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Effect of degradation period of *crotalaria juncea* (Sunnhemp) on root knot nematode (*Meloidogyne incognita*)

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Abstract
For protecting human health and the environment nematicides are banned and highly restricted. Thus various alternative control strategies and long-term integrative approaches is urgently needed in order to replace chemical nematicides. Sunnhemp (*Crotalaria juncea* L.), is a vigorous, fast-growing legume that is used as a cover crop in many tropical and subtropical areas recommended by PAU. This experiment is conducted to explore its use against root-knot nematode along with its antagonistic nature to nematodes, when incorporated into the soil as a green manure, sunnhemp adds organic manure. The present study intends to explore the allelopathic properties of *Crotalaria juncea* and time period for better degradation for management of root knot nematode against brinjal. The studies revealed that maximum increase in galling index and decrease in growth parameters was observed when degradation period was given of 10 days or after. This indicates that sunnhemp requires 10 to 20 days for decomposition due to which the availability of nutrients and release of allelopathic products happens to occur after 10 days.

Keywords: Effect, degradation period, root knot nematode

Introduction
Root–knot nematode, *Meloidogyne incognita* (Kofoid and White Chitwood) (Tylenchida: Heteroderidae) is a major plant – parasitic nematode affecting crops worldwide. In susceptible plants, the nematode population builds up to a maximum usually as crop reaches maturity (Shurtleff *et al* 2000) [5] and in some cases the plants die even before reaching maturity (Singh and Khurma 2007) [6]. Management of *Meloidogyne* spp. and other plant-parasitic nematodes has been challenging worldwide, particularly due to reduced availability or complete ban of effective chemical nematicides such as methyl bromide. Major limitations to wide use of synthetic nematicides include their hazards to environment, toxicity to important non-target organisms including humans, high cost, and limited availability in developing countries. This has prompted the search for environmentally safe alternative control methods. Scientists looking for alternative strategies are exploring the use of natural products with nematicidal activity such as organic amendments, root exudates, plant volatile compounds, endophytic bacteria, crop rotation, plant extracts and use of cover or antagonistic crops and resistant varieties. Various medicinal and antagonistic plants have been evaluated for their nematicidal activity. Antagonist crops such as marigold, sorghum, sudangrass, brassica, sunnhemp being non hosts of root-knot nematode are also recently being considered for management of nematodes, of these marigolds have been extensively studied. Sunnhemp (*Crotalaria juncea* L.), is a vigorous, fast-growing legume that is used as a cover crop in many tropical and subtropical areas. It has been recommended by PAU. These two factors enhance its possibility to explore its use against root-knot nematode. In addition to its antagonistic nature to nematodes, when incorporated into the soil as a green manure, sunnhemp adds organic manure. The present study intends to explore the allelopathic properties of *Crotalaria juncea* for management of root knot nematode against brinjal. Decomposition period of 5 days following which brinjal is grown did not show good growth parameters as compared to 10, 15 and 20 days and nematode population was also not decreased significantly.

Materials and Methods
The studies on efficacy of different application methods and biomass contents of *Crotalaria juncea* on root knot nematode population in successive crop brinjal were studied in pot house

of Department of Plant Pathology, PAU, Ludhiana. Earthen pots of 15cm diameter were filled with known initial population. Ten Seeds of *Crotalaria juncea* PAU-1691 were sown in pots filled with infested root knot nematode soil. It was allowed to grow for fifty days and then incorporated into pots. After incorporation of *Crotalaria juncea* waiting period of 0, 5, 10,15, 20 days was given before sowing of brinjal. Each treatments was replicated thrice. Observation on *Crotalaria juncea* and brinjal was recorded at time of incorporation and at end of crop respectively.

Results and Discussion

Maximum shoot length was observed when 20 days degradation period was given for decomposition of *Crotalaria juncea.* In this treatment shoot length was observed to be 15.3 cm and it was at par with 10, 15 days of degradation period (14.6 and 15.3 cm). Fifty percent increase was found in shoot length after 15 days of degradation period of sunnhemp and fifty eight percent increase in 20 days of degradation period. More than sixty percent increase also found in root length and weight in 15 and 20 days after degradation period.

The present studies revealed that maximum increase in galling index and decrease in growth parameters was observed when degradation period was given of 10 days or after. This indicates that sunnhemp requires 10 to 20 days for decomposition due to which the availability of nutrients and release of allelopathic products happens to occur after 10 days. Similar results were also found by Wang *et al* (2004) [7] who reported sunnhemp material decomposition occur quickly i.e. within two weeks after burial there was not much effect on nematode population in 5 days degradation period as the decomposition and release of nutrients was less in this short period leading to infection of root knot nematode incorporation at younger age. Degradation period of 10, 15 and 20 days showed similar pattern in decreasing nematode population and increased the growth parameters of successive crop brinjal. Decomposition period of 5 days following which brinjal is grown did not show good growth parameters as compared to 10, 15 and 20 days and nematode population was also not decreased significantly. This can be attributed to the reason that well-decomposed composts are stable and mineralize slowly. Similar results were observed by Akhtar and Malik (2000) [1] who reported that there is slow release of nematicidal products which may result in concentrations that are too low to be effective.

In the literature tested dosages of organic amendment varied from 1 to 269 t/ha 261 (McSorley and Gallaher, 1995) [4], but most dosages ranged from 1 to 20 t/ha. Increasing 262 dosages of organic amendment typically increased its efficiency in nematode control, up to a 263 level where phytotoxicity was observed. Kaplan and Noe (1993) [3] reported that five dosages of 264 poultry litter (10 to 45 t/ha), and found an inverse relationship between dosage and both the 265 total number of *M. arenaria* in tomato roots and the quantity of eggs in soil by). Three dosages of rapeseed green manure was compared by Crow *et al*. (1996) [2]. A 14 t/ha dosage (dry weight) reduced root galling on the subsequent squash crop, without any effect on yield. At higher 268 dosages (21 and 28 t/ha), root-galling was suppressed, but yield was decreased due to phytotoxicity. These phytotoxic effects were obviated when a two-week delay was applied between green manure application and squash planting.

Table 1: Effect of degradation period of *Crotalaria juncea* on growth parameters and root knot nematode in successive crop brinjal

Treatments	Shoot				Root				Mid of crop Nematode population/250cc soil	End of crop Nematode population/250cc soil	Root Gall Index (RGI)
	length (cm)	% increase	Fresh weight (g)	% increase	Length (cm)	% increase	Freshweight (g)	% increase			
5 DAY	11.1	8.8	10.6	7.6	4.2	16.6	3.2	6.6	356.6 (18.89)	386.6 (19.6*)	3.1
10 DAY	14.6	43.1	15.7	59.7	6.2	72.2	4.2	40.0	273.3 (16.55)	286.6 (16.9*)	2.5
15 DAY	15.3	50.0	16.7	69.1	6.8	88.8	5.0	66.6	266.6 (16.34)	246.6 (15.7*)	2.3
20 DAY	16.2	58.8	17.2	74.3	6.6	83.3	5.6	86.6	243.3 (15.61)	253.3 (15.9*)	2.4
Carbofuran @2kg a.i/ha	14.6	43.1	16.6	69.3	5.9	63.8	4.8	60.0	258.8 (16.8)*	267.3 (16.3)*	2.5
Control	10.2		9.8		3.6		3.0		386.6 (19.67)	673.3 (25.9*)	4.6
C.D. (P=0.05)	2.4		2.8		1.6		1.5		1.4		0.6

Initial population- 258.6 nematode/250cc soil

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