International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; SP6: 825-827

SKS Rajpoot
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

V Prasad
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

Saurabh Dixit
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

DK Verma
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

SP Giri
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

ML Maurya
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

RA Singh
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

T Kumar
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

Corresponding Author:
SKS Rajpoot
Crop Research Station, Masodha, A.N.D.U.A.T. Ayodhya Crop Research Station Ghaghraghat, A.N.D.U.A.T. Bahraich, Uttar Pradesh, India

(Special Issue -6)
3rd National Conference
On
PROMOTING & REINVIGORATING AGRI-HORTI, TECHNOLOGICAL INNOVATIONS [PRAGATI-2019]
(14-15 December, 2019)

Effect of planting dates on the population of rice stem borer (*Scirpophaga incertulas* walker) in eastern Uttar Pradesh

SKS Rajpoot, V Prasad, Saurabh Dixit, DK Verma, SP Giri, ML Maurya, RA Singh and T Kumar

Abstract
Experiments were conducted to determine the effects of planting date on incidence of rice stem borer in early, normal and late sown varieties of rice. Two rice varieties NDGR 201(non-aromatic) and Pusa Basmati-1 (aromatic) were used. For each date of planting, separate nursery of each variety were raised and transplanted same age of seedling at different dates in 500 m^2 field. The data on the incidence of insect pests and yield performances of rice varieties were studied. Rice yellow stem borer *Scirpophaga incertulas* Walker (Lepidoptera: Pyralidae), was the most important insect pest of rice, attacking all stages of the crop causing substantial losses in early, medium and late-sown crops, and degree of stem borer infestation depended on the planting time. The pest incidence was found least in early sown crop as compared to normal and late sown. The three planting times were the early 1st July, 2nd the normal planting 15th July and 3rd planting 31stJuly. The present study implies that adjustment of planting time is the most feasible effort to reduce stem borer infestation. The highest yield was observed in early sown crop in variety NDGR 201.Hence the use of tolerant rice varieties along with early sowing is recommended to protect the crop from yellow stem borer infestation.

Keywords: Oryza sativa, stem borers, infestation, planting time

Introduction

Material and methods

Rice (*Oryza sativa* L.) is one of the most important crops of the world and provides food to more than 50% global population. More than 90% of the world's rice is grown and consumed in Asia, where 60% of the earth's people live. It was estimated that 35-60% of the calories consumed by 3 billion Asians comes from rice. Several insects feed on rice, but stem borers are considered the most important rice pests, in particular *Scirpophaga incertulas* Walker and *S. innotata* Walker (Lepidoptera: Pyralidae) (Sigsgaard, 2000) [9]. Rice is the major source of nutrition for more than two billion people of developing countries of Asia. Among stem borers, the yellow stem borer (YSB) *scirpophaga incertulas* Walker (Lepidoptera: Pyralidae) is the dominant species in India and rice plant are most prone to stem borer infestation at the tillering and flowering stage. Stem borer infestation at vegetative stage of crop produces dead heart symptoms while infestation at reproductive stage produces white ear. The rice borers' activity increased steadily during heavy rains in the first 3 to 4 months, the average 23% damage eat flowering stage. Stem borer activity continued about the same level as the water receded; to reach maximum levels of 38 to 44% damaged stems at the late-ripening stage (Catling *et al*., 1984) [3]. Yield loss of 18 to 40% was reported due to the infestation of yellow

stem borer. Rice is essentially crop of warm, humid environment which the conducive to survival and proliferation of lepidopteron insect-pest like stem borer. Control of yellow stem borer is still best option is adjustment of planting date in low land ecosystem. It is the serious pest species of rice throughout the crop season, and abundant both in lowland rice and upland rice attacking young plant even in the nursery stage (Litsinger *et al*., 1987) [6]. Therefore, the challenge before the agricultural scientists today is to produce insect resistant plants. Breeders have developed some new rice cultivars that partially resist the attacks from the borers. Rice breeding programme often emphasized selection for insect resistant rice varieties. This study is intended to assess the yellow stem borer infestation and grain yield of two rice varieties grown at different planting dates.

Experiment were conducted during WS 2017 and 2018 at Crop Research Station, Masodha, which is situated at 26.47^{0}N (latitude), 82.12 ^{0}E (longitude) and at 113 m (altitude). The experimental station has adequate facilities for field screening of genotypes under varied water regimes. The soil is sandy loam low in organic carbon. It is rich in potassium, medium in phosphorus and possesses good water holding capacity. To evaluate the different planting dates on stem borer population on rice variety NDGR 201 and Pusa Basmati-1 were sown and transplanted subsequently at three dates in randomized block design with ten replication in 50m^2 plot size, spacing 20x15 cm. The three date of planting viz. early on 1st July, the normal planting on 15th July and late planting on 31stJuly.Observationswere recorded after 20 days of transplanting, on 20-sample (hills)in each plot. Sample (hills) were chosen diagonally. Number of healthy and infested tillers. The data on stem borer infestation was recorded at vegetative stage as dead heart (DH) and total tillers and percent incidence was worked out. Similarly, white ear (WE) and panicle bearing tillers were recorded near maturity of crop and percent white ear incidence was worked out. Stem borer damage was recorded from randomly selected 20 hills from each plot. The data on grain yield of each plot each replication was recorded separately by threshing. The data so obtain were subjected to statistical analysis after necessary transformation for final statistical analysis.

Results and discussion

From the perusal of table 1 it is observed that. White ears caused by stem borer were very high, in late planting (21.2 & 31.4%) followed by normal planting (10.8 & 18.1%) and in early planting (6.8 & 11.1%). However, dead heart damage was recorded in the three plantings date 2.4, 3.8, 8.0 (NDGR 201) and 3.3, 7.8, 16.9% (Pusa Basmati-1), respectively. It was found that early sown rice crop (first week of July) was the most resistant resulted lowest stem borer infestation was noticed in comparison to other plantings. Non-aromatic rice variety NDGR 201 produced average yield 4516 kg/ha, 4050 kg/ha and 3240 kg/ha, respectively. While aromatic variety Pusa basmati 1 produced average yield 3640 kg/ha, 2910 kg/ha and 2019 kg/ha respectively table-2.

The results of the present study showed that the early planting (1st July) was most effective to control incidence of yellow stem borer. The present findings are in agreement with results of Abraham *et al.*, 1992 [1]; Baloch and Abdullah, 2011 [2]; Padhi and Sen, 2002 [8]; Padhi 2004 [7] and Sarwar *et al.*, 2010 [10] who reported that early planting was found effective against yellow stem borer. In India, the yellow stem borer caused 1-19% yield loss in early-planted rice crop and 38-80% yield loss in late-planted rice Khan *et al.*, 2005 [4] and 2010 [5]. The present study supported the earlier finding that adjustment of planting time is important in reducing stem borer infestation.

The results of present investigation have reasonably led to conclusion that yellow stem borer *(Scirpophaga incertulas)* are the major pest of rice in agro climatic condition of Eastern Uttar Pradesh. In the YSB pest to epidemic proportion cannot be ruled out. The early planting of rice is effective control of yellow stem borer *(S. incertulas)*.Yellow stem borer was the dominant species of stem borers infested in all two rice cultivars tested. The infestation degree depended upon population of stem borer moths or planting time. The varietals resistance for stem borers may originate from two sources-natural variations present in cultivated rice and their non-cultivated relatives, and resistance from other organisms or plants. Current genetically engineered plant breeding technology can facilitate this trait transfer to make plants toxic to insect pests. Therefore, it is suggested that early transplanting of rice (1st week of July) to control yellow stem borer is most effective and reduces the use of costly insecticides in and also eco-friendly to environment.

Table 1: Stem borer damage during WS 2017 &2018 at different dates of planting

Early planting	**2017**	**2017**	**2018**	**2018**	**2017**	**2018**
Variety	**DH%**	**WE%**	**DH%**	**WE%**	**DH (mean)**	**WE (mean)**
NDGR 201	2.1	6.2	2.6	7.4	2.4	6.8
PB-1	3.4	11.2	3.2	10.9	3.3	11.1
Normal planting						
NDGR 201	3.6	11.2	3.9	10.4	3.8	10.8
PB-1	6.8	18.5	8.8	17.6	7.8	18.1
Late planting						
NDGR 201	8.2	19.8	7.8	22.6	8.0	21.2
PB-1	15.6	32.3	18.2	30.5	16.9	31.4

Table 2: Yield of rice during WS 2017 &2018 at different dates of planting

Early planting	**2017**	**2018**	**Average**
Variety	**Yield kg/ha**	**Yield kg/ha**	**Yield kg/ha**
NDGR 201	4310	4722	4516
PB-1	3350	3932	3640
Normal planting			
NDGR 201	3880	4220	4050
PB-1	2660	3160	2910
Late planting			
NDGR 201	3167	3313	3240
PB-1	1950	2088	2019

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