Original Research Article

EFFECT OF CROP MATRIX ON INSECT – PLANT INTERACTION UNDER TWO ENVIRONMENTAL REGIMES ON COWPEA

Abstract

The results revealed that inland ecosystem (Srivilliputtur) during summer and winter 2017, cowpea + sorghum intercrop system recorded low numbers aphid, thrips, pod bug and spotted pod borer *viz.*, (7.52 and 10.57/10 cm twigs, 0.96 and 2.06/10 flowers, 0.96 and 2.05/plant and 0.72 and 1.24 larvae/plant respectively) followed by cowpea + pigeonpea (8.65 and 11.64, 1.30 and 2.19, 1.04 and 2.17 and 0.99 and 2.09 larvae/plant respectively) compared to pure crop of cowpea (12.11 and 6.54/10cm twigs, 2.02 and 4.13/10 flowers, 2.08 and 3.25/plant and 1.71 and 2.99 larvae/plant respectively). In inland ecosystem during winter 2017, the mean number of leaf hopper low in intercropped with cowpea + pigeonpea (0.87/3 leaves) during summer 2017 and intercropped with cowpea+ sorghum was low (1.25/ 3 leaves).where as in coastal ecosystem (Kamudhi) during summer and winter 2017, Leaf hopper, aphid, thrips, pod bug and spotted pod borer *viz.*, (0.57 and 1.24/3leaves, 7.06 and 8.56/10 cm twig, 0.88 and 1.76/10 flower, 0.75 and 2.09/plant and 0.8 and 1.95 larvae/plant respectively) were low with cowpea + sorghum followed by cowpea + pigeonpea (0.85 and 1.37/3leaves, 8.72 and 9.40/10 cm twig, 1.12 and 2.14/10 flowers, 0.86 and 2.19/plant and 0.78 and 1.95 larvae/plant respectively) which was significantly minimum than pure crop of cowpea (1.21 and 2.54/ 3 leafhopper, 11.39 and 14.58/10 cm twigs, 1.81 and 3.67/10 flowers, 1.86 and 3.26/plant and 0.26 and 0.30 larvae/plant respectively).

Key words: In land ecosystem (Srivilliputtur), Coastal ecosystem (Kamuthi), Cowpea, Insect pests, Intercrop.

Introduction

Pulses are the major source of protein in the vegetarian diet in our country; besides being a rich source of protein, they maintain soil fertility through biological nitrogen fixation in soil and thus play a vital role in furthering sustainable agriculture.
In India, pest damage varies considerably in different agro climatic regions across the country mainly due to differential impacts of several abiotic factors such temperature, humidity and rainfall (Sharma, 2010). This has major implication for the intensification of yield losses due to potential changes in crop diversity and increased incidence of insect-pest in the context of impending

climate change. Indian agriculture reels under the risk of ever increasing insect pests due to climate change in the past 2-3 decades. Production of pulses hovers around 13-15 million tonnes as against the requirement of 19 million tonnes. With this background, the proposed study focuses on the effects of climate change on insect pests and their associated food webs in cowpea crops.

Material and Methods

The field experiments were conducted at farmer's field during summer season (February to April 2017) and winter (September to November 2017) under two environmental regimes at Srivilliputtur (Latitude, 9.512^{o} N, Longitude, 77.633^{o} E, Altitude, 252 m MSL, distance from seashore 132 km) and at Kamuthi (Latitude, 9.419^{o} N, Longitude, 78.370^{0} E and Altitude, 40 m MSL, distance from seashore 30 km) in Tamil Nadu, India with six treatments and replicated four times. Five intercrops *viz.*, sorghum, (*Sorghum bicolor*) (K 8); maize, (*Zea mays*) *(*TNAU maize hybrid CO 6*);* castor, (*Ricinuscommunis*)(CO 1); Pigeonpea,(*Cajanuscajan*)(VBN (Rg) 3); bajra,(*Pennisetumglaucum*)(CO 7) at 4:1 with cowpea VBN 2 (*Vignaunguiculata* (L.) Walp. Each treatment was raised in plot size of 5 x 4 m^{2} in randomized block design with spacing 45 x 10 cm.Crop cultivation as per the recommendation of Tamil Nadu AgriculturalUniversity were followed. Seeds were treated with thiram @ 2g/kg and bio fertilizer and rhizobium before owing. Basal application of N and P was givenat the rate of 25 kg/N ha and 50 kg P/ha. Farm yard manure was applied at 12.5 t/ha. DAP 2 % as foliar application was done on 25th and 40th day after sowing (DAS).The experimental area was kept free from insecticidal spray throughout the crop season in order to record the incidence of insect pests. Weekly observations weremade on the incidence of insect pests and natural enemies on fiverandomly selected plants in each plot of cowpea by direct count to till harvest. The trials were repeated with same crop varieties at Srivilliputtur (Inland ecosystem) and Kamuthi (Coastal ecosystem) during September – November 2017 season also.

Results and Discussion

In inland ecosystem during summer and winter 2017, cowpea + sorghum intercrop system recorded low numbers aphid, thrips, pod bug and spotted pod borer *viz.*, (7.52 and 10.57/10 cm twigs, 0.96 and 2.06/10 flowers, 0.96 and 2.05/plant and 0.72 and 1.24 larvae/plant respectively) followed by cowpea + pigeonpea (8.65 and 11.64, 1.30 and 2.19, 1.04 and 2.17 and 0.99 and 2.09 larvae/plant respectively) compared to pure crop of cowpea (12.11 and 16.54/10cm twigs, 2.02 and 4.13/10 flowers, 2.08 and 3.25/plant and 1.71 and 2.99

larvae/plant respectively). In inland ecosystem during winter 2017, the mean number of leaf hopper low in intercropped with cowpea + pigeonpea (0.87/3 leaves) during summer 2017 and intercropped with cowpea+ sorghum was low (1.25/ 3 leaves) (Table 1&2). The similar results was reported by Bairwa *et al.* (2007). In coastal ecosystem during summer and winter 2017, Leaf hopper, aphid, thrips, pod bug and spotted pod borer *viz.*, (0.57 and 1.24/3leaves, 7.06 and 8.56/10 cm twig, 0.88 and 1.76/10 flower, 0.75 and 2.09/plant and 0.8 and 1.95 larvae/plant respectively) were low with cowpea + sorghum followed by cowpea + pigeonpea (0.85 and 1.37/3leaves, 8.72 and 9.40/10 cm twig, 1.12 and 2.14/10 flowers, 0.86 and 2.19/plant and 0.78 and 1.95 larvae/plant respectively) which was significantly minimum than pure crop of cowpea (1.21 and 2.54/ 3 leafhopper, 11.39 and 14.58/10 cm twigs, 1.81 and 3.67/10 flowers, 1.86 and 3.26/plant and 0.26 and 0.30 larvae/plant respectively) (Table 1&2). According to findings of Nampala *et al.*, (2002), aphids and thrips populations were significantly reduced in the cowpea + sorghum intercrop but were higher in cowpea + green gram intercrop. These results are in conformity with Hassan (2013) who reported that the population of aphids (*Aphis craccivora* Koch.) and thrips (*M.sjostedi*) were significantly low in cowpea + sorghum intercropping than sole cowpea crop.

Conclusion

Indian agriculture reels under the risk of ever increasing insect pests due to climate change in the past 2-3 decades. Production of pulses hovers around 13-15 million tonnes as against the requirement of 19 million tonnes. With this background, the proposed study focuses on the effects of climate change on insect pests and their associated food webs in cowpea crops.

Reference

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Table 1. Effect of intercrops on sucking insect pests in cowpea (cv. VBN 2) under two ecosystems (Summer, 2017)

Intercrops	Cumulative mean of sucking pests*							
	Inland ecosystem (Srivilliputtur)				Coastal ecosystem (Kamuthi)			
	Leaf hopper(No./ 3 leaves)	Aphid(No./10 cmtwig)	Thrips(No./10flower)	Pod bug(No./plant)	Leaf hopper(No./ 3 leaves)	Aphid(No./10 cm twig)	Thrips(No./10 flower)	Pod bug(No./plant)
Cowpea + Sorghum	0.92[b] (0.96)	7.52[a] (2.74)	0.96[a] (0.98)	0.94[a] (0.97)	0.57[a] (0.75)	7.06[a] (2.66)	0.88[a] (0.94)	0.75[a] (0.87)
Cowpea + Maize	1.09[c] (1.04)	8.95[c] (2.99)	1.48[c] (1.22)	1.40[c] (1.15)	1.00[d] (1.00)	8.26[b] (2.87)	1.33[d] (1.15)	0.93[c] (0.96)
Cowpea + Castor	1.26[d] (1.12)	10.45[d] (3.23)	1.59[d] (1.26)	1.80[e] (1.34)	0.92[c] (0.96)	9.41[d] (3.07)	1.47[e] (1.21)	1.56[e] (1.25)
Cowpea + Pigeonpea	0.87[a] (0.93)	8.65[b] (2.94)	1.30[b] (1.14)	1.08[b] (1.04)	0.85[b] (0.92)	8.72[c] (2.95)	1.12[b] (1.06)	0.86[b] (0.93)
Cowpea + Bajra	1.23[d] (1.11)	8.91[bc] (2.98)	1.46[c] (1.21)	1.50[d] (1.22)	1.02[d] (1.01)	8.96[c] (2.99)	1.29[c] (1.14)	1.31[d] (1.14)
Cowpea (Pure crop)	2.12[e] (1.46)	12.11[e] (3.48)	2.02[e] (1.42)	2.19[f] (1.48)	1.21[e] (1.10)	11.39[e] (3.37)	1.81[f] (1.35)	1.86[f] (1.36)
SE.d	0.007	0.021	0.008	0.009	0.006	0.021	0.006	0.007
CD (P=0.05)	0.015	0.045	0.018	0.019	0.013	0.045	0.013	0.007

*Mean of four replications and 5 plants per replication; significant at 5%; figures in parentheses are square root transformed; in a column, means followed by a common letter(s) are not significantly different by DMRT (P = 0.05); *Mean of 15 DAS, 15 DAS, 36 DAS and 36 DAS observation

Table 2. Effect of intercrops on sucking insect pests in cowpea (cv. VBN 2) under two ecosystems (Winter, 217)

Intercrops	Cumulative mean of sucking pests*							
	Inland ecosystem (Srivilliputtur)				Coastal ecosystem (Kamuthi)			
	Leaf hopper(No./ 3 leaves)	Aphid(No./10 cmtwig)	Thrips(No./10flower)	Pod bug(No./plant)	Leaf hopper(No./ 3 leaves)	Aphid(No./10 cm twig)	Thrips(No./10 flower)	Pod bug(No./plant)
Cowpea + Sorghum	1.25[a] (1.12)	10.57[a] (3.25)	2.06[a] (1.44)	2.05[a] (1.43)	1.24[a] (1.11)	8.56[a] (2.93)	1.76[a] (1.33)	2.09[a] (1.44)
Cowpea + Maize	1.34[b] (1.16)	11.21[b] (3.35)	2.52[c] (1.59)	2.21[b] (1.49)	1.65[b] (1.28)	8.89[b] (2.98)	2.31[c] (1.52)	2.29[c] (1.51)
Cowpea + Castor	2.22[d] (1.49)	14.84[d] (3.85)	3.08[e] (1.76)	3.06[d] (1.75)	2.22[e] (1.49)	10.98[e] (3.31)	3.03[e] (1.74)	3.06[e] (1.75)
Cowpea + Pigeonpea	1.37[b] (1.17)	11.64[b] (3.41)	2.19[b] (1.48)	2.17[b] (1.47)	1.37[c] (1.17)	9.40[c] (3.07)	2.14[b] (1.46)	2.19[b] (1.48)
Cowpea + Bajra	1.64[c] (1.28)	12.92[c] (3.59)	2.74[d] (1.65)	2.92[c] (1.71)	1.83[d] (1.35)	10.61[d] (3.26)	2.43[d] (1.56)	2.75[d] (1.66)
Cowpea (Pure crop)	2.35[e] (1.53)	16.54[e] (4.07)	4.13[f] (2.03)	3.25[e] (1.80)	2.54[f] (1.59)	14.58[f] (3.82)	3.67[f] (1.92)	3.26[f] (1.80)
SE.d	0.006	0.037	0.011	0.010	0.020	0.019	0.013	0.010
CD (P=0.05)	0.013	0.079	0.024	0.022	0.041	0.040	0.028	0.021

*Mean of four replications and 5 plants per replication; significant at 5%; figures in parentheses are square root transformed; in a column, means followed by a common letter(s) are not significantly different by DMRT (P = 0.05); *Mean of 15 DAS, 15 DAS, 36 DAS and 36 DAS observation