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EFFECT OF INTERCROPPING ON THE INFESTATION OF EGG PLANT FRUIT BORER [*Daraba laisalis* Wlk] IN NORTHERN GUINEA SAVANNA OF NIGERIA

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ABSTRACT

Field experiment was conducted at Biu, Borno State, Nigeria during 2010 and 2011 cropping seasons. The aim of the study was to evaluate the influence of intercropping on the infestation and damage of egg plant fruit borer (*Daraba laisalis W*lk). The experiment was laid out in a randomized block design with three intercrops and one sole crop treatments replicated four times. The results obtained from the study showed that the population of egg plant fruit borer was reported minimum in the condition when egg plants were intercropped with cereal crops and the maximum population was reported from the sole crop of egg plant. Similarly types of trends were reported in the case of fruit damage and final yield. It is therefore concluded that poor- resource egg plant farmers can adopt the practice of intercropping with cereal crops to reduce or manage the population of egg plant fruit borer.

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1 Introduction

Egg plant (*Solanum melongena* L.) belongs to family Solanaceae and cultivated as vegetable crops. It is one of the most important vegetable crops in Africa, probably the fourth one after tomato, onion and okra (Grubben & Denton, 2004). Fruits are rich in essential vitamins and minerals which are good for health (Fayemi, 1999; Shippers, 2000). In spite of the economic and nutritional value of the crop, production is however hampered by the insect pests which attack the foliage, fruits and stems in Nigeria (Ukeh et al., 2007; Degri et al., 2013). Among the insect pests of egg plant, fruit borer (*Daraba laisalis* Wlk) is a major insect pest of egg plant and is responsible for severe damage to fruit and at severity yield loss reached to 20-70% (Federal Ministry of Agriculture and Natural Resources, 1996; Degri et al., 2013; Degri, 2014). Damage caused by this insect pest can be direct and indirect which resulting in broad spectrum problems. High reproductive capacity and rapid turnover of generations are the two important causes of severe damage (Aina, 1980; Onekuku, 2011). Management of the pest is very difficult since it residing and feeding inside the fruit. Synthetic insecticides have proved effective in the control of this pest. However, their environmental hazards and residual effect on fruits has been the major problem (Stoll, 2000; AVRDC, 2002). There is a need for an alternative control measure that is safe, adoptable, environmentally friend and affordable to poor-resource farmers in Nigeria.

The use of cultural practices like intercropping is one of alternative control measure. It is a practice often associated with poor-resource farmers. Intercropping practice is of economic benefit and one of the best cultural practices that have potential of reducing insect pest infestation by increasing crop diversity (Willey, 1985; Trenbath, 1993). Much of the intercropping studies have been concentrated on cereals-legumes or tree crops- annual crops such as maize-cowpea, maize-soybean, tree crop-cereals, sorghum-cowpea, (Uva, 1985). Although few studies have been conducted on cereal-vegetable (Ijoyah, 2012; Degri et al., 2012), literature on studies of intercropping cereal-vegetables are in scarcity. Therefore, the objective of this study was to assess the effectiveness and potentials of intercropping of egg plant with different cereal crops in reducing the incidence and damage of fruit borer in egg plant.

2 Materials and Methods

2.1 Experimental Site and Materials

The experiment was conducted at farmer's field at Biu (10^0 27'N and 11^0 45'E) for two successive year viz. 2010 and 2011 (June-October). The main aim of the study was to assess the influence of intercropping maize and egg plant on controlling the incidence and damage of egg plant fruit borer (*Daraba laisalis* Wlk). The experimental site is a well drained and flat with clay soil. Seeds of the egg plant and cereal were obtained from a reputable farm input seller in Biu. The round green types egg plant variety was used while the white quality protein maize (WQPM); Fara fara sorghum and SOSSAT 888 millet varieties which were popularly grown by the farmers in Biu were used for the component crops in the experiment.

2.2 Experimental Designs, Procedures and Cultural Practices

The experiment was conducted in a randomized block design with four treatments including a control (Only egg plant; eggplant + maize; egg plant + sorghum and egg plant + millet) each treatment was replicated four times. The seedlings of egg plant were first raised in nursery beds measuring 7 cm high for 4 weeks before being transplanted to the experimental plots at 60 cm X 60 cm spacing. The experimental field was cleared from weeds and debris, ploughed, harrowed and divided into plots of 4.0 m x 3.0 m before transplanting the seedlings. The component crops maize, millet and sorghum seeds were sown directly at the same time with the base crop (egg plant) at an intra- row spacing of 25 cm on top of the ridges at the seed rate of 2-3 seeds per stand. One week after transplanting egg plant and sowing the component seeds, failed stands were filled to maintain the required plant populations of the plots. After the crop establishment, the experimental plots were weeded manually using hand hoe and weeding continued whenever weeds appeared on the plots. NPK 15:15:15 fertilizer was applied at 37g/plant stand using row application method to each plot at 4 and 7 weeks after planting for the treatments. The component crops were harvested when they were ripped. The egg plant fruits were harvested when the oval fruit are big and hardened which were signs of ripening.

2.3 Data Collection

Data related to number of egg plant fruit borer larvae, fruit damage, undamaged fruits and fruit yield/plot were collected during the study. The number of fruit borer larvae per plant was counted after the fruits were harvested. This was done by dissecting bored fruits from 5 randomly selected plants in each plot. Before dissection, however, the fruits were sorted into damaged and undamaged. The number of damaged fruits from each plot were weighed and recorded. Damaged egg plants fruits were recognized by the visual presence of fruit borer larval holes on the fruits. Undamaged fruits recognition was based on the absence of fruit borer holes in the fruits. Fruit yield per plot was also recorded at harvest. The harvesting started at one week after transplanting (WAT) and continued for 12 weeks after transplanting (12 WAT) due to the perennial nature of the herb.

2.4 Data Analysis

The data collected on the number of fruit borer larvae, damaged and undamaged fruits and fruit yield were subjected to analysis of variance (ANOVA). Least significant difference (LSD) was used to separate the treatment means at 0.05 % level of probability as described by Gomez & Gomez (1984).

3 Results and Discussion

The results of egg plant fruit borer larvae counts was taken at fruiting stage and are presented in Table1. The results of the table revealed that the number of egg plants fruit borer larvae were significantly lower in intercropping than the only egg plant plots (P≤ 0.05). The sole egg plant plots had the highest number of fruit borer larvae in 2010 (10.28) and 2011 (9.87) cropping seasons, this number was followed by the egg plant + maize and egg plant + millet intercrop. The lowest fruit borer larvae count per plot in both years was reported from egg plant + sorghum intercrop (3.77 and 3.22). The results of the present study are in conformity with the finding of Pino et al. (1994) those who have reported the superiority of intercropping over the sole crops cultivation of egg plants. According to Trenbath (1993) pests and diseases incidence were higher in monocropping as compared to intercropping. Intercropping promises to be a very good cultural practice in the reduction and control of pests and diseases. This result implies that intercropping of egg plant with the cereals has significantly reduced the incidence of the fruit borer and the significance of their damage on the egg plant (Ram & Singh, 2010).

Table 2 revealed the numbers of damaged and undamaged fruit during the two years study period. All the intercrops were found at par among themselves. Maximum number of damaged fruits/plot was found in individual egg plant plots followed by those intercropping system which the component crops were harvested earlier before the ripening of the base crop, that is millet and maize crops. According to Reddy & Reddy (2007), crops which mature at different times have their own separate periods to make their influence on themselves. Such crops may not act as a barrier against the spread of pests and diseases. Significantly (P≤0.05) higher number of undamaged fruit/plot was recorded under egg plant + sorghum intercrop plots than other egg plant +cereal crop combinations because sorghum stays longer in the field to provide protection and barrier to the base crop egg plant while maize and millet matured and were harvested earlier there by exposing the egg plant fruits to the fruit borer (Olasantan & Lucas, 1992; Hugar & Palled, 2008; Ram & Singh, 2010).

Ijoyah (2012) reported that cereal-vegetable intercropping system planted at the same time and mature almost at the same time could be highly suitable for reducing and controlling pests and diseases compared to sole cropping.

There was significant difference among the individual egg plant plots and intercrop egg plant plots yield (Table 3). Individual egg plant crop had the lowest yield of 11.92Kg/plot while egg plant + sorghum crop combination had the highest fruit yield of 20.50kg/plot. Egg plant + sorghum crop intercrop out yielded other crop combinations because the two crops matured and were harvested almost the same time therefore complementing and sustaining their companionship (Olasantan & Lucas, 1992). Willey & Reddy (1981) reported that ability of the component crop to protect the base crop depends on the inherent efficiency of the individual crops that make up the system and on complementary effects between the crops.

Table 1 Effect of intercropping on population of egg plant fruit borer larval population during 2010 and 2011

	No. of fruit borer larvae/plant			
Crop combinations	2010	2011	Mean	% reduction over control
Egg plant (Control)	9.17^{a}	9.50^{a}	9.34^{a}	-
Egg plant + Maize	5.75^{c}	4.42^{c}	5.08^{c}	45.61
Egg plant + Sorghum	3.83^{d}	2.58^{d}	3.25^{d}	65.20
Egg plant + Millet	6.08^{b}	8.33^{ab}	7.25^{ab}	22.38
SEM	0.40	0.42	0.41	-
LSD(0.05)	0.82	0.84	0.83	-

Values given in table are average of four replicates; different letter in same vertical column are significantly different on LSD 0.05.

Table 2 Effect of intercropping on number of damaged and undamaged fruits during 2010 and 2011

Crop combinations	No. of damaged fruits/plot		No. of undamaged fruits/plot	
	2010	2011	2010	2011
egg plant control	10.28^{a}	9.87^{a}	8.92^{c}	9.18^{c}
egg plant + Maize	5.33^{c}	5.21^{c}	21.72^{b}	21.69^{b}
egg plant + Sorghum	3.27^{d}	3.22^{d}	24.42^{a}	24.11^{a}
egg plant + Millet	7.00^{b}	7.08^{b}	21.67^{b}	21.55^{b}
SEM	0.30	0.32	0.38	0.36
LSD(0.05)	0.62	0.61	0.54	0.53

Values given in table are average of four replicates; different letter in same vertical column are significantly different on LSD 0.05.

Table 3 Effect of intercropping on mean fruit yield in 2010 and 2011 cropping seasons

crop combinations	Mean fruit yield (Kg/plot)
egg plant (Control)	11.92[d]
egg plant + Maize	16.75[b]
egg plant + Sorghum	20.50[a]
egg plant + Millet	14.83[c]
SEM	0.42
LSD(0.05)	0.59

Values given in table are average of four replicates; different letter in same vertical column are significantly different on LSD 0.05.

Mumford & Baliddawa (1982) reported that there is often a significant decrease in the rate of pest population development in intercropping because of the unfavorable environment of intercrops to pests. Also a net reduction in damage and infestation occur in the intercrop hence higher yields in intercropping systems than sole cropping. There was significantly yield advantage in intercropping egg plant with cereals during the study. Egg plant + sorghum crop combinations gave the best protection of the fruit borer probably because the major principle of intercropping cereal crops with vegetable is to provide protection to the base crop, but when the component crop is harvested earlier than the base crop, the protection or barrier is removed thus the higher fruit borer damaged and lower yield under early harvested maize and millet plots.

Conclusion

The results indicate that egg plant-cereal intercrop have reduced the incidence and damage of the fruit borer of egg plant. Damage in the intercrop was significantly lower from that of the egg plant in the sole crop. There was also significant yield advantage in intercropping egg plant with cereals during the two-year study. It is therefore recommended that egg plant farmers in this agro ecological region adopt the practice of intercropping cereals with egg plant to minimize fruit borer infestation and damage and increase egg plant production.

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