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Seasonal Incidence of Rice Yellow Stem Borer (*Scirpophaga Incertulas* Wlk.) In Relation to Conventional and Sri Methods of Planting and Its Correlation with Weather Parameters

A.M Kakde[1] and K. G Patel[2]
([1]Ph.D Scholar, Deptt. Of Entomology, N.M College of Agriculture, N.A.U., Navsari-396 450, Gujarat)
([2] Principal, College of Agriculture, N.A.U., Bharuch-392001, Gujarat)

***Abstract*:** *An experiment on the influence of different planting methods on succession of rice yellow stem borer was carried out in rice field. This experiment was carried out with conventional (Transplanting) and SRI method of paddy cultivation. Under conventional method, yellow stem borer infestation appeared peak during first week of September (5.58% DH) and 1st week of October (5.79% WEH). In SRI method, the peak incidence was observed during first week of September (4.19% DH) and at last week of September (4.93% WEH). The results of both methods indicated that the weather parameters had less influence on the activity yellow stem borer damage.*

Keywords: *Conventional, Parameters, SRI, Weather, Yellow stem borer.*

I. Introduction

Rice is life and princess among the cereals, the staple food of 65% of the total population in India. It constitutes about 52% of the total food grain production and 55% of total cereal production. Rice is grown under diverse growing conditions such as irrigated, rainfed lowland, rainfed upland and flood prone ecosystems. India is the largest rice growing country, while China is the largest producer of rice.

Out of 722.22 MT production of rice in the world, Asian countries shared 90% (653.83 million tonnes) of world's rice production. While, India contributes 157.90 MT annual productions with 22% share of world's production and 24% of Asian countries rice production (FAO, 2011). In India, paddy is grown in 44.06 million ha constituting 34.4% of the total cultivable area. About 70% of our farmers are cultivating paddy and the production is about 105.31 million tonnes and productivity being 2178 t/ha. The productivity of rice has increased from 1984 kg per hectare in 2004-05 to 2393 kg per hectare in 2011-12. In Gujarat, it occupies about 2% of area among rice growing states. It is grown on 8.36 lakh ha area, which comprises nearly 90% of *kharif* and 10% of *summer* season rice with a total production of 17.90 lakh tonnes and the productivity of 2141 kg/ha (Anonymous, 2012), but it is lower than the country's productivity.

South Gujarat is an important rice growing tract of the state belonging to Dang, Valsad, Navsari and Surat districts of State. These districts occupy maximum rice growing area of the state, where the crop is mainly grown in *kharif* as well as in *summer* season. The reason is quite obvious, as the irrigation is available round the year through Ukai-Kakrapar command area, which makes the thing favourable for rice cultivation even for double cropping in a year. Thus, two harvests in a year coupled with better market price has boosted the economical condition of rice growing farmers of Valsad, Navsari and Surat districts. However, the average productivity is quite low and it is yet to be fully exploited to its maximum extent.

Yellow stem borer is one of the widely distributed, dominant and monophagous pest of paddy in the Indian subcontinent. It building damage in nursery as well as in transplanted crop causing drying of central shoot known as 'dead heart' (DH) in young plants, boring at heading stage usually occurs at the peduncle node and 'white earhead' (WEH) formed .

With this view, regular observations on incidence of pests in field not only found useful to determine the activity of insect pests in relation to several weather factors but also helps to study the population dynamics of the insects during particular period. To plan the different suitable control measures for the pest, knowledge of population dynamics is very much essential. It is also useful in development of forecasting model for pest. Use of population dynamic model for S. incertulas has been suggested as an aid to decision-making in borer management (Xia *et al.*, 1991).

very little attention has been given towards the use of system of rice intensification (SRI)and conventional methods of sowingand its correlation with weather parameters for the control of rice yellow stem borer under south Gujarat condition. Hence the present investigation were carried out.

II. Materials And Methods

An experiment was carried out at Wheat Research Station Farm, N.A.U., Bardoli during the *kharif* season of 2012 and 2013. All the post sowing recommended agronomical practices were followed. However, experimental area was kept free from insecticide spray throughout the crop season in order to record the season incidence of rice yellow stem borer.

The observations of yellow stem borer, *S. incertulas* Infestation were recorded at weekly interval till harvesting. The borer incidence were assessed by counting number of dead hearts (DH)in the initial stage of damage and number of white earheads (WEH) in both SRI and Conventional method of sowing at later stage from five randomly selected spots consisting of five hills each as well as from all the clumps in each plot. Both the dead hearts and white earheads were removed from the infested tillers so that only fresh infestation of the pest can be realized every time.

In order to study the effect of the weather parameters, viz., maximum temperature, minimum temperature, average temperature, morning relative humidity, evening relative humidity, average relative humidity, sunshine hours, rainfall and rainy days on population of rice yellow stem borer, correlation coefficient was worked out. The weekly meteorological data recorded at Wheat Research Station Farm, N.A.U., Bardoli during the *kharif* 2012 and 2013 between July to October period were utilized for this purpose. The simple correlation was worked out.

III. Results And Discussion

Seasonal incidence of rice yellow stem borer in relation to different methods of planting:

A. Conventional method (Transplanting):

i) I year (*kharif* 2012):

The per cent dead hearts (DH) before panicle initiation and white ear heads (WEH) after panicle initiation of yellow stem borer, *S. incertulas* were recorded at weekly interval according to standard weeks. The data are presented in Table 2 and in Fig. 1 revealed that the incidence of stem borer initiated from 32nd meteorological standard week (SMW) *i.e.* first week of August (0.71% DH) with the peak infestation at 36th SMW (5.17% DH) during *kharif* 2012. Furthermore, the fluctuations in the incidence were recorded, which again reach second peak during first week of October (40th SMW) with 5.86% WEH. The incidence of yellow stem borer was found till 42nd SMW (2.82% WEH).

ii) II year (kharif 2013):

The incidence of yellow stem borer during second year (Table 2 and Fig. 1) was also started at first week of August *i.e.* 32nd SMW with 0.60% DH and gain peak infestation 5.98% DH at first week of September (36th SMW) in conventional method of planting. Later, the incidence were decline and again recorded second peak at first week of October *i.e.* 40th SMW (5.71% WEH), which further showed the damage till 42nd SMW (1.55% WEH).

iii) Pooled:

It can be seen from the pooled data (Table 2 and Fig. 1) that the *S. incertulas* infestation with 0.66% DH was appeared from first week of August (32nd SMW) and reached to its first peak of 5.58% DH during first week of September (36th SMW). Thereafter, infestation declined gradually and found to be minimum and again increased during late stage of crop growth and found maximum (5.79% WEH) during 1st week of October (40th SMW) and formed second peak.

In earlier studies on seasonal incidence, Sarkar and Gayen (1992) observed two major peaks of *S. incertulas* adults, one in October-November and another during February in West Bengal. More or less similar conclusion has been drawn by Tripathy *et al.* (1999), in which they observed two broods of *S. incertulas*, of which first was during the last week of September and another during 2nd week of November, which coincided with the dough stage of rice in Bhubaneswar. Thus, the present findings are more or less in conformity with the earlier reports. In contrast to this, Kumar and Sudhakar (2001) from Rajendranagar (A.P.) reported the peak activity of yellow stem borer in 2nd fortnight of October during kharif season. Rai et al. (2002) also revealed the peak occurrence of yellow stem borer during first fortnight of October. These contrasts might be due to the effect of difference in climatic conditions and cultural practices of a particular locality. However, Kharat (2006) recorded the incidence of stem borer increased from 32nd SMW (August) and it started declining from 42nd SMW (October). Likewise, Saikia (2009) investigated that the stem borer moth population increased from mid August to mid October. The similar type of *S. incertulas* seasonal incidence fluctuation trend was recorded by Sankpal (2011), where the activity was observed from 3rd week of August to 2nd week of November showing peak level during 2nd week of September at vegetative stage and 2nd week of November at reproductive stage. Likewise, Gole (2012) stated the incidence of *S. incertulas* from second week of August (32nd SMW) up to the harvest of the crop, whereas, Justin and Preetha (2013) at Thirupathisaram (Kanyakumari) district showed that

the infestation of *S. incertulas* was found during August-September and December-February. These reports earlier on pest occurrence strongly support the results of present investigation.

B. SRI method:

i) I year (*kharif* 2012):

The incidence of the stem borer in SRI method (Table.1 and Fig. 1) was initiated from first week of August (32nd SMW) with 0.52% DH and gained two peak at first week of September i.e. 36th SMW (4.34% DH) and at last week of September i.e. 39th SMW (5.16% WEH) and then decline and ended on 42nd SMW (1.46% WEH).

ii) II year (*kharif* 2013):

During *kharif* 2013, the infestation of stem borer were also started from 32nd SMW (0.40% DH), which reach maximum on 36th SMW (4.04% DH) and 39th SMW (4.70% WEH). This infestation then start decline and was observed till third week of October (42nd SMW) with 1.05% WEH. The incidence of stem borer was comparatively less during second year trial (Table.1 and Fig.1).

iii) Pooled:

The pooled results of the stem borer per cent DH and WEH in SRI method is presented in Table. 1 and Fig.1. The initiation of stem borer incidence in SRI method was seen from first week of August (32nd SMW) with 0.46% DH. Thereafter, the incidence increase and gained two peak; first 4.19% DH was recorded at week of September (36th SMW) and second 4.93% WEH at last week of September (39th SMW). Further, this infestation turn down and observed up to the harvest with minimum infestation of 1.26% WEH at 42nd SMW. The infestation of stem borer was less in SRI method as compare to conventional method planting.

In earlier work of Researches, SRI planting method (Anonymous, 2009 and Anonymous, 2010) registered the lowest incidence of *S. incertulas*, while transplanting of paddy recorded higher population of this pest. Similar type of trend was also observed in this study. Likewise, Gole (2012) recorded the lowest per cent dead hearts due to *S. incertulas* in SRI (2.51%) as compared to Standard Transplanting Method (STP) (4.47%) and found significantly superior than rest of the treatments. Also, the lowest per cent white earheads due to *S. incertulas* was found in SRI (1.22%) than STP method (2.93%). These results confirm the present study.

Correlation of rice yellow stem borer incidence with weather parameters in relation to different methods of planting

A. Conventional method:

i) I year (*kharif* 2012):

The correlation co-efficient analysis data (Table.2) of stem borer showed non-significant results with weather factors. Where, minimum temperature (r= -0.348) had negative correlation with yellow stem borer incidence, while maximum temperature (r= 0.108), relative humidity (r= 0.177), rainfall (r= 0.325) and bright sunshine (r= 0.212) had positive correlation with the yellow stem borer.

ii) II year (*kharif* 2013):

The correlation results (Table.2) during *kharif* 2013 season were showed that minimum temperature (r= -0.027) and relative humidity (r= -0.241) had non-significant negative relationship while, maximum temperature (r= 0.174), rainfall (r= 0.038) and bright sunshine hrs (r= 0.263) had non-significant positive correlation with S. incertulas.

iii) Pooled:

The pooled data on the correlation co-efficient (Table.2) of yellow stem borer revealed non-significant results with weather factors. Minimum temperature (r= -0.194) had negative correlation with stem borer incidence, while maximum temperature (r= 0.133), relative humidity (r= 0.058), rainfall (r= 0.254) and bright sunshine (r= 0.233) had positive correlation with the yellow stem borer under conventional method.

In contrast to this, Sarkar and Gayen (1992) from West Bengal and Bhatnagar and Saxena (1999) from Jagdalpur reported a non significant but negative impact of rainfall and significant positive impact of sunshine hrs on stem borer activity and infestation. Padhi and Saha (2004) also reported negative impact of maximum temperature, rainfall, relative humidity and wind velocity, while positively correlation with minimum temperature, evaporation and sunshine hrs to the yellow stem borer moth population.

Further in another report, Kharat (2006) showed the correlation between incidence of stem borer and rainfall, while maximum temperature exhibited non-significant negative correlation, whereas exhibited non-significant positive correlation with minimum temperature, morning, evening and sunshine hrs as well as Sankpal (2011) recorded that maximum temperature as well as bright sunshine hrs had negative correlation with

yellow stem borer incidence at pre-harvest, while minimum temperature, morning relative humidity, evening relative humidity and rainfall had positive correlation with the yellow stem borer.

Justin and Preetha (2013) illustrated a significant positive correlation with relative humidity and negative correlation with minimum temperature and rainfall. This might be due to difference in environmental conditions.

B. SRI method:

i) I year (*kharif* 2012):

Under SRI method, the impact of weather parameters was non-significant at 1% and 5% level significance during first year trial (Table. 2). However, positive influence of maximum temperature (r= 0.012), relative humidity (r= 0.250), rainfall (r= 0.362) and bright sunshine hrs (r= 0.118) was recorded with stem borer incidence, while negative correlation was found in minimum temperature (r= -0.291).

ii) II year (*kharif* 2013):

The influence of weather parameters on stem borer damage also showed positive non-significant results during second year with maximum temperature (r= 0.185), rainfall (r= 0.091) and bright sunshine hrs (r= 0.271), whereas, negative correlation was found in minimum temperature (r= -0.095) and relative humidity (r= -0.234) (Table . 2).

iii) Pooled:

The pooled data of correlation co-efficient of yellow stem borer infestation with weather factors indicated non-significant results at 1% and 5% level significance in SRI method (Table.2). However, mean population incidence showed positive interaction with maximum temperature (r= 0.079), relative humidity (r= 0.081), rainfall (r= 0.300) and bright sunshine hrs (r= 0.186), while negative correlation was recorded with minimum temperature (r= -0.193).

These results under conventional and SRI method of planting indicated that the weather parameters had less impact on yellow stem borer infestation as well as no difference found among both type of planting, which justified that the damage was mainly concealed stem borer activity with plant phenology.

With view of Ramakrishnan and Venugopal (1991), stem borer correlation study showed that fitted multiple regression equations explained approximately 50% variation in dead heart/whitehead damage due to weather, but none of the factors contributed significantly to stem borer infestation. While, Hugar and Venkatesh (2009) studied the influence of weather factors on the infestation of S. incertulas in aerobic rice and the results revealed the non-significant and negative correlation with maximum temperature, morning relative humidity and rainfall as well as had significant positive correlation with sunshine hrs in kharif. These findings support the correlation results obtained in present findings.

IV. Figures And Tables

Table 1: Seasonal incidence of rice yellow stem borer in Conventional and SRI Method during *kharif* 2012 and 2013

Month	Std. Meteorological Weeks	% DH and % WEH of yellow stem borer					
		Conventional Method			SRI Method		
		Kharif 2012	Kharif 2013	Pooled	Kharif 2012	Kharif 2013	Pooled
JULY	28	0.00	0.00	0.00	0.00	0.00	0.00
	29	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.00
AUG.	32	0.71	0.60	0.66	0.52	0.40	0.46
	33	1.33	1.96	1.65	1.04	0.75	0.90
	34	2.14	2.33	2.24	1.81	1.38	1.60
	35	3.08	3.86	3.47	2.37	3.45	2.91
SEPT.	36	5.17	5.98	5.58	4.34	4.04	4.19
	37	4.52	4.62	4.57	3.91	3.98	3.95
	38	4.92	5.03	4.98	4.21	3.82	4.02
	39	5.73	5.63	5.68	5.16	4.70	4.93
OCT.	40	5.86	5.71	5.79	4.53	3.14	3.84
	41	3.44	2.66	3.05	2.42	1.64	2.03
	42	2.82	1.55	2.19	1.46	1.05	1.26
	43	0.00	0.00	0.00	0.00	0.00	0.00

Table.2: Correlation of rice yellow stem borer incidence with weather parameters in conventional and SRI method during *kharif* 2012 and 2013

Method & Year	Max. Temp. (^{0}C)	Min. Temp. (^{0}C)	Relative Humidity (%)	Rainfall (mm)	Bright Sunshine hrs.
Conventional method (% DH and WEH)					
I year (*kharif* 2012)	**0.108**	**-0.348**	**0.177**	**0.325**	**0.212**
II year (*kharif* 2013)	**0.174**	**-0.027**	**-0.241**	**0.038**	**0.263**
Pooled	**0.133**	**-0.194**	**0.058**	**0.254**	**0.233**
SRI method (% DH and WEH)					
I year (*kharif* 2012)	**0.012**	**-0.291**	**0.250**	**0.362**	**0.118**
II year (*kharif* 2013)	**0.185**	**-0.095**	**-0.234**	**0.091**	**0.271**
Pooled	**0.079**	**-0.193**	**0.081**	**0.300**	**0.186**
*** Significant at 5% level (r = 0.482) and ** at 1% level (r = 0.606).**					

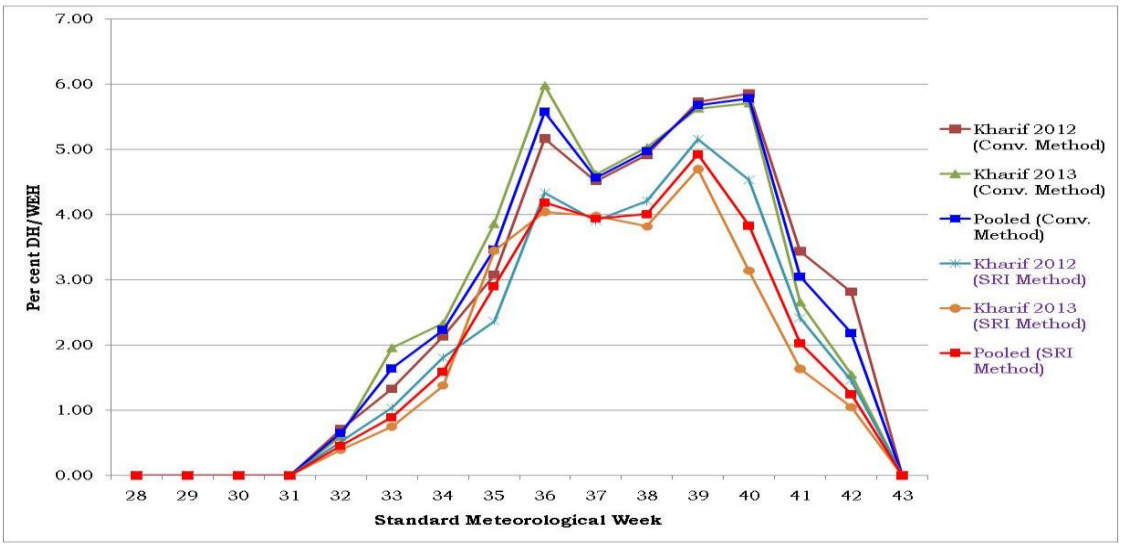

Fig. 1: Seasonal incidence of rice yellow stem borer in Conventional and SRI Method

V. Conclusion

Under conventional method of planting (Transplanting), yellow stem borer infestation with 0.66% dead heart (DH) was appeared from first week of August and reached to its first peak of 5.58% DH during first week of September (36th SMW). Thereafter, infestation declined gradually, but again increased during late stage of crop growth and found maximum (5.79% WEH) during 1st week of October.

In SRI method, the initiation of yellow stem borer incidence was observed from first week of August (32nd SMW) with 0.46% DH. Thereafter, the incidence increase and gained two peak; first 4.19% DH was recorded at week of September (36th SMW) and second 4.93% WEH at last week of September (39th SMW) and observed up to the harvest of crop. The infestation of stem borer was less in SRI method as compare to conventional method planting.

The data of correlation co-efficient of yellow stem borer infestation with weather factors indicated non-significant results in conventional and SRI method. The results both method of planting indicated that the weather parameters had less influence on yellow stem borer damage as well as no difference found among both type of planting, which justified that the stem borer activity concealed with plant phenology.

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