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## Assessment of utilization of chemical pesticide component of Integrated Pest Management (IPM) by farmers in Kogi State Nigeria

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### ABSTRACT

One of the major tasks facing farmers in Nigeria in their effort to feed the nation is the absence of adequate technologies for pest control. Integrated Pest Management (IPM) has been the basis for high productivities and sustainable pest management in most developed counties of the world by appropriately incorporating chemical control components. Low use of chemical pesticide has been cited as a major factor limiting growth in agriculture in most sub-Saharan Africa. In most African countries however, application of chemical pesticides is done without requisite knowledge with attendant negative effect. This study examined the extent the farmers in Kogi State utilize chemical pesticide components of IPM. Results indicate that few farmers in Kogi State know and use chemical pesticide without basic safety application principles. Many know but do not use it. Most of the non-adopters of chemical pesticides were aged and uneducated. Most of the pesticide vendors have little or no knowledge of the chemicals they sale. The negative aspect of the inappropriate use of the pesticides has resulted in severe losses of crops, livestock, and even human life due to ignorance of the farmers.

**Key Words:** Assessment, chemicals, pesticide, integrated pest management

### INTRODUCTION

Damage caused to crops due to pest infestation in agricultural sector in Nigerians economy is generally high 40-80% (Dadari *et al.*, 2005). Today, shortage of food is a buzz-word both in Nigeria and the world over. No doubt the robust population is mounting pressure on food production and also new manufacturing processes are however, creating another form of pressure on agricultural products. Example is the current production of motor spirit from sugar cane and other grains (Brain, 1995; FAO, 2008; ACIAR, 2009). Shortages of good farm land

are emerging; most fertile lands are diverted for other developmental uses. These force the formers to embark on continuous cropping on the available land which engender multiplication of pest and diseases (Brain 1995, Erich, 1997). In the tropic and subtropics the damage potential of pests is favored by warm climate and high rainfall, leading to low yield of most crops between 0.5t/ha- 1t/ha compared to over 5t/ha in the developed countries (Ogunlela *et al.*, 2005). In addition, in the tropic the post harvest lost is enormous 40-80 % (Ogunbile and Olukosi, 1990, Erich, 1997; Dadari *et al.*, 2005). In

view of low yield per hectare couple with colossal post harvest loss of 30-40 % due to pests and diseases, a sustainable pest management system must be adopted. Technical progress in the agricultural sector, which made possible to go on feeding the world's growing population, is dependent on chemical plant protection (Josef, 1994, Volker, 1994; Brain, 1995; ACIAR, 2009). Real progress in agricultural development cannot be made, without giving adequate attention to pest problem. Elsewhere Integrated Pest Management (IPM) with judicious use of chemicals was the bases of the high produce. In most African countries however, IPM is not yet part of national policy and the information is lacking the farmers. A wide range of studies have shown that farmers can maintain or improve yields following adoption of IPM as well as maintain or increase profits (Michael *et al.*, 1995, Pretty, 1995).

Low use of chemical inputs has been cited as a factor limiting productivity in most sub-Saharan Africa (Hailu, 1990; Adesina, 1996). The experiment was therefore designed to identify the extent the farmers in Kogi state use the crop protection chemicals component of IPM.

## MATERIALS AND METHODS

Kogi State is located in North Central of Nigeria, it lies between latitude 7° 51' N and 8° 17' N and between Longitude 6° 42' E and 6° 57' E (Awosusi and Oriye, 2015). A survey of the entire 21 Local Government Areas of Kogi State was conducted. The twenty-one Local Government Areas of the State were selected for investigation with 100 farmers/respondent in each Local Government in 2012. A total of 2,150 respondents were used. Questionnaires were administered through the extension agents in charge of each local government areas. In addition 50 chemical vendors/dealers were also selected across the state. Data were collected by interviewing the farmers/ respondents.

Investigations were conducted as follows:

- a. How many farmers in Kogi state know and use pesticide.
- b. The type of pesticide use in the state.
- c. Sources of information/train on the use of pesticide.
- d. Method of application of the pesticide.
- f. Safety application principles.

The data obtained were calculated as percentage.

## RESULTS

A total of 1,800 farmers/respondents that gave useful answers were recorded. Table 1 shows the distribution of farmers according to their awareness and use of pesticide. The result shows 44.44 % of farmers adopting the use of pesticide while 55.56 % were aware of chemical pesticide but do not use it. In addition, the table shows the distribution of farmers according to the source of information/training. Majority of farmers (42.86 %) obtained information or training on pesticide from friends and other farmers followed by (33.33 %) who acquire such information from pesticide dealer/vendor and (19.00 %) from extension agents. Table 2 shows the distribution of farmers according to age group. In the adopted group, the study revealed that age 18-30 were not actively participates in the farming business. Between the age 31-45, 50 % were men, 18.75 % were women while age <46, 25 % were men and 6.25 % were women while in none adopted group, age <46 constituted the population for both men and women. In addition, the table shows the distribution of farmers according to educational level. Primary school level top the group (37.5 %) followed by none education (25 %) followed by secondary (12.5 %) and tertiary (10 %) in men while in women (15 %) had primary. In none adopted group, none educated constituted the group.

Table 3 shows the distribution of farmers according to the type of chemical/pesticide used. Most farmers use insecticide (25.00 %),

followed by herbicide and calcium carbide (18.25 %) each, 15 % use fungicide and 10 % use nematicides. Only 5 % use plant growth regulators. Similarly, the table shows the distribution of farmers by method of application of pesticide. Most farmers adopted spraying of chemical (50 %), followed by seed dressing (31.25 %), and

12.5 % and 6.25 % use fumigation and dipping respectively. Furthermore, the table shows the distribution of farmers according to safety application principles. The study revealed that most farmers (50.00 %) practice calendar spray while no farmers observed pest population threshold level before application.

**Table 1:** Distribution of farmers according to adoption and source of information on use of pesticides in Kogi State

Category	Frequency	Percentage
Farmers adopting the use of pesticides	800	38.10
Farmers aware but not using pesticides	1300	61.90
Farmers unaware of pesticides	0	0.00
	n	p
Source of Information/Training		
Extension Agents	400	19.0
Friends/Other Farmers	900	42.86
Chemical Vendors/Dealers	700	33.33
Newspapers/Magazines	50	2.40
Radio/TV	50	2.40
	n	p

n = 2100; p = 100%

**Table 2:** Distribution of farmers according to age group and educational level

Sex	Age group	Adopted		Non-Adopted	
		Frequency	Percentage	Frequency	Percentage
Male	18 -30	-	-	-	-
	31 – 45	400	50	-	-
	46 >	200	25	700	70
Female	18 -30	-	-	-	-
	31 – 45	150	18.75	-	-
	46 >	50	6.25	300	30
		$n_1$	$p$	$n_2$	$p$
Educational Level					
Male	Primary	300	37.50	-	-
	Secondary	100	12.50	-	-
	Tertiary	80	10.00	-	-
	None	200	25.00	700	70
Female	Primary	120	15.00	-	-
	Secondary	-	-	-	-
	Tertiary	-	-	-	-
	None	-	-	300	30
		$n_1$	$p$	$n_2$	$p$

$n_1 = 800$ ,  $p = 100\%$ ,  $n_2 = 1000$



Table 3 shows the distribution of farmers according to the type of chemical/pesticide used. Most farmers use insecticide (25.00 %), followed by herbicide and calcium carbide (18.25 %) each 15 % use fungicide and 10 % use nematicides. Only 5 % use plant growth regulators. Furthermore, the table shows distribution of farmers by method of application of pesticide. Most farmers adopted spraying of chemical (50 %), followed by seed dressing (31.25 %), and

12.5 % and 6.25 % use fumigation and dipping respectively.

Table 4 shows the distribution of chemical dealers/vendors' knowledge of the pesticide. Most chemical vendors had little knowledge of the chemical they sell (50 %), while 30 % had very good knowledge of the pesticide and (20 %) had no knowledge of the pesticides they sale.

**Table 3:** Distribution of farmers according to types of pesticides and method of application

Category	Frequency	Percentage
Herbicide	150	18.25
Insecticide	200	25.00
Fungicide	120	15.00
Bactericide	60	7.50
Plant growth regulator	40	5.00
Nematicide	150	18.25
	<i>N</i>	<i>p</i>
Method of Application		
Seed dressing	250	31.25
Spray	400	50.00
Fumigation	100	12.50
Dipping	50	6.25
	<i>N</i>	<i>p</i>
Safety Application Principles		
Spray calibration problem	250	31.25
Calendar spray	400	50.00
Utilization of action threshold	-	-
Coveralls	40	5.00
Hand gloves	25	3.13
Boots	20	2.50
Head cover	30	3.75
Face shield	-	-
Safety goggles	-	-
Gas mask	10	1.25
Face aid	20	2.50
Observation of wind direction	5	0.63
	<i>N</i>	<i>p</i>

$n = 800, p = 100\%$

**Table 4:** Distribution of chemicals dealers/vendors knowledge of pesticide

Category	Frequency	Percentage
Very good knowledge of pesticide	15	30
Little knowledge	25	50
No knowledge	10	20
<b>Total</b>	<b>50</b>	<b>100</b>

## DISCUSSION

The finding of this work was in line with Enyinnia *et al.* (1999) who observed that farmers in Nigeria rarely use chemical for the increase of yield but to prevent total crop loss. Some stakeholder advice farmers against the use of chemical pesticide and warned that chemical pesticides are hazardous, can damage wild life, pollute soil and water (Brain, 1995) while some school of thoughts maintain that application of chemical pesticides was necessary for high yield. Some other was recommending change in pesticide management. Each institution was promoting its own ideas to the same groups of farmers and, not surprisingly, farmers started asking whose advice they should follow (ACIAR, 2009). In all, the level of education, sex, farm size, and age of farmer affect the use of pesticide (Nkamleu and Adesina, 2000). Most of the farmers that did not use chemical pesticides were old and uneducated. Studies have shown that aged men, women and small size farm holder rarely use pesticide (Hailu, 1990; Adesina, 1996). Also the youth and the educated one easily adopt the use of pesticide or any innovation in agriculture (Nkamleu, 2000).

The intensification of agricultural production per unit area and the establishment of monoculture of particular agricultural crops, often with a relatively narrow genetic base selected for yield performance or other quality, have provided an attractive environment for the development and spread of pests and diseases (Brain, 1995; Erich, 1997). The farmers use the insecticide either on stored produce or on some field crops

whose production is impossible without spraying insecticides like cowpea (Enyinnia *et al.*, 1990; (Ogunlela *et al.*, 2005). The lack of virgin land to cultivate and continuous cropping on a particular field could leads to heavy weed problem (Oerke *et al.*, 1994; Brain, 1995). In addition, the increase in the use of herbicide could be attributed to inadequate labour forces, since many Nigerian's youth have become employed in non-agricultural sectors (Ogunbile and Olukosi, 1990). The relatively low use of some selective chemicals like fungicide, bactericide, plant growth regulator and nematocide could be due to the low level of farmers' education. Most farmers in the third world countries are largely illiterate. Although, they are aware of the vital need to protect their produce from pests and save for the rainy day, yet they are uninformed of the type, quantity and method of application of the pesticides (Ogunlela *et al.*, 2005). This is particularly worrisome the high use (18.25 %) of calcium carbide despite the persisted warning against the use of the chemical either for pest control or to quicken ripening of fruits. The use of calcium carbide is being discouraged worldwide, due to associated health hazards. In our survey, we found fruit farmers and wholesalers rampantly using carbide gas to ripen a variety of fruits such as bananas, mangoes, pineapples and plantain rather than pest control. Calcium carbide treatment of food is extremely hazardous because it contains traces of arsenic and phosphorous, and once dissolved in water, it produces acetylene gas. Arsenic, phosphorous and acetylene gas may affect the different body organs and causes various health problems like headache, dizziness, mood

disturbances, sleepiness, mental confusion, memory loss, cerebral edema, seizures and prolonged hypoxia (Asif, 2012). It's highly dangerous for those consuming the product it was used on and also those handling it. Not only that it causes cancer, ulcer and other ailments but also severely impede neurological functions (Delaplane 1996). It's especially dangerous to pregnant women as the babies can develop abnormalities, which is why it must be banned in Nigeria. The popularity of spray method over other methods could be as a result of recent use of chemical herbicide by farmers whose major form of application was by spraying. Also the administration of chemical insecticide to control field pest was through spraying mostly. This development is at variance with the work of Erinle and Oyedokun (1981), Enyinnia *et al.* (1992) who reported that seed dressing chemical was the most widely accepted way of administering pesticide by farmers. The adoption of seed dressing method of administering chemical pesticide was due largely to the fact that the method is in tandem with farmers practice of dressing cut tuber and cut cassava in wood ash to control certain soil borne diseases (Erinle and Oyedokun, 1981; Enyinnia *et al.*, 1990, Daniel *et al.*, 1991). The study reveals that fumigation was mostly adopted by farmers for the control of stored produce pests than for the control of soil borne pests and diseases. Dipping method also was adopted by the farmers on cut tubers (yam setts) and cassava stem for planting against soil borne pathogen (Daniel *et al.*, 1991).

The study shows that 30 % of the chemical vendors/dealers have good knowledge of the pesticide they sale. This is unhealthy development for farmer in the state who supposes to obtain technical education from the vendors/dealers. The situation is a clarion calls to the ADP's extension worker and other relevant agents in the country to stem the tide, so that farmers can get relevant information to guide them in the safe and profitable use of

pesticide. Visit to local markets will confirm that prolific contamination of most food items has relation with the mode of sale of the chemicals by the local pesticides/ vendors, which is a potential threat to human and animal health. Indiscriminate and improper sale of pesticides by illiterate vendors without due procedure can scare people from the demand and use of pesticides (Ogunlela *et al.*, 2005).

Situation where few (19.00 %) famers obtain pesticide information through extension agents while 42.86 % of farmers obtained pesticide information through friends and other farmers is an indication that extension activities have been greatly reduced in recent time in the state. This Scenario is not healthy for farmers; as such situation could lead to mishandling of the pesticide, wrong method of application, wrong rate of application, health hazards and consequently not getting the high yield or expected result from the use of chemical pesticide by farmers. Pesticides products are usually labeled in English, which of course most farmers cannot read. The inability of users to read the directions on the package also leads to application of incorrect dosages (Dadari *et al.*, 2005). In dealing with technical input like chemical pesticide, sources of impeccable information are paramount to farmer. Access to extension and research agents can assist farmers in dealing with some technical complexities of chemical pesticides (Adesina, 1996, Nkamleu and Adesina, 2000).

Action threshold is the pest population levels at which actions needs to be taken to prevent the population from causing economic damage. The non utilization of action threshold by farmers can lead to waste of chemical, damage to the environment and increase cost of production. Low or no use of protecting clothing (overall 5 %, hand glove 3.12 %, boots 2.50 %, head cover 3.75 %, face shields Nil, safety goggles Nil, and gas mask 1.25 %) revealed the degree of exposure

of the applicator to the chemicals. This exposure could cause acute and chronic poisons to applicators. Investigation reveals that good protective clothing was not available and was often very expensive. There is wide spread dearth of information on first aid instructions in the event of poisoning and on the residual effect of the product. The 0.63% of farmers observes the wind direction before spraying was not a good development as pesticide drift can have serious economics, environmental and legal implications (Jet, 1996; Richard *et al.*, 2006). At present the marginal benefit of agrochemicals is often several times bigger than the marginal cost (Brain, 1995). (IPM), is a long standing, science based, decision making process that identifies and reduces risks from pests and pest management related strategies. However several factors influence decisions on which control strategies to use including the severity of the pest, the stage of pest development and expected impact of pest damage and the relative effectiveness of the available control methods (Richard, *et al.*, 2006).

Most of these factors suggest the need to increase the use of chemical pesticide component of (IPM) in Kogi State as this will be a fundamental part of the technology required to feed the burgeoning population of the developing countries to a higher nutritional standard with cheaply and higher quality food. This could be achieved through adequate education of farmers on proper and safe use of chemical pesticides.

However, exclusive reliance on chemical pesticide has adverse effects on the environment, such as the destruction of natural complex, water and soil pollution, and the negative effect on the non target organisms.

## CONCLUSION

The use of chemical pesticide is an important agricultural issue. Few farmers in Kogi State know and use chemical pesticide without

basic safety application principles and many know but do not use it. This study has shown that farmers can improve yields following adoption of IPM as well as maintain or increase profit by appropriately incorporate chemical control method. Most pesticide dealers/seller has little or no knowledge of the chemical they sell. The major objective of IPM is applying chemical pesticides with respect to the economic threshold, the level at which the marginal benefits of control exceed the marginal cost of control. But this study has reveals that the few farmers in Kogi State that use pesticide practices calendar spray rather than using economic threshold. This will not only damage the environment and the non target life but will reduce the profit and expected yield. The education of the farming population should be enhanced and this will forestall the misuse of agrochemicals and help famers to use pesticides judiciously. Agricultural extension services must be strengthened more sufficiently than they are now so as to perform their functions efficiently.

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