Original Research Article

The Impact of Sachet Water Sachets and Plastic Bottle Wastes on Agricultural Land at Ada, Ghana

ABSTRACT

The sachet and bottle water business is one of the fastest-growing business sectors in the Ghanaian economy. It has also been the major contributing factor to waste management issues in the country for decades now. The main aim of this research is to create awareness of the negative effects that indiscriminate disposal of water sachet and plastic bottle wastes have on the agricultural production. Interviews, a survey, key informant interview, focus group discussion and questionnaires were used in collecting primary data. Secondary data were obtained from the Department of Agriculture. 50 households were sampled out of 350 households using random sampling techniques. The data were analyzed using the Predictive Analystic Software (PASW) computer software. It was observed that sachet water is highly consumed in the area. The plastic waste from the sachet and the empty bottles are not properly managed, causing soil pollution, which has eventually contributed to the reduction in crop yield annually. It is recommended that there should be public education on plastic waste management and waste bins should be made available at public places.

Keywords: sachet water, bottled water, soil pollution, agricultural land,Ada, Ghana.

1. INTRODUCTION

The emergence of the sachet and bottled water industry in Ghana in the late 1990s has created employment opportunities in most of the rural areas in Ghana, especially the less privileged people who are usually the marginalized and vulnerable one. It is one of the fastest growing business ventures in Ghana, and those who are into the sachets and the bottled water business have made a lot of profit, acquired properties, sponsored themselves and their families to obtain higher education through the sales and supply of sachets and bottled water. According to the National Association of Sachet and Packaged Water Producers, the water packaging industry created about four million jobs in the country in the last five years [9].

Bottled water or Sachet water, known colloquially as" pure water" is a bottle or a sachet filled heat-sealed water drawn directly from a piped connection of municipally-treated water (or occasionally from a storage tank or borehole), that has gone through an industrial filtration process. The bottled and sachet water came to replace the traditional way of getting access to drinking water in public where the vendor used to scoop water out of a larger storage vessel using plastic or metal cup, to water sold in hand-tied plastic sachets [3].This indigenous system of selling water to the public was associated with a lot of hygiene issues, as the bags were generally filled with water by women and children under unhygienic conditions which contaminate the water, resulting in adverse health effects, such as cholera outbreak, gastrointestinal illness, reproductive problems, and neurological disorders [12]. Sachets and bottled water have become increasingly the sole source of drinking water at home for most Ghanaian families; even in the most remote villages due to its low price, convenience, ubiquity, and the public perception that sachet water is of higher quality than tap water.

Ada has been the market place for most the sachet water producers in the Greater Accra region and the Volta region because of its large local food market that brings people from all over the country on Tuesdays and Fridays. The higher consumption of sachets and bottle water in the area is causing a lot of harm to the environment especially agricultural lands due to the nuisance of littering behaviour of beneficiaries of the water. The sachet and plastic bottles used to produce the water are made of non-biodegradable substances which make them hard to decompose when they mix up with the soil. They

remain in the soil for several years, un-decomposed and causing problems like blocking water penetration into the soil, which turns to affect plant growth and development. A study by the European Union revealed that plastic waste contributes to the death of about one million sea birds and 100,000 marine mammals and large amount of birds [6]. It is emphasized that plastics are modern conveniences for carrying goods, they are responsible for the environmental and agricultural land degradation that has incidentally used up precious resources of the earth, in particular, petroleum [2]. The plastic materials create soil contamination and increases erosion by reducing soil water absorption and permeability. As the portion of soil above the plastic layer always remains loose, they are easily carried away in the heavy and seasonal rains creating serious soil conservation problems. Countries like Tanzania, Italy, United States of America, Australia, Ireland and some other countries have introduced laws to impose taxes or to ban the production and use of non-biodegradable plastics to solve the problems that polythene causes to the agricultural environment [2].

1.2 Statement of the problem

Despite the significance of sachet water production to Ghana's economy, its contribution to plastic waste generation and management problems in the country are on the increase due to inappropriate disposal of plastic sleeves and empty bottles. Residents of Ada have the habit of throwing garbage away anyhow; this creates serious problems in handling the plastic waste. The empty sachets and plastic bottle wastes are mostly seen in the gutters, market places, school compounds, major roads and on the farms as a result of the lack of organized solid waste collection and removal. During heavy rainfall all these plastic wastes are carried by runoff to the various farm lands which eventually mix up with the soil. This practice contributes immensely to land degradation which has negative impacts on crop production, consequently, creating food insecurity.

1.3 Main Objective

The main objective of the study is to create awareness on the negative effects of indiscriminate disposal of water sachet and plastic bottle waste and the effects they have on agricultural land.

1.4 Specific objectives

1. To assess the level of plastic bottle and sachet water consumption;
2. To identify the various ways by which plastic bottles and water sachets are being disposed after usage;
3. To examine the alternative use of water sachet and plastic bottles after drinking its content;
4. To identify the various sources of plastic waste on farmlands;
5. To assess annual crop yield output per hectare of land.

2. MATERIAL AND METHODS

The study was conducted in the Ada East District of Ghana. The Ada East District is conveniently located off the main connecting road between the Ghanaian capital of Accra and the Togolese capital of Lomé. It is bordered on the west by the Dangme West District, on the east and north by Keta district, South Tongu and North Tongu (Volta Region) and on the south by the Gulf of Guinea. In terms of ethnicity the people of Ada are predominantly Dangme who constitute 80% of the population. The District has a total estimated population of 71,671. Females constitute 52.5% of the population and males, 47.5% [7].

2.1 Sector economy

The key sectors of the District economy can be analyzed under three broad categories, namely Agriculture, Industry or manufacturing, Trading and services. Agriculture remains the dominant sector and employs about 59% of the labour force, followed by trade and service sector which employs 34.4% whilst

manufacturing or industrial sector employs 6.6% of the total labour force in the District. Temperatures are high throughout the year, ranging from 23 to 33℃, but the sea has a cooling effect. Rainfall is generally heavy during the major seasons between March and September. However, during the harmattan season the area is very dry with no rainfall at all. The district has one of the largest market in the country which brings a large number of traders from all over the country on Tuesdays and Fridays [7].

2.2 Sources of Data collection

Primary data were collected from interviews and a survey. Secondary data were also studied, acquired from different reports, published documents from the internet and unpublished data from records at the Department of Agriculture.

2.3 Rationale of the Selection of Study Area

Ada is the leading producer of vegetable and arable crops in the Greater Accra region. Field report (yearly) from the Department of Agriculture shows a continuous trend of crop yield decline as a result of land degradation caused by many factors of which plastic waste is a major contributor. The particular area is chosen for the study because it is easily accessible, and heterogeneous in socioeconomic, cultural and geographical structure. Most of the people in this area are engaged in agriculture and livestock farming, which are widely affected from soil degradation.

2.4 Sample size and Sampling procedure

Participants in the study were mainly drawn from the town of Kasseh. A sample size of 50 was used for the study. This figure was representative of the participants whose contributions reflected the real situation on the ground.

The study used questionnaires and interview. Primary information was acquired through the administration and filling of questionnaires. Interview with key informant was additional means for eliciting information. Secondary data were acquired from different reports, documents and related websites. Structured questionnaires were prepared to generate primary data from the study area. The researcher requested participants to fill the questionnaires to the best of their knowledge and truth. The primary data also were collected from key informants using the direct interview method. The interview is taken as a cross reference (checking) for the data obtained from the questionnaires. The informant was interviewed on the impact of plastic waste on soil fertility and crop production.

The collected filled questionnaires were tabulated by the help of the PASW, formerly SPSS program for statistical analysis widely used in research and data analysis through computer. All the necessary statistical tools like tables, graphs, means and medium were generated from the program.

3. RESULTS AND DISCUSSION

3.1 Gender of Respondents

The majority of the participants selected were females and they constituted 56% of the population whilst males represented 44%. According to the 2010 Population and Housing census, the district had a higher female (50.6%) population than males. The reason for higher female population could be that the area is one of the biggest local markets for food stuff in the region where thousands of people travel from the length and breadth of the country to trade on Tuesdays and Fridays and women are noted to be involved in trading than men in the Ghana.

Table 1: Gender of respondents

Gender	Frequency	Percentage (%)
Male	22	44
Female	28	56
Total	50	100

Sources: field survey, 2015

3.2 Educational Level of Respondents

The table 2 below shows that, the majority of the populace did not have formal education, almost half of them which represent 42%. 28% of them had basic education, whereas 12% were graduates from the tertiary institutions. Having the majority of the population not having formal education could affect their understanding of plastic waste management and its adverse effect on the soil. This confirms the findings of [9] that formal education for women in particular is a prerequisite for change in sanitation behaviour.

Table 2: Educational level of respondents

Education	Frequency	Percentage (%)
Basic school	14	28
High/Vocational	9	18
Tertiary	6	12
No formal Education	21	42
Total	50	100

Sources: field survey, 2015

3.3 Occupation of Respondents

Farming and trading remains the major occupation in the area as 54% of the population are directly engaged in trading and farming. Only 6% of the respondents do other professional jobs such as teaching, banking, carpentry etc. Agriculture therefore remains the main backbone of the economy of the Ada Area.

Table 3: Occupation of respondents

Occupation	Frequency	Percentage (%)
Student	5	10
Only farmer	9	18
Only trader	6	12
Farming and trading	27	54

Others	3	6
Total	50	100

Sources: field survey, 2015

3.4 Household Size of Respondents

The area has a large number of household size as indicated in the table 4 below, 52% of the population are made up of 6-10 members in the household. 11-15 members were the least representing 10%. Most people live in the external family system where uncles, nieces, grandmothers and others stay together with the man's nuclear family. This could account for the large household size in the area. Most farmers in Ghana also practice polygamy system of marriage where the man is allowed to marry more than one wife.

Table 4: Household Size of respondents

Household size	**Frequency**	**Percentage** (%)
1-5	19	38
6-10	26	52
11-15	5	10
Total	50	100

Sources: field survey, 2015

3.5 Type of Water Used by Respondents

Sachet water is the most consumed water as compared to bottled water, 76% of the respondents consume sachet water; 18% are those who consume both bottle and sachet water and 6% consume only bottled water. Water affordability depends on the individual's income, those with higher and sustainable income consume bottled water, whereas those with lower and unsustainable income consumes sachet water since it is cheaper.

Table 5: Type of water used by respondents

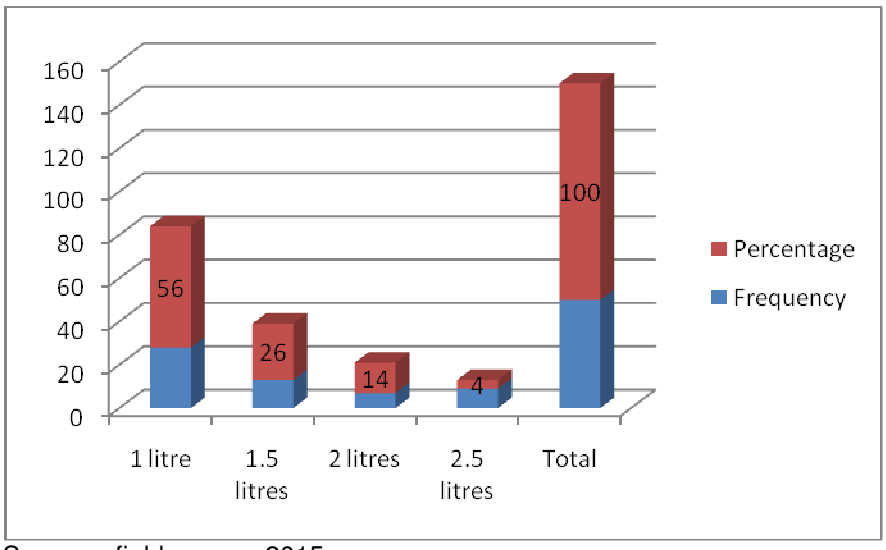
Type of water used	**Frequency**	**Percentage** (%)
Sachet	38	76
Bottle	3	6
Both	9	18
Total	50	100

Sources: field survey, 2015

3.6 Consumption Levels of Participants

Figure 1, below shows the water consumption level per a person in a day. 56% of the respondents drink 1 litre of water a day, which produces 2 empty sachets or 2 empty bottles. 26% consume 1.5 litres of water

a day whiles only 4% consume 2 litres in a day. Pure water (sachet water) is mainly used as drinking water in the households



Sources: field survey, 2015

Figure 1: Consumption levels of participants

3.7 Means of Disposing Waste Product

The table 6 show that respondents litter the water sachet and empty bottle waste on the environment after consumption. 44% of the respondent leave them on the compound both in the house, farms and in public places. The majority of the respondents leave the plastic wastes on the ground due to lack of proper waste management services. This confirms [13], observation that poor environmental conditions in most rural areas can be ascribed to improper management of solid wastes and the lack of seriousness in the enforcement of solid waste disposal code in West Africa. The majority of the respondents after drinking the water in the farms abandoned the empty bottles and the water sachet on the sites; these eventually mixed up with the soil during ploughing. This confirms what [5] stated that there are accounts of inadvertent contamination of soils with small plastic fragments as a consequence of spreading plastic materials on the soil by human, wind, rain water and flood events. 28% said they bury them into the soil while 18% gather them and burn on the farm after using. Few of them carry the waste home (10%). [1], observed in his research that about 83% of the population dump their refuse in either authorised or unauthorised sites in their neighbourhood, due to ignorance, negligence, weak capacity to handle solid waste and lack of law to punish sanitary offenders.

Table 6: Means of disposing waste product

Responses	**Frequency**	**Percentage** (%)
Bury in the soil	14	28
Left on the farm and public places	22	44
Burn	9	18
Others	5	10

Total	50	100

Sources: field survey, 2015

3.8 Alternative Use of Empty Sachets and Empty Plastic Bottles

The table 7 below shows the reuse of water sachet and bottle by respondents. 28% percent of the respondents gather the water sachet waste and sell them to trucks that moves around to buy. 20% of the respondents use the plastic bottles to store or sell liquid products in the market and shops, some of the liquid products sold are palm oil, vegetable oil, kerosene, pito, ice kenkeyetc. 4% use the water sachet for nursing seeds such as mango, ornamentals, oil palm, orange etc. majority of them do not put them into any use which represents 44%. [1] observed that low level of technology in waste recycling and management are the major causes of waste management and environmental problems in Ghana.

Table 7: Alternative use of empty sachets and empty plastic bottles

Responds	**Frequency**	**Percentage (%)**
Nursing seeds	4	8
Storing liquid products	10	20
Sold	14	28
No use	22	44
Total	50	100

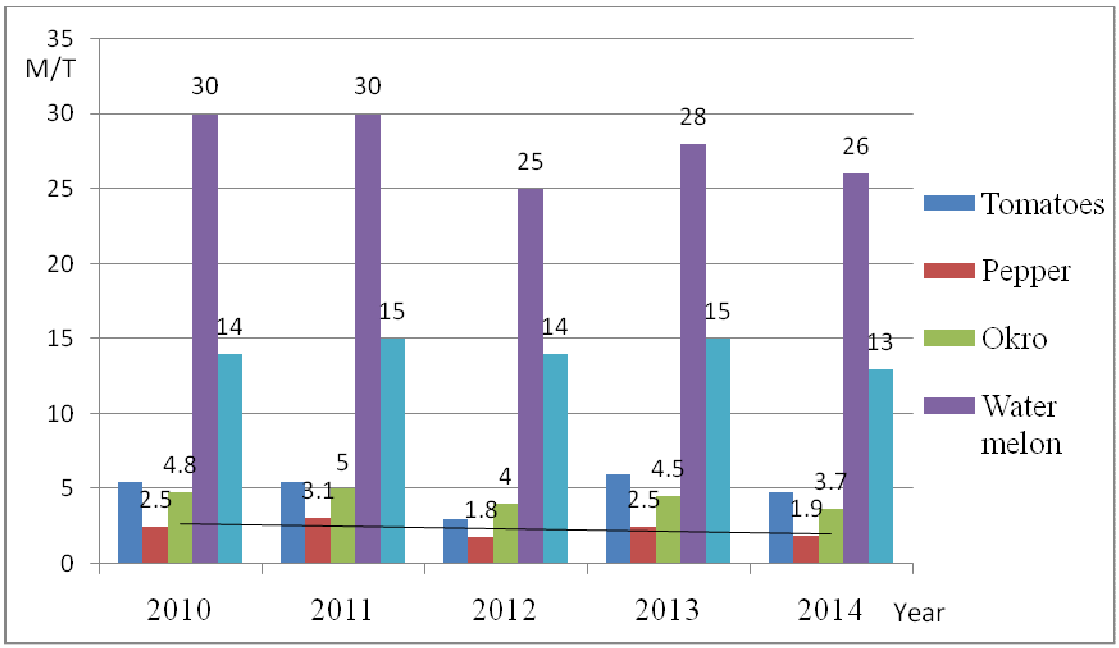
Sources: field survey, 2015

3.9 Annual Crop Yield per Hectare in the Ada East District

The annual yield per hectare of major crops growing in the area shows that yield per 1 hectare of a cultivated land kept on decreasing from 2010 to 2014. In 2010, yield per one hectare of tomatoes was 5.5 metric tonnes, it reduced to 3 M/T in 2012 and a little increase to 4.8 M/T in 2014. Pepper output per hectare reduced from 2.5M/T in 2010 to 1.9M/T in 2014. Average per hectare of okro was 4.8M/T in 2010 it increased to 5M/T in 2011 and steadily decline to 3.7M/T in 2014. Watermelon has declined in the last three years from 30M/T in 2010 to 26M/T in 2014.

This confirms the assertion by [11], that, accumulation of plastic materials into the soil increases biological degradation of litter and soil organic matter (SOM),which act as a trigger to rapid depletion of soil nutrients in general and carbon stocks in particular. High accumulation of water sachet and plastic materials in soil causes water logging on the upper layer of the soil, which eventually results in reduced aeration and conservation, poor penetration which adversely affect the crop yield. [4] observed in their research that the presence of heavy metals and phthalates in first strata of underground soil water is caused by migration and percolation of dumping of municipal and plastic waste in the soil which is a contributing factor to poor performance of crops

The District Director of Agriculture in the Ministry of Food and Agriculture confirmed that, “aside climate change, plastic materials are the contributing factors of soil nutrient depletion in the area.”



Source: Ministry of Food and Agriculture 2015.[8]

Figure 2: Annual crop yield per hectare in the Ada East District

4. CONCLUSION

Sachet and bottle water consumption was found to be very high in the study areas as it serves as the main drinking water for members of the households. The average household consumption was between 6 litres to 10 litres per day, and this produced 12 to 20 empty sachets or empty plastic bottles a day. The most preferred was sachet water (pure water) because of its affordability.

It was revealed that the majority (78%) of the participants littered the plastic sachets and empty bottles on the environment (farms, home and public places). Few farmers buried the plastic remains in the farms without considering the biodegradability of it or the environmental consequences.

It was also observed that, the plastic waste generated after using the water has little or no alternative use due to lack of recycling plants in the area and its environs. A fewer number of the respondents (28%) gather the sachets and sell to buyers that come around with trucks to purchase them. The people are not motivated to gather the waste products and sell due to the lower price offered by the buyers. About 600 to 800 pieces of empty sachets make up 1 kilo which was bought at a price worth twelve cents ($0.12) which is equivalent to50 pesewas.

The average annual crop yield data from the Ministry of Food and Agriculture (MOFA) keeps reducing annually as a result of land degradation. The plastic waste from water sachets and plastic bottles is increasing soil pollution, which effect is continuously giving a declining crop yield in the area.

5.0 RECOMMENDATIONS

5.1 Public education

The Local Government together with the Ministry of Food and Agriculture, the Environmental Protection Agency should embark on public education on plastic waste management practices to reduce the littering of plastic materials on the environment. Farmers should also be cautioned on the damages that plastic materials can cause on the soil and the adverse effects on crop yield. The education can be done through radio, television, newspaper or any other social media.

5.2 Provision of dustbin

The local government should make available waste bins in the public places to enable people to drop in waste after drinking water or using plastic materials. There should be individuals who are in charge of waste collection in the community to empty the bins on a regular basis to avoid over full of the dustbins. Landlords should provide dust bin in the homes to enable the tenants to drop in their waste. Plastic waste should not be mixed with general waste. Farmers should gather all the sachets or bottles and bring them to the house for proper disposal to avoid soil degradation.

5.3 Recycling of plastic waste

The government should liaise with private companies and water producers to establish a recycling plant at the district or a nearby area to enable the waste generated to be recycled.

5.4 Legislation on plastic materials

The government should introduce a law requiring the water producers to use biodegradable and compostable plastic materials for packaging the water produced. Else, they should come together as an Association to find lasting solutions to the waste problems.

5.5 Premium on plastic waste collection

The local government should support and encourage the collection of plastic waste in the district by increasing the amount paid to the collectors, this will make it attractive for people to gather plastic waste and sell. This will help reduce the littering of plastic waste on the environment.

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