

Avoidable Yield Loss Due to Fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) in *rabi* Sorghum

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ABSTRACT: Sorghum is the fifth most important cereal crop which is known for its drought resistance character and is referred as major millet. There are many limiting factors that contribute to reduction in yield of the crop, one among them are insect pests. The recently introduced polyphagous pest, fall armyworm is of great threat due to its high defoliating capacity which can cause high yield loss. A field experiment was conducted at AICRP on Sorghum, MARS, Dharwad to evaluate the impact of *Spodoptera frugiperda* on the yield of *rabi* sorghum, namely for two varieties, SPV 2217 and CSV 29R. The results revealed that there was maximum FAW infestation in SPV 2217 (48.75 and 9.17%) than CSV 29R (40.83 and 5.42%) in unprotected and protected conditions, respectively and SPV 2217 (8.23q/ha) experienced more yield loss as compared to CSV 29R (7.22q/ha).

Keywords: Fall armyworm, *Rabi* Sorghum, CSV 29R, SPV2217, Yield loss.

INTRODUCTION

Sorghum (*Sorghum bicolor* L.) (Moench) is the fifth most important cereal crop following rice, wheat, maize and barley. Due to its huge grain size compared to other millets, it is frequently referred to as "major millet". In India, it is also known as Jona, Jowar, Chola or Jola (Reddy and Patil 2015). The crop is well organized for its drought resistance character and is the most suitable for dry regions. It is the staple food in semi-arid parts of the world where grains are used as human food and stalks as a fodder for cattles.

The pest problem in sorghum starts from sowing and continues till harvest. Insects are one of the major limiting factors for sorghum production. About 32 per cent of the actual crop produce is lost due to insect pest in India and 150 insect species complex are reported on sorghum in India, of which the shoot fly is a major one followed by stem borers (Gahukar and Jotwani 1980). The recently introduced fall armyworm is worrisome due its high defoliating capacity. The fall armyworm (FAW), *Spodoptera frugiperda* is a destructive insect pest which belongs to family Noctuidae and order Lepidoptera. It is a polyphagous as well as highly notorious pest that harms economically significant farmed cereal crops such as maize, rice and sorghum. In India, the first report of the pest was confirmed in May 2018 (Sharanabasappa *et al.*, 2018) from Karnataka. Since then, this destructive pest has rapidly spread within the country and extended its reach to

neighboring countries due to its potential migrating capacity. In India, the first occurrence of this pest on sorghum and bajra was noticed during October 2018 at the fields of Agricultural Research Station, Ananthapuram district, Andhra Pradesh. The damage on sorghum fields was up to the extent of 70 per cent (Venkateswarlu *et al.*, 2018). In sorghum fall armyworm infestation in the whorl reduces grain yields of susceptible lines by 55 to 80 per cent (Andrews, 1988). Hence, the present investigation emphasizes on estimation of yield loss due to fall armyworm mainly on two different varieties of *rabi* sorghum CSV 29R and SPV 2217.

MATERIALS AND METHODS

During *rabi* season of 2022-23, field trials were conducted at All India Coordinated Research Project on sorghum Main Agricultural Research Station (MARS) University of Agricultural Sciences in Dharwad, Karnataka. The objective of this trial was to study the impact of *S. frugiperda* on yield loss in two sorghum varieties *viz.*, SPV 2217 and CSV 29R. The trials were conducted with four replications for each variety in order to meet out the minimum degrees of freedom. Each variety had two sets of plots: one set of 8 plots was protected from insect infestation by applying insecticides at regular intervals, referred to as the "protected plots," while the other set of 8 plots was left unprotected. In protected condition the seeds were

treated with cyantraniliprole 19.8% + thiamethoxam 19.8% @5ml per kg of the seeds before sowing and crop was protected by pest infestation with a spray of spinetoram 11.5 SC at the rate of 0.3ml/l.

Observations were recorded on the per cent infestation (readings taken at 15 days interval starting from first appearance of the pest) and yield per plot. The data obtained was subjected to paired t-test analysis to determine the significant difference among the treatments. Additionally, the percentage of yield loss caused by *S. frugiperda* was calculated using formula, Percent avoidable yield loss =

$$\frac{\text{Yield in protected crop} - \text{Yield in unprotected crop}}{\text{Yield in protected crop}} \times 100$$

RESULTS AND DISCUSSION

Pest infestation: The presence of the pest in field trials on both varieties was first observed at 26 Days after emergence (DAE) of the sorghum crop. The average maximum pest infestation was found in unprotected conditions in both the varieties compared to protected conditions. Among the varieties SPV 2217 had maximum infestation in both protected (9.17 %) and unprotected conditions (48.75 %) compared to CSV 29R in protected (5.42 %) and unprotected conditions (40.83 %) (Table 1).

Yield loss: Under protected conditions, the variety CSV 29R exhibited higher grain yield of 38.03 q/ha, surpassing the yield of SPV 2217, which had a grain

yield of 37.06 q/ha. Similarly, in unprotected conditions, CSV 29R variety outperformed SPV 2217 with a grain yield of 30.81 q/ha compared to 28.83 q/ha in SPV 2217 (Table 1).

SPV 2217 experienced highest reduction in grain yield, with a loss of 8.23 q/ha, compared to CSV 29R, which had a yield loss of 7.22 q/ha. Additionally, the per cent avoidable yield loss was found to be highest in SPV 2217 (22.21 per cent), while CSV 29R showed lower avoidable yield loss of 18.98 per cent (Table 1).

Slight higher loss in yield was observed in SPV 2217 as compared to CSV 29R. This could be due to nutritional differences within the varieties. However further investigation on the role of nutritional content on infestation of fall armyworm among the varieties need to be explored. Another reason might be due the higher incidence of the pest in SPV 2217 than CSV 29R in both protected and unprotected conditions. The present findings are in agreement, with the studies conducted by Henderson *et al.* (1966) who found that in during 1957, 1960 and 1962, the yield loss in RS 610 sorghum was 19.6, 5.4 and 10.4 per cent respectively. Additionally, they observed reduction in yield of 27.2 per cent due to the combined infestation of the southwestern corn borer and fall armyworm. Stark and Burton (1979) reported yield loss in wheat land variety of sorghum, ranging from 21 to 44 per cent due to FAW. Further, under protected condition, the grain yield per plot was 4.38 kg/plot, while it ranged from 3.53 to 4.17 kg/plot in the uncontrolled plots.

Table 1: Response of selected sorghum genotypes to *Spodoptera frugiperda* in terms of per cent infestation and grain yield.

Sr. No.	Genotypes	Per cent infestation				Grain Yield (q/ha)			
		Treatments	26 DAE	41 DAE	56 DAE	Average	Yield(q/ha)	Yield loss(q/ha)	Per cent loss
1.	SPV 2217	Unprotected	53.75	38.75	53.75	48.75	28.83	8.23	22.21
		Protected	7.50	8.75	11.25	9.17	37.06		
		't' cal	6.44**	6.57**	8.87**			9.92**	
2.	CSV 29R	Unprotected	50.00	32.50	40.00	40.83	30.81	7.22	18.98
		Protected	5.00	5.00	6.25	5.42	38.03		
		't' cal	9.86**	4.62*	6.08**			10.39**	

**significantly different ('t' Table (0.01) = 5.841); *significantly different ('t' Table (0.05) = 3.182)
DAE- Days After Emergence

CONCLUSIONS

The present study concluded that the higher yields were observed in CSV 29R in both protected and unprotected conditions while the avoidable yield loss due fall armyworm ranged from 18.98 per cent in CSV 29R to 22.21 per cent in SPV 2217. However there was a significant difference in the yields of protected and unprotected conditions whereas no significant difference was found between the yields of both the varieties.

FUTURE SCOPE

Large scale and high pest intensity simulated studies for HPR involving two sorghum genotypes SPV 2217 and CSV 29R and assessing the insecticide resistance in fall armyworm to various conventional insecticides in sorghum

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