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ASSESSING THE USE OF CHEMICALS BY VEGETABLES GROWERS WITHIN THE TAMALE METROPOLIS

BY

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Abstract

The study was conducted in the Tamale Metropolis to assess the use of chemicals by vegetables growers. It has come to the realization that most vegetables farmers or growers within Tamale and Ghana as whole cannot cultivate vegetables within the use of agro chemicals.

This research was conducted basically in Tamale which is an emerging Metropolis with many expatriates and almost all people from every part of the country moving to Tamale. This has brought a surge in the demand for vegetables for various uses.

Vegetables farmers or growers in order to meet the surge in demand for vegetables employ all accepted and unacceptable means to produce more vegetables. The study brings to bear the level of education, sex, socioeconomic background and farmers' knowledge in the use of agro chemicals.

Agrochemical acquisition on the market and what most governing bodies are doing to prevent overuse of these agrochemicals and the needed training that is required for most of these vegetables farmers in order to produce vegetables of international standards.

Keywords: vegetables, edible portions, roughages, balanced diet, employment.

INTRODUCTION

The term Vegetable comes from the Latin word vegetabilis which means the process of a plant growing (Wikipedia, 16/10/2020). Vegetable is defined as the succulent edible plant parts that may be eaten as supplementary foods or side dishes in the raw state or in the cooked form, alone, with meat or fish in stew, soup, and various preparations (Stephens, 2005).

Vegetables may be sweet, aromatic, bitter, hot, tasteless, and sometimes requiring salting and considerable seasoning to render them more tasty and acceptable (Wertz, 2013). Different edible portions of plants are used as vegetables such as flower buds (Cauliflower), leaves (Lettuce), roots (Carrots), bulbs (Onions), fruits (cucumber), and stems (Ginger) as exotic ones.

Some of the indigenous vegetables include okra (fruits), a yoyo (*Corcorus olitorius*), and allefu (*Amarantus*). Vegetables provide some nutritional values to ensure a balanced diet.

Some of the nutrition obtained from vegetables includes vitamins, minerals, iron, calcium, and phosphorus (Welbaum, 2015). Vegetables are a source of roughages which stimulate intestinal muscle to avoid constipation. The fibre content of vegetable adds to the bulk of the food which prevents the consumer from becoming hungry (Adegbau, 2020).

Vegetable production offers employment to the majority of the people in the Tamale Metropolis, especially during the dry season (Obuobie, 2006).

Tamale, the administrative capital of the Northern Region is a fast-growing city with a population of six hundred and seventy-two thousand (672,000) (GSS, 2020) and a growth rate of 4.67% per annum (G.S.S., 2020).

This growth in population and associated infrastructural development has led to the town's advancement from Municipality to Metropolitan status (Daily Graphic, 2003).

This has led to increase demand for food and other commodities, especially vegetables.

The Metropolis is host to a number of Europeans and other expatriate communities as well as other affluent Africans who can afford the vegetables. It is therefore important that vegetable production should be characterized by high and stable yield, good quality (texture, appearance, flavor, taste and smell, safety and nutritive value, and long shelf life) to match the increasing human population.

To meet this ever-increasing demand for vegetables, there is the need for appropriate chemical usage (application of fertilizer and insecticides) for soil management and crop protection. It is in view of this that the study ought to assess the use of chemicals by vegetable growers within the Tamale Metropolis.

LITERATURE REVIEW

TYPES OF FERTILIZER

Any substance that is added to soil to supply one or more plant nutrient and intended to increase plant growth is a fertilizer (Duke et al, 2012).

The two main types of fertilizers are organic and inorganic Fertilizer (Duke et al, 2012).

Organic fertilizers, examples of which are manure, wood ash, compost, green manure are general soil amendments. They neither burn nor harm vegetables and have a long positive effect on the soil without any harm to the groundwater (Duke et al, 2012). Organic fertilizers are composed mainly of wastes and residues from plant and animal life. (Duke et al, 2012).

Inorganic fertilizers are usually simple chemical compounds made in a factory or obtained by mining which supplies plant nutrients and are not residues of plant and animal life (Duke et al, 2012). Inorganic fertilizers are chemical additives that are designed purposely for plants to absorb (Mayer, 2018). Examples of those inorganic fertilizers include muriate of potash, aluminum sulphate, NPK, etc. The three most essential nutrients that are mostly required and used by plants are nitrogen, potassium, and phosphorous (Mayer, 2018). These elements nitrogen, phosphorus, and potassium are the three elements usually sold in fertilizers (Duke et al, 2012).

TYPES OF MANURE

The peasant farmer knows that organic matter means manure and is in the form of poultry or sheep manure (Cliffelf, 1992). Animal manure and green manures are the two main classes of manure in soil management (Crow, 2010). Crops grown for green manure are ploughed back into the soil to increase fertility. Examples of crops used for green manure are mostly leguminous crops such as clover, alfalfa, and beans. Animal manure is mostly droppings of herbivores such as sheep, goat, cattle, and poultry. It also includes plant materials used as bedding for animals which are laced with droppings and urine (Cliffelf, 1992).

Arnika and Amans (2011) said that after five years of incorporating poultry litter at an annual rate of 110g/ha the bulk density of the ploughed layer of a loamy clayey soil reduces. Manure from cattle has been shown to improve soil aggregation (Dittoh et al, 2012). Gale et al (2006) also reported that animal manure reduces bulk density of soil and improves water holding capacity of soils.

Application of cattle manure would not require any further application of chemical fertilizer as the most essential nutrient needed by the plants are readily available in large and adequate quantities from the cattle manure (Gale et al, 2006)).

Agricultural by-product application such as pito mash etc. on the land has been shown to improve soil physical properties. There are also several reports and research that describe studies in which animal manure has no effect on some physical properties of the soil (Gale et al, 2006). The nutritive content of manure varies from one animal to the other.

HISTORY OF CHEMICAL (INSECTICIDES AND FERTILIZERS)

According to modern history, chemical insecticide usage started in the United States dates from 1867 when Paris green proved effective on the Colorado potato beetle. Within a decade Paris green and kerosene oil emulsion were being employed against a variety of chewing and sucking insects (Blanke, 2019).

In the beginning part of the 20th century, plant-derived insecticides and fluorine compounds were developed. With the exception plant derivatives such as pyrethrum rotenone and nicotine, early insecticides were almost all inorganic chemicals (Blanke, 2019).

In 1939, the discovery of the insecticides DDT (Dichloro Diphenyl Trichloroethene) a synthetic organic compound led to the discovery and search of thousands of organic molecules in a search for potent chemicals (Blanke, 2019).

Presently hundreds of chemical insecticide agents are registered by the United States Environmental Protection Agency and license issued for more than ten thousand (10000) formulations. In the 1920s insecticide use in the United States promoted concerns over residues in food stuffs and calls for regulation (Bokhtair, 2005).

In 1960s with increased worldwide interest in environment protection, chemical insecticides become object of scientific and popular protest. Critics charged that chemical insecticides were dangerous and provoked the development of resistance by target pests, sabotaging ecological systems, and poisoning people and other organisms as well as the environment.

In reaction to this, government have restricted or prescribed many of the dangerous insecticides including many chlorinated hydrocarbon standbys: benzene, DDT, hexachloride, linden, aldrine, dieldrine, chlorclane heptachlorendrin, and all-powerful broad-spectrum contact and stomach poisons (Larramendy, 2006).

Chemists have now invented alternative insecticides that attack selectively instead of indiscriminately and that break down into nontoxic substances in the environment.

TYPES OF INSECTICIDES

Insecticides may be organic and inorganic. Some organic insecticides are rotenone, nicotine, and pyrethrums whilst others are synthetic or inorganic such as chlorinated hydrocarbons (example; DDT, dieldrine, carbonates related to urea such as carbofuran, carbarel), organic phosphorus esters, and parathions. Inorganic insecticides include arsenic, lead, and copper compounds (Larramendy, 2006)

It is reported that synthetic insecticides have toxicological and environmental problems which include residue in food, soil, and water, its adverse effect on non-target insects and other beneficial organisms, and development of resistant strains of insects. Neem extract from Neem leaves and Neem seeds have been tested during the last two (2) decades for use as a natural insecticide (Locke, 1990)

Locke (1990) indicated that general Neem extract is known to disrupt or inhibit the development of insect egg, larvae, and pupae and to prevent molting of larvae or nymphs.

He reported that sexual communication and mating may be interrupted by repelling the adult insect and even if mating occurs, the female may be deterred from producing eggs.

He further stated that non-synthetic insecticides such as neem extract is broad-spectrum in activity degrade rapidly into harmless metabolites and leaves no residue in the environment when they are applied.

INSECTICIDES CLASSIFICATION

Classifications of insecticides are based on their mode of action, type, and particular insect on which it is capable of killing (Hayo, 1996). On their mode of action, insecticides are classified as stomach poisons, contact poisons, residual poisons, systematic poisons, repellants, fumigants, attractant insect growth regulators, and pheromones.

Stomach poison is applied to plants so that they will be ingested as insects chew the leaves. Contact poison attack insects directly and is used to control species which obtain food through piercing leaves surfaces and sucking liquids (Hayo, 1996).

Residual insecticides are applied to surfaces of plants so that insects touching on them will pick up lethal dosages. Systematic insecticides are applied to plants or animals and are absorbed and transported to all parts of the organisms both plants and animals so that when insects feed on them will obtain lethal loses.

Repellents are used to prevent insects from closely approaching their host. The insecticides attractants cause insects to come to a specific location in preference to normal food source (Metcalf and Luckman 1990).

Fumigants are mostly applied as gas or in the form which vaporizes into a gas so that they can enter the insect's respiratory systems (Hayo, 1996).

Classification of insecticides is grouped according to a particular stage of the insect on which is capable of controlling as larvicides, ovicides, and adulticides (Hayo, 1990). This is so because insect development progresses through several distinct stages during their life cycle (Hayo, 1990).

For instance, ovicides are used against the egg stage of insects, and adulticides are used for all forms of matured insects.

Some of the classifications of insecticides are based on the type of insect which it is capable of controlling such as acaricides for the control of spider, mites, and aphidicides for the control of aphids (Hayo, 1990).

CONTROL OF PESTS

The ability of a vegetable grower to effectively control pest is the foundation of his success in the business. Butterflies, larval stages of moths, mite, cricket, grasshopper, ants, and snail are the major pests that draw the attention of the farmer.

Pest can be controlled biologically through the use of enemies of the insects such as disease-causing bacteria, spiders, predators, and parasitic insects as well as birds. They can also be controlled physically through the use of traps, scarecrows, etc. It can also be done through biological, physical, and mechanical means.

COMMON PEST FOUND IN VEGETABLE PRODUCTION IN GHANA

Some of the pest found with vegetables in Ghana includes some of the following, butterflies, crickets, grasshopper, ants, snails, caterpillars, and other conspicuous insects. Some of the pest includes whiteflies, leaf miner flies, diamond black moth, aphids, thrips, termites, worms, and beetle. (Hayo, 1990).

COMMON CHEMICALS USED IN VEGETABLE PRODUCTION IN GHANA

These include karate, acetastar 46EC, plan D, termicot,cypercot, cyperdicot, FastTrack boost xtra, etc. All these are sold at various agrochemical outlets within the Tamale Metropolis.

COMMON PEST AND THE VEGETABLE IT AFFECTS

Tomato is affected by leaf miner flies, white fly, bugs, etc.

Cabbage is attacked by diamond black moth, aphids, beetle, etc.

Onion is affected by thrips, worms, and beetles.

Pepper is attacked bug, mosquito, termites, and beetle.

METHODOLOGY

A baseline survey was carried out in some selected major vegetable-growing areas within the Tamale Metropolis. The survey took place from July -October 2020 to access the application of agrochemicals by farmers.

This was accomplished by administering questionnaires to vegetable growers. In all sixty (60) farmers were interviewed. A pre-test of the questionnaires was done before the final sixty questionnaires were administered.

The Northern part of Ghana is located between latitude 8° - 11°N and longitude 0° - 3°W. It is administratively divided into Upper East, Upper West, and Northern Region.

The administrative capital of the Northern Region is Tamale and by far the biggest town in the Region.

DESCRIPTION OF THE STUDY AREA

About 80% of the people in the region depend on farming for their livelihood. Agriculture is mostly rain-fed and has the potential for irrigation though limited. The vegetation cover the study area of the Guinea Savannah woodland that is basically of trees of varying sizes and density, dispersed in a ground cover of tall perennial bunch of grasses and associated herbs.

The soil is mostly laterite with a texture of mainly silt or sandy loam. In Northern Ghana, the rainfall pattern is unimodal with an annual rainfall of 1100mm, and occurs over 95 days of rain. The rains start in March/April, reaches its maximum in August, and the declines to a complete stop in mid-November. Maximum day temperature ranges from 33°C between November and February and minimum temperature of 20°C to 23°C in January to October.

The survey is included six suburbs in the Tamale Metropolis namely Water Works, Sangani, Gumbihini, Zagyuri, Bilperla, and Vitim.

AGE DISTRIBUTION OF FARMERS

AGE (YEARS)	NUMBER OF FARMERS	PERCENTAGES
20 - 29	16	40.00
30 - 39	13	32.50
40 - 49	09	22.50
Above 50	02	05.00
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

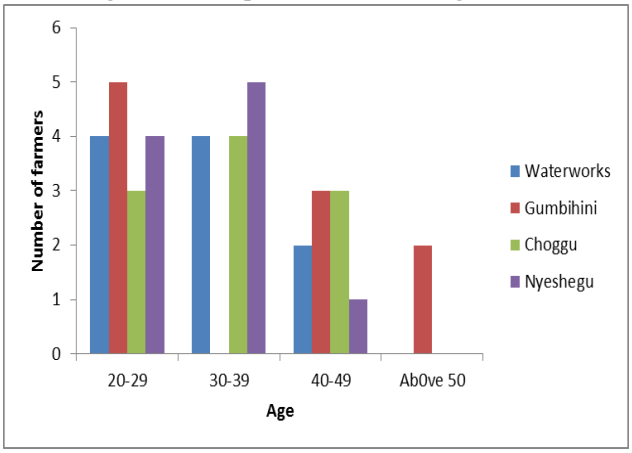
The table above shows that majority of the farmers are between the ages of 20 – 49. The survey revealed that vegetable farmers within the study area are males.

Females only come in to assist their husbands when the farm work become too much or they are not around.

	20 - 29	30 - 39	40 - 49	Above 50
Waterworks	04	04	02	00
Gumbihini	05	00	03	02
Choggu	03	04	03	00
Nyeshegu	04	05	01	00
Total	**16**	**13**	**09**	**02**

Source: Field Survey, 2020

FIG 1: Diagrammatic representation of the ages of the farmers

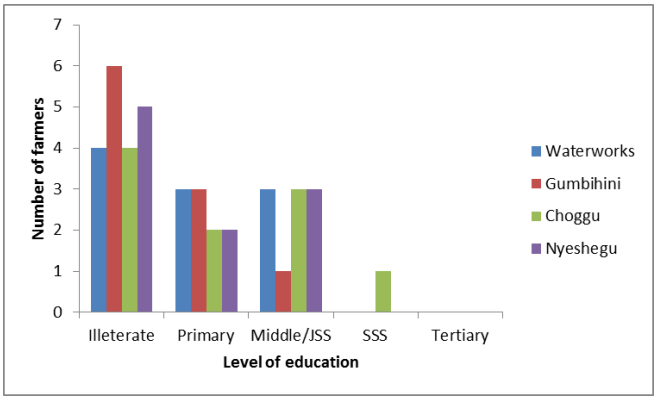


LEVEL OF EDUCATION

	Illiterate	Primary	Middle/JHS	SSS	Tertiary
Waterworks	04.0	03	03	0.0	00
Gumbihini	06.0	03	01	0.0	00
Choggu	04.0	02	03	1.0	00
Nyshesgu	05.0	02	03	0.0	00
TOTAL	19.0	10	10	1.0	00
PERCENTAGE	**47.5**	**25**	**25**	**2.5**	**00**

Source: Field Survey, 2020.

FIG 2: Diagrammatic representation of level of education of the farmers



From the above table and diagram, it shows that majority of the farmers have low level of education and this has contributed mostly to mis-application of chemicals by these vegetable farmers.

AVERAGE ACRES UNDER CULTIVATION

AVERAGES	NUMBER OF FARMERS	PERCENTAGES
200-299m	12	30.00
300-599m	15	37.50
600-899m	08	20.00
2000m and above	05	12.50
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

The table above shows that most of the farm sizes ranges from backyard garden to half an acre. Farmers who cultivate exotic vegetables normally make beds whilst those into indigenous vegetables mostly plant direct on the soil. Most of the measurement is done through improvisation by the use of feet and eye measurement.

SOURCE OF WATER

SOURCE OF WATER	NUMBER OF FARMERS	PERCENTAGES
Dugout	05	12.50
Well	15	37.50
Rainfall	20	50.00
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

Majority of farmers depend on rainfall for their vegetable production and a few depend on supplementary source of water. This is the reason why vegetables are expensive especially during the dry season due to lack and shortage of water.

TYPES OF VEGETABLES CULTIVATED

TYPE OF VEGETABLE	NUMBER OF FARMERS	PERCENTAGES
Cabbage	06	15.00
Lettuce	03	07.50
Pepper	03	07.50
Tomatoes	05	12.50
Carrot	02	05.00
Okra	02	05.00
Garden eggs	02	05.00
Amaranthus	08	20.00
Ayoyo African spinach(bra)	02 07	05.00 17.50
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

The distribution shows that about 20% of the farmers cultivate “amaranthus” popularly known as “alefu” followed by cabbage and other vegetables.

MANAGEMENT PRACTICES

TYPE OF MANURE USED BY THE FARMERS

TYPE OF MANURE	NUMBER OF FARMERS	PERCENTAGES
Poultry manure	30	75.00
Sheep/goat manure	10	25.00
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

Every farmer uses manure, poultry manure recorded the highest number of users.

TIME OF DAY FOR MANURE AND FERTILIZER APPLICATION

TIME	NUMBER OF FARMERS	PERCENTAGES
Morning	15	37.50
Afternoon	05	12.50
Evening	20	50.00
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

Majority of the farmers apply manure and most chemicals during the evening. About 37.50% in the morning and 50% in the afternoon.

TYPES OF CHEMICAL FERTILIZERS USED BY THE FARMERS

TYPE OF FERTILIZER	NUMBER OF FARMERS	PERCENTAGES
NPK	15	37.50
Sulphate of ammonia	05	12.50
Foliar fertilizer	10	25.00
Pesticides	10	25.00
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

Among the farmers who use chemical fertilizers, about 37.50% use N.P.K. Chemical fertilizer usage depends on the type of vegetable crop being cultivated.

METHODS OF CHEMICAL APPLICATION

METHOD	NUMBER OF FARMERS	PERCENTAGES
Broadcasting	30	75.00
Placement	10	25.00
TOTAL	**40**	**100.00**

Source: Field Survey, 2020

It is recorded from the above table that 75% of the farmers used broadcasting method and 25%used placement for their manure and chemical fertilizer application.

CROP PROTECTION PRACTICES
TRAINING IN VEGETABLE PRODUCTION

COMMUNITY	YES	NO
Waterworks	03	07
Gumbihini	04	06
Choggu	02	08
Nyeshegu	01	09

Source: Field Survey, 2020

From the table, it was revealed that 75% of the vegetable farmers have no training in vegetable production whilst 25% had training in vegetables.

USE OF FERTILIZER

	DO YOU USE	FERTILIZER	TYPE OF	FERTILIZER	
COMMUNITY	YES	NO	ORGANIC	INORGANIC	BOTH
Waterworks	05.00	05.00	07.00	00.00	03.00
Gumbihini	09.00	01.00	08.00	01.00	01.00
Choggu	09.00	01.00	09.00	01.00	00.00
Nyeshegu	10.00	00.00	10.00	00.00	00.00
TOTAL	**33.00**	**07.00**	**34.00**	**02.00**	**04.00**
PERCENTAGE	**82.50**	**17.50**	**85.00**	**05.00**	**10.00**

Source: Field Survey, 2020

TYPES OF INSECTICIDES USED BY THE FARMERS

TYPE OF INSECTICIDES	NUMBER OF FARMERS	PERCENTAGES
PAW 2.5 EC	10	28.57
LAMDA SUPER 2.5 EC	20	57.14
KARATE	05	14.29
TOTAL	**35**	**100.00**

Source: Field Survey, 2020

The above tables show the types of insecticides and fertilizers used mostly by the farmers during the survey and administrating of the questionnaires.

FREQUENCY OF INSECTICIDES APPLICATION

NUMBER OF TIMES	NUMBER OF FARMERS	PERCENTAGES
1	07	20.00
2	10	28.57
3	09	25.71
4	09	25.71
TOTAL	**35**	**100.00**

Source: Field Survey, 2020

The above table showed that 52% of the farmers are able to apply insecticides up to three (3) times and above whilst 48% apply once or twice in a day before harvesting.

WAYS OF CALIBRATING CHEMICALS FOR SPRAYING

TYPE OF INSECTICIDES	RATES OF APPLICATION	NUMBER OF FARMERS	RECOMMENDED RATE OF APPLICATION
Pawa 2.5 EC	25ml of chemical to 13litres of water	01	500-800ml is recommended per hectare
	50ml of chemical to 18litres of water.	01	35- 50ml for knapsack(15L)tank
	100ml of chemical to 16litres of water	01	
	25ml of chemical to 18litres of water	00	
Lambda super 2.5 EC	40ml of chemical to 1litre of water	05	400-800ml per hectare.
	80ml of chemical to 18litres of water	04	35-50ml per knapsack(15L) tank
	5ml of chemical to 3litres of water	00	
Lambda super 2.5 EC	10ml of chemical to 13litres of water	01	
	20ml of chemical to 16litres of water	01	
Karate	25ml of chemical to 18litres of water 25ml of chemical to 3litres of water	00	1litres per hectare 75-80ml/knapsack(15L) tank

Source: Field Survey, 2020

Sources of the recommended rate of application are from the labels of the chemical containers and the chemical sellers. The table above shows that majority of the vegetable farmers who use insecticides calibrate the chemical based upon the instruction they receive from the agrochemical sellers.

The rate of 400 to 800ml/ha and 35 to 50ml/knapsack sprayer of 15L capacity is recommended for most chemicals and vegetables but farmers applied different rates of the chemicals for the same vegetables.

CONCLUSION

The survey conducted revealed that vegetable farming within the Tamale Metropolis are mostly dominated by males and the youth due to it's high demand in labor. All the farm work is done by the farmers themselves; the farmers do not hire any extra labor.

The survey also revealed that majority of the farmers have low level of education and the high illiteracy rate make adoption of modern technologies difficult.

The farmers also use different kinds of fertilizers and insecticides at different rates due to inadequate training on the use of fertilizers and insecticides. Time and frequency of application of the agrochemicals too varied amongst the farmers. The survey also revealed that farmers who cultivate exotic vegetables such as cabbage, carrots, lettuce, etc use more agrochemicals due to its low resistance to pest and diseases as compared to farmers in the cultivation of local vegetables such as amaranthus cochorus, etc. The survey showed the exotic vegetables are normally nursed before been transplanted on the field whilst the local ones are mostly planted directly on the field.

Most of the farms are located around water bodies such as dugout, wells, streams, and rivers as their source of water. These farms are normally located around swampy areas and areas liable to being water-logged.

Poultry manure and cow dung is used by majority of the farmers due to its fast growth of plants and also it's availability in the neighborhood especially the cow dung.

Broadcasting method is mostly used in the application of fertilizers whilst a few practice placement method

RECOMMENDATION

I would recommend that the vegetable farmers come together to form cooperative union and organization. This will help the farmers get access to loans and other financial assistance from banking institutions and other credit facilities.

I would finally recommend that institution like Environmental Protection Agency (EPA), Ministry of Food and Agriculture(MOFA), Ghana Agricultural Inputs Dealers Association(GAIDA) all should come together to train farmers on the correct and approved way of application of agrochemicals.

Government should enforce laws and regulation governing the distribution and movement of agrochemicals within the country.

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