Development of an Integrated Pests Management strategy for African Bollworm (Helicoverpa armigera Hub) on Chickpea

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Abstract

The African bollowrm, *Helicoverpa armigera* (Hub.); is a primary pest that infest chickpea in the field. On-station trials at Hudeiba Research Station were designed to develop an integrated pests management strategy for the bolloworm through evaluation of some botanical, chemical insecticide and their mixtures. The performance of each package was evaluated based on several factors such as pest larval counts, percent pod damage, and crop's yield. The results indicated that, the use of botanical plus chemical insecticide mixtures were superior over untreated control option. The advantage of spraying chickpea with neem, *Azadirchta indica* (Juss.) seed extract is also illustrated. Since the use of chemicals may not be feasible to smallholder farmers in the state, botanical pesticides such as neem could substitute it. As it's a technology readily available in almost all-household use as shade tree. Therefore, there is also need to explore the availability of other such indigenous knowledge from food legume growers in the region.

Key words:

African bollworm, botanical, chickpea, chemical, development, integrated pest management, insecticides and farmers.

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Introduction

Among the pulse crops grown in the Sudan chickpea (*Cicer arietinum* L.) is the third largest in terms of area after faba bean and common bean. The relatively long and cool winter season in the Northern Sudan is more suitable for the crop compared to central and Southern parts (Sheikh Mohamed, 1996). However, the crop is now successfully gorwn in the east (Hawata), west (Jebel Mara) (Faki et al., 1992; Sheikh Mohamed, 1989, 1990, 1991) and today in Central Sudan.

Among the several factors causing low yields of chickpea, damage caused by insect pests in considerable. African bollworm (*Helicoverpa armigera* Hub.) is the major insect pest that causes heavy yield losses, as it feeds on chickpea flowers, buds, pods and occasionally on the leaves. Although some insecticides have been recommended for controlling African bolloworm (Bushara, 1991 and Mohamed, 1993), smallholder farmers continued to use any insecticide they encounter to control legumes pests (Oji *et al.,* 2001). Ajayi (1989) reported that, the cost of pesticides is largely beyond the means of smallholder farmers. Besides, chemicals are expensive and not environmentally friendly (Brader, 1979 and Cisneros, 1984). Hence, with the increasing demand for food safety by the growing populations, international trade and emerging trend towards sustainable agriculture effort was made to develop simple, cheap, environmentally friendly and sustainable pest control methods for smallholder farmers.

Materials and Methods

Experiments comprising of botanicals, soft chemical insecticides and their mixtures were carried out in Hudeiba research station in 1997/98, 1998/99, 1999/2000, 2000/2001 winter seasons. The treatments include Neem seed extract 5kg/fed alone, Neem seed extract 2.5kg/fed. + Sevin 0.5kg/fed, Australian acacia pod powder 2.5kg/fed. + Folimat 200ml/fed., Australian acacia, Acacia stenophylla pod powder extract 5kg/fed. Alone, Folimat 400ml/fed. And Control. The experimental design used was randomized complete block design with four replicates in plots measuring $42m^2$. Chickpea variety Shendi was use for the experimentation. Neem seed and Australian acacia pod

extracts processing were as follows; Neem seed or Acacia pods were crashed with a mortar and pestle to separate kernels from the shells. The Kernels were pounded into a paste or powder. The paste or powder was then mixed with the right amount of water in plastic containers. Using a stick, the contents were thoroughly stirred up and left overnight in tightly closed plastic containers. In the next morning it was stirred up again and then sieved to remove residues that might block sprayer's nozzle.

Other cultural operations were as per Agricultural Research Corporation (ARC) standards. Parameters taken were number of bollworm larvae, percent pod damage and yield (ton/ha). African bollworm larvae were assessed by taking two board counts per plot i.e. two boards measuring 120 × 30 cm were placed between plant rows at two sites selected at random. The plants were shaken toward these boards and counts of bollworm larvae that fall on the white-painted surface were then taken instantly. A 3- gallon pneumatic knapsack sprayer was used to spray the pesticides as per the application rates indicated.

Results and Discussion

Statistical analysis of the data presented in (Tables 1,2 and 3) showed that, *A. Stenophylla* + Folimat, Neem seed extract + Sevin and Folimat alone were consistently effective in reducing the pod-borer damage on chickpea. Sole applications of Neem seed extracts was better than untreated control in both controlling the African bollworm and improving chickpea yield. According to Siddig (1991) Neem seed extract control pests by three modes of action- repellent, antifeedant and growth regulatory effect in addition to a comparatively weaker insecticidal effect. Seeds of neem tree contain the highest concentration of *azadirachtin* and other biologically active chemical compounds are also present in A. indica (Jacobson, 1989; Koul, 1990; Schmutterer, 1990). Baba (1994) reported neem as a source of effective compounds against many pests including store pests.

There were significant differences in yields due to the different treatment potency; again indicating that, the insect had great effect on chickpea yield. The best yield was given by plots treated with *Acacia*

Stenophylla + Folimat, followed by Neem seed extract + Sevin and Folimat alone. Neem seed extract alone occupied an intermediate position.

Conclusion

The results suggested that, the use of neem seed extract + Sevin and neem seed extract alone could provide an economic management starteg for bollworms on chickpea since neem tree is available in all household in the chickpea growing areas of the River Nile State. Therefore, there is also need to promote these technologies and explore the availability of other such indigenous knowledge from food legume growers in the region.

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Table 1:
Efficacy of botanical , chemical insecticides and their mixtures against *Helicoverpa armigera* in chickpea 1999/2000 season .

Treatments	Dosage rates	Prespray count†	Postspray larval count†		Pod damage (%)	Yield (ton/ha)
			3DAS	7DAS		
Neem seed extract	5kg/ fed.	1.82	1.41	1.28	2.4	2.2
Neem seed extract + Sevin 85% WP	2.5kg/fed+0.5kg/fed	2.05	1.31	1.21	1.9	2.3
Acacia stenophylla pod powder	5kg/fed.	1.96	1.39	1.31	2.9	2.2
A. stenophylla pod powder + Folimat	2.5kg/fed.+200ml/fed.	1.82	1.00	1.00	2.2	2.7
Folimat 80% E.C	400ml/fed.	2.19	1.21	1.10	3.3	2.4
Control	water	1.95	2.14	2.10	3.4	1.8
C.V%		36.05	26.34	20.1	23.2	19.4
S.E.±		0.35	0.18	0.13	0.32	0.13
Sign/ Level		ns	*	***	*	ns

*,**,*** = Significant at 0.05, 0.01 and 0.001 p levels respectively.
†figures transformed to $\sqrt{x+1}$.
DAS = Days after spray.

Table 2:
Effect of some botanical, chemical insecticides and their mixtures on *Helicoverpa armigera* in chickpea, 2000/2001 season.

Treatments	Dosage rate	Pre spray count†	Post-spray larval Count†			% Pod damage	Yield ton/ha
			3 DAS	7DAS	14DAS		
Neem seed extract	5kg/ fed.	3.5	1.7	2.6	3.2	3.0	3.7
Neem seed extract+Sevin	2.5kg/fed+0.5kg/fed	2.6	1.5	1.3	2.3	3.8	3.7
A.stenophylla	5kg/fed.	3.4	1.7	2.0	2.1	1.5	1.4
A.stenophylla + Folimat	2.5kg/fed.+200ml/fed.	2.9	1.0	1.7	1.0	2.0	4.3
Folimat	400ml/fed.	2.5	1.0	1.3	1.0	2.5	3.7
Control	water	3.3	3.7	4.6	3.4	4.5	2.6
C.V.%		14.4	38.5	5.3	12.9	33.1	26.0
S.E.±		0.2	0.34	0.05	0.14	0.47	0.3
Sign. Level		ns	***	***	***	**	***

*,**,*** = Significant at 0.05, 0.01 and 0.001 p levels respectively.
†figures transformed to $\sqrt{x+1}$.
DAS = Days after spray.

Table 3:
Effect of some botanical, chemical insecticides and their mixtures on *Helicoverpa armigera* in chickpea, 2001/2002 season.

Treatments	Dosage rates	Pre spray count†	Post-spray larval Count†					% Pod damage	Yield ton/ha
			3DAS	7DAS	14DAS	21DAS	25DAS		
Neem seed extract	5kg/ fed.	5.6	2.3	1.8	3.3	2.5	2.1	4.2	2.7
Neem seed extract+Sevin	2.5kg/fed+0.5kg/fed	3.4	1.5	1.7	2.6	2.3	1.5	3.5	2.9
A.stenophylla	5kg/fed.	4.7	1.7	1.6	3.6	2.6	3.1	5.2	2.1
A.stenophylla + Folimat	2.5kg/fed.+200ml/fed.	5.5	1.4	1.8	2.4	2.6	1.4	1.5	2.9
Folimat	400ml/fed.	3.1	1.7	1.8	1.5	1.5	1.3	2.6	3.4
Control	water	5.0	4.1	2.7	5.9	5.1	5.3	4.4	1.8
C.V.%		19.6	19.6	17.0	28.4	24.4	26.4	31.7	25.3
S.E.±		0.44	0.2	0.2	0.5	0.4	0.3	0.6	0.4
Sign. Level		**	***	**	***	***	***	**	*

*,**,*** = Significant at 0.05, 0.01 and 0.001 p levels respectively.
†figures transformed to $\sqrt{x+1}$.
DAS = Days after spray.