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Assessment of Yield Loss Due to Rice Root - Knot Nematode, *Meloidogyne graminicola* in Aerobic Rice

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Field studies were conducted in 2012 and 2013 to determine yield loss of rice under aerobic rice cultivation due to natural infestation by *Meloidogyne graminicola*. The yield loss due to *M. graminicola* was assessed as 26.36 and 41.8 per cent during two seasons in 2012 and 2013, respectively.

Key words: Carbofuran; *Meloidogyne graminicola*; root-knot nematode; rice; yield loss.

Rice is consumed by about 3 billion people and it is the most common staple food of a large number of people on earth; in fact it feeds more people than any other crop (Maclean *et al* . , 2002). In Asia, with continuous growth in population, demand for food continues to increase greatly while the amount of water available for irrigation is decreasing (IRRI, 1997). More than 75 per cent of the rice supply comes from 79 million ha of irrigated land. Since the water use efficiency of rice is being low the growing of rice requires large amount of water. As a consequence of diversion of an increasing proportion of the available water for human usage, diminishing and erratic rainfall and depletion of ground water resources, the availability of water for irrigated rice is becoming less and less. Hence it is essential for the introduction of water-saving aerobic rice which is high yielding rice grown under non-flooded conditions in non puddled and unsaturated soil. Soil-borne pests and diseases find different living conditions in aerobic soils and especially root knot nematodes have been reported to become problematic when the production system becomes partially or fully aerobic (Prot and Matias, 1995). Bouman (2002) reported that high yield of rice declined in Brazil and China after 3-4 years under aerobic conditions, possibly due to nematodes. Therefore a study was undertaken to assess the impact of *Meloidogyne graminicola Golden & Bireh field* infestations on plant growth and yield in aerobic rice.

Materials and Methods

Assessment of yield loss due to M. graminicola in aerobic rice

Field experiments were conducted during June 2012 to January 2013 on rice variety PMK 4 in *M. graminicola* (345 juveniles per 250 cm_3 soil sample) sick areas using a paired t- Test design with 13 replications and plots size of 4m x 3m. Recommended agronomical practices were followed throughout the period of study. A set of plots were treated with carbofuran 3G @ 1 kg a.i/ha and another set of plots untreated were served as control to compute yield loss due to *M. graminicola*.

Assessment of yield and other agronomic traits

Grain yield per plot at harvest and adjusted to 12.5% moisture (CIMMYT, 1985) was recorded using the formula

$$\frac{\text{Grain Weight (Kg / Plot)} \times 10 \times (100 - \text{Grain moisture content})}{87.5 \times \text{Plot area}}$$

Percentage yield loss was calculated as

$$\frac{\text{Yield in nematicide treated plot - Yield in nematicide infested plot} \times 100}{\text{Yield in nematicide treated plot}}$$

At harvest, ten randomly selected plants per plot were observed for the plant growth parameters.

Quantification of nematode densities and assessment of root damage

Ten soil samples were collection from each plot at a depth of 15 cm and pooled to obtain composite samples. The samples were need for the extraction of nematodes using modified Baermann's funnel method (Schindler, 1961).

Root damage was assessed by stained root mass and the number of galls in one gram root sample was assessed 105 days after sowing. At the end of the experiment, ten randomly selected plants per plot were carefully uprooted and the adhering soil washed off and gall index scored on a 1 – 5 scale (Heald *et al*., 1989). Number of eggsmasses present in roots were also recorded.

Results and Discussion

In nematicide untreated plots, the rice yield was 2522.53 kg /ha in the first season and 2377.6 kg / ha in second season. However in plots treated with carbofuran yield of 3187.69 kg /ha in 2012 and 3353.60 kg /ha in 2013 were obtained. In the first season, number of galls in rice root was only 22.24

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Table 1. Yield loss due to *M. graminicola* in rice variety PMK 4

Season	Treatment	No. of tillers / hill	Grain yield (kg /ha)	No. of J2 / g root	No. of J2 / 250 cc soil	No. of galls /root system	GI
2012	Carbofuran 3G @ 1 kg a.i/ ha	12.92 (55.66)	3187.69 (26.36)	19.10 (-30.82)	230.19 (-57.19)	22.24 (-41.55)	2
	Untreated control	8.30	2522.53	27.61	537.77	38.05	4
	t - value	5.15	23.76	2.14	4.00	4.18	
2013	Carbofuran 3G @ 1 kg a.i/ ha	13.69 (122.60)	3353.6 (41.04)	15.41 (-56.05)	98.73 (-87.57)	9.53 (-81.56)	1
	Untreated control	6.15	2377.6	35.07	794.69	51.69	5
	t - value	9.09	21.86	6.48	12.84	7.56	

GI = Gall index. Figures in parentheses are per cent increase (+) or decrease (-) over control

in the nematicide treated plots, while it was 38.05 in untreated plots. In second season the number of galls in nematicide untreated plot was 51.69 as against 9.53 in treated plots.

Plant growth parameters were improved in carbofuran treated plots compared to untreated plots in both seasons. Similarly in both seasons, the number of tillers per hill was greater (12.92, 13.69) in carbofuran treated plots compared to untreated control (9.09, 8.30) (Table 1). The number of *M. graminicola* egg masses, J2 / g of root and soil were lower in the carbofuran treated plots compared to untreated plots. The increase in plant growth parameter and yield through soil treatment with carbofuran in the management of *M. graminicola* for computing yield loss confirmed the earlier finding of Padgham *et al*. (2004).

The present study concluded that the loss due to *M. graminicola* ranged from 26.36 to 41.8 per cent in rice variety of PMK 4 was lesser than the earlier report of 11 to 73 per cent in flooded rice by Soriano *et al*. (2000) and between 20 and 98 per cent (Plowright and Bridge, 1990; Prot and Matias, 1995; Tandingan *et al*., 1996).

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