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Original Article

# Efficacy of Some Organic Amendments for the Control of Ufra Disease of Rice

M Abdul Latif[1], Sharmina Akter[1], M Shahjahan Kabir[1], M Ansar Ali[2], M Anwar Hossain[1*] and M Loothfor Rahman[1]

*[1]Plant Pathology Division, Bangladesh Rice Research Institute (BRRI), Joydebpur, Gazipur 1701, Bangladesh, [2]Regional Station, Bangladesh Rice Research Institute (BRRI), Rajshahi, Bangaladesh*

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**Nine organic amendments, namely, Bishkatali leaf dust, mustard cake, sesame cake, jute seed dust, Neem leaf dust, Neem cake, Neem seed dust, Bankalmi leaf dust and rice husk were used in controlling rice ufra disease in three Boro seasons during 1994-1996. The amendments were applied at the rate of 200 kg/ha except for rice husk (500 kg/ha). All the amendments reduced the damaged tiller, ufra 3 and total ufra significantly and gave higher percentage of healthy panicles and increased yield over control (diseased). In all seasons, due to application of Bishkatali leaf dust, mustard cake, sesame cake, jute seed dust, Neem leaf dust, Neem seed dust, Bankalmi leaf dust and rice husk the yield was increased that ranged from 61.60-67.17, 56.07-71.43, 67.98-75.98, 65.78-78.51, 62.25-76.10, 61.79-79.06 and 62.53-80.16, 61.01-71.43% respectively over the control (diseased). The organic amendments could be used as the alternatives of nematicides for the control of ufra disease.**

**Keywords: Organic amendments, Ufra disease, Rice**

## Introduction

Ufra caused by the stem nematode, *Ditylenchus angustus* Filipjev[1] is an important disease of rice in some South and South East Asian countries[2-4]. Yield loss caused by this disease has been reported up to 10-15% in India[5-6], 20-90% in Thailand[7], 50-100% in Vietnam[8] and 40-60% or occasionally 100% in Bangladesh[2]. This disease is known as a devastating in terms of both plant damage and yield loss in deepwater rice[7-9]. At present it is not only a disease of deepwater rice but also a disease of Boro and transplanted rice ecosystems[6,9-10].

Nowadays, the ufra disease is sporadically occurring both in the irrigated[10] and rain fed low land rice[11]. The ufra nematodes usually over-winter in quiescent and coiled condition on dry infected stubble and panicles[1] until sowing or planting of the next crop. It also survives in active form in crop stubbles or its ratoon growth in the fields under continuous rice cultivation. Nematodes from these infested stubble or ratoon growth release in water during wetland preparation of fields, attacks the newly planted seedlings causing the diseases in transplanted Aman and Boro rice. Therefore, such intensive rice cultivation, limits controlling this disease through cultural or crop rotation practices all the year round. Thus, the present work was undertaken to study the effects of organic amendments in controlling ufra disease of rice.

## Materials and Methods

The layout of the experiment was done in T-Aman season. Each plot was surrounded by 20-25 cm high mud plastered levee. The seedlings were infected with 100 nematode/seedling in seedbed[12]. Thirty 5-day-old seedlings with visible chlorotic ufra symptom on the leaf sheath were transplanted in the plot. At maturity, the rice was harvested, leaving 3-4 inches nematode infested straw in the field. Two control treatments (healthy and diseased) were also included in the experiments. The straw was incorporated into the soil in the following Boro season.

Three experiments were conducted at Bangladesh Rice Research Institute (BRRI) Farm, Gazipur during Boro season of 1994, 1995 and 1996 to evaluate nine different organic amendments, namely, Bishkatali (*Polygonum hydropiper*) leaf dust, mustard (*Brassica nigra*) cake, sesame (*Sesamum indicum*) cake, jute (*Corchorus olitorius*) seed dust, Neem (*Azadiraxhta indica*) leaf dust, Neem cake, Neem seed dust, Bankalmi (*Ipomoea sepiaria*) leaf dust and rice (*Oryza sativa*) husk. Rice variety BR3 was used for this experiment. The amendments were applied at the rate of 200 kg/ha, except for rice husk (500 kg/ha), at 7 days before transplanting of seedling in a 2 m x 2 m plot at 25 cm x 15 cm spacing. The experiment was conducted in randomised complete block design (RCBD) with four replications. Thirty 5-day-old healthy seedlings were transplanted in organic amended plot. Two controls were used for this experiment, one was healthy and other was diseased. At harvest, crop from the whole plot was cut and diseased panicles were categorized into damaged tiller (no panicle initiation), ufra 1 (panicle completely enclosed in leaf sheath), ufra 2 (partially emerged panicle but unfilled grain) and ufra 3 (completely emerged

*Corresponding author:
*Dr. M Anwar Hossain, Chief Scientific Officer & Head, Plant Pathology Division, Bangladesh Rice Research Institute, Joydebpur, Gazipur 1701, Bangladesh*
*Tel (Office): (02) 9257506, (02) 9257401-5/333; Tel (Home): (02) 9263287, (02) 9257401-5/320; Cell: 0193 127921, 01715 034094, E-mail: mahossn03@dhaka.net, brripath@bdonline.com*

panicle with unfilled grain)[13]. Data on percent damaged tiller, ufra 3, total ufra (damaged tiller + ufra 1 + ufra 2 + ufra 3), healthy panicles and yield (t/ha) were taken for statistical analysis. Yield was adjusted at 14% moisture level after harvest. Yield increased over the control was also determined for each season.

**Results and Discussion**

The percentages of different ufra categories, healthy panicles and yield varied significantly among the treatments in three Boro seasons. In Boro 1994, percentage of damaged tillers ranged from 1.20-11.39% (Table 1). In general, all the amendments lowered the damaged tiller, ufra 3 and total ufra significantly and gave significantly higher yield than the control (diseased). Among the treatments, Neem leaf dust performed best in controlling damaged tiller, ufra 3 and total ufra (1.53, 14.64 and 20.59% respectively) where as that of control (diseased) plot showed 11.39, 53.33 and 94.06% respectively. Although healthy panicles were less than control (healthy) treatment (98.63%), it ranged from 46.73-79.41%. The highest yield (4.94 t/ha) was obtained by applying Bankalmi leaf dust. Statistically similar yield was obtained in using sesame cake, jute seed dust, Neem leaf dust and Neem seed dust (4.08, 4.56, 4.10 and 4.68 t/ha respectively); where healthy control and diseased control treatments gave 4.83 t/ha and 0.98 t/ha respectively.

**Table 1.** *Effect of different organic amendments in controlling ufra in Boro 1994*

| Organic amendment | Dose (kg/ha) | % ufra infestation | | | Healthy panicle (%) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| | | Damaged tiller | Ufra 3 panicles | Total ufra | | |
| Control (disease) | - | 11.39$^{a}$ | 53.33$^{a}$ | 94.06$^{a}$ | 1.41$^{g}$ | 0.98$^{f}$ |
| Control (healthy) | - | 0.05$^{g}$ | 0.77$^{g}$ | 1.36$^{g}$ | 98.63$^{a}$ | 4.83$^{a}$ |
| Neem cake | 200 | 2.63$^{d}$ | 34.88$^{b}$ | 35.27$^{d}$ | 46.73$^{f}$ | 2.43$^{e}$ |
| Mustard cake | 200 | 1.20$^{f}$ | 24.4$^{bc}$ | 39.26$^{c}$ | 60.74$^{e}$ | 3.43$^{d}$ |
| Sesame cake | 200 | 1.71$^{e}$ | 20.04$^{de}$ | 33.86$^{d}$ | 66.14$^{d}$ | 4.08$^{bc}$ |
| Jute seed dust | 200 | 4.46$^{b}$ | 17.49$^{ef}$ | 26.21$^{e}$ | 73.79$^{bc}$ | 4.56$^{bc}$ |
| Neem leaf dust | 200 | 1.53$^{ef}$ | 14.64$^{f}$ | 20.59$^{f}$ | 79.41$^{b}$ | 4.10$^{bc}$ |
| Neem seed dust | 200 | 1.85$^{e}$ | 14.41$^{f}$ | 25.37$^{e}$ | 74.63$^{bc}$ | 4.68$^{ab}$ |
| Rice husk | 500 | 3.27$^{c}$ | 21.94$^{cd}$ | 43.02$^{b}$ | 56.98$^{e}$ | 3.43$^{cd}$ |
| Bankalmi leaf dust | 200 | 3.99$^{b}$ | 16.22$^{f}$ | 27.43$^{e}$ | 72.57$^{c}$ | 4.94$^{a}$ |

Each value is the average of four replications. In a column means followed by a common letter(s) are not significantly different at 5% level by Duncan's multiple range test (DMRT).

Similar potentiality of using organic amendments in controlling ufra disease was found in Boro 1995 (Table 2). The percentage as different disease parameters (damaged tiller, ufra 3 panicles and total ufra incidence) varied significantly among the treatments. Damaged tiller varied from 0.92-4.09% at the vegetative stage that was significantly lower than the control (diseased) treatment (13.32%). A similar trend was also observed for ufra 3 panicles, considering the total ufra incidence it ranged from 16.17-32.30 % among the treatments compared to 95.08 % in the control (diseased) treatment. A low incidence of ufra (15.05%) was also recorded in the control (healthy) treatment possibly due to spill over of nematode contaminated water from the diseased plots. Both healthy panicles and grain yield were significantly higher in the amended plots over the control (diseased) plot. The parentage of healthy panicles varied from 67.71-83.82% in the amended plots some of which being very close to that of control (healthy) treatment (85.05%). Similarly, grain yields varied from 3.46-5.42 t/ha in the amended plots, which was 5.37 t/ha in healthy control and 1.52 t/ha in diseased control treatment (Table 2). Like Boro 1994, Neem leaf dust performed best in controlling damaged tiller, ufra 3 and total ufra, and the highest yield was obtained by using Neem seed dust. This treatment slightly out yielded (5.42 t/ha) than the healthy control treatment. Among the other amendments, jute seed dust, Neem leaf dust and Bankalmi leaf treated plots showed less than 30% ufra infection and yielded 5.22-5.23 t/ha, which was very close to the healthy control treatment. The yield increase was about 2-4-fold more in most of the amended plots compared to only 1.52 t/ha yield in the diseased control treatment (Table 2). These results suggested that tested amendments have the potentiality to control ufra disease.

**Table 2.** *Effect of different organic amendments in controlling ufra in Boro 1995*

| Organic amendment | Dose (kg/ha) | % ufra infestation | | | Healthy panicle (%) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| | | Damaged tiller | Ufra 3 panicles | Total ufra | | |
| Control (disease) | - | 13.32$^{a}$ | 18.93$^{b}$ | 95.08$^{a}$ | 4.93$^{c}$ | 1.52$^{e}$ |
| Control (healthy) | - | 0.96$^{d}$ | 11.83$^{cd}$ | 15.05$^{e}$ | 84.95$^{a}$ | 5.37$^{a}$ |
| Bishkatali leaf dust | 200 | 1.67$^{cd}$ | 13.24$^{cd}$ | 16.17$^{e}$ | 83.82$^{a}$ | 4.63$^{c}$ |
| Mustard cake | 200 | 0.92$^{d}$ | 28.25$^{a}$ | 31.85$^{b}$ | 68.16$^{b}$ | 3.46$^{d}$ |
| Sesame cake | 200 | 1.07$^{d}$ | 26.32$^{a}$ | 31.50$^{b}$ | 68.51$^{b}$ | 4.92$^{bc}$ |
| Jute seed dust | 200 | 2.79$^{bc}$ | 14.67$^{c}$ | 21.10$^{c}$ | 78.90$^{a}$ | 5.23$^{ab}$ |
| Neem leaf dust | 200 | 1.68$^{cd}$ | 14.59$^{c}$ | 19.51$^{cd}$ | 80.49$^{a}$ | 5.22$^{ab}$ |
| Bankalmi leaf dust | 200 | 1.71$^{cd}$ | 20.80$^{b}$ | 30.13$^{b}$ | 69.88$^{b}$ | 5.22$^{ab}$ |
| Neem seed dust | 200 | 1.48$^{cd}$ | 11.03$^{d}$ | 16.20$^{de}$ | 83.81$^{a}$ | 5.42$^{a}$ |
| Rice husk | 500 | 4.09$^{b}$ | 11.66$^{cd}$ | 32.30$^{b}$ | 67.71$^{b}$ | 4.69$^{c}$ |

Each value is the average of four replications. In a column means followed by a common letter(s) are not significantly different at 5% level by Duncan's multiple range test (DMRT).

Like the results of Boro 1994 and 1995, potentiality of using organic amendments in controlling ufra disease was found in the year Boro 1996 (Table 3). The percentage of damage tiller, total ufra incidence, healthy panicle and yield of control (healthy) varied significantly from all other treatments. Percent damaged tiller ranged from 1.02-3.42 in amended plot where that of healthy and diseased was 20.31 and 0.80% respectively. Among the amendments, although rice husk and Neem seed dust reduced ufra 3, percent total ufra reduced and percent healthy panicle was found significantly by all the amendments that used in 1996. Percent healthy panicles ranged from 65.81-80.31, and that of healthy and diseased controls were 83.92 and 3.87% respectively. Significantly higher yield was found in all amended plots that ranged 3.84-4.5 t/ha as compare to the diseased control treatments. Use of different parts of indigenous plants is one of the important alternative strategies to reduce nematode population and its activity in soil and host plants. The potentiality of different plant parts have been tested either as soil amendment[14] or root dip treatment in leaf extracts[15].

**Table 3.** *Effect of different organic amendments in controlling ufra in Boro 1996*

| Organic amendment | Dose (kg/ha) | % ufra infestation | | | Healthy panicle (%) | Yield (t/ha) |
|---|---|---|---|---|---|---|
| | | Damaged tiller | Ufra 3 panicles | Total ufra | | |
| Control (disease) | - | 20.31[a] | 17.80[c] | 94.13[a] | 3.87[c] | 1.54[c] |
| Control (healthy) | - | 0.80[f] | 2.31[e] | 6.10[e] | 83.92[a] | 5.40[a] |
| Bishkatali leaf dust | 200 | 1.87[d] | 17.51[c] | 28.31[c] | 71.52[b] | 4.01[b] |
| Mustard cake | 200 | 2.32[c] | 27.31[a] | 30.10[bc] | 69.01[b] | 3.84[b] |
| Sesame cake | 200 | 1.02[e] | 28.13[a] | 29.11[bc] | 70.05[b] | 4.81[ab] |
| Jute seed dust | 200 | 2.34[c] | 16.90[c] | 24.30[cd] | 75.80[ab] | 4.50[b] |
| Neem leaf dust | 200 | 1.81[d] | 17.92[c] | 19.63[d] | 80.31[a] | 4.08[b] |
| Bankalmi leaf dust | 200 | 3.42[b] | 21.0[b] | 32.50[bc] | 67.51[b] | 4.11[b] |
| Neem seed dust | 200 | 1.31[ed] | 10.91[d] | 30.10[bc] | 69.80[b] | 4.03[b] |
| Rice husk | 500 | 3.38[b] | 10.60[d] | 34.22[b] | 65.81[b] | 3.95[b] |

Each value is the average of four replications. In a column means followed by a common letter(s) are not significantly different at 5% level by Duncan's multiple range test (DMRT).

Yield recovery rate due to ufra disease varied year to year for the same treatment. However, the range of recovery rate was 59.67-80.16%, 56.07-71.96% and 59.90-67.98% in 1994, 1995 and 1996 respectively (Table 4). Regardless of season, yield was increase with all treatments using mustard cake, sesame cake, jute seed dust, Neem leaf dust, Neem seed dust, Bankalmi leaf dust and rice husk as organic amendments that corresponded to yield ranged from 61.60-67.17, 56.07-71.43, 67.98-75.98, 65.78-78.51, 62.25-76.10, 61.79-79.06 and 62.53-80.16, 61.01-71.43% respectively over the control (diseased). These organic amendments could be used as the alternatives of nematicides for the control of ufra disease. Application of Furadan 5G in soil at 1.0 kg *a.i.*/ha in an infested Boro field resulted an increase of yield by 1.05-times over diseased control[16].

**Table 4.** *Percent yield recovery in three Boro crop seasons under the different organic amendments*

| Organic amendment | Dose (kg/ha) | Yield recovery (%)* | | |
|---|---|---|---|---|
| | | Boro 1994 | Boro 1995 | Boro 1996 |
| Control (disease) | - | - | - | - |
| Control (healthy) | - | - | - | - |
| Neem cake | 200 | 59.67 | - | - |
| Mustard cake | 200 | 71.43 | 56.07 | 59.90 |
| Sesame cake | 200 | 75.98 | 69.10 | 67.98 |
| Jute seed dust | 200 | 78.51 | 70.94 | 65.78 |
| Neem leaf dust | 200 | 76.10 | 70.88 | 62.25 |
| Neem seed dust | 200 | 79.06 | 71.96 | 61.79 |
| Rice husk | 500 | 71.43 | 67.59 | 61.01 |
| Bankalmi leaf dust | 200 | 80.16 | 70.88 | 62.53 |
| Bishkatali leaf dust | 200 | - | 67.17 | 61.60 |

*Yield recover (t/ha) = (yield increased due to use of organic amendments – yield of control disease) x 100/yield increase due to application organic amendments)

From the above results, it was found that organic amendment has the potentiality to decrease ufra infestation, and to increase healthy panicles and increased yield. Hossain *et al*.[17] and Mian and Rodriguez-Kabana[18] found effective control of root knot nematode by applying mustard oil cake. This organic matter reduces disease incidence and severity of nematode disease[17,19]. Rahman and Miah found the significant effect of tea waste, rice husk, Neem leaf dust and tobacco stem dust in reducing reproduction factor of nematode.

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