Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.5264

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **5 (5):** 20-24 (2017)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Natural Enemies in Rice Field with Different Levels of Fertilizers

G. Madhuri*, P. C. Dash, K. K. Rout and L. K. Rath

Dept. of Entomology, College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar

*Corresponding Author E-mail: madhurigorege01@gmail.com

Received: 20.07.2017 | Revised: 29.08.2017 | Accepted: 3.09.2017

ABSTRACT

The field experiment was conducted at Central Research Farm of Orissa University of Agriculture and Technology, Bhubaneswar during summer 2014-15 and kharif- 2015 to evaluate the effect of different graded levels of fertilizers and manure on incidence of natural enemies on rice with twelve treatments and four replications in sub plot size of 15m x 10m taking Lalat and Swarna as test cultivar during summer 2014-15 and kharif -2015 following the recommended package of practices. The imbalance nutrients like 150 % NPK, 100% N, 100% PK and 100% NP produced more insect incidence which as encouraged the spiders on rice in various treatments it was ascertained that the treatment T_9 (100 % N) harboured more spider/hill followed by T_3 (1.91/ hill) and T_{10} (1.72/ hill). In rest of the treatments the spider population varies from 0.98/hill T_{12} to 1.41/hill in T_1. Same trend followed by Mirid bug with high population in T_9 (2.87/ hill) compared to rest of the treatments. Incidence of Mirid bugs and different species of spiders increased with application of increased doses of nitrogen and NPK fertilizers. Whereas, balanced nutrients (100% NPK) supplemented with micro-nutrients (S, B, Zn, FYM) resulted lower incidence of insect pests followed by Mirid bugs and spiders.

Key words: *Spiders, Mired bug, Rice, Fertilizers and Micronutrients.*

INTRODUCTION

Rice (*Oryza sativa* L.) is an important staple food crop for more than half of the world population and accounts for more than 50% of the daily calorie intake[6]. Approximately 52% of the global production of rice is lost annually owing to the damage caused by biotic stress factors, of which 21% is attributed to the attack of insect pests[12]. The overall losses due to insect damage in rice were estimated to be 25 per cent. Spiders are carnivorous arthropods. They are classified into 40,000 species, and are found all over the world in almost every kind of habitat. Spiders consume a large number of prey, and do not damage plants. They can achieve equilibrium in pest control, after which their own numbers are suppressed by their territoriality and cannibalism.

Cite this article: Madhuri, G., Dash, P.C., Rout, K.K. and Rath, L.K., Natural Enemies in Rice Field with Different Levels of Fertilizers, *Int. J. Pure App. Biosci.* **5(5):** 20-24 (2017). doi: http://dx.doi.org/10.18782/2320-7051.5264

For some time, spiders have been considered important predators which help regulate the population densities of insect pests[7,2,5,11]. The Mirid bug, *Cyrtorhinus lividipennis* is a plant feeding and predatory insect, preferring plant, leaf hopper eggs and young nymphs[10]. It is now one of the important predators of brown plant hopper (BPH) and white backed plant hopper.

MATERIAL AND METHODS

The field experiments were laid out during *summer* 2014-15 and *kharif* 2015 Randomized block design (RBD) with twelve treatments and four replications at Central Farm, OUAT, Bhubaneswar to assess the incidence of natural enemies (Spiders and Mirid bug) of rice raised under NPK nutrient levels with FYM and micro nutrients. The soil of the experimental plot was lateritic sandy loam. The seedlings of rice variety Lalat and Swarna was taken as the test cultivar in *summer* 2014-15 and *kharif* 2015 were planted in plots of size 15m x 10m at spacing of 20cm x 10cm with recommended agronomic practices.

Methods and time of application of manures and fertilizers:

Nitrogen was applied in 3 splits *i.e.* 25% as basal, 50% at 15 days after transplanting at maximum tillering stage and 25% at panicle initiation stage. Total phosphorus and sulphur was applied as basal. Potash was applied as 50% basal and 50% at panicle initiation stage. Boron was applied as two foliar sprays at 0.25% at panicle initiation stage and 15 days after panicle initiation. The required amount of FYM was incorporated one week before transplanting.

Sampling techniques for record of pest population:

The number of spiders was counted 10 random selected hills/ sub plot at 30 DAT up to 80 DAT at 10 days interval during *kharif* and *summer* seasons. Whereas Mirid bug from 60 DAT up to 80 DAT during *kharif* 2015 were computed as suggested by Gomez[4] and the mean data were subjected to statistical analysis after suitable transformation.

RESULTS AND DISCUSSION

Incidence of spider (no/hill) during summer 2014-15:

During summer 2014-15, the spider population/ hill recorded at different periods of observation exhibited marked difference among the treatments (Table 1). The difference between the treatments at 30DAT happened due to very low number of spider on T_{11} and T_{12} (0.75 and 0.85/ hill, respectively) which did not differ between themselves. Rest of the treatments were at par among themselves. But at 40 DAT, T_9 supported 2.0 spider/ hill remaining at par with T_2, T_3, T_8, T_{10} etc. While other treatments *viz.*, T_1, T_4, T_5, T_6, T_7, T_9 and T_{12} did not differ among them. The treatments T_{11} retained the lowest population of spider (1.00/ hill). At 50DAT, the results were similar to that of the population build up of spiders at 30DAT. A much variation was observed in the latter subsequent three observations. As regards to mean performance, it can be seen that highest spider population was seen in T_9 (100% N) with 2.22spider/ hill, followed by T_3 (1.91/ hill), T_{10} (1.72/hill), T_2 (1.64/ hill) and T_1 (1.41/ hill). Preap *et al*.[8] reported succulent rice plant with hard leaf blade makes easier for web spiders to use leaf blades as frames for webbing and thinner canopy make them easier to find enough space for webbing.

Incidence during *Kharif* – 2015

The predatory spider population recorded during *kharif*, 2015. Table 2 indicated that at 30 DAT, T_8 supported higher number of spider/ hill (3.00) which was no significant from T_9 and T_3 (each with 2.62 spider/ hill), T_{10} (2.50/ hill) and T_2 (2.12/ hill). There was marked change in the spider activity regardless of the treatments imposed at 40 DAT. At this time T_9 supported 3.12 spider/ hill which were statistically at par with T_3, T_{10}, T_2 and T_5 treatments while the control treatment supported 1.25 spider /hill. At 50 DAT, T_9 also supported highest spider/hill (3.25) followed by T_3, T_{10} and T_2 treatments, having no significant difference among treatments. Other treatments supported 2.37 spider/ hill (T_5 and

T_{11}) to more than 1.50 spider/ hill in rest of the treatments including control. The spider activity at 60 DAT almost followed the same trend as observed at 50 DAT. At 70 and 80 DAT, the treatments like T_9, T_3, T_{10}, T_2, T_1 etc were superior to rest of the treatment in harbouring more spider/ hill than the rest. With regard to mean value, it was observed that the treatments T_9, T_{10} and T_3 were more eco friendly as they supported higher spider population as compared to rest of the treatments tested. So it clearly indicate that N is responsible for higher incidence of spiders and Mirid bug (no/ hill) population. Chau *et al*.[1] reported spiders and mired bugs were most abundant in treatment of 200 kg N ha^{-1} with rate of 2.44 and 2.19adults/m^2 compared to control. Sarao *et al.*[9] concluded that the population of natural enemies was more abundant at higher dose of nitrogen (172.81 kg N ha^{-1}; 375 kg urea).

Incidence of Mirid bug (no/ hill) during *Kharif* – 2015

The data presented in Table 3 indicated that the Mirid bug population was heterogeneous as significant difference in population on different treatments was marked. Highest bug population was seen in T_9 at 60DAT (2.87/ hill) that remained at par with T_3, T_2, T_{10} and T_1 treatments. At 70DAT, the trend was more or less similar with highest number of bugs being observed in T_9 (3.25/ hill). Similarly at 80DAT, T_9 recorded highest bugs/ hill (2.50) also remained statistically at par with the above four treatments. In rest of the treatments the bug population was considerably low. The control treatment throughout the period of observation recorded either 1 insect/hill or less than that as regards to mean population, T_9 recorded 2.87 bugs/hill, while the control treatment supported only 0.79 bugs/hill. Hedge *et al*. observed nitrogen nutrient increased the rate of survival and reproduction of *Cyrtorhinus lividipensis* due to availability of sufficient nutrient which provided ideal conditions to maintain the greater population and bigger size in high nitrogen treatments. Thus, the present finding corroborate with the finding of above authors. The treatments comprising of NPK nutrients in combination with micro- nutrients like Zn, B etc had less population of natural enemies. Probably, the less host population in their treatments might be responsible for low natural enemies' population.

Table 1: Incidence of spider (No/ hill) in rice during summer 2014-2015 at Bhubaneswar

Treatments	Incidence of spider (No/ hill) at						Mean (No/ hill)
	30 DAT	40DAT	50DAT	60DAT	70DAT	80DAT	
T_1- 100% PK	1.12 (1.06)	1.25 (1.11)	1.62 (1.26)	1.75 (1.30)	1.62 (1.26)	1.12 (1.06)	1.41
T T_2-100% NPK	1.25 (1.11)	1.50 (1.21)	1.75 (1.32)	2.25 (1.49)	1.87 (1.36)	1.25 (1.09)	1.64
T_3-150% NPK	1.50 (1.21)	1.87 (1.36)	2.25 (1.49)	2.25 (1.46)	2.00 (1.38)	1.62 (1.26)	1.91
T_4-100% NPK+ Zn	1.25 (1.11)	1.12 (1.06)	1.50 (1.20)	1.25 (1.08)	0.62 (0.78)	0.50 (0.71)	1.04
T_5-100% NPK+ FYM	1.00 (1.00)	1.12 (1.06)	1.50 (1.21)	1.62 (1.25)	1.50 (1.21)	1.00 (90.98)	1.29
T_6-100% NPK+ FYM + Lime	1.3 (1.15)	1.50 (1.20)	1.50 (1.20)	1.62 (1.26)	1.00 (0.98)	0.75 (0.86)	1.27
T_7-100% NPK +B + Zn	1.25 (1.11)	1.30 (1.15)	1.62 (1.26)	1.47 (1.20)	0.87 (1.03)	0.68 (0.78)	1.18
T_8-100% NPK + S+ Zn	1.41 (1.16)	1.47 (1.20)	1.32 (2.25)	1.47 (1.20)	0.75 (0.85)	0.68 (0.78)	1.17
T_9-100% N	1.87 (1.26)	2.00 (1.41)	2.25 (1.49)	2.50 (1.51)	2.12 (1.43)	1.62 (1.27)	2.22
T_{10}-100% NP	1.62 (1.27)	1.62 (1.26)	2.00 (1.41)	1.87 (1.38)	2.00 (1.38)	1.25 (1.21)	1.72
T_{11}-100% NPK + Lime	0.75 (0.85)	1.00 (0.98)	1.25 (1.08)	1.37 (1.16)	1.25 (1.25)	1.00 (0.98)	1.10
T_{12}- Control	0.85 (0.67)	1.12 (1.04)	1.17 (1.06)	1.12 (1.06)	1.25 (1.09)	0.37 (0.53)	0.98
SE (m) ±	0.12	0.09	0.10	0.14	0.13	0.10	-
CD (5%)	0.34	0.26	0.30	0.42	0.37	0.28	-
CV (%)	21.88	15.80	16.2	23.29	22.66	20.98	-

Figures in parenthesis are √(x + 0.5) transformed values, 100% NPK = 80:40:60 kg ha^{-1}($N:P_2O_5:K_2O$); FYM = 5 t ha^{-1}; Lime = 1 t ha^{-1}; Zn=12.5kg Zn SO_4 ha^{-1}; B = 0.25% ; S = 30 kg gypsum ha^{-1}.

Table 2: Incidence of spider (No/hill) in rice during *kharif*-2015 at Bhubaneswar

Treatments	Incidence of spider (No/hill) at						Mean (No/hill)
	30DAT	40DAT	50DAT	60DAT	70DAT	80DAT	
T_1- 100% PK	2.12 (1.46)	2.37 (1.54)	2.50 (1.57)	2.62 (1.60)	3.12 (1.76)	2.50 (1.58)	2.53
T T_2-100% NPK	2.12 (1.49)	2.62 (1.62)	2.75 (1.65)	2.87 (1.69)	3.37 (1.83)	2.75 (1.66)	2.76
T_3-150% NPK	2.62 (1.62)	3.00 (1.73)	3.12 (1.76)	3.25 (1.80)	3.50 (1.86)	3.12 (1.76)	3.10
T_4-100% NPK+ Zn	1.00 (0.98)	1.50 (1.22)	1.62 (1.25)	1.87 (1.36)	2.12 (1.44)	1.25 (1.08)	1.56
T_5-100% NPK+FYM	1.87 (1.36)	2.50 (1.58)	2.37 (1.53)	2.50 (1.57)	2.62 (1.62)	2.37 (1.53)	2.37
T_6-100% NPK+ FYM + Lime	1.62 (1.27)	2.00 (1.41)	2.00 (1.40)	2.25 (1.49)	2.50 (1.57)	2.00 (1.45)	2.06
T_7-100% NPK +B + Zn	1.50 (1.22)	1.87 (1.36)	1.62 (1.30)	1.87 (1.36)	2.00 (1.41)	1.75 (1.32)	1.76
T_8-100% NPK + S+ Zn	3.00 (1.73)	1.75 (1.32)	1.62 (1.26)	1.75 (1.32)	1.87 (1.36)	1.50 (1.22)	1.91
T_9-100% N	2.62 (1.62)	3.12 (1.76)	3.25 (1.80)	3.37 (1.83)	3.50 (1.87)	3.25 (1.80)	3.18
T_{10}-100% NP	2.50 (1.58)	2.75 (1.65)	2.87 (1.68)	2.75 (1.65)	3.37 (1.83)	3.00 (1.73)	2.87
T_{11}-100% NPK + Lime	1.75 (1.32)	2.25 (1.49)	2.37 (1.53)	2.62 (1.61)	2.75 (1.65)	2.12 (1.45)	2.31
T_{12}- Control	0.87 (0.93)	1.25 (1.11)	1.50 (1.21)	1.75 (1.30)	1.62 (1.27)	1.00 (1.00)	1.33
SE (m) ±	0.08	0.07	0.08	0.08	0.06	0.06	-
CD (5%)	0.24	0.21	0.23	0.25	0.20	0.19	-
CV (%)	12.36	10.08	11.04	11.39	8.56	9.23	-

Figures in parenthesis are √(x + 0.5) transformed values, 100% NPK = 80:40:60 kg ha-1(N: P_2O_5:K_2O); FYM = 5 t ha^{-1}; Lime = 1 t ha^{-1}; Zn=12.5kg Zn SO_4 ha^{-1}; B = 0.25%; S = 30 kg gypsum ha^{-1}.

Table 3: Incidence of Mirid bug in rice during *kharif* – 2015 at Bhubaneswar

Treatments	Incidence of Mirid bug (No/hill) at			Mean (No/hill)
	60 DAT	70DAT	80DAT	
T_1- 100% PK	2.12 (1.44)	2.37 (1.54)	1.75 (1.32)	2.08
T T_2- 100% NPK	2.37 (1.53)	2.62 (1.61)	1.87 (1.34)	2.28
T_3-150% NPK	2.62 (1.61)	2.87 (1.69)	2.37 (1.53)	2.62
T_4-100% NPK+ Zn	1.00 (0.98)	1.25 (1.08)	0.87 (0.93)	1.04
T_5-100% NPK+FYM	2.00 (1.41)	2.12 (1.44)	1.62 (1.26)	1.91
T_6-100 NPK+ FYM + Lime	1.62 (1.26)	1.87 (1.36)	1.25 (1.11)	1.58
T_7-100% NPK +B + Zn	1.37 (1.16)	1.50 (1.21)	1.00 (0.98)	1.29
T_8-100% NPK + S+ Zn	1.25 (1.11)	1.37 (1.16)	0.75 (0.85)	1.12
T_9-100% N	2.87 (1.69)	3.25 (1.80)	2.50 (1.58)	2.87
T_{10}-100% NP	2.25 (1.49)	3.00 (1.73)	2.12 (1.44)	2.45
T_{11}-100% NPK + Lime	1.75 (1.30)	2.12 (1.45)	2.00 (1.38)	1.95
T_{12}- Control	0.75 (0.85)	1.00 (0.98)	0.62 (0.78)	0.79
SE (m) ±	0.09	0.09	0.09	-
CD (5%)	0.27	0.26	0.28	-
CV (%)	14.27	12.93	16.23	-

Figures in parenthesis are √(x + 0.5) transformed values, 100% NPK = 80:40:60 kg ha^{-1} (N:P_2O_5:K_2O); FYM = 5 t ha^{-1}; Lime = 1 t ha^{-1}; Zn=12.5kg Zn SO_4 ha^{-1}; B = 0.25% ; S = 30 kg gypsum ha^{-1}

CONCLUSION

Presence of spiders on rice in various treatments it was ascertained that the treatment T_9 (100 % N) harboured more spider/hill followed by T_3 (1.91/ hill) and T_{10} (1.72/ hill). In rest of the treatments the spider population varies from 0.98/ hill T_{12} to 1.41/ hill in T_1. Same trend followed by Mirid bug with high

population in T_9 (2.87/ hill) compared to rest of the treatments.

REFERENCES

1. Chau, L.M., Hoang, D.C., Phan, T.B., Luong, T.P., Jiaan, C. and Heong, K.L., Impacts of nutrition management on insect pests and diseases of rice. *Omon rice J.*, **11:** 93-102. (2003).
2. Dondale, C.D., Annotated list of spiders (Araneae) in Nova Scotia apple orchards. *Canadian Entomol.,* **88:**, 697-700 (1956).
3. Fox, C.J.S. and Dondale, C.D., Annotated list of spiders (Araneae) from hayfields and their margins in Nova Scotia. *Canadian Entomol.,* **104:** 1911-1915 (1972).
4. Gomez, K.A. and Gomez, A.A., Statistical procedures for agricultural research, second edition. A wiley inter science publication. John Wiley and Sons, Singapore, pp. 302-307 (1984).
5. Kajak, A., Andrzejeuska, L. and Wojcik, Z., The role of spiders in the decrease of damages caused by Acridoidea on meadows — Experimental investigations. *Ekol. pol. (A).*, **16:** 755-764 (1968).
6. Khush, G.S., What it will take to feed five billion rice consumers by 2030. *Pl. Mol. Biol.,* **59:** 1-6 (2005).
7. Pickett, A.D., Patterson, N.A., Stultz, H.T. and Lord, F.T., The influence of spray programs on the fauna of apple orchards in Nova Scotia: I. An appraisal of the problem and a method of approach. *Scient Agric.*, **26:** 590-600 (1946).
8. Preap, V., Zalucki, M.P., Nesbitt, H.J. and Jahn, G.C., Effectiveness of brown planthopper predators: Population suppression by two species of spiders, *Pardosa pseudoannulata* and *Araneus inustus*. *J. Asia-Pacific Entomol.*, **4(2):** 187-193 (2001).
9. Sarao, P.S. and Debjani, D., Diversity of natural enemy fauna in rice ecosystem in relation to different levels of nitrogen. *J. Biol. Control.,* **22(1):** 125-130 (2008).
10. Shepard, B.M., Barrion, A.T. and Litsinger, J.A., Helpful Insects, Spiders, and Pathogens. International Rice Research Institute, Los Baños, Philippines. pp. 127 (1987).
11. Tanaka, K., Movement of the spiders in arable land. *Pl. Prot.,* **43(1):** 34-39 (1989).
12. Yarasi, B., Sadumpati, V., Immanni, C.P., Vudem, D.R. and Khareedu, V.R., Transgenic rice expressing *Allium sativum* leaf agglutinin (ASAL) exhibits high-level resistance against major sap-sucking pests. *Pl. Biol.,* **8:** 102-115 (2008).