J. Agrofor. Environ. 2(2): 85-88, 2008 ISSN 1995-6983

Effect of cultural practices for the management of Brown Planthopper

M.T. Haque[1], M.E. Haque[2] and L.I. Kabir[3]
[1]Entomology Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh,
[2]DAE Khamarbari, Dhaka, [3]SAIP, DAE, Mymensingh

Abstract: A detail study was made on cultural practices for integrated management of brown planthopper (BPH), *Nilaparvata lugens* (Stål.) (Homoptera: Delphacidae), a major pest of rice in Bangladesh. The experiment with cultural practices was conducted in Boro season during the period of January to May 2005 at BINA Farm, Mymensingh. Six different treatments were assigned in a RCBD. The treatments were- Removal of old leaf (C_1), Field with no stagnant water (C_2), Removal of old leaf in the field with no stagnant water (C_3), Removal of old leaf in the field with no stagnant water and bending of rice plants (C_4), Higher plant spacing (C_5) and control (C_6). Among the treatments, removal of older leaves from the rice plant in the field with no stagnant water and bending of plants (C_4) provided a good control of the pest. As it was evident that removal of water has negative impact on BPH population, draining out of water from the field could be practised to reduced and manage BPH in rice field. Cultural practices like wider spacing could also be practised in managing BPH. The results of this experiments are discussed for their possible use in integrated management of brown planthopper.
Key words: Brown planthopper, cultural practices, rice

Introduction

Rice is the world's single most important food crop (David, 1992) and contributes more than 20 per cent of all calories consumed by the entire human population. More than 90 per cent of the world's rice is produced and consumed in Asia, where more than half of the world population lives (David, 1992; Anon. 1993). Many insect pests have been reported to attack rice crop among which brown planthopper (BPH), *Nilaparvata lugens* (Stål.) has become a serious problem to rice cultivation in Bangladesh. The brown planthopper, *N. lugens* belongs to the plant-sucking group of insects under the order Hemiptera, suborder Homoptera and family Delphacidae. This insect prefers rain fed and irrigated wetland fields to upland rice and direct sown fields to transplanted fields. It is known only to feed on rice and the weed *Leersia hexandra* (Heinrichs and Mochida, 1984). Light infestation reduces plant tiller, plant height, crop vigour, productive tiller, grain weight and increases unfilled grain per panicle (Bae and Pathak, 1970), while heavy infestation turns the plants yellow which dry up rapidly developing the symptoms "Hopperburn" (Kisimoto, 1960). Brown planthopper also acts as a vector for the economically important ragged stunt, grassy stunt and wilted stunt viruses (Rivera *et al*., 1966 and Ou, 1985). Dyck (1973) reported that plant spacing, the cropping system and fertilizer management may prevent buildup of certain pest populations. Other methods of cultural control such as flooding the fields or ploughing, aim at destroying BPH populations. Keeping plots flooded or saturated favors buildup of the BPH. Thus, a thorough knowledge on the eco-biology of the BPH, other pests and the crop plant is needed before cultural control techniques are introduced.

Materials and Methods

The experiment with cultural practices was conducted in Boro rice season during the period of January to May 2005 at BINA Farm, Mymensingh. Six different treatments were assigned in a RCBD. The treatments were (i) Removal of old leaf (C_1) (ii) Field with no stagnant water (C_2) (iii) Removal of old leaf in the field with no stagnant water (C_3) (iv) Removal of old leaf in the field with no stagnant water and bending of rice plants (C_4) (v) Higher plant spacing (C_5) and (vi) control (C_6) **(Fig. 1).** Three levels of BPH (50, 75 and 100) were considered in the experiment. There were 18 treatments combination in the study. Each treatment was replicated three times. The plot size was 1m × 1m. 'Ail' (demarcation line) of the plot was 20 cm in height and 15 cm in width. Each plot had facilities for irrigation and drainage. The plots were treated with Urea, T. S. P., M. P. and Gypsum fertilizer using recommended dose. Row to row distance was 20 cm and plant to plant distance was 15 cm in all the plots except the treatment C_5, where the distance between rows was 30 cm and between plants was 25 cm. The plots in the treatments C_2, C_3 and C_4 were maintained with no stagnant water but with sufficient moisture in the soil. Remaining plots were supplied and maintained with sufficient water. In treatment C_4 bending of rice plants was practised at every 5 rows using a bamboo stick to increase the sunlight and movement of air in the field. Each block was covered with a big size nylon nets. The different numbers of BPH (50, 75 and 100) were released to the plots after 45 days after transplanting (DAT). Data were collected at 24 hours interval. Number of BPH moved from one plot to another plot was recorded. Data were recorded daily until 10 days.

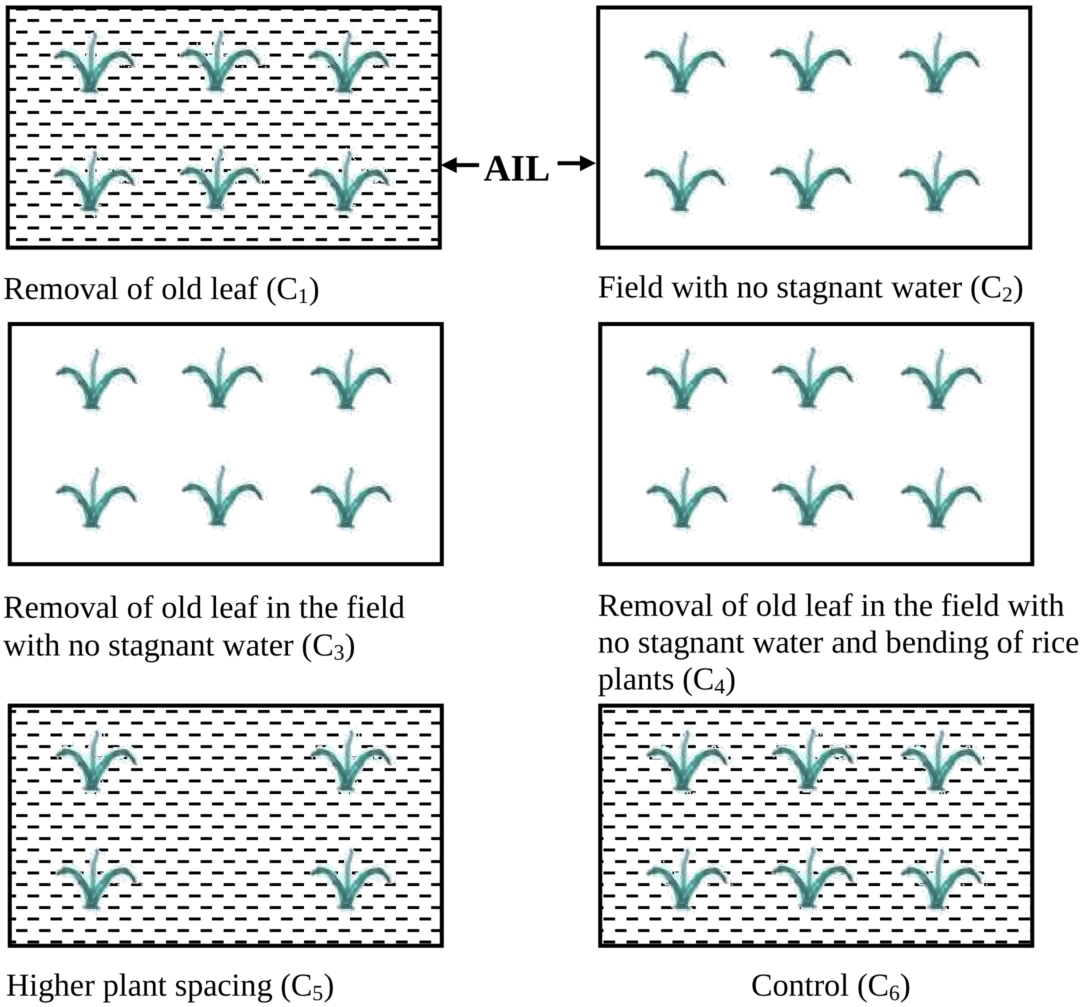

Fig.1 Layout of cultural practice treatments for the management of brown planthopper.

Results and Discussion

The number of brown planthopper was significantly different in the plots of cultural practices at different days after treatments. Population of BPH after one day was highest (110.3) in control plots when the released BPH number was 100 and the next higher number was in the treatment C_1 (102.7) **(Table 1)**.

Population of BPH in C_2, C_3 and C_5 were 95.33, 96.00 and 96.67, respectively with the same number of BPH at release time. The lowest (47.33) population of the pest was found when 50 BPH was released to the plots where drainage of water and bending of rice plant were practised. Population of BPH in day five was observed highest (207.7) in the treatment C_6 when the released BPH number was 100 which was followed by the treatment C_1 (125.7) **(Table 2)**.

Population of BPH in C_2, C_3 and C_5 were 80.33, 72.00 and 76.67, respectively when the same of BPH was released. Population was lowest (34.67) in the treatment C_4 with the 50 released BPH. After nine days of the treatment the number of BPH was found highest (228.7) in C_6 with the maximum number of BPH at release time **(Table 3)**. This was followed by the treatment C_1 (135.0) when the treatment C_2, C_3 and C_5 had the BPH 73.67, 56.00 and 66.00, respectively. Population of BPH was minimum (26.33) in the treatment C_4 with the 50 BPH at release.

Table 1 Population of BPH recorded at different cultural practices after one day of release.

Cultural practice	50 BPH	75 BPH	100 BPH
C_1	57.00 a	76.67 b	102.7 ab
C_2	48.00 b	70.00 b	95.33 bc
C_3	47.67 b	71.00 b	96.00 bc
C_4	47.33 b	67.00 b	92.67 c
C_5	47.67 b	71.33 b	96.67 bc
C_6	55.33 a	89.33 a	110.3 a

Table 2 Population of BPH of three levels by six cultural practices after five days of release.

Cultural practice	50 BPH	75 BPH	100 BPH
C_1	71.67 b	86.67 b	125.7 b
C_2	37.67 c	52.67 c	80.33 c
C_3	34.33 c	46.67 c	72.00 cd
C_4	34.67 c	38.00 c	55.33 d
C_5	35.00 c	51.33 c	76.67 c
C_6	86.33 a	182.3 a	207.7 a

Table 3 Population of BPH of three levels by six cultural practices after nine days of release.

Cultural practice	50 BPH	75 BPH	100 BPH
C_1	80.67 b	92.00 b	135.0 b
C_2	32.00 c	45.67 c	73.67 c
C_3	26.67 c	40.67 c	56.00 d
C_4	26.33 c	26.33 d	40.67 e
C_5	32.33 c	43.33 c	66.00 cd
C_6	107.3 a	202.0 a	228.7 a

Means followed by different letters in a column are significantly different at 5% level.
C_1 = Removal of old leaf
C_2 = Field with no stagnant water
C_3 = Removal of old leaf in the field with no stagnant water
C_4 = Removal of old leaf in the field with no stagnant water and bending of rice plant
C_5 = Higher plant spacing & C_6 = Control

BPH usually prefer to stay in water logged plots and shady places. The experimental results showed that population of BPH was highest in the control (untreated) plot and second highest was in the treatment "Removal of old leaf". There was enough water in both the treatments where water was never drained out. The higher population of BPH in control plots clearly indicates that pest has preference for shady environment. The population of BPH was minimum in the plots having no stagnant water and where the old leaves were removed and bending of the plants was followed. The drainage of water along with extra sunshine and ventilation might have created unfavorable microclimate for the pest BPH. As it was evident that removal of water has negative impact on BPH population, draining out of water from the field could be practiced to reduce and manage BPH in rice field. The experimental results showed that BPH was higher in closer plant spacing of 15×20 cm compared to wider spacing of 25×30 cm. Cultural practices like wider spacing and bending of plots could also be practiced in managing BPH.

The most appropriate spacing would let enough sunshine penetration to prevent increase of BPH but would provide a suitable habitat in which biological control agents could develop (Suenage, 1963). Water management as an important cultural method to suppress the pest. Jaswant *et al.* (1998) found that pest suppression is possible by water management in the field. The population buildup of BPH was higher in closer plant spacing of 10 x 10 cm compared to wider spacing of 30 x 30 cm (Mangal *et al.*, 2001). Close spacing of rice plants is believed to contribute to the rapid increase of the BPH population. Experiments at IRRI showed that at times of peak insect populations, both tall and short peta crop had significantly more BPH per tiller at 10×10cm spacing than at 50×50cm spacing (Kalode, 1974).

References

Pathak, M.D. 1970. Life history of *N. lugens* (Homoptera: Delphacidae) and susceptibility of rice varieties to its attacks. Ann. Ent. and Soc. Amer. 63 (1): 149-155.

David, C.C. 1992. Anonymous. 1993. IRRI-Rice Almanac. Int. Rice Res. Inst., Los Banos, Philippines. 142 p.

Bae, S.H. and The world rice economy: Challenges ahead. In: rice Biotechnology. CAB International, UK, 1-18pp.

Dyck, V.A. 1973. The role of ecology in insect pest control. Paper presented at a Saturday seminar, 26 May 1973. International Rice Research Institute, Los Banos, Philippines. 11p (mimeo.).

Heinrichs, E.A. and Mochida, O.M. 1984. From secondary to major pest status: the case of insecticide-induced rice brown planthopper, *Nilaparvata lugens* resurgence. Prot. Ecol. 7: 201-218.

Jaswant, S., Dhaliwal, G.S., Arora, R., Randhawa, N.S. and Dhawan. A.K. 1998. Ecological approaches to insect pest management in rice. Ecological Agriculture and Sustainable Development: 29 (2): 202-215.

Kalode, M.B. 1974. Recent changes in relative pest status of rice insects as influenced by cultural ecological and genetic factors. International Rice Research Conference, 22-25.

Kisimoto, R. 1960. Hopperburn injury formation of the brown planthopper. Japanese J. Plant Prot. ect.14: 377-382.

Mangal, S., Bentur, J.S., Kalode, M.B. and Sain, M. 2001. Influence of agronomic and cultural practices on rice hopper pests and their natural enemies. J. Appl. Zool. Res. 12(1): 8-13.

Ou, S.M. 1985. Rice Diseases. Commonwealth Agriculture Bureau, Commonwealth Mycological Institute, UK, 360p.

Rivera, C.T., Ou, S.H. and Lida, T.T. 1966. Grassy stunt diseases of rice and its transmission by the brown planthopper, *N. lugens* (Stal.) Plant Disease Rep. 50: 453-456.

Suenaga, H. 1963. Analytical studies on the ecology of the two species of planthoppers, the white back planthopper (*Sogatella furcifera* Horvath) and the brown planthopper with special reference to their outbreaks. Bull. Kyushu Agric. Exp. Stn. 8: 1-152.