GLOBAL JOURNAL OF BIO-SCIENCE AND BIOTECHNOLOGY

www.scienceandnature.org

STUDIES OF NEEM SEED OIL (NSO) APPLICATIONS AND CULTIVARS ON INSECTS OF COWPEA (*VIGNA UNGUICULATA* (L.) Walp) IN THE DRY SAVANNA OF NORTH EASTERN NIGERIA

M. M. DEGRI[1] & I. A. SODANGI[2]
[1]Department of Crop Protection, University of Maiduguri, Nigeria
[2]Department of Crop Production, University of Maiduguri, Nigeria
Corresponding author's: email=mikedegri@gmail.com

ABSTRACT
Field trials were conducted during 2010 and 2011 cropping Seasons to determine the minimal neem seed oil applications and cultivar which can reduce cowpea yield losses on the field due to pod-sucking bugs (PSBs) and legume pod borer (LPB) infestations in Maiduguri located in the dry semi-arid zone of North eastern Nigeria Treatments consisted of four cowpea cultivars (IT89 KD-391, IT 90K-284-2, Kanannado and Gwallam) and four spray applications (one, two, three and four sprays) which were laid out in a randomized complete block design in a split plot replicated three times observations were taken on insect pest population counts, number of pods/plant, number of normal sects/pod, and 100 Seed weight per plant . Improved cowpea cultivars (IT89 KD-391 and IT90-284-2) and four spray applications significantly reduced PSBs and LPB infestations, and number of damaged pods per plant. Results also showed that number of pods/plant, undamaged pods/plant, normal seeds/pod and 100 seed weight were increased compared to local cowpea cultivars (Kanannado and Gwallam and one and two spray applications, the interaction effects of the cowpea cultivars and pray applications followed the same trend, this study provides reliable information on the insect pests abundance and the critical stages need to target cowpea control intervention necessary for obtaining high grain yield in the field, IT89 KD-391 and IT90K- 284-2 sprayed four times provided adequate protection for the production of short duration cultivars of cowpea in the dry Savanna region of Nigeria.

KEYWORDS: Cowpea, cultivar, Neem oil, spray applications, pod-sucking bugs, Legume pod borer)

INTRODUCTION

Cowpea (*Vigna unguiculata* (L.) Walp.) is a major staple food crop and a major source of cheap protein source for most people and nitrogen to the soils in the tropical lowland of Africa, Asia and south America, It is usually preferred by farmers because of its role in maintaining soil; fertility through nitrogen fixing and good fodder for lives tock (Asiwe, 2009). Cowpea yields are known to be low in most parts of the tropics because of heavy insect pest problems (Degri and chaudhanry, 1998, Degri *et al.*, 2012) therefore, high crop grain yields can be achieved with sustainable use of resistant varieties and carefully timed and scheduled application of botanical insecticides to coincide with stages in cowpea phonology where insect pest pressure is high (Sharah and Ali, 2008, De gri, 2011).
Many studies suggested that using the right variety of cowpea and applying insecticide at the targeted susceptible phonological stages such as the flower bud initiation, full flowering, early podding and pod filling stages are the best and effective in the control of PSBs and LPB (Jackai and Singh, 1983, Jackai *et al.*, 1992, Dike, 1996, Emosairue and Ubana, 1998, Dzemo *et al.*, 2010). In Africa and Asia, cowpea growers do ues a lot of synthetic insecticides sprayed several times often with serious environmental and human hazard s and rely too much on local cultivars such misuse of synthetic insecticides on cowpea coupled with low yielding local cultivars has led to an intense search for pest control options that will increase grain yields with biopesticides Insecticide application schedules or ca lender and monitoring used complementary with other pest control; options such as use of resistant varieties minimizes environmental hazards, reduce costs and the effects of spr ay frequencies and intensity on non target organisms (Alghali, 1992, Kyamany awa, 1996, Karungi *et al.*, 2000, Dzemo *et al.*, 2010). There is a dearth of information on spray application of biopesticides and its interaction between cultivars in the dry savanna zone of Nigeria. This study therefore aims to evaluate the minimal time and frequency of need seed oil applications and the right cultivar that can reduce cowpea insect pests attack and increase grain yield production.

MATERIALS & METHODS

Field trials were conducted at the Teaching and Research form of Department of crop protection University of Maiduguri studies at Latitude 11^0 51N and Longitude 13^0 05'E, 520mm mean annual rainfall at the dry savanna zone of North eastern Nigeria during 2010 and 2011 cropping season (July-October) to evaluate the effects of cultivars and neem seed oil applications on insect pests of cowpea. The soil in the study area was sandy loam.
The experimental land was harrowed and manually ridged at 0.75m apart using a hoe, the 4.0m x3.0m ($12.0m^2$) spaced at 1.5m between plots separated by an alley of 2.0m. The experimental design was a randomized

complete block design in a split-plot with cultivar as main plots and neem seed oil applications as subplots all replicated three times. Four cowpea cultivars (IT89KD-391, IT90K-284-2, Kanannado and Gwallam) with various characteristics (Table 1) were obtained from Borno State Agricultural Development program (BOSADP) and neem seed oil (NSO) (*Azadirachta indica* A. Juss was obtained from katsina State and used for treatments.

TABLE 1: Characteristics of cultivars used in the study and their source.

Variety	Source	Growth habit	Maturity	Seed coat	Seed size
It 89 KD – 391	IITA	Erect	Early	White	Small
IT 90 K – 284 -2	IITA	Erect	Early	White	Small
Kanannado	BOSADP	Semi-erect	Late	White	Large
Gwallam	BOSADP	Semi-erect	Medium	White	large

The cowpea cultivars seeds were dressed with All-star 45WP at one sachet to 2 kg of seeds to enhance good germination and protect the seedling from fungal infection and seedling pests soon after emergence. The seeds were sown 2 seeds per stand at 50 cm x20 cm (erect) and 75 cm x 20 cm (Semi-erect) spacing, 2.5-4.0 cm sowing depth. The neem seed oil was applied at 50ml/L water after emulsifying with bar soap at the interval of one week beginning from flow bind formation. Spray application one received one NSO application at flower but formation. 5 WAP), two spray applications (received two NSO application at flower and formation and full flowering stage 5, and 6 WAP), three spray applications (received three NSO applications at 5, - 6 and early pudding (7 WAP) stages) while four spray applications (received four NSO applications at 5, 6, 7 and pod filling stage (8 WAP). Insect pests population count were done by direct count method of the conspicuous nymphs and adults for pod-sucking bugs (PSBs) and of the conspicuous holes for the legumes pod bore (LPB) from commend cement of flower bud formation till pod physiological maturity early in the morning (6.00-8.00am) on randomly selected five plants per plot and tagged. The number of pod per plant were obtained at maturity; the number of undamaged pods per plant number of damaged pods plant number of normal seeds pod and 100 seed weight were obtained at harvest when most of the pods were ma turned and turned brown ready for harvest. The 100 seeds weight were obtained from the harvested pods of each plot and weighed using a Metter balance (PE, 2000 model, Wiley co Sussex, England) to obtain the overage weight per plot.

Statistical Analysis

Data collection were subjected to analysis of variance (ANOVA) using statistix version 8.1 and the means were compared using least significant difference (LSD) at 5 $^{0}/_{0}$ level of probability.

RESULTS & DISCUSSION

Effects of neem seed oil (NSO) applications on pod-sucking bugs (PSBs) and Legume pod borer (LPB) population on cowpea cultivars under different, neem seed oil (NSO) applications. There were significantly lower insect pest population on the improved cowpea cultivars (IT89KD-391 and IT90K-284-2) than the local cowpea cultivars (kanannado and Gwallam) Table 2. The result further showed that four neem seed oil applications had significant, the lowest insect pest populations while the one neem seed oil application had significantly the highest insect pest populations.

TABLE 2. Insect pests' population on cowpea cultivars under different spray regimes in Maiduguri

Insect count	Mv	M	Ac	Rd	Ct	Nv
It 89kd – 391	1.42	1.08	2.00	1.75	1.75	1.25
IT90K – 284-2	1.33	1.00	1.92	1.75	1.58	1.17
Kanannado	2.42	1.67	3.25	2.83	2.33	1.83
Gwallam	2.08	1.92	3.25	3.08	2.83	1.75
SE ±	0.33	0.32	0.45	0.33	0.36	0.26
LSD	0.68	0.65	0.92	0.67	0.73	0.54
Spray						
1Spray	3.00	1.92	5.00	5.33	3.92	3.37
2Sprays	2.58	2.42	3.08	2.17	2.50	2.00
3Sprays	1.25	0.58	1.58	0.92	0.92	0.67
4Sprays	0.42	0.75	0.75	1.00	1.67	0.17
SE ±	0.33	0.32	0.45	0.32	0.36	0.26
LSD	0.68	0.65	0.92	0.66	0.73	0.54
C×S	*	*	*	*	*	*

The combined effects of the cultivars and application showed that all cowpea cultivars sprayed four times had significantly the lowest populations of both the pod-sucking bugs (PSBs) and legume pod-borer (LPB) *Maruca vitrata, Anoplocnemis curvipes, Clavigralla tomentosicollis, Mylabris sp, Nezara viridula and Riptortus dentipes* .however, result of interaction effects between cultivars and neem seed oil applications showed that there were significantly higher insect pests populations on both the improved and local cowpea cultivars sprayed one time with NSO during the study. The significantly lower insect pest population in the improved

cowpea cultivars could be due to their ability to withstand (result) the insect population builds up. If implies that in nature, peak population of insect pest do not accurate the early flowering and podding stages unless the crop is planted late or the plant is a late maturing type (Jackai and sign 1983, Ekesi, 1999 and Dzemo *et al.*, 2010).

The significantly higher insect pest population on the local cowpea cultivars indicates that these cultivars are susceptible to in sect pests infestations and are also late maturing which enables the crops flowering and pudding stages to experience series attack during the pest population build-up period (Alghali, 1992, 1993, the Kyamanyawa, 1996, karungi *et al.*, 2000) four applications of NSO had significantly lower insect pest populations while one NSO application had significantly higher insect pest population. This implies that four NSO applications provided adequate protection for the cowpea cultivars than one NSO application. This indicates that neem seed oil (NSO) applications targeted one at flower bud formation, one at full flowering, one at early pudding and one at pod filling stages controlled the PSBs and LPB infestations (Ajeigbe and sign, 2006). One neem seed oil application did not provide adequate protection for cowpe a because the NSO application targeted only one stage (flower bud formation) which did not reduce the insect pests populations at the other critical stages (Amatobi *et al.*, 2007, Degri, 2011, Degri *et al.*, 2012)

Four NSO applications significantly reduced insect pests' infestations and building-up in the field under all the cultivars. This implies that the combined effects of cowpea cultivars resistance and effectiveness of the neem seed oil applications were responsible for the adequate protection of the crop from the devastations effects of the pests (Dzemo *et al.*, 2010).

Effect of neem seed oil (NSO) on yield parameters of cowpea cultivars

Result on number of pods per plant, number of undamaged pods per plant, damage d pods, normal seeds /pods and seed weight presented in (Table 3, 4, 5, 6, and 7) respectively. The results showed that there were significantly higher number of pods /plant undamaged pods/plant normal seed per pod seed weight recorded under improved cowpea cultivars (IT89KD-391and IT90K-284-2) While local cowpea cultivars (Kananndo) had significantly the lowest number of pods/plant undamaged pods/plant normal seed per pod and 100 seed weight.

TABLE 3: Effects of Neems Seed oil applications on number of pods per plant of cowpea cultivars in Maiduguri

Cultivars	No. of pods /plant
IT 89KD-391	22.50
IT 90K-284-2	22.50
Kanannado	19.58
Gwallam	19.25
SE ±	0.44
LSD	0.89
Spray regimes	
1 Spray	16.17
2 Sprays	19.92
3 Sprays	22.17
4 Sprays	25.58
SE ±	0.44
LSD	0.90
CXS	*

The numbers of damaged pod/plants were significantly higher under local cowpea cultivars (Kanannado and Gwallam) and significantly lower in improved cultivars (IT89KD-391 and IT90K-284-2) (Table 5). The higher damaged pods per plant under the local cowpea cultivars could be due to its inability to resist or reflush or regrow after being inflicted by the insect pest at flowering and pod formation stages (Asiwe, 2009).

Four application of the neem seed oil (NSO) significantly gave the highest number of pods/plant, undamaged pods/plant, normal seeds/pod and seed weight, but significantly the lowest number of damaged pods per plant. Four applications of NSO provide adequate protection for cowpea cultivars hence the significantly higher number of pods, seed weight but lower number of damaged pods (Alghali, 1992; sign et al., 1999, Onyibe *et al.*, 2006; Dugje *et al*., 2009).

Four application of NSO at flower bud, flowering, early podding and pod filling stages adequately protected the cowpea from being damaged and ensures optimal flower, pod and seed protection (Dzemo *et al.*, 2010; Egho, 2010, Degri *et al.*, 2012).

The interaction effects between cultivars and applications showed that all cultivars sprayed four times significantly produced the highest number of pods per plant, undamaged pods, normal seeds and seed weight but lowest damaged pods per plant of cowpea cultivars minted with the use of improved cowpea cultivar that are also early maturing and drought resistant in the dry semi-arid zone of Nigeria enhanced cowpea growth performance which also provided adequate protection for cowpea during the study period.

TABLE 4 Effects of NSO applications on number of undamaged pods per plant of cowpea cultivars in Maiduguri

Cultivar	No. of undamaged pods /plant
IT 89KD-391	15.00
IT 90K-284-2	15.17
Kanannado	14.00
Gwallam	14.33
SE +	0.57
LSD	1.17S
1. Spray	8.00
2. Sprays	10.17
3. Sprays	18.75
4. Sprays	21.58
SE ±	0.57
LSD	1.17
CXS	*

This resulted to reduction in pest population, increase number of pods, undamaged (normal) pods, normal seeds and seed weight but decreased number of damaged pods per plant and hence more grain yield. The extent of PSBs and LPB population build –up and damaged in any system are affected by plant cultivars and the interaction between pests and environmental factors (Amatobi, 1995, Opole *et al.*, 2005, Ajeibe and Singh, 2006).

TABLE 5 Effects of Neem Seed oil applications on number of damaged pods per plant of cowpea cultivars in Maiduguri

Cultivar	No. of damaged pods /plant
IT89KD-391	4.92
IT90K-284-2	5.50
Kanannado	5.50 7.83
Gwallam	4.92 7.50
SE +	0.67
LSD	1.36
1. Spray	8.75
2. Sprays	9.92
3. Sprays	3.42
4. Sprays	3.67
SE ±	0.67
LSD	1.36
CXS	*

TABLE 6: Effects of Neem Seed oil application on number of normal seeds per pod of cowpea cultivars in Maiduguri

Cultivar	No. of normal Seed/pod
IT 89KD-391	10.67
IT90K-284-2	10.00
kanannado	9.83
Gwallam	9.82
SE +	0.44
LSD	0.89
Spray	
1.Sprays	6.67
2. Sprays	9.83
3. Sprays	10.75
4.Sprays	13.17
SE ±	0.44
LSD	0.89
CXS	*

This study had shown that there is a significant difference between damaged pods among different applications. There were significantly higher pods, seeds, and weight among the treatment and significantly lower damaged pods recorded in improved cowpea cultivars and four applications.

TABLE 7: Effects of NSO application on 100 seed weight of cowpea cultivars in Maiduguri 2010 and 2011 cropping seasons

Cultivar	100 seed weight (g)
IT89KD-391	10.80
IT90K-284-2	10.86
Kanannado	10.25
Gwallam	10.44
SE ±	0.22
LSD	0.44
Spray	
1.Sprays	9.56
2.Ssprays	9.81
3.Sprays	10.82
4.Sprays	12.26
SE ±	0.22
LSD	0.44
CXS	*

This differences in pod damaged will definitely cause low quality seeds which sometimes may not be viable. Thus the improved cultivars and four applications provided a good cover against pods and seeds infestation by PSBs and LPB Paving way for better seed production (Mugo, 1989, Kyamanyawa, 1996; Muthomi *et al.*, 2007).

CONCLUSION

Result from this study clearly indicate that insecticide of any type (synthetic or botanical) application remains an important strategy for suppressing cowpea insect pests on the field if targeted on the susceptible phonological stages of the crop such as flower buds, full flowering, padding and seeding stages. With proper timing combined with early maturing cultivars that are drought and pest resistance used, cowpea grain yield losses can be reduced seriously in the arid part of Nigeria. This combination of good improved cultivars and four applications targeted at high infestation of PSBs and LPB tested in this study significantly reduced the damage due to pod-sucking bugs and legume pod bores of cowpea.

REFERENCES

Ajeigbe, H. A. and Singh, B. B. (2006) Integrated pest management in cowpea: effects of time and frequency of insecticide application on productivity. *Crop Protection* 25:920-925.

Alghali, A. M. (1992) Insecticide application schedules to re duce grain yield losses caused by insect pests of cowpea in Nigeria. *Insect science and its Application* 38:420-424.

Amatobi, C. I. (1994) Field evaluation of some insecticides for the control of insect pests of cowpea (*Vigna unguiculata* (L.) Walp.) in the Sudan savanna of Nigeria *International Journal of Pest Management* 40 (1): 13-17.

Amatobi, C. I. (1995) Insecticide application for economic production of cowpea grains in the northern Sudan savanna of Nigeria. *International Journal of Pest Management* 41:14-18

Asiwe, J.A.N. (2009) Needs Assessment of cowpea production practice, Constraints and utilization in South African .*African Journal of Biotechnology* 8:5383-5388.

Degri, M. M. (2011) Evalution of aqueous plant extracts and karate in controlling spiny brown bug (*Clavigralla tomentosicollis* Stal (Hemiptera: Coreidae) on cowpea in Nigerian Sudan savanna .*Nigeria Journal of Experimental and Applied Biology* 12(2): 187

Degri, M. M. and chaidhary, J. P. (1998) The chemical control of cowpea pod borer (*Maruca vitrata* F.) on cowpea in Bauchi state, Nigeria. *Indian Journal of Entomology* 60 (1): 148- 151

Degri, M. M., Maina, Y.T. and Richard, B.I. (2012) Effect of plant extracts on post flowering insect pest and grain yield of cowpea (*Vigna unguiculata* (L.) Walp.) in Maiduguri, semi arid zone of Nigeria .*Journal of Biology Agriculture and Health care* 2 (3): 46-51

Dike, M. C. (1996) Evaluation of Neem products for the control of pests of cowpea. *Nigeria Journal of Entornology* 32 (2000): 186-191

Dugje, I.Y., Omoigui, L.O., Ekeleme, F., Kamara, A.Y. and Aleigbe (2009) Farmers guide to cowpea production in West Africa. IITA, Ibadan, Nigeria 19pp.

Dzemo, W. D., Niba, A. S. and Asiwe, J.A.N. (2010) Effect of Insecticide spray application on insect pest infestation and yield of cowpea (*Vigna unguiculata* (L.) Walp) in the Transkei, South Africa. *African Journal of Biotechnology* 9:1679-1686

Egho, E.O. (2010) Studies on the control of major insect pests and yield of cowpea (*Vigna unguiculata* (l.) Walp.) under calendar and monitored application of synthetic chemical in Abraka, southern Nigeria. *Archives of Applied Science Research* 2(4): 224-234

Ekesi, S. (1999) Insecticide resistance in field populations of the legume podborer, *Maruca vitrata* Fabricuis (Lepidoptera: Pyralidae) on cowpea, *Vigna unguiculata* (L.)Walp) in Nigeria. *International Journal of Pest Management* 45:57-59

Emosairue, S.O. and Ubana, U.B. (1998) Field evaluation of neem seed oil for the control of some cowpea insect pests on south Eastern Nigeria. *Global Journal of Pure and Applied Science* 4:237-241

Jackai, L.E.N. and Singh, S.R. (1983) Varietal resistance in the integrated pest management of cowpea pests. *Insect Science and its Application* 4:199-204

Jackai, L.E.N., Inang, E.E and Nwobi, P. (1992)The potential for controlling post flowering p[ests of cowpea, *Vigna unguiculata* Walp. using neem, *Azadirachta indica* A. Juss. *Tropical Pest Management* 38(1):56-60

Kamara, Y., Chikeye, D. Omoigui, L.O. and Dugje, I.Y. (2007) Influence of insecticide spraying regime and cultivars on insect pests and yield of cowpea in dry

savanna of North eastern Nigeria, *Journal of food Agriculture and Environment* 5(1):154-158

Karungi, J., Adipala Kyamanyawa, S., Ogenga-latigo, M.W., Oyobo, N. and Jackai, L.E.N. (2000) Pest management in cowpea part 2. Integrating planting time, plant density and insecticide application for the management of cowpea field insect pest s in Eastern Uganda. *Crop Protection* 19:237-245

Kyamanyawa, S. (1996) Influence of time of insecticide application on control of insect pests of cowpea and grain yield at Mtwapa, coastal province of Kenya, *African Crop Science Journal* 4:373-382

Mugo, H. M. (1989) Studies of insect pests of pigeon pea (*Cajanus cajan* Mills) during the flowering and pest flowering stage and their impact on seed yield in Kenya. M.Sc. Thesis University of Nairobi, 380pp

Muthomi, J., W., Otieno, P.E., Chemining'wa, G.N. and Nderite, J.H. (2007) Effect of chemical pesticide spray on insect pests and yield of food grain legume. *African Crop Science Conference Proceedings* 8:981-986.

Onyibe, J.E., Kamara, A .Y. and Omoigui, L.O. (2006) Guide to cowpea production in Borno State. Nigeria promoting sustainable agriculture in Borno State (PROSAB), Ibadan, Nigerian. 36pp

Opole, R. A., Mathenge, P. W., Auma, E. O., Van Rheehen, H.A. and Wanbugu, P.W. (2005) Strategic practices for improving bean seed production in western Kenya. *Africa Crop Science Conference Proceedings* 7:123-128

Parth, I. A. (1993) The effect of different deltamethrin spray schedule on yields and potential seed yield of cowpea at foumbot, Cameroon. *International Journal of Pest Management* 39:193-196

Sharah, H. A. and Ali, E. A. (2008) Impact of insecticide spray regime on insect abundance in cowpea (*Vigna unguiculata*) in North Eastern Nigeria. *International Journal of Agriculture and Biology* 10(3):255-260

Singh, B. B., Asante, S. K., Ajeigbe, H. and Mohammed, S. G. (2000) General guide for cowpea cultivation and seed production Sasakawa Global 2000 Nigeria project. Federal Ministry of Agriculture, Abuja, Nigeria, 63pp.