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Research Paper

Pesticides usage in Cabbage (*Brassica oleracea*) Cultivation in the Ejisu-Juaben Municipality of the Ashanti Region of Ghana

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Abstract: *One of the setbacks to cabbage production in the forest ecozone of Ghana is insect pests. These insect pests are controlled in various ways, prominent among them being the use of pesticides. The objectives of this research were to document the various pesticides used by farmers in cabbage production and assess the mode of application of the pesticides About twenty six (26) different pesticides were used by farmers to control insect pests on cabbage. Sixty-one percent (61%) of farmers mixed two or more pesticides together without considering their compatibility or active ingredients but just relied on trade names. It was also revealed that some banned chemicals (like Lindane, Endosulfans and DDT) and those not recommended for vegetables (like Akate master i.e. bifenthrin, Confidor i.e. Imidacloprid+thiamethoxam and Cocostar i.e. bifenthrin+pirimiphosmethyl) were also being used. This suggested that such farmers clearly misused pesticides which affected the quality and safety of cabbage heads for consumption. Fifty-one percent (51%) of the farmers did calendar spraying which was usually between 3-4 days interval, whereas, the rest sprayed only when they noticed the presence of insect pests. Furthermore, 79% of the farmers continued spraying pesticides during harvesting period, hence no waiting period was adopted. Only, 21% of the farmers adopted a waiting period of one week, on the average, which in itself was not enough, considering the kinds of pesticides used. The study concluded that cabbage farmers misused pesticides, in terms of the type used and the quantities applied. In addition, consumers were exposed to high pesticide residue levels due to the limited or no waiting period before cabbage heads were harvested (least safe harvesting time).*

Keywords: vegetables, banned chemicals, harvesting period, organochlorines, residue levels.

Introduction

Cabbage has traditionally been used for its medicinal properties as well as for food. It has anti-inflammatory property and contains chemicals which can prevent cancer. Food in the cabbage family inhibit the growth of breast, stomach and colon cancer due to phytochemicals (indoles) which tend to burn up the female hormones, estrogen and ward off cell changes that lead to colon cancer[1]. Cabbage has high nutritive value, supplying essential vitamins, proteins, carbohydrates and vital minerals[2]. Cabbage is known to contain water – 93ml, protein – 15g, fat – 0.2g, carbohydrates - 4g, fibre – 0.8g, calcium – 40mg, iron – 0.5, vitamin potency – 30iu, thiamine – 0.05mg, riboflavin – 0.05mg, nicotinamide – 0.3mg and ascorbic acid – 40mg[3].

Despite its medicinal and food uses, cabbage production in Ghana is beset with several constraints. These include the high cost of inputs such as pesticides, fertilizers and attack by insect pests and diseases. Caterpillars of Diamond back moth (*Plutella xylostella*), the cabbage web worm (*Hellula undulasis*) and Cabbage aphids (*Brevicoryne brassicae*) are the most serious pests of cabbage production of cabbage in Ghana. To reduce damages caused by insect pests, various synthetic insecticides are applied at different stages of growth of the plant. These synthetic insecticides have some toxicological and environmental consequences which include toxic

residue in food, soil, water, adverse effects on non- target insects and other beneficial organisms as well as the development of resistant strain of insects[4].

The gross and improper use of synthetic insecticides is an issue of much concern. Typical examples of insecticide used are Polythrine C and Cypercal. These insecticides are normally used against insect pests on cotton. It has been estimated by the World Health Organization (WHO) that about 20,000 people die each year from pesticide poisoning and at least 3 million people suffer acute health effects[5]. New evidence links organochlorines to decreased sperm count in males, birth defects, the increase in testicular cancer, and other reproductive and development effects. At least 22 organochlorines or groups of organochlorines are known to mimic or interfere with the body's hormones. The total number of organochlorines that disrupt the endocrine system is in the hundreds. Thousands of other organochlorines have not been tested[5, 6].

Pesticides are considered to be indispensable for the production of adequate food supply for an increasing world population and for the control of insect-borne diseases and so there has been a rapid rise in the quantity of pesticides used in Agriculture over the past ten years[7]. The majority of pesticides used in Agriculture in Ghana are employed in the forest zones located in the Ashanti, Brong Ahafo, Western, and Eastern regions of the country[8]. Pesticide residue in food items have been a concern to environmental and consumer groups of their wide spread use. Research has shown that diets with greater proportions of fruits and vegetables can prevent or delay a number of debilitating and life-threatening diseases. At the same time, public acceptance and adoption of these findings is being discouraged by the possible health risk associated with minute amounts of pesticide residues, sometimes found in or on these foods. The objectives of this research, therefore, were to document the various pesticides used by farmers in cabbage production and assess the mode of application of the pesticides.

Material and Methods

The research work was a field survey to assess the use of pesticides to control insect pests on cabbage production in forest ecozone of Ghana and the work was carried out in the Ejisu-Juaben Municipality (noted for cabbage production) in the Ashanti region of Ghana. Fifty (50) cabbage farmers were randomly selected from ten (10) major cabbage production communities in the municipality for interview and questionnaire administration. The ten communities were New Bomfa, Akyawkrom, Adumasa, Bomfa, Duampompo, Nobewam, Esaase, Wabiri, Peminase and Achiase.

Questionnaires administered covered among others the following areas: types of pesticides used to control insect pests in the municipality, active ingredients of the pesticides, dosage of application of the various pesticides, reasons for choosing a particular pesticides, frequency of spraying in a growing season, time of the day that spraying took place, efficiency of pesticides in terms of eliminating the insects pests, spraying intervals, safety precautions adopted, and period between last spraying and harvesting. Data from the survey were statistically analysed using the Statistical Package for the Social Scientist (SPSS version 17). The results were presented in pie charts and tables with the values in percentages.

Results and Discussion

Results of the field survey are shown in pie charts covering the sex and educational levels of respondents, as well as the assessment of pesticides used to control insect pests of cabbage and their mode of application in the forest ecozone of Ghana.

Sex and Educational Level of Farmers: Only12% of the respondents were females while the remaining 88% were males. The domination of males aged between 20 and 45 year may be because cabbage production is laborious and needs intensive care with frequent spraying of pesticides to control insect pests. Fewer people in the villages and small towns progress academically. This is reflected in the educational level of the farmers. Eighty percent (80%) of the respondents had only basic education, while 18% had no formal education. Only 2% had post-secondary education and could be teachers in the area who may be producing cabbages as way of supplementing their formal income.

Pesticides Used by Farmers to Control Insect Pest: Table 1 shows a total of 26 different types of pesticides (by trade or common name) used by farmers to control insect pests in cabbage production.The results also revealed that insecticides such as Cypercal 50 EC, Karate 5 EC, Perical 450EC, Orthene 750sp, Mektin 1.8 EC, Lambda Cyhalothrin groups (Pawa 2.5 EC, Wrecko 2.5 EC, Lambda Super 2.5 EC and Kombat 2.5 EC), Dursban 4 EC, Golan SL, Deltapaz, Dimethoate Cymethoate, Thionex 35EC and Rimon 10 EC were the most commonly used to control insect pests on cabbage production in the forest ecozone of Ghana. It was observed that quite a number of the farmers used hazardous pesticides usually used to control insect pests in cotton and often labeled in the French language suggesting that such chemicals were smuggled into the country from neighbouring countries. Also pesticides such as Cocostar, Confidor and Akate Master, which are made for the control of insect pests in cocoa plant, are often used by farmers to kill insect pests in their cabbage fields because they are cheaper and readily available on market. Again, all kinds of pesticides, whether registered or not, were being used by farmers to control insect pests. These practices also contributed to indiscriminate use of pesticides leading to the high pesticides residues in cabbage heads as was revealed in the laboratory analysis[9].

Table 1
Pesticides used by farmers in survey area to control insect pests on cabbage

Common Name (Trade Name)	Active Ingredients	Recommended interval between spraying and harvesting
Golan S L	Actemiprid	7 days
Deltapaz 2.5 EC	Deltamethrin	7 days
Cypercal 50 EC	Cypermethrin	7 days
Karate 5EC	Lambda Cyhalothrin	7 days
Pyrical 480 EC	Chloropyriphos Ethyl	7 days
Orthene 750 sp	Acephate	4 days
Pawa 2.5 EC	Lambda Cyhalothrin	4 days
Cymethoate	Cymethoate	7 days
Dimethoate	Dimethoate	15 days
Sumithion	Fenitrithrin	
Dursban 4 E	Chlopyriphos	15 days
Thionex 35 EC	Endosulphan	-
Cymthox	Fenvalerate	-
Thiodan	Endosulphan	-
Mektin 1.5 EC	Abamectin	-
Confidor 200sl	Imidacloprid	-
Diazol 50 EC	Diazion	7 days
Wrecko 2.5 EC	Lambda Cyhalothrin	15 days
Endocel	Endosulphan	15 days
Lambda Super 2.5 EC	Lambda Cyhalothrin	3 days
Attack	Emamectin benzoate	
Kombat 2.5 EC	Lambda Cyhalothrin	3 days
Actellic	Pyrimiplus methyl	-
Polythrine C	Cypermethrin + profenetos	7 days
Rimon 10 EC	Noraluran	7 days
Cocostar	Bifenthrin + pirimiphosmethyl	7 days

Mixing of Different Pesticides Together for Spraying: As many as 61% of farmers interviewed mixed two or three different pesticides together for the controlling of insect pests on their cabbage farms. The remaining 39% of the respondents used single pesticides for the control of insect pests (Figure 1). The results further revealed that farmers did the mixing without considering the effectiveness each chemical. Thus, farmers usually mixed together chemicals with the same active ingredients but different trade names. Typical example was the Lambda Cyhalothrin groups and this was a clear misuse of pesticides which would affect the health of growers and the consumers as well as the quality of the cabbage heads.

The low educational level of the farmers and the high farmer to extension agent ratio meant there was not enough technical advice and education on the use of such chemicals and so the farmers relied on friends and chemical sellers for advice.

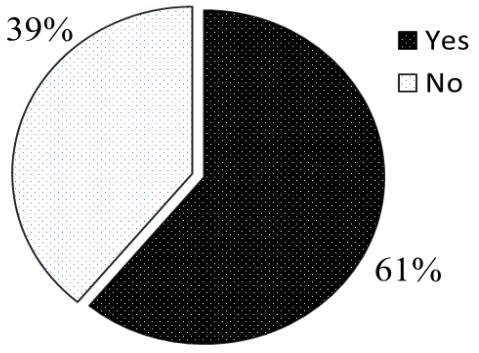

Figure 1: Mixing of different pesticides for spraying

Reason(s) for Choosing Specific Pesticides by Farmers: Figure 2 indicates the reasons for the choice of specific pesticides by farmers for the control of insect pests in their cabbage farms. Seventy-eighty percent (78%) of the farmers interviewed chose pesticides based on their availability on market in their area of operations. The 12% of the farmers chose pesticides based on their low price and the remaining 10% chose specific pesticides based on their efficient control of insects pests. Choice of specific pesticides by farmers mostly depended on the availability of them on the market, whether they were meant for vegetable production or not. In addition to the use of wrong pesticides, most of the farmers used wrong dosages of pesticides to control insect pests. The farmers mostly depend on chemical dealers and colleague farmers' instructions because many of them had no formal education or had just basic education and, therefore, could not read and understand the instructions on the labels. Some of the labels were also found to be in French.

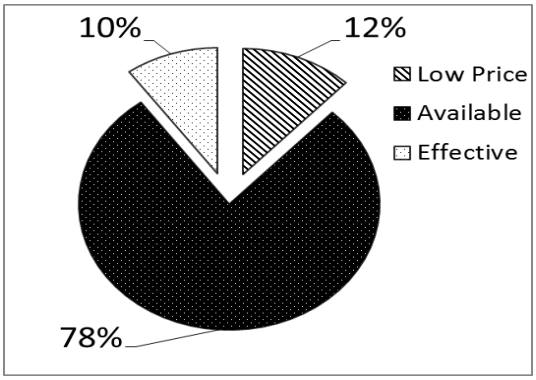

Figure 2: Reason for choice of pesticide

Factors Determining When Farmers Apply Pesticides to Control Insect Pests: Fifty-one percent (51%) of the farmers interviewed did routine (calendar) spraying of pesticides to control insect pests on their cabbage (Figure 3). However, forty nine percent (49%) of the respondents decided to spray pesticides against insect pests upon noticing their presence on their cabbage farms, whether or not the numbers of insects are at the threshold.

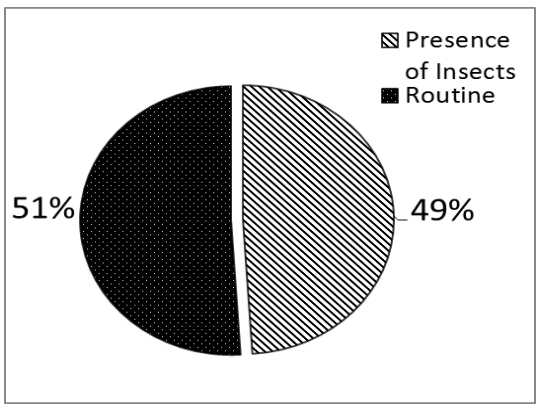

Figure 3: When to apply pesticide

Majority of farmers sprayed whenever they saw insects on the crop, whether at the threshold or insects were not pests. Even though majority of the farmers sprayed in the mornings and evenings (which are safe time of the day for spraying) the practice whereby farmers indiscriminately used any pesticides that came their way, still, meant the safety of the cabbages produced could not be guaranteed.

Frequency of Spraying Pesticides: Eight percent (8%) of the farmers sprayed pesticides between 1 and 5 times in a growing season. Majority (45%) of the farmers, however, sprayed pesticides between 11 and 15 times within a single growing season of cabbage cultivation to control insect pests' infestation. Twenty-seven percent (27%) sprayed pesticides between 16 and 20 times within a growing season of cabbage cultivation.

Those who sprayed between 6 and 10 times were 18%, while only 2.0% sprayed more than 20 times within a growing season of cabbage to control insect pest infestation (Figure 4). The study also showed that the frequency of spraying depended on the type and the dosage of pesticides used. Those who used recommended pesticides such as Rimon 10EC (Novaluron), Mektin 1.8EC (Abamectin), Deltapaz 2.5EC (Deltamethrin) and Pyrinex 48EC (Chlorpyrifos) for controlling insect pests of cabbage at recommended dosage, applied pesticides less frequently (1-2 weeks interval) than those who used non recommended pesticides and sprayed more frequently (3-4 days interval). Also, 33% of the farmers indicated that the pesticides used in controlling insect pests were very effective (i.e. 80-90% control of insect pests). Forty-one percent (41%) of the farmers, indicated that pesticides used in controlling insect pests were effective (i.e. 60-70% control of insect pests). The remaining 26% of the farmers revealed that pesticides used in their cabbage farms were moderate (40-50% control of insect pests), in controlling insect pests and so sprayed more frequently.

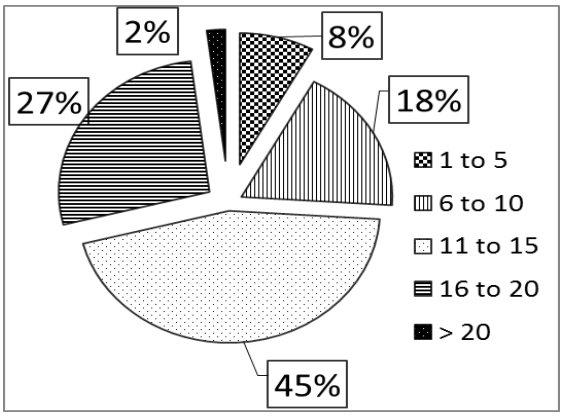

Figure 4: Frequency of spaying

Spraying Intervals and Harvesting: Forty-five percent (45%) of the farmers sprayed their crops at weekly interval. Nineteen percent (19%) sprayed at 4 days interval. Sixteen percent (16%) of the farmers sprayed at two weeks interval. Twelve percent (12%) of the farmers also sprayed at four

days interval. However, 6% sprayed at six days interval while only 2% sprayed at three days interval (Figure 5). It is worth noting that eighty percent (80%) of the farmers interviewed continued spraying of pesticides during time of harvesting cabbage heads. This led to higher residue levels on the fresh cabbages[9]. The remaining 20%, however, stopped spraying of pesticides during the time of harvesting and on the average allowed 5 days waiting period after spaying. The farmers could not wait for the safe harvest period because they did not want insect damage on crop, which reduces market price, sometimes the middle-women who sponsor them put a lot of pressure on them to harvest for them.

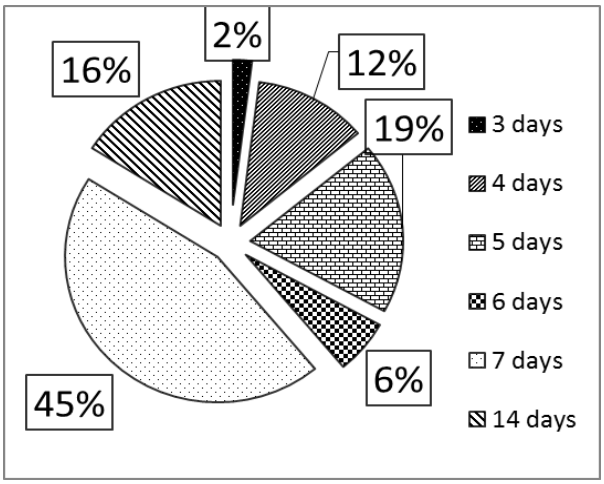

Figure 5: Spraying interval (days)

Application Dosage of Pesticides and Safety Precautions Adopted by Farmers : Figure 6 reveals that only 25% of the respondents used recommended rates of various pesticides for the control of insect pests on their cabbage farms. Majority (55%) of them, however, used dosages above the recommended rate. The remaining 20%, however, used dosages below the recommended rate of application of the various pesticides used to control insect pests on their cabbage farm.

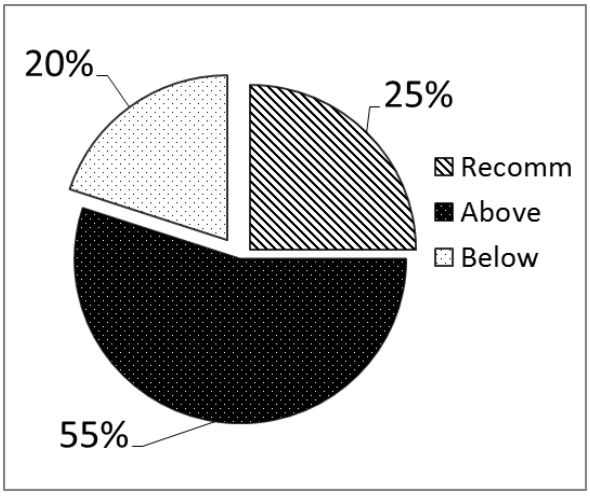

Figure 6: Dosages applied

Even though majority (67%) of the farmers indicated that they adopted safety measures, such as the use of protective clothing and nose respirators during spraying of pesticides while the remaining 33% did not adopt any safety precautions during spraying of pesticides, further questioning revealed that they actually meant using simple nose masks (sometimes wet rags or handkerchiefs), pairs of trousers and sometimes wellington boots during spraying. Most of them were also not aware of the effect of wind direction and spray drift.

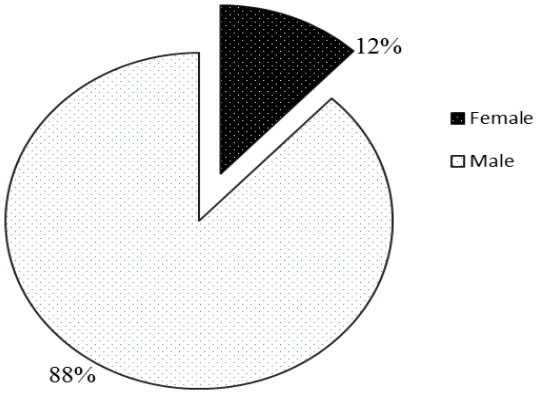

Figure 7: Educational level of farmers

Conclusion

The result of field survey revealed that as many as 26 different pesticides were used to control insect pests in cabbage production. These practices which include the use of non-recommended pesticides such as Akate master i.e. bifenthrin, Confidor i.e. Imidacloprid+thiamethoxam and Cocostar i.e. bifenthrin+pirimiphosmethyl) and banned organochlorine pesticides such as DDT, Endosulfan and lindane affected the safety and quality cabbage produced. This suggested that there is misuse of pesticides and so may affect the quality and safety of cabbage heads produced for consumption. The study concluded that cabbage farmers misused pesticides, in terms of the types used and quantities applied and the farmers themselves were not adequately protected on the job. In addition, consumers were exposed to high pesticide residue levels due to limited or no waiting period before cabbage heads were harvested. To mitigate the identified problems, stakeholders such as Ministry of Food and Agriculture, EPA and Associations of Agrochemical Dealers must form a common platform to combat the importation and smuggling of banned pesticides into the country and intensify the education, training and information dissemination activities on pesticides and their residual effects in all the farming communities in the country, especially communities noted for the production of vegetables. This would help minimize the mishandling and misuse of pesticides which is becoming a health threat to both consumers and growers.

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