Effect of nematode management on rice grain yield in nursery

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Abstract. The effect of solarization and nematicide was assessed in the farmers' field of Sone Canal Command of Bihar (India). Solarization of nursery was useful in nematode management. It also reduced the incidence of pest, disease and weed growth. In nematicide (Furadan, Carbofuran) treated nursery, bird damage was less and the incidence of diseases and insect pest was negligible but weed growth was higher. Though solarization of nursery was useful in nematode control, it is costly to the farmers. The cost of nematicide (Furadan) was 1/50th lower than the cost of polyethylene (LPDE) sheets. Resource-poor farmers may prefer to use the nematicide for nematode management.

Keywords. Furadan, grain yield, nematode population, nursery bed, rice, solarization.

INTRODUCTION

Nematodes often cause severe damage to the cultivated crops but their role as limiting factor in agricultural production is not appreciated in comparison to pest and diseases. The assessment of crop losses due to nematodes is difficult for want of precise techniques. Plant parasitic nematodes in general and rice root-nematode *Hirschmanniella oryzae* in particular, are widely distributed in the rice growing areas of the country causing significant losses to the crop (Panwar and Rao 1998). More than 144 different species of stylet bearing nematodes occur in association with rice culture (Gedder and Smart, 1987 & Singh *et al.* 2005). Seedlings are one of the factors for transmission of rice root and root knot diseases from nursery beds to the fields.

The present investigations were therefore designed to study the effects of soil solarization (polyethylene mulching) and treatment of carbofuran in nursery beds on the population of plant parasitic nematodes and growth characters of seedlings and grain yield.

MATERIALS AND METHODS

For estimation of initial and final nematode population, soil samples were collected before transplantation and after harvest of rice crop from farmers' fields at different villages of RP Channel-5 area of Patna main canal, Sone Canal Command, Bihar. The Sone Canal Command is one of the oldest canal command established in 1875. The site is located between 84°.51'N latitude and 84°.55 E longitude. The experiment was conducted in 6 farmers' fields. Initial population of parasitic as well as non-parasitic nematodes were estimated by modified Cobb's decanting and sieving method (Christie and Perry 1951) before treating the beds.

The dialogue was made with SHG members and farmers in April 2003 for initiating the assessment of nematode management in rice fields. The idea was broadcasted about solarization of nursery fields for healthy growth of seedlings. Two farmers each in head, middle and tail reach of the canal showed willingness to assess this technology. Six farmers' fields were chosen for this purpose. A transparent polythene sheet of 65 m^2 was provided to six farmers. During 10-13 May 2003, the fields

Table 1. Efficacy of nursery bed treatments for the control of nematodes of rice seedlings.

(a) Species-wise nematode population/100g soil (Average of 12 farmers' fields).

Treatment	Nematode population/100g soil							
	Hirsch. manniella	*Meloido-gyne incognita*	*Tylencho-rhynchus mashhoodi*	*Helicoty-lenchus indicus*	*Hoplolaimus indicus*	Total parasitic	Saprozoic	Total
Initial	92.5	5	305.15	42.0	10.0	455.0	752.5	1207.5
Solarization	-	-	55.8	-	-	55.8	342.5	398.3
Furadan	-	-	40.5	-	-	40.5	290.0	330.5
Untreated control	147.0	2.8	336.0	53.4	34.5	573.7	836.8	1410.5

(b) Growth characters of seedlings

Treatment	Nematode population/ 100g soil	Height of seedlings cm	Weight of green seedlings g
Initial	455.0	-	-
Solarization	55.8 (-87.7)	41.0 (+20.6)	32.3 (+59.1)
Furadan	40.5 (-91.1)	38.7 (13.8)	29.3 (+44.3)
Untreated control	573.7 (+26.1)	34.0	20.3
CD at 5%	424.25209	6.78115	2.05417

Table 2. Effect of nursery field solarization and nematicide treatment on grain yield of rice in RP Channel –5, Patna Main Canal of Sone Command.

Date of nursery sowing	Variety	Grain yield (q/ha)		
		Solarized field nursery	Furadan used nursery	Control
30 June 2003	MTU 7029	59.00 (7.2)	61.11 (11.1)	55.00
22 June 2003	MTU 7029	61.00 (8.9)	58.00 (3.6)	56.00
27 June 2003	MTU 7029	55.55 (6.4)	54.44 (4.2)	52.22
27 June 2003	MTU 7029	57.00 (7.5)	53.00 (0)	53.00
20 June 2003	Basmati	37.5 (7.14)	37.5 (7.14)	35.00
20 June 2003	Basmati	35.2 (0.57)	36.00 (2.85)	35.00
		Percent increase yield over coutrol are given in parenthesis		

were irrigated and polyethylene sheets was placed and air-tightened. Four weeks after solarization the sheets were removed and fields were sown for rice nursery. At the same time in parallel field, the nematicide carbofuran (Furadan 3-G) @ 3g/m^2 was used in 65 m^2 area in order to compare the effects of application of nematicide and solarization. Rice seedlings raised under three different conditions (solarized, carbofuran treated and control) were transplanted in main

Table 3. Farmers' opinion about solarized and Furadan treated rice nursery fields

Solarized nursery field

Nursery time opinion

During nursery, germination is good and weed and insect pest are negligible. This nursery bed is better than others. Diseases are very less. Plant height is better with more tillering.

At crop stage

- Healthy plant
- Very less incidence of insect pests
- Better yield is expected

After harvest

- Higher yield
- Costly to afford

Furadan treated nursery

- Good germination
- Plant height is good
- Pest attack especially brown plant hopper is negligible.
- Better yield
- Economically under farmers reach

field and observation on grain yield was made. Farmer's response at the time of nursery, crop stage and harvest of rice was also taken under consideration.

RESULTS AND DISCUSSION

Data in respect of height, green weight of 100 seedlings, grain yield and final nematode population were recorded after 40 days of germination (Table 1). Total average populations of parasitic nematodes were 455 per 100 g soil with *Hirschmanniella oryzae, Meloidogyne incognita, Tylenchorhynchus mashhoodi, Helicotylenchus indicus, Hoplolaimus indicus* among which the first three were the dominant species.

The effect of both the treatments was highly significant and at par with each other in reducing nematode population and increasing growth of seedlings in comparison to untreated control. Total nematode population was reduced by 94.2 and 91.1 per cent in solarized and carbofuran treated beds respectively. Except for *T. mashhoodi* none of the parasitic forms were found in soil in both the treatments after 40 days of treatments of the beds. While in untreated (control) 26.1 per cent increase in population was observed.

Corresponding with the decrease in nematode population there was increase in height and weight of seedlings by 20.6 and 59.1 per cent in solarized beds and 13.8 and 44.3 per cent in carbofuran treated beds. Somewhat similar observations were recorded by other workers for the control of nematodes of rice in nursery beds (Panwar and Rao, 1998). Uniform germination, better seedling growth, less incidence of weeds and insect pests were observed in solarized nursery fields.

Solarization is a method of heating of thee soil's surface by using transparent low-density polyethylene (LDPE) film sheets placed on the soil's surface to trap the solar radiation. This raises the soil temperature to a level lethal for many soil borne pathogens. Khan *et al.*, 2003 reported the lowest microbes in solarized fields due to increased soil temperature. In Furadan treated nursery fields, there was no effect on weed population but fewer incidences of other pest against control fields. The crop vigour was better in solarized field nursery. There was increase in grain yield by 7-8 per cent due to nursery field solarization and 3-5 per cent due to Furadan application in nursery field (Table 2). The parasitic nematodes in solarized nursery field were found to be 500/litre soil as compared to 750 in carbofuran (Furadan) treated field and 2200 in control plot (John Bridge, unpublished).

According to farmers' perception, in solarized field there was less weed incidence and few incidences of False Smut, although it was lower than that in the control. In the Furadan treated field nursery, bird damage was less and the incidence of diseases and insect pest was negligible. Farmers' opinion

was taken at every stage of the crop (Table 3). In their opinion the Furadan is economical because the cost of pesticide is of 1/50th as compared to polyethylene sheets.

Acknowledgements. This is a part of the DFID project (NRSP-R7830/39). The financial support received from DFID is thankfully acknowledged.

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