Original Research Article

Impact of Different Sowing Windows and Legume Intercrops on the Incidence of Fall Army Worm (FAW) (*Spodoptera frugiperda*) and Yield of Hybrid Maize in Western Agro Climatic Zone of Tamil Nadu

ABSTRACT

The present investigation was undertaken during the *Kharif* and *Rabi* seasons of 2019 to study the influence of different sowing windows and intercropping of legumes on the level of infestation of fall armyworm on maize crop. Three dates of sowing were adopted in each season and intercrops like cowpea, soybean, sunnhemp, and tephrosia were included besides sole maize with and without insecticide sprays. The results showed that the maize sown during July and October months has reported less FAW infestation and provided a higher grain yield than the rest of the sowing windows taken in *Kharif* and *Rabi* seasons, respectively. The maize intercropped with cowpea and sunnhemp has performed well in terms of yield and the leaf damage was also found to be lower apart from the insecticide applied maize crop.

Keywords: Fall armyworm, Maize yield, Intercropping, Sowing window

1. INTRODUCTION

Maize (*Zea mays* L.) is one of the foremost cereal crops due to its high value as a staple food, animal feed and fuel (Abebe and Feyisa, 2017). Though there are over 40 species of pest identified in maize, the recent invasion of Fall Armyworm (FAW) becomes the major one leading to a low level of yield. Fall Armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) is the devastating pest of maize native to America. It has spread to the African continent for the first time outside its natural habitat during 2016 because of its prolific reproducing ability and capacity to migrate long distances over 100 km in single night. In India, it was first reported during 2018 at the College of Agriculture, Shivamogga, Karnataka (Sharanabasappa *et al.,* 2018).

The pest FAW is known to attack rice, maize, sorghum, cotton, *etc*. The eggs of FAW are known by their clustered egg-laying capacity which ranges from few to hundreds in numbers. The larvae go through six instars after hatching from eggs for a period of 14 to 19 days. Later, the larvae undergo a pupal stage in soil for about 9 to 12 days (Shranabasappa *et al.,* 2018). The early instar larva causes skeletonized leaves and windowed whorls while the matured larva feeds on maize cob resulting in a fall in yield and quality (Capinera *et al.,* 2017). The severe FAW infestation during mid to late growth stages caused a yield reduction of 15 to 73 percent in maize (Hruska and Gould, 1997).

The foremost strategy adopted across the globe to manage FAW is the application of chemical insecticides. Though the application of insecticides reduces the pest damage and decreases the spread of the pest, its constant use may lead to the development of insecticide resistance in FAW (Xu *et al.,* 2010). Hence, the alternative technique for the management of FAW should be environment-friendly and cost effective. It was reported that the integrated approach includes push-pull technology, use of botanical extracts, intercropping, natural enemies and parasitoids, utilizing locally available materials like sand, ash, sawdust, *etc* effectively reduces the incidence of FAW (Khatri *et al.,* 2020: Keerthi *et al.,* 2020). Keeping this in view, the present investigation has been carried out to find a management option that deliberates ecological values.

2. MATERIAL AND METHODS

The field experiments were carried out in Eastern Block Farm at Tamil Nadu Agricultural University, Coimbatore during 2019. The investigational field is situated at 11°N latitude and 76°57´E longitude and an altitude of 426.7 m above MSL in the Western Agro-Climatic Zone (ACZ) of Tamil Nadu. The soil of the experimental site was sandy clay loam in texture. The climatic condition of the site was hot semi-arid under the Koppen climate classification. The wet season of the site lasts from June to November months.

Maize was sown at three dates in two seasons and different intercrops were adopted. The split-plot design was adopted and replicated thrice. The details of the treatments were given below.

Sowing Window (Main plot)	**Kharif 2019**	**Rabi 2019**
D_1	June 15th	September 15th
D_2	July 15th	October 15th
D_3	August 15th	November 15th

	Legume Intercropping (Sub plot)
S_1	Sole maize without insecticide spray (Absolute Control)
S_2	Sole maize with recommended insecticide sprays (Chemical check)
S_3	Maize + cowpea
S_4	Maize + soybean
S_5	Maize + sunnhemp
S_6	Maize + tephrosia

The fields were ploughed with a cultivator and rotovator to get a fine, clod-free tilth. After forming ridges and furrows, the area was delineated into plots, and treatments were allocated. Neem cake was applied two weeks before the sowing and fertilizers were applied as per recommendation given by TNAU (250: 75: 75 kg NPK/ha). Maize was sown at a spacing of 60 x 25 cm while the intercrops were sown in between the maize rows. The intercrops were sown in between the two maize rows following the additive series of intercropping. The four intercrops used in the study were brown manured at 50 days after sowing by spraying 2, 4-D herbicide. The chemical pesticides for treatment S_2 (Sole maize with recommended insecticide spray) were sprayed once at 20 DAS and 40 DAS using Azadirachtin (20 ml/10 litre) and Emamectin benzoate (4 g/10 litre), respectively.

The damage caused by FAW on maize foliage was scored till the tasseling stage by using the scoring scale (0 to 9) of Davis and Williams (1992) and the yield of maize was recorded for different sowing windows. The observation on the leaf damage of maize was recorded once in a week from 15 DAS to 50 DAS.

3. RESULTS AND DISCUSSION

The influence of different sowing windows and legume intercropping on the incidence of fall armyworm leaf damage is presented in Table 1.

Irrespective of the sowing windows, the sole maize with recommended insecticide sprays (S_2) has produced a higher grain yield than other treatments. This was due to the quick action and higher toxicity of insecticides that were sprayed at the whorls of maize where the larva resides and this was in accordance with the findings of Pitre (1986) who reported that application of insecticide granules in the whorls are effective and may provide a higher level of control to FAW. The next better yield was found in maize intercropped with cowpea (S_3) followed by sunnhemp (S_5) in all three sowing windows of the *Kharif* and *Rabi* seasons of the study. This may be due to the reason that the cowpea and sunnhemp intercrops can minimize the egg masses laid by FAW by masking the odor fumes. The results are similar to the findings of Meagher *et al.* (2004), who reported that the FAW larvae took more time to develop in cowpea and sunnhemp and also the pupae weight was found to be 20 to 25 percent lower than the other treatments implemented.

The maize sown during July (7200 kg/ha) and October (7015 kg/ha) months has produced higher grain yield (Fig. 1 & 2) compared to the other sowing windows in both *Kharif* and *Rabi* seasons, which might be due to reduced damage by FAW in July (1.47) and October (1.18) months. The minimal leaf damage during these two sowings might be due to the copious amount of rainfall (Fig. 3) received during its initial vegetative growth stages. This effective rain might have provided better growing conditions for the maize crop during its initial stages and have reduced the spread and damage of FAW. This result was similar to the outcomes of Harrison *et al.* (2019), who stated that the first effective rains provide better growing conditions for maize, making use of more heat units at the beginning of the cropping season.

4. CONCLUSION

It was evident from the above results that the maize crop sown during July and October months received favorable growing conditions and was also found to have a minimal infestation of FAW during its cropping period. The maize intercropped with cowpea and sunnhemp performed well in reducing the infestation of the pest. Hence, sowing of maize during the July and October months along with cowpea and sunnhemp intercrops could be an ecofriendly approach to achieve higher grain yields of maize with reduced FAW infestation.

Table 1. Influence of sowing windows and intercrops on the leaf damage of fall armyworm on maize (Scoring)

	KHARIF 2019				RABI 2019			
Treatments	**JUNE 15**	**JULY 15**	**AUG 15**	**MEAN**	**SEP 15**	**OCT 15**	**NOV 15**	**MEAN**
Sole maize without insecticide spray	3.06	2.18	2.82	**2.68**	2.22	1.91	3.20	**2.44**
Sole maize with rec. insecticide spray	1.58	1.48	1.59	**1.55**	1.36	1.18	1.61	**1.38**
Maize intercropped with cowpea	2.35	1.63	2.04	**2.00**	1.58	1.42	2.13	**1.71**
Maize intercropped with soybean	2.78	1.95	2.52	**2.40**	2.01	1.77	2.83	**2.20**
Maize intercropped with sunnhemp	2.61	1.74	2.20	**2.18**	1.78	1.53	2.43	**1.91**
Maize intercropped with tephrosia	2.68	1.84	2.33	**2.28**	1.86	1.65	2.58	**2.03**
MEAN	**2.50**	**1.79**	**2.25**		**1.80**	**1.57**	**2.46**	

(*Data are not analyzed statistically)

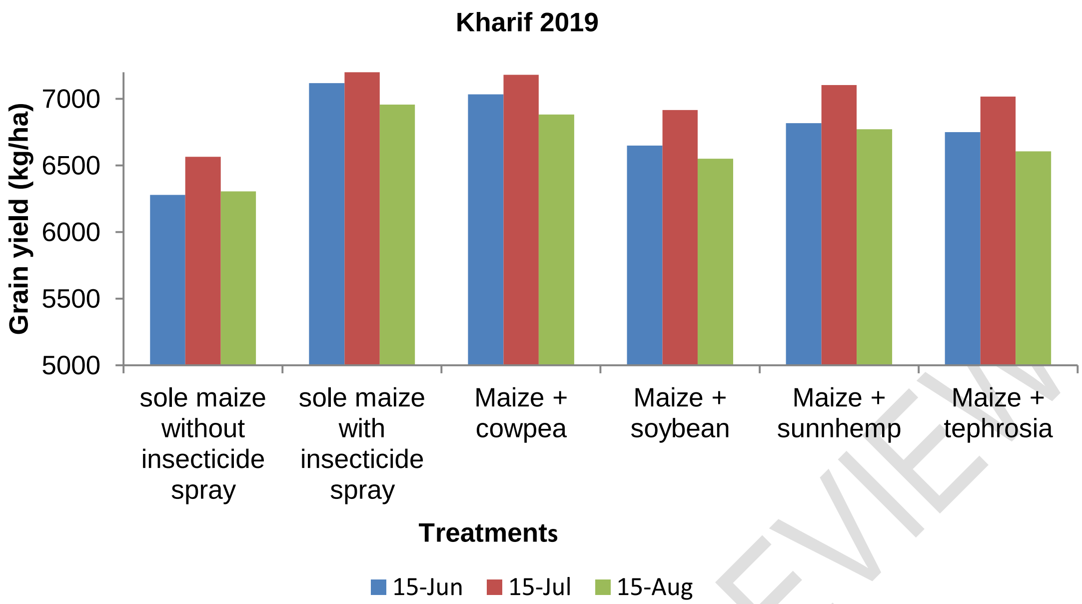

Fig 1. Influence of sowing windows and legume intercrops on the grain yield of hybrid maize (kg/ha) during Kharif 2019

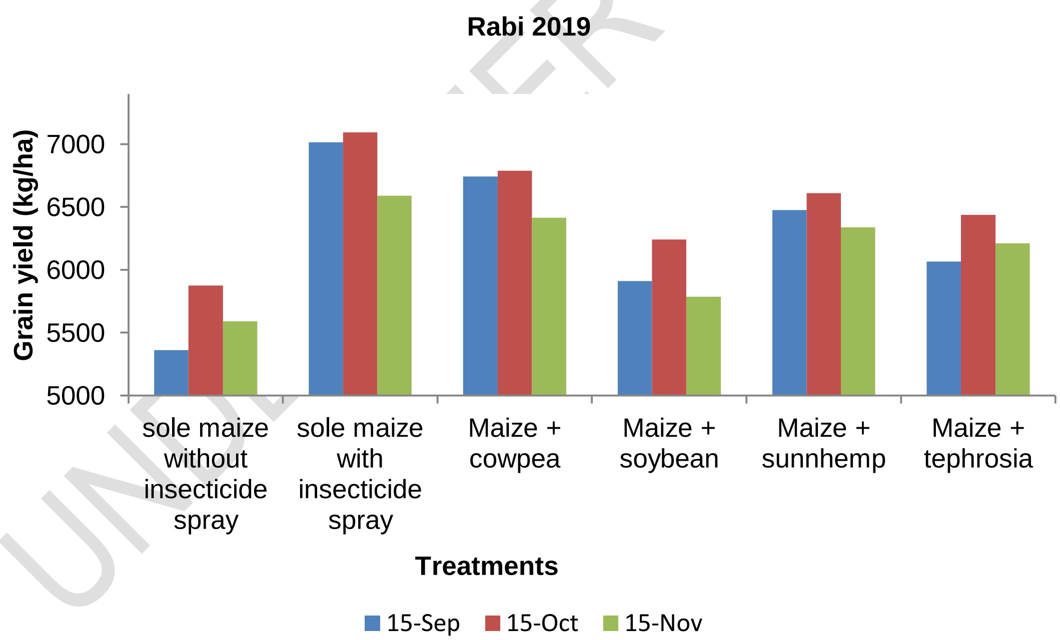

Fig 2. Influence of sowing windows and legume intercrops on the grain yield of hybrid maize (kg/ha) during Rabi 2019

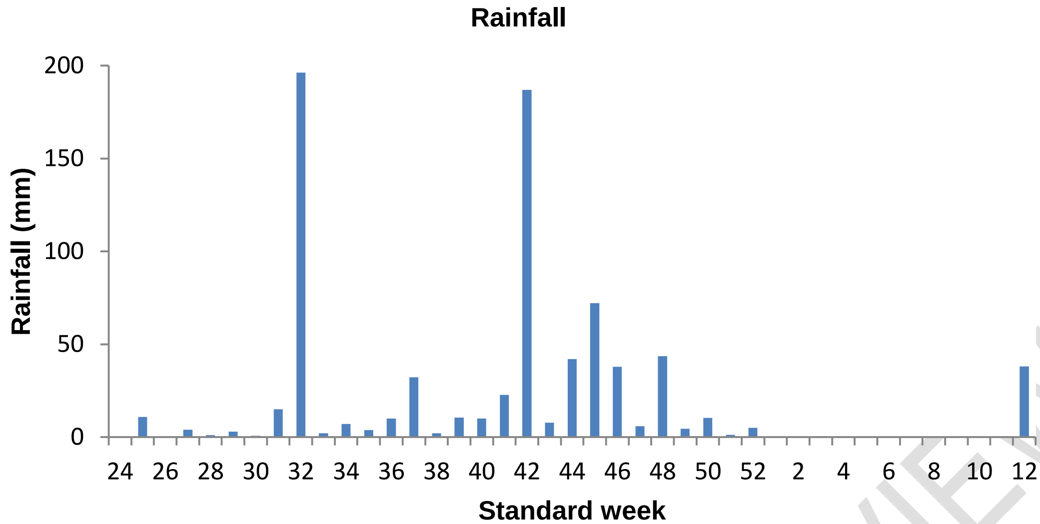

Fig 3. Rainfall during Kharif and Rabi seasons 2019

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