

## Impact of the proportionally applied organic and inorganic fertilizers on the damaging potentiality of yellow stem borer on rice

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### ABSTRACT

Degree of deterioration to the paddy cultivar *Swarna mashuri* (MTU 7029) by yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) under different alternative doses of organic and inorganic N fertilizers was carried out during the *kharif* crop season of 2008-2010 at Cooch Behar, West Bengal, India. There were nine different proportional combinations of N fertilizers from both organic and inorganic sources. Farm yard decomposed manure, pressed mud, green manure with *Sesbania acculeata* and vermin-compost were the chief organic N sources. While commercially available urea granules was the only inorganic N source. Maximum incidence of adult YSB population ( $1.93 \pm 0.12$  individuals /5 hills) and egg masses ( $2.82 \pm 0.52$  egg mass /quadrate) were observed when 160 kg N/ha was applied as urea granules. Incidence of YSB population ( $0.56 \pm 0.12$  individuals /5 hills) and egg masses ( $1.12 \pm 0.35$  egg mass /quadrate) were minimum when the field fertilized was with 3.5 tons of vermicompost alone. The count of dead heart" (16.12%) and "white head" (12.56 %) was maximum when high doses of inorganic N fertilizers (160 kg N/ha) was applied. These values differed significantly from all other treatments. Lower yield under this treatment was due to comparatively higher incidence of the pest and excessive vegetative growth of the plants. Best yield was noted when bio-fertilizers in combination with chemical fertilizers are used. The yield was maximum (36.74q/ha) when green manure with *S. acculeata* 45 kg seeds/ha + 80 kg N/ha was applied to the field. The next best yield was obtained from the application of 80 kg N/ha + 5 tones of farm yard manure/ha and the value was 32.80 q/ha. Extent of pest infestation ( $1.06 \pm 0.13$  individuals /5 hills and  $2.05 \pm 0.35$  egg mass /quadrate) and the yield (34.15 q/ha) was moderate under the combined application of green manure at 45 kg/ha and 80 kg N/ha.

**Keywords:** Organic, inorganic, N fertilizer, yellow stem borer, rice

## **INTRODUCTION**

The most important management for high yielding rice production is judicious and effective nutrition management. Fertilizer is one of the most important nutrition factors of increasing the productivity of rice. But due to high cost of fertilizers and economic condition of Indian farmers, its use should be economized. One of the important alternatives to economize the use of chemical fertilizers is to integrate crop residues or apply farmyard manure in combination with chemical fertilizers to the field (Sarker *et al.*, 1996). In most of the cases, at country side, nutrient loss from the decomposed litters is related to the unscientific storage and improper application to the agricultural fields due to the inadequate knowledge of the farmers (Budhar, *et al.*, 1997). Organic manure when in combination with chemical sources of N is applied to the fields, economizes the yield generation, increases the soil health quality, reduces nutrient loss and also minimizes pest related damage (Chatterjee *et al.* 1976). But fertilizer affects the response of rice plants to insect pests and diseases due to the change of microclimate within the rice plant canopy. The knowledge of proper nutrition management on relationship among rice pests is a basis for setting up a high yield production system under modern IPM practices. Ramesh *et al.* (2005) have noted that organic crops have been shown to be more tolerant as well as resistant to insect attacks and organic rice is reported to have thicker cell wall and lower levels of free amino acid than conventional rice. Further phenolic compounds and silica amount increases significantly with the age of the plant, but the survival of the borer larvae decreased as crop age advanced. So, the degree of resistance in rice varieties to *S. incertulas* was influenced by the presence of high silica content (Chand *et al.*, 2000) and high phenolic compounds (Carbonari *et al.*, 1998). Rice genotypes having high phenolic compounds and silica with lower sugar content could be utilized in the breeding programme for developing borers' resistant varieties.

Magdoff *et al* (2000) have pointed out that farming practice that cause nutrition imbalances can lower pest resistance but has restricted production. Meyer (2000) further has postulated that soil nutrient availability not only affects the amount of damage that plants receive from herbivores but also the ability of plants to recover from herbivores. Alice *et al.* (2003) have recorded that the incidence of BPH population was low in plots treated by organic amendments. Increasing soluble nitrogen levels in plant tissue by applied chemical fertilizers was found to decrease pest resistance in some cases (Phelan *et al.* 1995). Chino *et al.* (1987) have reported that asparagine content of plant phloem sap was significantly lower under organic cultivation, thereby adversely affecting the feeding activity of BPH. van Emden (1966) have noted that increase in fecundity and developmental rates of the green peach aphid, *Myzus persicae*, were highly correlated to increased levels of soluble nitrogen in leaf tissue. Judicious and time fitted fertilizer management is essential to suppress insect pest incidence.

Stem borers (SBs) are reported as the important insect pest of rice. Stem borers in the order

Lepidoptera are widely prevalent and serious insect pests of rice (Catling, *et al.* 1987) In India, 18 stem borer species in the family Pyralidae and three species in the family Noctuidae have been recorded (Banerjee, 1964, Kapur, 1967). Usually one to four species is important in any given area. The predominant species in India include yellow stem borer, *Scirpophaga (Tryporyza) incertulas* (Walker), striped stem borer, *Chilo suppressalis* (Walker), and pink stem borer, *Sesamia inferens* (Walker). The yellow stem borer, *S. incertulas* is the most dominant species in India. Yellow stem borer (YSB), *Scirpophaga incertulas* Walker is the predominated borer species in India and occupies nearly all the agro-ecological zones (DRR, 1965–2003; Kulshreshta *et al.*, 1970). Damage to rice plant by the borers is caused by the attacks to the paddy plant from the very early seedling stage until grain maturity stage. Caterpillar larvae of YSB life cycle are the prime stage which confers maximum deterioration to the growing rice plant due to tissue necrosis. Infestation and subsequent damage to tillers results in ‘dead-heart’ during tillering stage. The developing larvae bore at the bases of the tiller stalk causing the development of ‘white ears’ resulting in chaffy and incomplete grains. The extent of SB’s induced yield losses have been estimated to range from 30 to 70% in pest outbreak years and from 2 to 20% in pest non outbreak years in Bangladesh (Senapati, *et al.* 1999.). .

Judicious and proportion-based application of organic and inorganic fertilizer in relation to rice growth stage can suppress the pest incidence without any conciliation of the final yield generation. In this contemplation a study was undertaken in the field of widely adopted paddy cultivar *Swarna mashuri* (MTU 7029) at Cooch Behar, Jalpaiguri and West Bengal, India where no study even of preliminary in nature relating to the assessment of the impact of organic and inorganic sources of fertilizer on YSB incidence was done earlier.

## **MATERIALS AND METHODS**

***Location and agro-climatic condition:*** Study for three consecutive *khariif* crop years (2008 -2010) was conducted at the farmer’s agricultural field at Cooch Behar district, West Bengal, India. The area is situated in the *sub-Himalayan* region of northeast India known as *terai* zone of West Bengal State. This *terai* zone is situated between 25° 57’ and 27° N latitude and 88° 25’ E and 89° 54’ E longitude. The average annual rain fall varies from 2400 to 3200 mm, the maximum rainfall occurs during the rainy months of June to September amounting to more than 80% of the total rain fall. The mean maximum temperature is usually high 36.9<sup>0</sup>C in April and low 9.1<sup>0</sup>C in the early part of January. The relative humidity at 8:30 hours is 65% and 95% in March and July respectively. The relative humidity in the afternoon at 17:30 hours is 55% and 90% in March and November respectively.

***The cultivar:*** *Swarna mashuri* (MTU 7029), a widely cultivated high yielding variety is generated following the cross between IR 20 and Pusa 33. This cultivar is considered for the present field experiment. Farmers of this area cultivate the variety in wide scale.

***Field preparation and experiment layout:*** Field experiment was conducted in randomized block

design with 35-day old transplanted seedlings of rice cultivar *Swarna mashuri* (MTU 7029) at 15x10 cm seedling spacing. The soil of the experimental field was sandy loam with PH-6.9 and EC was 0.25 mmhs/cm. Field N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O was 322, 59 and 347 kg/ha respectively. Single super phosphate (SSP), Muriate of potash (MoP), gypsum and zinc sulphate was applied basally to the main field and at the rate of 120, 90, 60 and 10 kg/ha respectively. Applied fertilizer dose was estimated in terms of kg / per hectare. Treatments include nine different doses of organic and inorganic fertilizers. viz, 3.5 tones of vermicompost/ha (T1), 5.5 tones of farm yard manure/ha (T2), 40 kg N/ha + 3.5 tones of vermicompost/ha (T3), 80 kg N/ha + 4.5 tones of farm yard manure/ha (T4), green manuring with *Sesbania acculeata* @45 kg/ha + 50 kg N/ha (T5), 120 kg N/ha (T6), 12t pressed mud/ha + 80 kg N/ha (T7), green manuring with *S. acculeata* 45 kg seeds/ha + 80 kg N/ha (T8), 160 kg N/ha (T9). Field without any fertilizer application was considered as control (T10). Organic fertilizer was applied to the main land at about 20-25 days prior to seedling transplantation and mixed thoroughly. Application of green manure was carried out at about 65 days prior to seedling transplantation and it was laddered properly. Inorganic fertilizer was divided in to two equal splits and is applied at vegetative and reproductive growth stage of paddy respectively. Each experimental plot was 35x35 m<sup>2</sup> by size and was separated from the nearby plot by a vacant land space of 5 m in all sides. Size of the vacant alley region was properly maintained. There were three replications for each of the treatments for each of the experiment year.

**Assessment on pest activity and pest induced damage:** Occurrence of yellow stems borer (YSB) egg masses was assessed by flat metallic quadrat (1.5x1.5m). The adult population was estimated from randomly selected 5 hills at both vegetative and reproductive growth stage. The average value taken from two growth stages was worked out. Infestation by YSB results in the characteristics symptom of dead heart (DH) and white head (WH) during vegetative and reproductive growth stages respectively. Incidence of DH (%) and WH (%) was assessed from 75 paddy hills are diagonally selected from each plot during vegetative and panicle formation stage respectively and from that percentage was calculated following formula as described by Singha and Pandey (1997):

$$\text{DH and WH (\%)} = \frac{\text{Number of DH and WH} \times 100}{\text{Total number of tillers counted}}$$

**Statistical analysis:** The data was so collected was statistically analyzed by computer programme-software SPSS 12 and accordingly CD value was determined. Value of correlation was also determined between the extent of yield loss with the field incidence of DH (%) and WH (%).

## RESULTS AND DISCUSSION

Combinations of nine different proportions of organic and inorganic fertilizer were made. Effect of such combinations on the incidence of YSB egg masses and the incidence of adult individuals,

consequences of plant damage and the degree of grain yield potentiality were carried out. Variation of the relative incidence and extent of plant damage under different treatments was noted. The results are presented in table 1 and 2.

**Observation on the necrosis of the rice plant by the YSB larvae:**

The larva after hatching immediately enters in to the leaf sheath of the rice plant; it then feeds ravenously for subsequent 2-3 days. Subsequently the larva bores at the nodal region of the rice stem. 50-72 minutes after egg hatch, most of the larvae migrate to the nodal area of rice plant. Almost all of the *S. incertulas* larvae will have either entered the leaf sheaths of the rice plant on which they enclosed or will have dispersed to other plants. After hatching, occasionally, some larvae move to other plants or other tillers of the same plant leaf sheath.



**Fig.1. (a):** Full grown fifth instar larva of yellow stem borer, (b) Damage and tissue necrosis of rice plant due to the boring and accommodation of yellow stem borer larva within the stem (c) Full grown fifth instar larva after its penetration with the stem (d) White panicle showing the symptom of dead heart [DH], (e) field showing occurrence of DH under the application of 120 N fertilizer/ha

**Table 1:** Effect of different combination of inorganic and organic fertilizer treatment on the occurrence of DH and WH

Treatments	YSB egg mass (1.5 x 1.5 m)	Incidence of YSB in relation to growth stages (individuals/ 5 hills)		
		vegetative	reproductive	Average
T1	1.12±0.35	0.57 ±0.16	0.55±0.09	0.56±0.59
T2	1.45±0.74	0.91±0.17	0.63±0.19	0.77±0.18
T3	1.41±0.68	0.88±0.16	0.56±0.15	0.72±0.31
T4	2.43±0.83	1.43±0.14	1.21±0.19	1.32±0.21
T5	2.05±0.35	1.31±0.14	0.81±0.15	1.06±0.13
T6	2.55± 0.76	1.63±0.18	1.32±0.23	1.48±0.17
T7	1.18±0.54	0.76±0.14	0.59±0.11	0.68±0.21
T8	1.63±1.14	1.32±0.21	0.74±0.17	1.03±0.14
T9	2.82 ±0.52	1.96±0.29	1.90±0.22	1.93±0.12
T10	1.14±1.25	0.67±0.17	0.59 ±0.11	0.63±0.15
<b>CD (P=0.05)</b>	0.34	0.21	0.14	0.28

**Table 2:** Effect of integrated application inorganic and organic fertilizer on YSB incidence

Treatments*	Extent of YSB infestation to the rice cultivar (%)								Grain yield(q/ha)			
	2008		2009		2010		Average		2008	2009	2010	Average
	DH	WH	DH	WH	DH	WH	DH	WH				
<b>T1</b>	7.93 (2.90)	3.52 (2.10)	6.96 (2.73)	4.20 (2.17)	6.98 (2.74)	4.09 (2.14)	7.29 (2.79)	3.94 (2.11)	23.93	25.13	25.86	24.98
<b>T2</b>	7.56 (2.84)	5.73 (2.50)	7.67 (2.86)	5.44 (2.44)	7.44 (2.82)	6.01 (2.55)	7.56 (2.84)	5.72 (2.49)	23.58	24.71	25.86	24.72
<b>T3</b>	7.51 (2.83)	5.82 (2.51)	7.46 (2.82)	5.77 (2.50)	7.48 (2.83)	7.40 (2.82)	7.48 (2.83)	5.82 (2.51)	30.35	29.37	30.40	30.04
<b>T4</b>	11.68 (3.49)	7.38 (2.81)	11.58 (3.48)	7.01 (2.74)	11.63 (3.48)	6.76 (2.69)	11.63 (3.48)	7.05 (2.75)	37.15	35.95	37.12	36.74
<b>T5</b>	8.90 (3.07)	6.53 (2.65)	8.86 (3.06)	6.69 (2.68)	8.83 (3.05)	6.61 (2.67)	8.86 (3.06)	6.61 (2.67)	33.86	34.35	34.24	34.15
<b>T6</b>	12.69 (3.63)	9.53 (3.17)	13.90 (3.79)	8.88 (3.06)	13.50 (3.74)	8.86 (3.06)	13.36 (3.72)	9.09 (3.10)	34.15	34.08	34.06	34.10
<b>T7</b>	7.41 (2.81)	5.33 (2.42)	7.38 (2.81)	5.53 (2.46)	7.47 (2.82)	5.40 (2.43)	7.42 (2.81)	5.42 (2.43)	26.57	26.34	26.89	26.60
<b>T8</b>	8.51 (3.00)	6.36 (2.62)	8.66 (3.03)	6.42 (2.63)	8.59 (3.02)	6.19 (2.59)	8.59 (3.01)	6.321 (2.61)	33.97	32.00	32.31	32.76
<b>T9</b>	16.80 (4.16)	12.74 (3.64)	15.69 (4.02)	11.44 (3.46)	15.85 (4.04)	13.50 (3.74)	16.12 (4.08)	12.56 (3.61)	27.34	25.56	24.99	25.96
<b>T10</b>	7.25 (2.78)	4.21 (2.17)	7.37 (2.80)	4.25 (2.18)	6.98 (2.74)	4.33 (2.20)	7.20 (2.77)	4.26 (2.18)	18.57	17.23	16.30	17.36
<b>CD(P=0.05)</b>	0.51	0.63	0.70	0.68	0.55	0.49	0.47	0.38	1.77	1.67	1.56	2.49

**Treatments\*:** 3.5 tones of vermicompost/ha (T1), 5.5 tones of farm yard manure/ha (T2), 40 kg N/ha + 3.5 tones of vermicompost/ha (T3), 80 kg N/ha + 4.5 tones of farm yard manure/ha (T4), green manuring with *Sesbania acculeata* @45 kg/ha + 50 kg N/ha (T5), 120 kg N/ha (T6), 12t pressed mud/ha + 80 kg N/ha (T7), green manuring with *S. acculeata* 45 kg seeds/ha + 80 kg N/ha (T8), 160 kg N/ha (T9). Field without any fertilizer application was considered as control (T10).

Effective searching for a suitable node is basically manifested by chemoreception. Characteristic odour from rice plant acts as stimulatory queues for the larvae for the selection of suitable plant node. Generally, one larva is recorded inside a single stem but occasionally 2-4 larvae may also be noticed. Penetration to rice stem and is primarily guided by the plant growth stage and the climatic conditions specially the ambient temperature. Nature of rice stem damage due to YSB larval is rice cultivar specific. In the cultivar Swarna mashuri two types of larval feeding were noted; deep

circular (feeding on a particular area) and random (feeding irregularly throughout the stem). The larva in general makes deep circular cuts near the base of the upper internodes', mostly the topmost internodes'. 39.17% tillers of the total harbored YSB larvae while the rest are infestation free. Among the infested tillers 74.79% contained only one larva. Incidence of 2 larval individuals is occasional and was noted from 24.06% tillers. Occurrence of more than 2 larvae in an individual rice hill is occasional and is recorded from only 2.29% tillers. In an average 85.94% tillers showed deep circular cuts at the nodal base. Random feeding was noted from 15.06% infested tillers only. Feeding resulted in the formation of DH+WH. But for 33.95% tillers fully expressed symptoms of DH+WH was noted. 57.19% infested tillers did show partial expression of DH+WH while there was no visible external symptom of DH+WH for 8.87% infested tillers.

***Incidence of YSB egg masses and adult moth population (Table 1):***

Variation in the incidence of YSB egg mass and adult population in relation to the applied dose of fertilizer was noted. Highest incidence of YSB egg masses at vegetative growth stage of rice plant was observed in T9 (2.82±0.52). This occurrence was immediately followed by T6 (2.55±0.76), T4 (2.43±0.83), T5 (2.05±0.35), T8 (1.63±1.14), T2 (1.45±0.74), T3 (1.41±0.68), T7 (1.18±0.54), T10 (1.14±1.25) and T1 (1.12±0.35) in descending order. Statistically insignificant difference in consideration of both egg mass and adult YSB incidence was noted between (T7 and T10), (T10 and T1) and (T4 and T6) respectively.

Impact of fertilizer on the incidence of YSB adult population was significantly noted. Incidence of adult YSB moth individuals during vegetative stage was numerically maximum in T9 (1.96±0.29). The next highest incidence was observed in T6 (1.63±0.18). This was followed by T4 (1.43±0.14), T5 (1.31±0.14), T8 (1.32±0.21), T2 (0.91±0.17), T3 (0.88±0.16), T7 (0.76±0.14), T10 (0.67±0.17) and T1 (0.57 ±0.16) respectively in descending order. At early reproductive growth stage of paddy, YSB moth incidence was maximum in T9 (1.90±0.22). The next highest number of adult moth was estimated in T6 (1.32±0.23), T4 (1.21±0.19), T5 (0.81±0.15), T8 (0.74±0.17), T2 (0.70±0.19), T3 (0.61±0.15), T7 (0.59±0.11) and T10 (0.49 ±0.11) respectively in descending order. The least was registered in T1 treatment (0.03±0.09). Numerically maximum incidence of moth population in average was noted in T9 (1.93±0.12). The next highest incidence was observed in T6 (1.48±0.17). This was followed by T4 (1.32±0.21), T5 (1.06±0.13), T8 (1.03±0.14), T2 (0.77±0.18), T3 (0.72±0.31), T7 (0.68±0.21), T10 (0.63±0.15) and T1 (0.56 ±0.12) respectively in descending order.

***Estimation on the Extent of damage (Table 2):***

Incidence and extent of damage caused by yellow stem borer was assessed in terms of dead heart (DH) and white head (WH) and the result of three consecutive experiment years was averaged. Numerically highest number of DH was recorded in T9 (15.85 %) where high doses of N were applied. The resultant incidence of DH and WH differed statistically and significantly different in all other treatments considered in the present study. Incidence of T9 was followed by T6 (13.50 %) and T4 (11.63%). T5 (8.83%), T8 (8.59%), T2 (7.51%), T3 (7.45%), T7 (7.40%), T10 (6.98%) and T1

(6.80%) ranked after wards respectively in descending order. In consideration of DH and WH statistically insignificant variation was noted between (T1 and T3), (T2 and T3) and (T1 and T10) respectively. Minimum incidence of DH was registered in T10 (5.45 %) treatment.

Field incidence of WH also follows similar fashion. Numerically highest incidence of WH was recorded in T9 (13.50 %). Value in T9 was followed by T6 (8.86%). Treatments like T4 (6.76%), T5 (6.61%), T8 (6.19%), T2 (6.01%), T3 (5.82%), T7 (5.40%), T10 (4.33%) and T1 (4.09%) ranked after wards respectively in descending order. Insignificant difference in consideration of WH was observed between the treatment (T2 and T7), (T7 and T9) and (T3 and T1) respectively. In general higher the incidence of DH higher would be the availability of WH. The growing YSB larvae renders more damage to the early growth stages of rice plant, causes tissue necrosis; consequently numerical incidence of DH was comparatively higher than WH. WH affects grain formation. Formation of WH at early growth stage of rice plant may be compensated following the generation of new tillers thus there is finally no yield reduction.

**Estimation on Final Yield generation:** Maximum grain yield was recorded in T8 (36.74q/ha), this was followed by T4 (34.10 q/ha) treatment (Table 2). These two treatments varied significantly. In both the treatment bio-fertilizers in combination with chemical fertilizers are used. The lowest grain yield was recorded in T10 (17.36 q/ha). No type of fertilizer; either of biological or chemical origin were applied in T10. Results of T10 significantly differed from all other treatments. But grain yield was not noticed satisfaction in T9 (25.96 q/ha) where grain was produced under the application of high dose of chemical fertilizers. In consideration of grain production some treatments varied insignificantly. These treatments are (T2, T1, T9 and T7) and (T6, T5) respectively.

**Generation of pest loss equation:** Equation of correlation in consideration for extent of yield reduction due YSB infestation was prepared. Data from three experiments was considered for equation generation. The constant factor in the equation was 37.203. Reduction of yield for DH was by -0.3346 units and for WH was by -0.5278 units. So the damage effect was more profound for WH.

$$\text{Yield loss} = 37.203 - 0.3346 [\text{DH}] - 0.5278 [\text{WH}], R^2: 82.73$$

Correlation model explained that the extent of yield loss corroborates to the extent of infestation. Per unit increase in DH and WH causes yield reduction of 0.3742 and 0.5471 units respectively.

Bhuiya and Akanda (1982) have reported that organic materials in combination with chemical fertilizers showed admirable response to rice production. Imbalanced use of inorganic fertilizers and soil nutrient has resulted in declining soil fertility and therefore leading to stagnating or decreasing of crops yields. Balanced fertilization carry different meanings considering the nutrient input-output relationship in soil plant system, ratio of fertilizer products and balanced in cost and return of fertilization.

Application of high dose of inorganic N fertilizer alone in T9 has resulted in comparatively lower yield. This is due to high level of YSB incidence. High N level causes luxurious foliage growth with a short span of time which intern indulges high pest incidence. Incidence of pest is inversely



proportional to the grain yield. In the present experiment highest grain yield was generated when application of *S. acculeata* @40 kg/ha was supplemented with the addition of 80 kg urea/ha. Present findings parlay matches to the result of Prasad *et al.*(2010) They have reported that the maximum yield generation in the paddy cultivar *Barh avarodhi* with moderate YSB infestation (6.6% WH). In there experiment field was fertilized with *S. acculeata* at 40 kg/ha with the subsequent additional dose of 40 kg inorganic N in two splits. Application of the fertilizer should be fitted with the plant growth and the incidence of the stem borer incidence. Suharto and Usyati (2005) have commented that seedling planting time is the most feasible effort to reduce stem borer infestation because none of the rice cultivars tested was able to minimize damage under heavily infestation of yellow stem borer.

Abraham *et al.* (1992) have also noted that the activity of stem borer of first generation appeared after transplanting. Srivastava *et al.* (2003) have reported that the population of stem borer after its arrival into the field increased in subsequent generation and caused serious damage Similar observation have been made by Khan *et al.* (2010) while determining the tolerance of rice varieties to manage borers that fine varieties (Basmat-aromatic) were highly susceptible to the yellow stem borer compared to the coarse varieties tested (non aromatic). Field application of inorganic N fertilizer in high quantum has brought the greenness of the foliage which is conducive for female YSB to lay high number of egg cluches. Impact of only chemical N fertilizers on the incidence of *S.incertulas* has been reported (Ishii and Hirano, 1959; Saha and Saharia, 1975; Prakasa Rao, 1988 and Saroja and Raju, 1981). Prasad *et al.* (2004) have noted that the extent of rice crop damage increases at significant level following the application of 200 kg N / ha They have further noted that the extent of damage was 5.4% and 4.8% at 120 kg N / ha and no N/ha application respectively. But in their experiment they have studied only the incidence of DH and WH under the combined application of organic and inorganic sources of fertilizer. Assessment of the incidence of YSB egg masses was not duly done. Basically addition of *S. acculeata* after being fully decomposed has created a slow N releasing fiber matrix.

Inorganic N when added during the rice plant growth stage gets entrapped in the 'fiber matrix'. N applied to the field is available to the growing rice plants in slow but steady manner. This process of slow N availability to the plants disallows heavy foliage development within a short time and also unnecessary N loss by run-off. Sharma and Mitra (1991) have reported that oragnic matter failed to increase rice yield but uptake of nutrient increased significantly. They have also noted that Integrated Plant Nutrition System (IPNS) had no significant influence on the other tested crops. Contrary to the present findings they have noted that application of cow dung has no direct effect on the yield of succeeding crops. Rahim *et al.* (1995) have also reported that different kinds of manure could not influence the grain yield of transplanted *aman* rice significantly as compared to recommended doses of mineral fertilizer.Israel *et al.*( 1963) have also noted high incidence of YSB following high input of inorganic fertilizer. Yield from the application of vermicompost and pressed mud were of intermediate in nature with moderate pest infestation. The present finding was supported

by the observation of Singh *et al* (1990) who have reported that NPK ratio of 120-60-60 Kg/ha increased the susceptibility of rice crop to rice stem borers. Saha and Saharia (1970) have also observed that the incidence of stem borers from 8.36% in plots without nitrogen fertilizer to 20.12% in those treated with 100 Kg/ha. In the present study the pest incidence was next to least owing to the slow releasing activity of fiber matrix formed by the application of *S. acculeata*.

## CONCLUSION

Application of manure and organic fertilizers in combination of inorganic N have more effective than only chemical fertilizer to induce rice plant growth and tolerance to insect pests. Defense in rice variety to *Scirpophaga incertulas* was recorded at low nitrogen level. Application of manure and organic fertilizers influences the activity of yellow stem borer larva and the final yield generation. Manure compost and organic fertilizer also obtained the same yield as compared to chemical fertilizer by lowering unfilled grains and increasing weight of grains. Best yield was noted when bio-fertilizers in combination with chemical fertilizers are used. The yield was maximum (36.74q/ha) when green manure with *S. acculeata* 45 kg seeds/ha + 80 kg N/ha was applied to the field. The next best yield was obtained from the application of 80 kg N/ha + 5 tones of farm yard manure/ha and the value was 32.80 q/ha.

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