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A PANACEA TO ECONOMIC STABILITY
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WASTE TO WEALTH: TURNING WASTE PLASTIC BOTTLES TO FENCING MATERIALS FOR AGRICULTURAL PURPOSES

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Abstract

Waste is anything that is not value again and would like to be thrown away. Plastic bottles become a waste when there is no further need of them and would like to be disposed. Although, plastic bottles used as packaging material offer convenience and create unnecessary waste in landfills. Materials used in this study comprises waste plastic bottles, 12mm (one inch) iron rod, binding wire and ½ acre vegetable garden. The waste plastic bottles were collected by hand picking at selected locations such as schools, markets, parties and social gatherings in Eruwa township and analyzed. Seven (7) different types were identified as mostly used plastic bottle. Twelve (12) waste plastic bottles were selected from each type for making a row of the fencing materials. The rows produced were then used for the fencing sections on the vegetable garden. The total number of used plastics bottle are 3,995 and the total cost is twenty five thousand naira (₦25,000.00). The fencing was found suitable, economical and less labour intensive. Turning the waste plastic bottle to fencing material is a way of making our environment clean. Therefore, it is recommended for use by farmers to prevent their garden from damage by animals and clean the environment.

Key words: Waste, waste plastic bottle, waste to wealth, fencing material, vegetable garden and conventional material.

Introduction

In the year 2012 alone, it was computed worldwide that about 280 million tones of plastic were produced while 130 million tones of plastics will be released in daily lives of human being. Also remaining plastic fraction will remain as litters on the land and in ocean (Ikebude, 2017). Similarly, plastic waste brings grave environmental menace to modern life since it is made up from several toxic chemicals and therefore pollute soil, air and water, if not properly managed or treated. The plastic waste may obstruct the ground water movement (Amusan *et al* 2018). It rapidly fills up landfills as choking water bodies (Igoni, *et al* 2017). Waste plastic bottles make approximately 11% of the content of landfills causing serious environmental consequences. It is now recognized that we cannot afford to lose these as waste. An adage says, one man's waste is another man's wealth, instead it is important to utilize the plastic bottles as a valuable resource that can be converted into a variety of useful products. This process of conversion of waste to a product can be viewed as means of generating wealth. Hence, the phrase "waste to wealth" will help in sustainability and conservation of resources in our environment.

In Nigeria, the potential of waste to wealth enterprise is very high, currently, not enough has been done in realization of the objective. Increasing opportunities for this enterprise can have manifold advantages such as re-utilization of discarded waste plastic bottles into economic use and resulted into; (i) reduction of pressure induced by waste plastic bottles on the environment (ii) creation of opportunities for income employment generation and improve quantity life.

Finding had shown that plastic bottles are discarded every year all round the world and only 47% is collected for use (Icheadu *et al* 2020). For the environmental conscious citizens and organizations disposing off the non-bio-degradable waste plastic bottle has become a major concern. The problem with the utilization of waste plastic bottles is particularly acute in a country like India where the collection rate for the waste plastic bottles is well

above the global average (Robinson *et al* 1986). The use of plastic bottles generally makes life much easier, but the method of its disposal create problem in the society. There are two alternative solutions, against the plastic bottles disposal and these include (i) recycling and (ii) reusing processes. However, recycling of a waste most times requires additional energy for treating the materials for production of other usable materials and the process generates waste, water and air pollution. Thus, reuse remains the best solution to waste management because it does not create pollution, no additional energy is required and very economical. Findings had been performed towards the direction of utilization of waste plastic bottles for construction of water tank as a sustainable material in India (Atulchaurasia *et al* 2019). Andreas Froese, the founder of Eco Tec Environmental solution, in searching for an inventive solution to junk established the innovation of building plastic bottle houses, they constructed over 50 buildings including residential houses, schools, churches in Parks in, Bolivia, Columbia, Honduras, Mexico, India, Nigeria and Uganda (Twumasi *et al*, 2017). They also established the innovation of the first plastic bottle house in Africa constructed in the village of Yelwa in Kaduna state of Nigeria were plastic bottles used instead of bricks (Simanshu *et al*, 2017). Plastic bottles had been identified as one of the regular waste that can be used in making of garden fencing.

What is a fence?

A fence is a structure that enclosed an area, typically outdoors, protect crops by preventing animals and even prevent easy access into our garden. The earliest fencing systems used by European settlers in New Zealand were designed not to manage stock but protect crops, garden and orchard. (Laffan *et al* 1998) A variety of methods were used depending on the materials available in the preparation of the fence.

Types of fencing

1. **Post-and-rail fences:** This type of fencing was the preferred method when timber was readily available and accessible. It was cheap and relatively easy to erect. The first fencing on Orari Gorge station in south Canterbury was put up in the late 1850s 8kilometers of posts and four rails (Laffan *et al* 1998).
2. **Hedges:** Settlers planted hedges known to farmers as live fences which were cheap to establish, the cost was low and the planting required little labour. Once established it provided shelter for the wind or the open garden. The disadvantage was that it take time for a hedge to grow dense enough to form an adequate barrier for stock. It also needs regular trimming to maintain a tight form with wide gaps where sheeps and goats could push through. However, the most serious problem with live fence was that the best plants-gorse, broom and various thorns proved to be highly invasive and can take over many thousands of acres for establishment (Giddings *et al* 2002).
3. **Wire Fencing:** Wire fencing provide a visual and physical barrier to animals. It is erected in sections with the wires tied to strainer posts at each end of the section (called a strain). It is used in a way that when the wires are strained tightly and supported properly, animals will be unable to push between them or go over or under the fence.
4. **Barbed Wire:** In the early 1879 barbed wire appeared in New Zealand and was initially known as American wire. It is used more widely to house animals and more common with top wire on most fences to be barbed. There have always been concerns about wire because of the damage it done to the hides of livestock (McCutchan *et al* 1980).
5. **Electric fencing:** This is perhaps the most revolutionary advance in fencing with steel wire in the 1860s which had been the electrical made of fencing. It exploits the learned response of stock to a short, sharp shock when animals come in contact with the wire. The advantage of electric fencing is that it can be build much more cheaply than traditional fences. It needs fewer posts and wires and required less labour for its construction. However, some of the disadvantages of electric fencing are, it requires high voltage supply and power failure reduces ability in controlling stock. Thus, serious attention is need for the system to work

properly. The fences also need regular checking to preempt fault. Although, when faults occur it is often difficult to detect and there is a much higher labour input towards the maintenance of electric fence compared to traditional fence.

6. **Conventional fence:** The conventional fence use prefabricated rolls, plain wires or barbed wire to create a physical stock proof barrier on the farm.

Benefits of the use of empty plastic bottles as a fencing material

Plastic bottles had been identified as one of the regular everyday waste that can be utilized in making of garden fence. The use of the empty plastic bottle as a fencing material for Agricultural purpose will attract the following benefits:

- i. The removal of the plastic bottle waste that blocks the drains channels in the environment and controls flooding.
- ii. It also reduces the breeding place for mosquito and thus, a method eradicating the malaria vector in the surrounding.
- iii. It is readily available; plastic bottles had become unavoidable packaging materials globally. Most people use one plastic bottle package product daily. Thus as long as beverage companies continue with the use of plastic bottle and its consumption by man, plastic bottle will then remain readily available as a fencing materials in our environment.
- iv. Durability and longevity; Plastic bottles had been known to remain un-decomposed for a very long period of years thus garden fenced with plastic bottle materials tends to improved durability and life- span of the fence.
- v. These plastic bottles are made in different beautiful colours and these contributed to the beautification of the garden and make it more attractive.
- vi. This type of fence is very simple to maintain. The plastic bottles can be easily replaced any time when needed.

Therefore it will be worthwhile to consider the utilization of empty plastic bottles combined with wire as fencing materials on the farm and the society as a whole.

Materials and method

Materials:- The materials used in this study comprises of plastic bottles (different types), 12mm(one inch) iron rod, building wire or plain wire and vegetable garden (1/2acre), measuring tape, hammer, nail, cutter and pliers.

Methods:- The plastic bottle were collected from different sites and bins around the schools, marketplaces, religion centres and social gatherings or parties in Eruwa town as shown in (Figure 2). The bottles collected were described as follows; seven (7) different types of mostly used plastic bottles in Eruwa town includes; Coke (35cl), Mr. V Premium table water (75cl), Fanta (35cl), Pepsi, (50cl), Chapman (35cl), Malt (33cl) and Bigi Cola (35cl)

Twelve plastic bottles were selected from each of the listed bottles for making the fencing material. Each of the bottles were punched with sharp nails at four sides-two holes at the upper part and another two holes at the lower part. The punched twelve plastic bottles were fixed into the two 3ft binding wire, making one row of the fencing material. The same method was used to produced more rows of fencing base on the availability of plastic material on the site as shown in (Figure 3i and 3ii).

The rows of plastic bottle produced were taken to the vegetable garden for fixing. Twenty 12mm (one inch) iron rod of 6ft each were pegged to the ground 3ft apart using hammer to create a post; six(6) rows of the fencing material were used for a section and for the other sections to complete the garden as shown in (figure 1).

Statistical calculations were done as shown in the diagram below:

Data (x)	1	2	3	4	5	6	7
Frequency	525	1,250	575	500	375	500	279

Statistical calculations:

- 1a. Calculate the:
 - i. Mean
 - ii. Median
 - iii. Mode
 - iv. Draw a bar chart

x	f	fx
1	525	525
2	1,250	2,500
3	575	1,725
4	500	2,000
5	375	1,875
6	500	3,000
7	270	1,890
	3,995	13,515

$$\sum f \quad \sum fx$$

- i. Mean (x) = $\frac{\sum fx}{\sum f} = \frac{13,515}{3,995}$
- ii. Median = 3
- iii. Mode = 2

Result and discussion

After the necessary measurements and calculations were done, the data obtained were presented in a table I and a bar chart in the figure I below.

From the result, it can be deduced that an average of 571 plastic bottles were used to make a fence of ½ an acre of the experimental vegetable garden. The result also indicated the number of plastic bottle used for the whole garden for the selected sampled bottles as shown in the table I below.

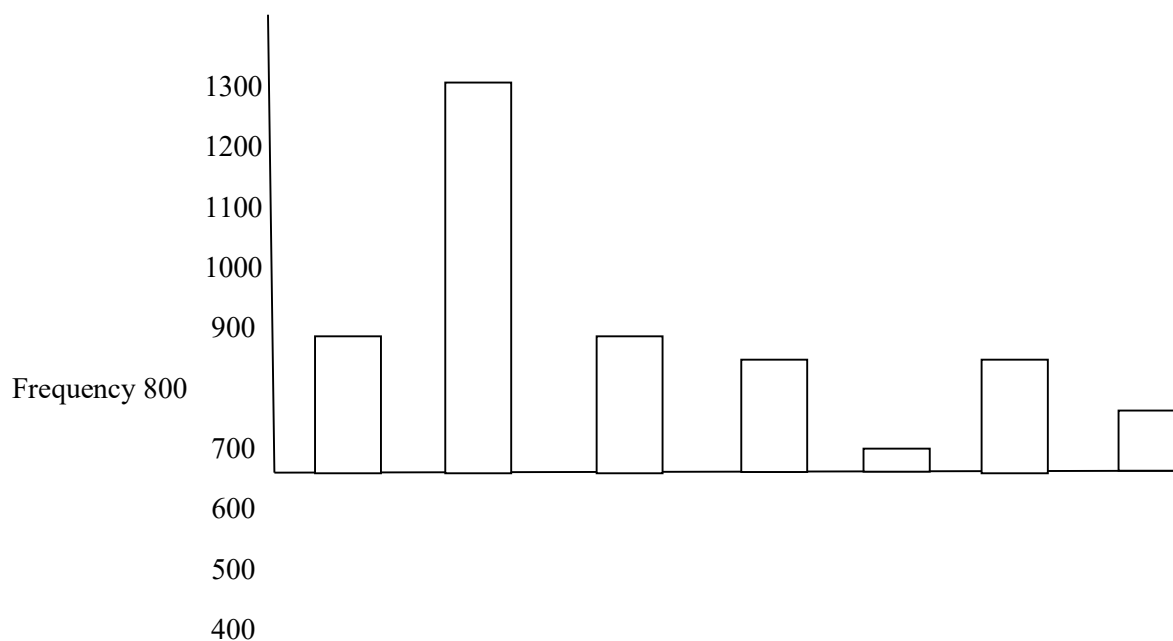
The bar chart (figure I) also indicated that the lower the volume of the plastic bottles (in case of malt bottles) the higher the number of plastic bottle used.

The result showed that 3,995 plastic bottles were used to complete the whole fence. This suggested that the completed vegetable garden fence (figure 1) had been able to utilized 3,995 plastic bottles from Eruwa town, which supposed to littered the environment.

S/NO.	BOTTLES	(CL)	USED
1	Mr. V. Bottled water	75	525
2	Coke	35	375
3	Bigi Cola	35	1,250
4	Pepsi	50	575
5	Chapman	35	500
6	Fanta	35	500
7	Malt	33	270
			3,995

Table 1: Types of plastic bottles, volume and numbers

iv.



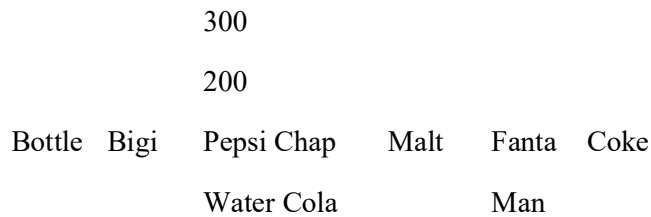


Figure I Bar chart:- Showing the types and number of plastic bottles.

Conclusion and recommendation

From the work, half acre of land used an average of 571 plastic bottles for fencing. It indicated that this quantity of empty bottles would have littered the environment by blocking water drains, scattered on the street, washed to canals and resulted into flooding, breeding places for mosquitoes and other vectors.

Similarly, the use of these bottles as fencing materials on gardens would minimize the effect of animals on the farm. The utilization of these bottles will improve the environmental sanitation and improve farmers productivity.

Therefore, it can be concluded that there is a positive impact on the waste management problems in Eruwa Township especially from empty plastic bottles if this fencing Technology is adopted for fencing of farm and environment.

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Fig 1. Complete Plastic Bottle Fence



Fig 3(i). Plastic Bottle Fence Materials produced



Fig 2. Dumping Site of Waste Plastic Bottles



Fig 3(ii). Plastic Bottle Fence Materials produced