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Pesticide use in the production of Tomato (*Solanum lycopersicum* L.) in some areas of Northern Ghana

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Tomato (*Solanum lycopersicum* L.) is a very important vegetable used in almost all meals and is consumed in diverse ways. In Ghana, farmers and consumers of fruits and vegetables face immense risk of exposure owing to the use of toxic chemicals that are banned or restricted in the country or in other countries. The objective of this study was to ascertain farmers' access and use of recommended agro-chemicals for the production of tomatoes in three sampled farming communities in Northern Ghana. Sixty semi-structured questionnaires were administered and data analysed using Minitab Statistical package with T-test for significance. Various agro-chemicals were used by farmers which include: those not suitable for tomatoes production; unapproved or banned agro-chemicals and those suitable for tomatoes production. Communities which produced the "Burkina" variety used about 70% of the sampled pesticides compared with 30% for the "Wosowoso" variety. The agro-chemical most used (32.8%) was Dichlorodiphenyltrichloroethane (DDT) though banned from the Ghana registered list of pesticides. Farmers have access to, and use agro-chemicals for tomato production in the study areas. Farmers therefore need to be sensitized on the use of recommended and appropriate agro-chemicals and the hazards associated with the use for the crop, farmer and environment.

Key words: Banned, food safety, growth regulators, organochlorines, pesticides, tomato.

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is a plant species from the Solanaceae family, which originated from the Americas. Like its close relatives, chili peppers and potato, tomato was probably introduced to Africa in the 16th century (Esquinas-Alcazar, 1981). Although definitive statistics on area and production of most crops are not readily available for many African countries, tomato is one of the most widely cultivated vegetable on the continent. The total production area in Africa increased from 159,593 ha in 1961 to 660,215 ha in 2007, and quantities produced increased from 1,968,812 tonnes in 1961 to 14,918,554 tons in 2007 (FAO, 2009). According to FAO (2009), the largest area and the highest production in Africa are found in Northern Africa,

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including Egypt, Morocco, and Algeria, and the smallest area and the lowest production in Southern and Central Africa, respectively (FAO, 2009). The average yields range from 6 t/ha in Central Africa to 34 t/ha in Southern Africa, with the southern region higher in productivity mainly because of South Africa (FAO, 2009). There has been an increase in area and production in individual countries over the past 50 years, but at different rates; productivity largely remained low. In Tanzania, the area increased from 1,400 ha in 1961 to 19,000 ha in 2007, but yield remained stagnant between 7.1 to 7.6 t/ha (FAO, 2009).

According to MoFA (2012), the total land size used for the production of tomato is 44.8 ha while 62.8 ha of land is used for the production of other vegetables in Ghana. Aside this large area of land used for the production of tomato, tonnes of tomato is imported from neighboring countries such as Burkina Faso and Togo to meet the demand for tomatoes. FAO (2015) estimated a produced quantity of 320,500 tonnes with a domestic quantity supply of 630,893 tonnes, an export of 4,828 tonnes and an import of 315,221 tonnes for tomato and tomato products in Ghana for the year 2011.

Tomato is a very important vegetable used in almost all meals either cooked or uncooked. The fruit may also be processed into juice, soup, ketchup, puree, paste or powder.

In Ghana, farmers and consumers of fruits and vegetables face immense risk of exposure owing to the use of toxic chemicals that are banned or restricted in the country or in other countries (Nasr et al., 2007). Wrong application techniques and time of spray of fruits and vegetables, badly maintained or totally unsuitable equipment and agrochemicals exacerbate these risks of residual deposition (Al-Wabel et al., 2011). Some agro-chemical residues in vegetables may however, be unavoidable even when sprayed in accordance with good agricultural practices (Uysal-Paha and Bilisli, 2006).

Research conducted for the past decade internationally and in Ghana points to the presence of pesticide residues in fruits and vegetables such as cabbage, onion, cucumber, lettuce, tomatoes, okra and pepper (Hanson et al., 2007; El-Nahhal, 2004; Hussain et al., 2002). Most of these pesticide residues are often classified as organochlorines or organophosphates with a preference for the organophosphorus for been less persistent, does not often bio accumulate, and are less hazardous to the farmer, consumer and environment.

Organochlorines are considered persistent organic pollutants (Pops), a category of chemicals that include nine organochlorides (aldrin, chloradane, DDT, dieldrins, endrin, heptachlor, hexachlorobene, mirex and toxphen) targeted by Stockholm convention in May 2001 which was aimed to eliminate their production and restrict or ban their use throughout the world (Lemairie et al., 2004). This can be explained in part by the long life of many organochlorines in the environment (dieldrins, DDT and its metabolites (DDD and DDE) can remain in the soil for decades) and long distance transport in wind and water current as well as food imports from countries that continue to use these pesticides. Inhalation and dermal contact are additional routes of exposure, both for individuals working directly with the pesticides and for children who are exposed to pharmaceuticals products, containing organochlorines such as head lice treatments. Infants are also exposed when organochlorine pesticides that have accumulated in their mother's bodies are passed to them in breast milk.

A higher proportion of pesticide poisonings and deaths occur in developing countries because there are inadequate protective clothing, and washing facilities; insufficient enforcement; poor labelling of pesticides; illiteracy; and insufficient knowledge of pesticides concentration in vegetables (Pimentel and Greiner, 1996). The objective of this study was to ascertain farmers' access and use of the recommended agro-chemicals for the production of tomatoes.

MATERIALS AND METHODS

Study area

Farmers were sampled from Pungu and Doba in the Kassena Nankana East District of the Upper East Region and Bunglung in the Savelugu/Nanton Municipality of Northern Region. These communities were sampled based on their dry season production of tomatoes which supplies the major cities such as Bolgatanga and Navrongo in the Upper East Region and Tamale in Northern Region when the supplies from the Southern part of Ghana are out of season. Farmers in Pungu and Doba produce the "Burkina" variety while farmers in Bunglung produce the variety "Wosowoso".

Data collection and analysis

Data was collected using semi-structured questionnaire, field visits, and interviews for farmers while one agro input shop per community was visited for the agro input market survey. Sample size of thirty farmers was used for each district and data analysed using T-test for significance in Minitab version 16. Secondary data on the pesticide register was accessed from the Environmental Protection Agency, Ghana in the identification of recommended, registered and banned pesticides.

RESULTS AND DISCUSSION

Pesticide used by farmers and availability

All sampled communities had a point of sale for agro-chemicals which were medium to small-scale. Various agro-chemicals and growth regulators were in use by farmers from the three sampled areas (Table 1). From Table 1, farmers used a combination of agro-chemicals suited for tomatoes, agro-chemicals not suited for tomatoes, unapproved and banned agro-chemicals affirming the assertion that consumers are exposed to

Table 1. List of agro-chemicals in use by farmers.

Chemical	%
***Dichlorodiphenyltrichloroethane (DDT)	32.8
Top Cop	18.8
Confidor	10.9
*Super force	9.4
*Harvest more	6.2
Kocide	4.7
*Grow force	3.1
Sulfa 80 WDG	3.1
Zap 2.5 EC	3.0
*Top harvest	1.6
Kombat	1.6
Lambda 25 EC	1.6
*Sidalco liquid	1.6
**Neem extract	1.6
Total	**100**

*Agro-chemicals not found on the EPA's register of pesticides; **Plant extract; ***Banned.

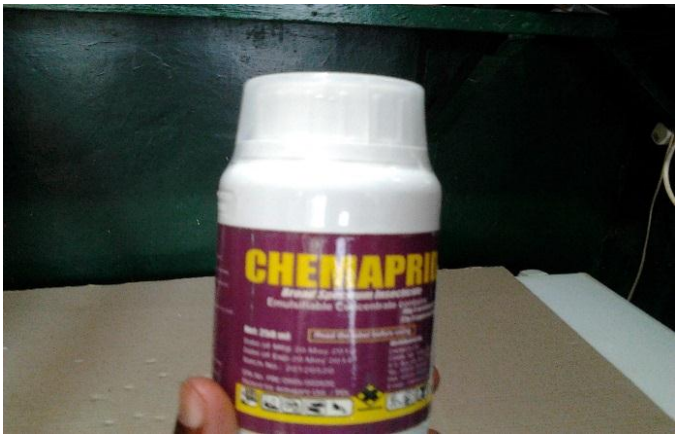

Figure 1. Chemaprid, a broad-spectrum insecticide sold to farmers as DDT.

pesticide residues through the consumption of tomatoes (Essumang et al., 2007). Communities which produced the "Burkina" variety used about 70% of the sampled pesticides compared with 30% for the "Wosowoso" variety.

The most used agro-chemical (32.8%) was Dichlorodiphenyltrichloroethane (DDT) which was classified as banned (EPA, 2013) and farmers did not believe DDT was banned. A follow-up visit to the agro-chemical shops further indicated that DDT was sold to some farmers in "second hand" containers unlabelled per the quantity of chemical required. It was also found that some agro-chemical outlets sell out broad-spectrum chemicals (Figure 1) to unsuspecting farmers as DDT, without considering the target crop.

This could be termed as causing economic fraud on users due to users' ignorance and inability to read the information on the label. About 50% of farmers disagreed DDT was banned for agricultural use. From a total of 13 agro-chemicals used in the study areas, five excluding the neem extract are approved and recommended (Zap 2.5 EC, Top Cop, Sulfa 80 WDG, Lambda 25 EC and Kombat) for tomato production. Confidor an insecticide for controlling capsid, bugs and insect pests in cocoa pods and Kocide 2000 a fungicide for the control of diseases in cocoa were found in use for tomato production in some sampled areas accounting for 10.9 and 4.7% respectively.

This could be considered as pesticide "misuse" even if it controlled the target disease or pest effectively as the two crops are physiologically varied and are processed and used differently. In addition, the Kocide was labelled as "packaged for Cocobod – Not for sale" (Figure 2), but found its way to the input sellers.

Growth regulators such as grow force, harvest more, sidalco liquid, super force and top harvest could not be found on the pesticide register but were used by farmers and were readily available at some agro-chemical shops. It was found that only pre-harvest pesticides were used in their production. It was also found that plant based control pesticides such as neem extract was not commonly used by farmers. Farmers argued that its preparation was tedious and time consuming.

Pesticide application practices

The stages for application of chemicals were not being followed by farmers. Chemicals were sometimes applied when diseases and pests/insects appear, and when produce are almost ready to be harvested. About 50% of the farmers often mix two or more agro-chemicals with the perception that it will ensure high efficacy. This practice can be attributed to the farmers' educational background as about 60% were not educated and did not know the health implications of using non recommended chemicals, application dose, time of application and the lethal phase before consumption. Surprisingly, 30% of farmers had separate plots for tomato production for their household use, where they do not apply agro-chemicals used for their commercial tomato farmlands. The farmers attributed the use of pesticides on their commercial tomato for public consumption based on the fact that consumers preferred good looking fruits at the point of sale. About 80% of farmers applied pesticides without protection (personnel, equipment, chemical and environment) and did not consider the time for most applications while 40% kept unused chemicals in bed rooms and kitchens for future use confirming with Al-Wabel et al. (2011). Most farmers derived and updated their knowledge and skills from friends, their continuous

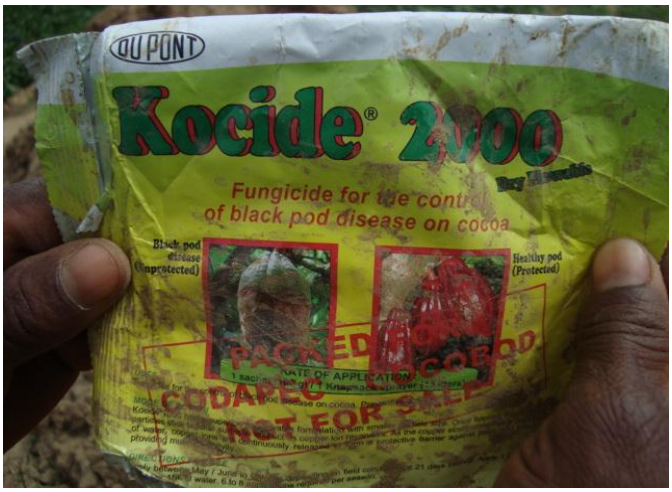

Figure 2. Used Kocide pouch left on the farm.

production and the use of the chemicals based on trial and error.

CONCLUSION AND FUTURE IMPLICATIONS

Farmers have access and are using agro-chemicals for tomato production in all three sampled communities with pesticides, weedicides and growth regulators been the most used. Most of these agro-chemicals were however, not meant for the cultivation of tomato nor vegetables and could result in the accumulation of pesticide residues. About 50% of the agro-chemicals in use were not found in the EPA's register of pesticides which sends a very worrying situation as to how these pesticides found their way onto the market. DDT, though banned could be found on the market in concealed "second hand" packaging materials and unlabelled while some farmers were been short-changed by agro-chemical dealers by selling out, general broad-spectrum agro-chemicals as DDT. Many farmers did not know that DDT was banned for some time now. Most farmers applied agro-chemicals without protection and kept pesticides in bed rooms and kitchens for future use.

To curb these problems associated the use of pesticides, input dealers, extension agents and farmers must be educated on the hazards related to the use of pesticides to themselves, the crops, consumers and the environment as a whole. Input dealers must engage qualified personnel who can provide technical and agronomic assistance to farmers in selecting the right type of chemical, applying them in right quantities and at the right time. Authorities with the responsibility to regulate the use and misuse of agro-chemicals must be proactive and check the influx of these banned chemicals on the market in order to save human lives, the environment and to prevent economic fraud on farmers.

The extension services division must be resourced to ensure extension agents recommend suitable agro-chemicals and also be able to reach out to farmers. The creation of plant clinics in communities will help farmers identify problems with crops and access professional solutions which would help reduce agro-chemical use and abuse in the farming communities in Ghana. A check list of approved and banned agro-chemicals should be supplied to input dealers and farmer groups.

Conflict of Interests

The authors have not declared any conflict of interests.

REFERENCES

Al-Wabel MI, El-Saeid MH, Al-Turki AM, Abdel-Nasser G (2011). Monitoring of Pesticide Residues in Saudi Arabia Agricultural Soils. Res. J. Environ. Sci. 5:269-278.

El-Nahhal Y (2004). Contamination and Safety Status of Plant Food in Arab countries. J. Appl. Sci. 4:411-417.

EPA (Environmental Protection Agency) (2013). Revised Register of Pesticides as at 30th June, 2013 under Part II of the Environmental Protection Agency Act, 1994 (Act 490).

Esquinas-Alcazar JT (1981). Genetic Resources of Tomatoes and Wild Relatives – a Global report. International Board for Plant Genetic Resources, Food and Agriculture Organization of the United Nations, Rome 65 pp.

FAO (Food Agriculture Organisation) (2009). FAOSTAT/FAO Statistics Division. Available at: http://faostat.fao.org (Accessed: 31 March 2013)

Hanson R, Dodoo DK, Essumang DK (2007). The effect of some Selected pesticides on the growth and reproduction of fresh water *Oreochromis niloticus*, *Chrysicthys nigrodigitatus* and *Clarias griepings*. Bull. Environ. Contam. Toxicol. 79:544-547.

Hussain S, Masud T, Ahad K (2002). Determination of pesticides residues in selected varieties of mango. Pak. J. Nutr. 1:41-42.

Lemaire G, Terouanne B, Mauvais P, Michel S, Rahman R (2004). Effects of Organochlorine Pesticides on Human Androgen Receptor Activations in Vitro. Toxicol. Appl. Pharmacol 196:235-246.

MoFA (Ministry of Food and Agriculture) (2012). Production Summaries Available at: http://mofa.gov.gh/site/.

Nasr IN, Sallam AAA, Abd El-Khair AA (2007). Monitoring of certain Pesticide Residues and some Heavy Metals in fresh Cow`s Milk at Gharbia Governorate, Egypt. J. Appl. Sci. 7:3038-3044.

Uysal-Paha C, Bilisli A (2006). Fate of endosulphan and delmethrin residues during tomato paste production. J. Central Eur. Agric. 7:343-348.