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IMPACT OF ORGANIC SOURCES OF NUTRIENTS ALONG WITH THE RESISTANT SOURCES FOR MANAGEMENT OF BROWN PLANT HOPPER AND WHITE BACKED PLANT HOPPER IN RICE

B. Usha Rani, K. Suresh and R. Rajendran
Department of Agricultural Entomology, Agricultural College and Research Institute, Madurai-625 104, Tamil Nadu

ABSTRACT

Use of resistant sources is one of the important techniques in integrated pest management, because the resistant cultivars are amenable to fit in integrated pest management strategies. Although resistant cultivars were developed and planted over large areas, they cannot maintain the insect population to below the economic threshold level due to various other stresses during the period of cultivation. In the absence of expected level of natural heritable resistance, creation and combination of induced resistance in plants to pests by the nutritional manipulation through organic farming is one of the promising supplements in encountering the pests and to obtain sustainability in rice production. For that a field experiment was conducted during November 2003 - February 2004 in Agricultural College and Research Institute, Madurai. The resistant sources used were TKM 6, IR 36 along with one check MDU 5. The organic nutrients used were FYM + biofertilizers + lignite fly ash + neem cake. It was found that the variety IR 36 treated with FYM, *Azospirillum*, phosphobacterium, SSB, lignite flyash and neem cake recorded the lowest population of BPH and WBPH per tiller. However highest grain yield of 5.40 t/ha was recorded in the treatment with the variety IR 36 + NPK as inorganic form.

INTRODUCTION

One of the most promising ways to reduce the dependence on pesticides in agriculture is to grow insect resistant crops. Varieties possessing multiple resistances to a number of insect pests and diseases are ideal in IPM programmes. In the 'post green revolution era' the major emphasis is given only on sustainability and efficiency rather than on further intensification of expensive inputs. In the current insect pest management system, the most reliable method is of a judicious combination of varieties which are inherently less infected/damaged with other possible nonchemical or eco-friendly methods/components aimed to minimize the pest population either by supplementing or complementing so as to formulate a successful pest management programme. Hence, a field experiment was conducted to see the impact of various resistant sources along with organic nutrients on the management of brown plant hopper and white backed plant hopper in rice.

MATERIALS AND METHODS

To evaluate the impact of resistant sources with organic sources of nutrients on the management of brown plant hopper in rice, a field experiment was conducted during November 2003 - February 2004 in a randomized block design (RBD) using test variety with the following treatments and three replications. All the agronomic practices were followed uniformly in all the plots with plot size of 5 × 4 m^2. IR 36, TKM 6 and MDU 5 are the resistant genotypes used in this study programme. The organic manures such as farm yard manure (FYM) (12.5 t/ha) and biofertilizers (*Azospirillum* + phosphobacterium + silicate solubilizing bacteria (SSB) each at 2 kg/ha) were applied basally. Neem cake was applied in four splits, 50 per cent as basal and remaining 50 per cent in three splits at 20 days interval (125 kg/ha as basal, 125 kg/ha in 3 equal splits). Lignite fly ash was applied in three splits, first as basal and subsequent splits at monthly intervals (250 kg as basal and 250 kg in two equal splits). Population counts of hoppers were taken from 10 randomly selected tillers. Results were expressed as mean population/tiller. At harvest, the grain yield was recorded in all the plots. The data on percentage and numbers were transformed into corresponding arc sine (angular) values and square root transformed values and analysed statistically. Mean values were compared using Duncan's Multiple Range Test (DMRT).

Treatment Details

T_1 - TKM 6 + FYM + Biofertilizers + lignite fly ash + neem cake
T_2 - TKM 6 + NPK alone (100: 50: 50 kg NPK/ha)
T_3 - TKM 6 alone
T_4 - IR 36 + FYM + Biofertilizers + lignite fly ash + neem cake
T_5 - IR 36 + NPK alone (100 : 50 : 50 kg NPK/ha)
T_6 - IR 36 alone
T_7 - MDU 5 + FYM + Biofertilizers + lignite fly ash + neem cake
T_8 - MDU 5 + NPK alone (100 : 50 : 50 kg NPK/ha)
T_9 - MDU 5 alone

RESULTS AND DISCUSSION

BPH (Brown plant hopper): There were no significant differences among treatments on 30 days after transplanting (DAT). At 45 DAT, the variety IR 36, treated with FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake, was significantly superior and registered less population of 2.43 as against 5.77 BPH per tiller in the treatment with MDU 5 + NPK as inorganic form, with the corresponding per cent reduction of 57.80 (Table 1). On 60 DAT, the population was significantly less in IR 36 + FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake (1.67 BPH/tiller) with a corresponding per cent reduction of 75.73 over MDU 5 + NPK as inorganic form. While computing the overall mean population, recorded throughout the period, it was found that the variety IR 36, treated with FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake, recorded the lowest population of 1.94 BPH per tiller, followed by TKM 6 + FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake (2.61 BPH/tiller) and MDU 5 + FYM, *Azospirillum*, phosphobacterium, SSB, lignite flyash and neem cake (2.82 BPH /tiller) with the corresponding per cent reduction of 63.03, 51.13 and 46.98, respectively over MDU 5 + NPK as inorganic form.

WBPH (whitebacked plant hopper): The population of WBPH varied significantly among the treatments (Table 2). On 30 DAT, the population was significantly less on IR 36 treated with FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake (0.20 WBPH/tiller) with corresponding per cent reduction of 83.78 and 62.26 over MDU 5 + NPK and IR 36 + NPK as inorganic form. On 45 DAT, the population of WBPH among treatments ranged between 0.60 and 1.73 per tiller. The treatment IR 36 + FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake recorded significantly less population of 0.6 WBPH per tiller and the corresponding per cent reduction of 65.38 over MDU 5 + NPK as inorganic form. On 60 DAT, the population of WBPH ranged from 0.97 to 4.17 per tiller. FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake on IR 36 significantly reduced the WBPH population by 76.80 per cent over MDU 5 +

Table 1: Influence of resistant sources with organic sources of nutrients on BPH population in rice.

Treatments	Days after transplanting					Overall mean	
	30	45		60			
	BPH No./tiller*	BPH No./tiller*	% reduction over NPK	BPH No./ tiller*	% reduction over NPK	BPH No./ tiller*	% reduction over NPK
TKM 6+FYM+NC+Azos +Phos + SSB + LFA	2.17	3.07 (1.75)^{b}	46.82	2.60 (1.75)^{c}	62.14	2.61	51.13
TKM 6 + NPK (inorganic form)	3.33	5.00 (2.24)^{cd}	13.29	6.43 (2.03)^{d}	6.39	4.93	11.39
TKM 6 alone	3.30	4.90 (2.21)^{cd}	15.03	6.40 (2.00)^{d}	6.80	4.52	12.40
IR 36+FYM+NC+Azos+ Phos+SSB+LFA	1.73	2.43 (1.56)^{a}	57.80	1.67 (1.03)^{a}	75.73	1.94	63.03
IR 36 + NPK (inorganic form)	3.03	4.70 (2.17)^{cd}	18.50	3.10 (1.47)^{b}	54.85	3.61	31.86
IR 36 alone	3.00	4.33 (2.08)^{c}	24.86	3.03 (1.41)^{b}	55.83	3.46	34.59
MDU 5 +FYM+NC+Azos +Phos+SSB+LFA	2.43	3.17 (1.77)^{b}	45.09	2.87 (1.73)^{c}	58.25	2.82	46.98
MDU 5 alone	3.73	5.37 (2.32)^{d}	6.88	6.47 (2.03)^{d}	5.78	4.83	5.64
MDU 5+NPK (inorganic form)	3.90 NS	5.77 (2.40)^{e}	-	6.87 (2.71)^{e}	-	5.51	-

*Mean of three replications; Values in parentheses are square root transformations.
In a column, mean followed by same letter are not significantly different at P = 0.05 as per DMRT
FYM - Farm Yard Manure, NC - Neem cake, LFA - Lignite fly ash, Azos - *Azospirillum*, phos - Phosphobacterium, SSB - silicate solubilising bacteria

NPK as inorganic form. While computing overall periods of observation, again the variety IR 36 with organic source of nutrients recorded the highest reduction of population (75.32 %) over MDU 5 + NPK as inorganic form.

The results of the field experiment conducted revealed that the population of BPH and WBPH was significantly reduced due to varietal influence of IR 36 as well as application of FYM, *Azospirillum*, phosphobacterium, SSB, lignite fly ash and neem cake as compared to MDU 5 + NPK as inorganic form. The inheritable resistance character of IR 36 and IR 64 against rice hoppers has been reported by earlier workers (Huynh & Khan 1981, Heinrichs et al. 1986, Chen et al. 1991). It has been well established that IR 36 has genes for BPH resistance (Heinrichs et al. 1986, Huynh & Xhan 1981). These resistant genes in nature might have favoured the less activity of hoppers. In the present study the consistent reduction in population of plant and leaf hoppers might be due to nonpreference for settling and feeding besides antibiosis or a combination of both. This desirable effect is quite likely to be due to the presence of the defense chemicals like phenols in crop plants, and this reasoning is in conformity with the findings of Suresh (1988) who reported that the phenols are often associated with feeding deterrence or growth inhibition. Athisamy (1994) also reported that *Azospirillum* at higher doses in combination with organic manure decreased the feeding rate of BPH and adversely affected its growth and development. In the present study, it is also evident that addition of lignite fly ash led to translocation of silica into the plant system, especially in culms and leaves imparting induced resistance in rice plant to BPH, GLH and other sucking insects. Further, Krishnamoorthy et al. (2001) reported that the soil application of neem cake @ 250 kg/ha significantly reduced the leaf hopper

Table 2: Influence of resistant sources with organic sources of nutrients on WBPH population in rice.

Treatments	Days after transplanting						Overall mean	
	30		45		60		WBPH	%reduction
	WBPH No./ tiller*	% reduction over NPK	WBPH no./ No./ tiller*	% reduction over NPK	WBPH No./ tiller*	% reduction over NPK	No./ tiller*	over NPK
TKM 6+FYM+NC+ Azos+Phos+SSB+LFA	0.70 (0.83)^{bc}	43.24	1.17 (1.08)^{bc}	32.69	1.20 (1.09)^{b}	71.20	1.02	49.05
TKM 6 +NPK (inorganic form)	0.93 (0.97)^{de}	24.32	1.40 (1.18)^{d}	19.23	3.90 (1.98)^{ef}	6.40	2.08	16.65
TKM 6 alone	0.90 (0.95)^{cd}	27.03	1.33 (1.16)^{cd}	23.08	3.73 (1.93)^{e}	10.40	1.99	20.17
IR 36+FYM+NC+Azos +Phos+SSB+LFA	0.20 (0.44)^{a}	83.78	0.60 (0.77)^{a}	65.38	0.97 (0.98)^{a}	76.80	0.59	75.32
IR 36+NPK (inorganic form)	0.53 (0.73)^{b}	56.76	1.00 (1.00)^{b}	42.31	2.73 (1.65)^{d}	34.40	1.42	44.49
IR 36 alone	0.50 (0.71)^{b}	59.46	0.97 (0.98)^{b}	44.23	2.60 (1.61)^{d}	37.60	1.36	47.10
MDU 5+FYM+NC+ Azos+Phos+SSB+LFA	0.93 (0.97)^{de}	24.32	1.40 (1.18)^{d}	19.23	1.57 (1.25)^{c}	62.40	1.30	35.32
MDU 5 alone	1.20 (1.01)^{ef}	2.70	1.70 (1.34)^{e}	1.92	4.00 (2.00)^{f}	4.00	2.30	2.88
MDU 5+NPK (inorganic form)	1.23 (1.11)^{f}	-	1.73 (1.32)^{e}	-	4.17 (2.04)^{f}	-	2.38	-

*Mean of three replications, Values in parentheses are square root transformations.
In a column, means followed by same letter are not significantly different at P = 0.05 as per DMRT.
FYM - Farm Yard Manure, NC - Neem cake, LFA - Lignite aly ash, Azos - *Azospirillum*, phos - Phosphobacterium, SSB - silicate solubilising bacteria

Table 3: Effect of promising resistant sources with organic sources of nurients on yield of rice.

Sl. No.	Treatments	Yield (t/ha)
1.	TKM 6 + FYM + NC + Azos + Phos + SSB + LFA	3.77^{de}
2.	TKM 6 + NPK (inorganic form)	3.87^{de}
3.	TKM 6 alone	2.83^{e}
4.	IR 36 + FYM + NC + Azos + Phos + SSB + LFA	4.69^{bc}
5.	IR 36 + NPK (inorganic form)	5.40^{a}
6.	IR 36 alone	3.97^{d}
7.	MDU 5 + FYM + NC + Azos + Phos + SSB + LFA	4.41^{cd}
8.	MDU 5 + NPK (inorganic form)	4.97^{ab}
9.	MDU 5 alone	2.63^{e}

*Mean of three replications; In a column, means followed by same letter are not significantly different at P = 0.05 as per DMRT. FYM - Farm Yard Manure, NC - Neem cake, LFA - Lignite Fly Ash, Azos - *Azospirillum*, phos - Phosphobacterium, SSB - silicate solubilising bacteria

population and this is in close agreement with the present investigation.

Yield: The grain yield recorded in various treatments ranged from 2.63 to 5.40 t/ha. Significantly higher grain yield was recorded in the plots treated with NPK than organic nutrients. Highest grain yield of 5.40 t/ha was recorded in the treatment with the variety IR 36 + NPK as inorganic form. It was followed by the variety MDU 5 + NPK as inorganic form (4.97 t/ha) and IR 36 + organic nutrients (Table 3). In the present study, next to NPK fertilizers the highest yield was obtained in the organic manure treatment. The higher yield in organic combinations might be due to less pest incidence as well as periodical, rational and balanced nutrient supply to the plant. Further the combination of organic nutrients with neem cake, FYM, *Azospirillum* and lignite fly ash maintaining good soil health for higher and stable productivity besides imparting induced resistance to major insect pests. These results are in conformity with the findings of Chandramani (2003) who found that the grain yield of rice was significantly high in the treatments containing FYM, neem cake plus either all the three biofertilizers or lignite fly ash or both.

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