 (±9.7)	56 (±17)	58 (±16)	41 (±12)	44 (±13)	40 (±11)
Hoplolaimus	0 (±0)	0 (±0.2)	0 (±0.3)	1 (±0)	0 (±0.6)	0 (±0)	0 (±2.4)	2 (±0)	0 (±0)
Paratylenchus	2 (±1.4)	3 (±0.9)	7 (±1.8)	2 (±1.2)	3 (±1.1)	2 (±1.2)	7 (±4.1)	8 (±6.1)	11 (±9.8)
Pratylenchus	0 (±0.4)	1 (±0)	0 (±0.3)	0 (±0)	0 (±0.4)	0 (±0)	0 (±2.6)	4 (±0)	0 (±0)
Bacterivores	169 (±29)	156 (±32)	164 (±28)	942 (±179)	877 (±120)	952 (±179)	1031 (±231)	1048 (±170)	845 (±146)
Acrobeles	1 (±0.8)	1 (±1.1)	1 (±0.5)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Alaimus	3 (±0.7)	1 (±2.6)	2 (±1.5)	1 (±0.9)	1 (±1.4)	0 (±0.4)	6 (±0.6)	1 (±3)	5 (±3.1)
Butlerius	0 (±0)	0 (±0)	0 (±0)	19 (±4.9)	21 (±5.5)	19 (±7.3)	16 (±3.4)	16 (±5)	20 (±5.3)
Cephalobus	11 (±2.7)	9 (±3.2)	9 (±2.4)	7 (±1.5)	4 (±3.1)	4 (±2.3)	5 (±6.6)	8 (±2.3)	6 (±2.9)
Diploscapter	0 (±0.3)	0 (±0)	0 (±0.2)	2 (±0)	0 (±1.7)	0 (±0)	2 (±0.7)	1 (±1.1)	6 (±3.2)
Eucephalobus	23 (±3.8)	21 (±4.3)	33 (±8.2)	20 (±3.1)	16 (±7.2)	18 (±4.7)	12 (±4.4)	19 (±3.8)	17 (±4.2)
Panagrolaimus	0 (±0)	0 (±0)	0 (±0)	1 (±0.9)	1 (±1.4)	0 (±0.4)	0 (±0)	0 (±0)	0 (±0)
Plectus	2 (±2.9)	6 (±1.1)	3 (±1.2)	0 (±0.2)	0 (±0)	3 (±1.3)	2 (±1.6)	3 (±1.2)	3 (±1.2)
Prismatolaimus	10 (±4)	12 (±2.7)	13 (±3.3)	5 (±5)	13 (±1.9)	10 (±4.4)	10 (±2.5)	8 (±2.5)	11 (±2.5)
Rhabditis	118 (±27)	106 (±28)	104 (±20)	886 (±180)	821 (±121)	896 (±180)	978 (±229)	991 (±173)	778 (±145)
Fungivores	340 (±38)	333 (±39)	352 (±37)	306 (±27)	308 (±34)	326 (±39)	315 (±20)	241 (±50)	277 (±34)
Aphelenchoides	4 (±1.1)	3 (±1.7)	4 (±1.9)	0 (±2.6)	4 (±0)	2 (±1.7)	2 (±0.4)	0 (±1.3)	7 (±4.4)
Aphelenchus	11 (±8.3)	32 (±2.7)	24 (±4.3)	18 (±3.3)	19 (±5.4)	27 (±7.2)	13 (±9.1)	20 (±5.3)	25 (±6.8)
Diphtherophora	1 (±0.3)	0 (±0.8)	2 (±0.9)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Ditylenchus	0 (±0)	0 (±0)	0 (±0)	27 (±10)	44 (±7.1)	31 (±13)	22 (±5.3)	16 (±9.9)	24 (±8.1)
Tylenchus	324 (±31)	297 (±38)	323 (±35)	261 (±24)	242 (±32)	266 (±33)	277 (±18)	205 (±47)	222 (±27)
Omnivores	0 (±1.5)	2 (±0.2)	2 (±1.4)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0.5)
Aporcelaimus	0 (±1.5)	2 (±0.2)	2 (±1.4)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0.5)
Dorylaimoides	0 (±0.7)	1 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Prodorylaimus	0 (±0.1)	0 (±0.2)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	1 (±0)	0 (±1.1)	0 (±0)
Predators	4 (±1)	4 (±1.2)	5 (±1.5)	0 (±1.5)	4 (±0.4)	1 (±0.4)	4 (±2.7)	5 (±2.2)	4 (±1.5)
Ironus	2 (±1)	2 (±1.1)	2 (±1)	0 (±0.3)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)
Mononchus	2 (±0.7)	2 (±0.8)	2 (±0.8)	0 (±1.5)	4 (±0.4)	1 (±0.4)	3 (±2.7)	5 (±2)	4 (±1.5)
cp 1	118 (±27)	106 (±28)	104 (±19)	909 (±180)	843 (±121)	915 (±181)	996 (±228)	1009 (±174)	804 (±145)
cp 2	376 (±40)	369 (±40)	395 (±42)	333 (±27)	328 (±37)	352 (±40)	333 (±24)	272 (±50)	303 (±33)
cp 3	11 (±4)	13 (±2.6)	14 (±4)	5 (±5)	13 (±1.9)	10 (±4.4)	10 (±2.5)	8 (±2.5)	11 (±2.5)
cp 4	7 (±1.2)	5 (±2.5)	7 (±2.4)	2 (±2)	5 (±1.4)	1 (±0.6)	10 (±2.7)	6 (±3.2)	9 (±3.1)
cp 5	0 (±1.5)	2 (±0.2)	2 (±1.4)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0)	0 (±0.5)
MI	2 (±0)	2 (±0)	2 (±0)	1 (±0)	1 (±0)	1 (±0.1)	1 (±0)	1 (±0.1)	1 (±0.1)
MI2-5	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)	2 (±0)
BI	33 (±1.6)	33 (±1.8)	33 (±1.2)	9 (±1.9)	12 (±1.3)	11 (±1.8)	10 (±1.4)	9 (±1.9)	11 (±1.8)
CI	50 (±3.5)	50 (±4.2)	50 (±2.9)	9 (±2.6)	14 (±1.5)	12 (±2.3)	11 (±1.6)	9 (±2.6)	12 (±2.2)
EI	65 (±1.8)	65 (±1.9)	64 (±1.3)	91 (±1.9)	88 (±1.3)	89 (±1.8)	90 (±1.4)	91 (±2)	89 (±1.9)
SI	12 (±2.3)	14 (±1.6)	14 (±2)	4 (±2.9)	11 (±1.4)	7 (±3.4)	15 (±2.5)	13 (±2.7)	16 (±3.2)

F = Firebird Farm; M = Molokhia; U = USDA PI 404029;

cp 1 = colonizer-persister group 1; cp 2 = colonizer-persister group 2; cp 3 = colonizer-persister group 3; cp 4 = colonizer-persister group 4; cp 5 = colonizer-persister group 5; MI = maturity index; MI2-5 = maturity index cp 2-5; BI = basal index; CI = channel index; EI = enrichment index; SI = structure index.