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FARMERS PERCEPTION AND MANAGEMENT OF GRAIN LEGUMES STORAGE INSECT PESTS IN MAIDUGURI, NORTH-EASTERN NIGERIA

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Abstract: A survey research was carried out in Maiduguri Metropolis between January – April, 2011 to assess farmers' perception and management of grain Legume storage insect pests. The survey used open–ended structured questionnaires and oral interview to obtain this information from the farmers. The results showed that the most important grain legumes grown in Maiduguri include cowpea (*Vigna unguiculata* (L.)Walp) groundnut (*Arachis hypogeal* L.) and Bambara groundnut (*Vigna subterranean* L. Verdcourt) and that the common grain legumes insect pests that infest cowpea and groundnut in Maiduguri were cowpea weevil *Callosobruchus maculatus* and groundnut borer *Caryedon serratus*. These farmers used mostly bags, sacks, Rhumbus, jerry canes and drums for storing their legumes. The result also showed that the farmers used botanical products like chilli pepper powder, wood ash, Bitter leaf powder, bitter melon powder and neem seed oil for storing their grain legumes and synthetic insecticides like Actellic dust, Aluminium phosphide (phostoxin) and Atellic EC for controlling stored grain legume insect pests. The survey result indicated that these botanical products and synthetic insecticides were effective against the grain legumes insect pests for storage period. Farmers are recommended to use good storage facilities, practice good sanitary measure in their store to reduce losses and to handle both the botanical and synthetic protectants with care to avoid poisoning.

Keyword: Farmers, Legumes, Perception, Management, Storage and Pests.

INTRODUCTION

Grain Legumes are simple dry fruits that develop from a simple carpel and dehisce commonly refer to as pod. Grain legumes are important major stable food crop in the sub-Sahara Africa, especially in Nigeria. The seed form a major source of protein to man and feed for animals. The young leaves and immature pods are eaten as vegetable. Common legumes cultivated in semi-arid region of Nigeria include cowpea (*Vigna unguiculata),* Bambara groundnut (*Vigna sudterranean)*, Soya beans (*Glycine max*), green grain (C*ajanus cajan* (L.) Mill) (Ofuya, 2001). Grain legumes form the major staple food crop that are cheap and are rich source of alternative protein (Ofuya, 2003).

In spite of the great value of grain legumes, cowpea for example in many Tropical and Sub-tropical countries particularly Nigeria their availability and utilization have been impaired due to the seed damage by insect pests particularly the larvae of cowpea seed beetles (*Callosobruchus spp*.) (Jackai and Daoust, 1986; Ofuya and Lale, 2001; Lale, 2001; Lale, 2002). Attack by this insect pest species begins in the field and continues in storage causing substantial damage to stored grain legumes as the pest rapidly increase (Singh, 1990; Ofuya and Lale, 2001; Lale, 2001; Lale, 2002). Stored grain legumes are particularly susceptible to greater insects damage rendering large quantities useless by contaminating the commodities with faecal

materials (frass) odors, webbings, shed exoskeleton (exuvia) and whole or fragmented dead individuals. The activities of these insect pests may also heat grains and cause moisture laden, warmed air to rise to the surface where it cools resulting in the condensation of the accumulated moisture on the surface of the grains. These in turn causes caking of the grain due to the growth of mold and encourage spoilage (Lale, 2001 and Ambrose, 2007).

Effective control of stored grain legumes pests with minimal pesticide use requires an integrated approach combining sanitation, monitoring and other preventive practices (Wada and Tologbonse, 1999, Degri, 2008). The application of synthetic pesticides to stored products by farmers and the use of plant protestants form the major management measure for stored products (Botten burg, 1995, Ofuya, 1986, Golob, 1997). Many farmers in the Northern region of Nigeria store their farm products for domestic consumption and sale or for seed in thatched granaries (Rhumbus), tins, sacks, baskets, calabash gourd and earthen ware pots (Degri, 2008). Majority of farmers in Northern Nigeria recognized the importance of proper crop storage, storage losses and prevention (Anon, 1984, Ajayi *et al.*, 1987, Bottenburg, 1995, Lale, 2001, Degri, 2007). They employed local or indigenous storage facilities to forestall the menace of these insect pests. They use storage insecticides where available and affordable like the banned and highly restricted Lindane (gammalin A) methyl bromide and the acceptable ones like Alluminium or magnesium phosphide (phostoxin), Actellic dust, coopex, Actellic EC for storing their legume grains against cowpea beetles, termites, rats and disease pathogens (Degri, 2007). Estimates of grain legume losses by storage insect pests and disease pathogens range from 50-100% in the tropical region (Lale, 1995; Golob, 1997 and Lale, 2002). Insect pests cause heavy losses to stored grains including grain legumes especially in humid and warm areas of the world (Ofuya and Lale, 2001).

The use of synthetic insecticides to control pests directly on grains have been restricted due to their carcinogenicity, tetratogenicity, high and acute residual toxicity, hormonal imbalance, long degradation period, environmental pollution and adverse effects on food and humans (Ofuya and Lale, 2001, Sahayaraj, 2008). Their uninterrupted and in-discrimate use has not only lead to development of resistant strains but accumulation of toxic residue on food grains used for human consumption has led to health problems (Anon, 1984; Degri, 2008).

Recently, in different parts of the world, attention has been paid towards exploitation of plant products as novel chemotherapeutants in plant protection. The plant-based insecticides are non phototoxic, easy biodegradable and stimulate natural host metabolism. Plant product usage as pesticides are of value to pest management due to its availability in our locality, low mammalian toxicity and low environmental pollution (Ajayi *et al.*, 1987, Lale, 1995 Apuuli *et al.,* 1996, Ofuya, 1986, Ofuya and Lale, 2001, Sahayaraj, 2008).

It is therefore clear from the foregoing that degredation of stored grain legumes constitute a major constraint by insect pest to a successful production and utilization in the tropics (Ofuya, 2003) and a major factor militating against the grain legume availability and food security in Nigeria (Lale, 1995, Lale, 2001). It is therefore imperative that greater attention should be paid to grain legumes storage in order to make them available for the throughout the year.

MATERIALS AND METHODS

A survey was conducted in Maiduguri metropolis to assess the perception and management of grain legume storage insect pests by farmers. The survey was conducted between January - April, 2011 after grain legume harvest. Five different grains in Maiduguri Metropolis (Latitude

11° 51'N and Longitude 13° 15' E with mean temperature of 36°C and an annual rainfall of 562 mm) were randomly selected for the study. Ten (10) farmers who grow, store and sell the grain legumes from the five (5) different markets were selected randomly from each market and they were given open-ended structured questionnaires and oral interview to respond. The choice of these categories of respondents was because they handle grain legumes and are expected to understand the various insect pests that attack the grain legumes in store and also have some knowledge of managing them during storage. The respondents were also supposed to know the various storage facilities, structures, insecticides, natural plant materials use in the management of the storage pests. Some of the respondents who do not know how to read and write were assisted by conducting oral interview with them, while those who were literate were given the questionnaire and were given one week to study and respond to the questions. The questionnaires were later retrieved after one week from the respondents.

The data generated through the open-ended structured questionnaires were presented in descriptive statistics.

RESULTS AND DISCUSSION

Distribution of Respondents According to Training Workshop Received

The result on the distribution of respondents according to training workshop received on stored product pests management is presented in table 1. The result showed that more male farmers (36%) respondents received training on the management of grain legume storage pests from BOSADP followed by (26%) respondents from NFDP II while IFAD (8%) gave the least training to the respondents in Maiduguri area. The highest number of trainings received by the respondents from BOSADP and NFDP II on storage insect pests management by male indicate that male farmers had more access to extension agents and advisory services than female farmers. It also implies that BOSADP and NFDP II provided more extension and advisory services to the male farmers than other organizations, hence the high perception and management of grain legume storage pests by male farmers than female farmers in the study area (Bottenburg, 1995, Wada and Tolobonse, 1999).

Table 1: Distribution of Respondents According to Training Workshop Received by Farmers

	Gender					
Organizers	**Male**		**Female**		**Total**	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
MOA	6	12	1	2	7	17
BOSADP	14	28	4	8	18	36
IFAD	4	8	0	0	4	8
NFDP II	12	24	1	2	13	26
CBARDP	6	12	2	4	8	16
Total	**42**	**84**	**8**	**16**	**50**	**100**

MAO = Ministry of Agriculture,
BOSADP = Borno State Agricultural Development Programme,
IFAD = International Fund for Agricultural Development
CBARDP = Community Based Agricultural Rural Development Project,
NFDP II = National Fadama Development project II.

The lowest percentage (8%) recorded under IFAD followed by MOA (14%) during the study indicate that these agricultural organizations do not provide extension and advisory services to

farmers and the low percentage of females in receiving training on storage pest management could be due to their low social activities, cultural and religions inclination in the study area (Bottenburg, 1995, Wada and Tolobonse, 1999, Degri, 2007).

Types of Grain Legumes Grown and Sold in Maiduguri Area

Table 2 shows the types of grain legumes grown by farmers (respondents) in the study area. The result shows that Cowpea (44%) is the major grain legume grown in Maiduguri area followed by groundnut (36%). Soybean was least (6%) grown by the farmers in the study area. The result indicates that cowpea and groundnut were the most important and preferred grain legumes by the farmers in the area. It also implies that these grain legumes do better in the hot and dry semi–arid zone ecology and tolerate drought and the poor soils in the area than other grain legumes (Izge *et al*., 2009, Dugje *et al*., 2009) who reported that cowpea and groundnut perform well on a wide range of soils and conditions than soybean and other grain legumes are not grown much in the study area because of the nature of the soils and the amount of rainfall (560 mm) which generally influence the growth and performance of the crops.

Table 2: Types of Grain Legumes Grown and Sold in Maiduguri Area

Types of Grains Legumes	Frequency	Percentage (%) of Respondents
Groundnut	18	36
Cowpea	22	44
Soybean	3	6
Bambara groundnut	7	14
Total	**50**	**100**

Types of Storage Insect Pests Associated with Grain Legumes in Maiduguri Area

The result on insect pests of storage grain legumes is presented in Table 3. The result shows that cowpea weevil (*Callosobruhus macultus* (F.) (58%) was the dominant insect pests of grain legumes on cowpea, followed by groundnut borer (*Caryedon serratus*) (20%) while rodents and (12%) and termites (10%) were minor insect pests on grain legumes.

The high infestation of *C. maculatus* on cowpea and *C. serratus* on groundnuts could be due to the availability of the host crop which are grown in the area (Since 1990 Lale, 2001, Ofuya and Lale, 2001).These grain legume insect pests were found attacking their crops in the markets because these coleopterans can easily breed and spread fast due to cross- infestation, unhygienic store and poor or unsuitable packaging facilities and poor market structures (Bottenburg, 1995, Wada and Tologbonse, 1990, Degri, 2007).

Table 3: Types of Storage Insect Pests Associated with Grain Legumes in Maiduguri Area

Types of Grains Legumes	Frequency	Percentage (%) of Respondents
Termites *(Termites species)*	5	10
Rodents *(Rodentia)*	6	12
Groundnut Borer *(Caryedon serrantus)*	10	20
Cowpea weevil (Callosobruchus maculates)	20	58
Total	**50**	**100**

Farmers in the study area stored grain legume for the purpose of domestic consumption, sale and seed. Most of the storage facilities are available locally and therefore could be in-effective or not quite effective in protecting the grain legumes for a reasonable period of time. The result presented in (Table 4) showed that 42% of the farmers used plastic socks and polythene bags for storing their grain legumes. 16% of the farmers used metal drums/tins and earthen

Buildings called Rhumbus for storing their grain legumes respectively. Other storage facilities such as Jerry canes (8%), earthen pots (6%), calabash quads (6%), Silos (4%) and plastered baskets (2%) were used by some farmers for grain legume storage of grain legumes.

The implies that plastic sacks and polythene bags are used mostly for grain legume storage because of their ease of transportation, storage, purchase by farmers and also use for sacking the grains in the domestic markets or surrounding market, (Wada and Tologbonse, 1999). The other storage facilities are use mostly by the farmers for grain legume storage for seeds and consumption. This is because they are difficult or cumber some in transporting them to local markets (Degri, 2007).

Table 4: Types of Storage Facilities Used For Grain Legumes Storage in Maiduguri Area

Types of Grains Legumes	Frequency	Percentage (%) of Respondents
Metal drums/tins	8	16
Polythene bags	21	42
Rhombus	8	16
Silos	2	4
Earthen pots	3	6
Jerry cans	4	8
Calabash gourds	3	6
Plastered baskets	1	2
Total	**50**	**100**

Types of Chemicals Used for Grain Legume Storage in the Study Area

Table 5 shows the result of the types of synthetic insecticides used for the protection of storage grain legumes by farmers in the study area. The result indicates that actellic dust (Pirimiphos – methyl) (36%) was mostly used for grain legume storage followed by atelic EC (28%) and Aluminum phosphate (phostoxin) (20%) during the survey period. Lindane and methyl bromide were less used for storage purpose the high percentage use of atelic dust EC and phostoxin tables were due to their efficiency, availability in the open markets (Wada and Tologbonse, 1999, Degri, 2007). Lindane (Gammalin A) and methyl bromide were not commonly used by the farmers for grain legume storage probably due to their bane or strict restriction on these products by World Health Organization (WHO) in collaboration with United Nations Environmental Protection (UNEP), (NAFDAC) Lindane and methyl bromide are among the most poisonous insecticides banned long time ago (Fields and White, 2002, Winks and Ryan, 1990, TEAP, 2000) and should not be used for grain legume storage, either for consumption, sale or seed. Methyl bromide and lindane act rapidly, controlling insects in less than 8 hrs in space fumigations. They have a wide spectrum of activity, controlling not only insect pests but also nematodes and plant pathogenic microbes. These chemicals were banned in 2005 in developing countries except for exceptional quarantine purposes because they deplete ozone in the atmosphere (MBTOC, 1998; TEAP, 2000; Thomas, 2001). The wide spread use of synthetic insecticides by farmers and grain merchants should be adequately educated by various extension agents on the general hazards and poisoning effect or toxicity of these products. Farmers should be taught the safest and friendly use of these products to avoid their ugly experience to consumers, handlers, operators, animals and the environment to which they operate (Degri 2008).

Table 5: Types of Synthetic Insecticides Used for Grain Legume in Maiduguri Area

Name of Insecticide	Frequency	Percentage (%) of Respondents
Actellic Dust	18	36
Atelic EC	14	28
Aluminum Phosphide (Phostoxin) Tablets	10	20
Gammalin A (Lindane)	4	8
Methyl Bromide	4	8
Total	**50**	**100**

Many alternatives have been tested as replacements for these chemicals such as physical methods like heat, cold treatments and sanitation, fumigants such as phosphine, sulfuryl fluoride, carbonyl sulfide, carbon dioxide, carbon disulfide, ethylene oxide, sulphur dioxide, methyl formate, acetaldehyde etc. (Snelson, 1987; Mueller, 1995; MBTOC, 1998; Thomas, 2001). Phostoxin (aluminium or magnesium phosphide) is a good product for replacing methyl bromide because it has been found to provide effective space fumigations (Winks and Ryan, 1990; Mueller, 1995; MBTOC, 1998; TEAP, 2000).

Actellic products are favoured for use on stored grains because of relatively low mammalian toxicity and suitable rates of degradation that are directly related to temperature and product moisture content (MBTOC, 1998).

Types of Botanical Insecticides Used for Grain Legume Storage in the Area

Table 6 shows the various types of plant products used by farmers for grain legume storage. The result showed that most of the farmers (36%) used Chilli pepper powder for storing grain legume in store. Wood ash (26%) also are used for grain legume protection Plant product like bitter leaf powder (16%) bitter melon leaf powder (14%) and neem seed oil (8%) were some of the botanical materials that grain legume farmers in the study area use for storing their grain and seed. The higher patronage of Chilli pepper powder and wood ash by grain legume farmers could be due to their effectiveness, availability, and ease of application compared to other botanical products (Ivbijaro and Agbaje, 1986, Lale 1995, Lale, 2001, Degri, 2007). The result also indicates that grain legume farmers might have been trained on the use of these plant products for the control of stored legumes (Ofuya, 1986, Bottenburg, 1995, Wada and Tolobonse, 1999, Lale, 2002).

Table 6: Types of Botanical Insecticides Used for Grain Legume Storage in Maiduguri Area

Types of Grains Legumes	Frequency	Percentage (%) of Respondents
Wood ash	13	26
Chilli pepper powder	18	36
Bitter leaf powder	8	16
Neem seed oil	4	8
Bitter melon leaf powder	7	14
Total	**50**	**100**

Grain legume pest control requires a combined use of various appropriate management measures to succeed. The storage facilities and structures should be kept clean, dry and well ventilated to stop the buildup of the storage pests (Snelson, 1987; Caswell, 1996, Delima, 1987, Lale, 2001). Packaging systems, good transportation systems and good marketing structures should be adopted with effective extension services and good enforcement of quality control laws on grain merchants will help to reduce losses being encountered by grain legume farmers. The widespread use of both synthetic and plant based portents by farmers in the stored

products calls for toxicological studies on these products to ascertain their safety, active ingredient, quality and quantity to be used for known quantity of grains and the environmental impact assessment of the methods.

CONCLUSION

The present study has shown that grain legume farmers in the study area grow cowpea groundnut and Bambara groundnut. These grain legume farmers encounter serious losses from cowpea weevils, groundnut borer, termer and rodents. The farmers use storage facilities like plastics. Polythene bags metal, drums/tins, Rhumbus and earthen pots for storing their grain legumes for consumption seed sale. They also complement this storage.

Structures and facilities with botanical products like chilli pepper powder, wood ash, bitter leaf powder, bitter melon powder and neem seed oil. They also use synthetic insecticides like atelic dust, Aluminum/magnesium phosphide (phostoxin) and actellic EC for the control of stored grains. These practices were adapted to some certain extent due to the training provided to the grain legume farmers by the extension agents and advisory services of some agricultural organizations like BOSADP, NFDP II, (BARDP and MOA in the study area.

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