KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, GHANA

COLLEGE OF ENGINEERING

DEPARTMENT OF CHEMICAL ENGINEERING

ENGINEERING IN SOCIETY (CENG 291)

THE MISMANAGEMENTS OF ORANGE FRUITS IN MAMPONTENG, AKYEASE

REPORT BY; KYEREMATENG POKUAA VINCENTIA

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ACKNOWLEDGEMENT

To begin it all, my outermost gratitude goes to the Almighty God for granting me all the strength and the insight to do this project. I wouldn't have come this far without his protection and directions about this project.

Secondly, I deeply appreciate the monumental contributions of my great Academic tutor Mrs. Dr. Emmanuella Kwaw-Boateng together with other lecturers, heads of Department and the Provost of the college of Engineering ING. Professor Mark Adom – Asamoah for this honored initiative.

And to my parents, Mr. and Mrs. Kyerematen and siblings, I say a very big thank you for your conscientious efforts and words of encouragement.

Lastly, I thank my good friends who also assisted me immensely throughout this project. And not forgetting my neighbors and the rest in my community who helped me with the parts of the questionnaires and interviews thank you as well.

ABSTRACTS

This report covers a pressing issue in Mamponteng Akyease. In this report, Mamponteng, a town in the Ashanti region of Ghana, and a suburb of Kumasi, West Africa is used as the case study.

This report talks about the extreme waste on orange trees and the fruits in Akyease, Mamponteng.

The main motive of this study is to find reasons why people will have a nice idea of planting these trees and then at the end of the day, wouldn't know how to manage them well and that yield the wastage of these trees and fruits, also try and know what causes that.

Furthermore, the effects if any, and suggested solutions to control this extreme waste on orange trees and fruits.

The study collected data from both primary and secondary sources which include; the field investigation, group discussions and interviews, articles and other forms of interviews.

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CHAPTER ONE

1.0 INTRODUCTION

1.1Background to the course

The Engineering in Society (CENG 291) has been in existence for quite a time now and it's a practical course for all first year Engineering students in the college of Engineering of the Kwame Nkrumah University of Science and Technology. Students undertake this project which seeks to identify their environmental challenges which hinder development, where they are to go out to identify a problem and find ways of solving them.

OBJECTIVES AND AIMS

The actual aim of the course is to inculcate in students an appreciation of the fact that the purpose of Engineering is to solve societal problems. It's aimed at encouraging students early in their programs of study to draw a link between their chosen fields of engineering and the application of this field to the issues that confront the day to day lives of people. At the end of the course, students would develop in appreciation of the areas of life that their field of study can be applied to.

1.2 OBJECTIVES OF ASSIGNMENT

This report seeks to investigate the mismanagement of orange trees and the fruits as a problem in Akyease.

The project is aimed at achieving the following

The importance of orange trees and fruits to the body in terms of health, how to solve the problem in the field of chemical engineering ie talking about the orange as a fruit, what the roughages, seeds and the juice can be used for in order to solve this canker.

CHAPTER TWO

2.0 METHOLOGY

2.1 Problem Identification

This problem was identified and recognized by the inhabitants of a community during an interaction being made to know the pressing needs and problems of the community. During these interactions, people showed more concern about the rate at which the waste done on orange trees and fruits has been rampant in the community and that they have to always sweep hard every morning before they can get rid of it and sometimes find it difficult to dump them both at the places to dump and to talk about the weight every time.

2.2 Preparation of Map

Before downloading the map, three things were involved; internet bundle also known as the mobile data, GPS and Google (earth) Map. I searched Google for the Google Earth Map. When the Google earth map appeared, I typed the map from Kumasi to Mamponteng in the small space provided, the map appeared and I took a screenshot of the map in order to save the map in the gallery of my phone.

2.3 Collection of data

Much information was taken through numerous researches. This data was collected in Akyease, Mamponteng. In collecting this data, a lot of processes went into this. One of the methods is the distribution of questionnaires to the people in my vicinity to fill. Also the primary data were also collected through investigations, group interviews and one-on-one interviews. Lastly, the secondary data were also collected through other articles and internet sources.

CHAPTER THREE

3.0 DISCUSSION OF RESULTS

3.1Description of study Area

The Kwabre East District Assembly has been in existence since 2007 in the Ashanti region of Ghana.

Therefore Mamponteng is a small town and it's the capital of the Kwabre District in the Ashanti region of Ghana. Mamponteng is approximately 14.5 kilometres from Kumasi. Akyease is one of the major towns in the district and that's where the project was undertaken.

The community is found in between the lands of fawoade and Mamponteng and its popularly known as the new site. This community is meagerly populated with a total population of about 1,000. It shares its borders with Bempenase, Asenua, Fawoade and Dwumanafo.

The youth and working force dominate this town of which most of them are illiterates and therefore do much of farming.

Majority of the working force are sellers and others are into farming.

A household survey conducted in 2005 indicated that 75% of the population was engaging in small scale farming. The major stable plants they farm are plantain and oranges.

Orange trees are being planted almost in every house you find yourself in.

However, the pressing issue in this community is the way the people waste these orange trees and fruits.

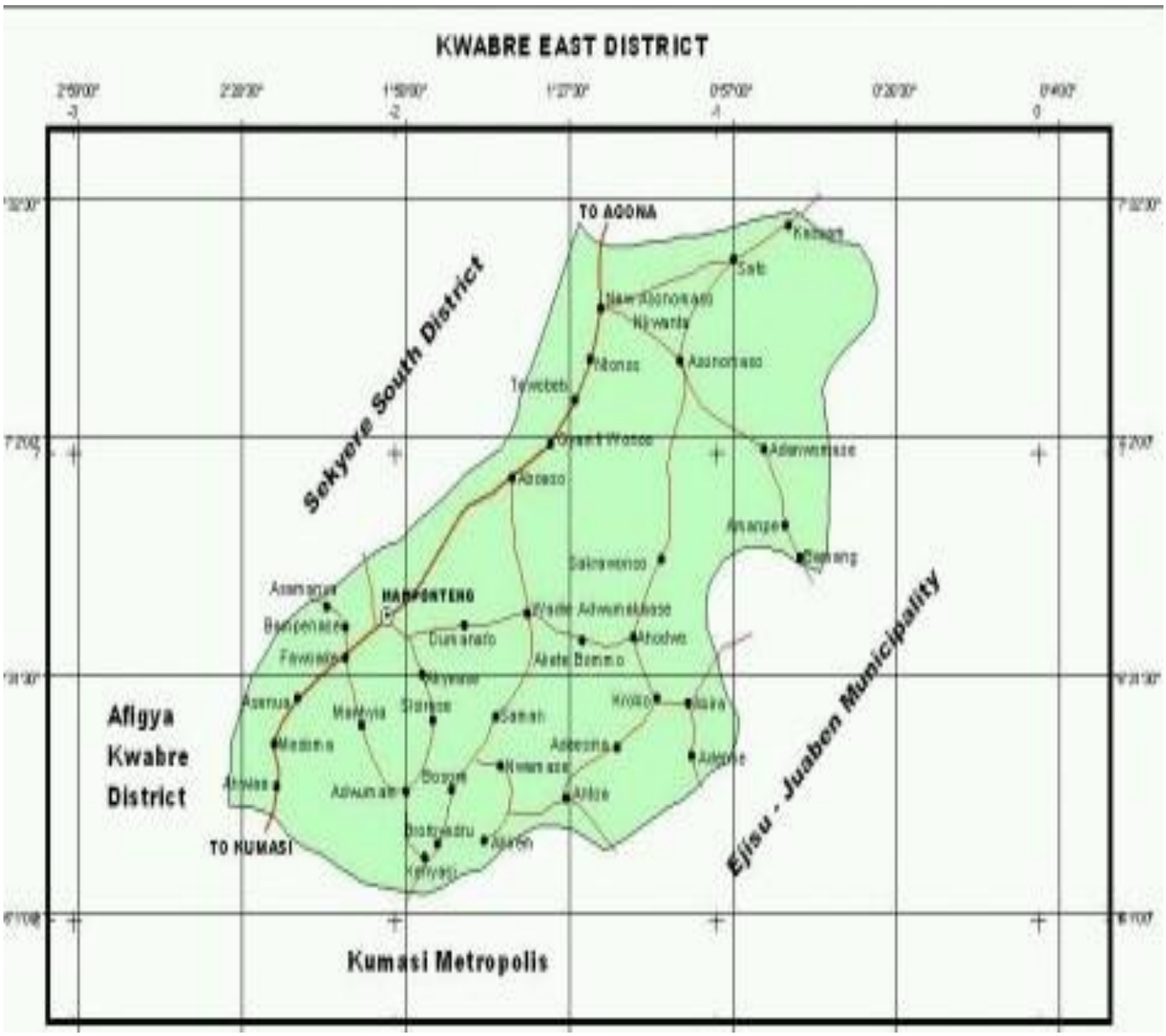


Figure 1: showing the map of Mamponteng district in the Ashanti region

DESCRIPTION OF THE NATURE AND CHARACTERISTICS OF THE PROBLEM

What are oranges and why are they needed?

Oranges are large round juicy citrus fruits with a tough bright reddish-yellow rind. They are also examples of berries and are of many varieties ie blood oranges and the navel oranges also known as common oranges.

Navel orange

Blood orange

FIGURE 2: Varieties of orange

Studies have shown that type 1 diabetics who consume high- fiber diets have lower blood glucose levels and type 2 diabetics may have improved blood sugar, lipids and insulin levels, which means oranges are of very great importance. Citrus fruits are also of great importance to the body;

1. The excess dirt, soot or bacteria block your skin pores resulting in the occurrence of pimples. Oranges have a high content of citric acid which is effective in drying away acne.
2. The seeds of oranges can also reduce constipation as well just as the pawpaw seeds.
3. The roughages of oranges help us to free our bowels well and have good health.
4. The orange peels also contain a high amount of dietary fiber, which regulates bowel movements, thus eliminating harmful wastes and toxins from the body.

Generally orange trees can be used for some of these native medicines that the herbalists produce. Orange trees can be used for medicines for diseases like ulcer and just a normal stomach ache. The stems of these trees are the ones mostly used.

Dried orange slides can be used during Christmas. They are perfect for Christmas crafts, decorations, wreaths and floral arrangements. It is easy to make a lot cheaper than buying the already made ones. The only things needed are oven, oven rack and oranges. This can be achieved through the following steps:

- Cut the oranges into slices approximately 2cm thick
- Place the slides onto an oven rack - not a baking tray as it will stick and burn!
- Place in a cool oven – it can be 120 degree Celsius.
- Allow to dry for about 2-3 hours
- Leave in an oven until cool.
- Use in garlands, wreaths, decorations, potpourri etc. You can attach them to a wire to be used in floral arrangements.

3.2.1 The Extreme Mismanagement of Orange Trees and Fruits.

In Akyease, majority of the people there are in the agricultural sector. This is due to the fact that, it is a new site and most people are living in uncompleted buildings. The planting of other types of food is sparsely found there. For examples are tubers, plantain, leguminous fruit and especially orange trees.

The growing of orange trees is becoming so much rampant to the extent that even the inhabitants get to mismanage and waste a lot of them.

So in the summer time, when the trees and fruits fall off, these orange trees become of no use and people leave them just to die. And same as in the rainy season, the fall of orange fruits haphazardly makes sweeping difficult and houses too dirty.

FIGURE 3: Typical examples of mismanaged trees

Effects of mismanagement of orange plant

Notwithstanding the conscientious effort made by some other great people, individual gardeners/farmers are faced with challenges. To those who plant a lot of the orange trees are faced with a lot of problems which includes;

i. Pests and parasites invasion
ii. No proper disposal of these orange plants
iii. Post- harvest losses

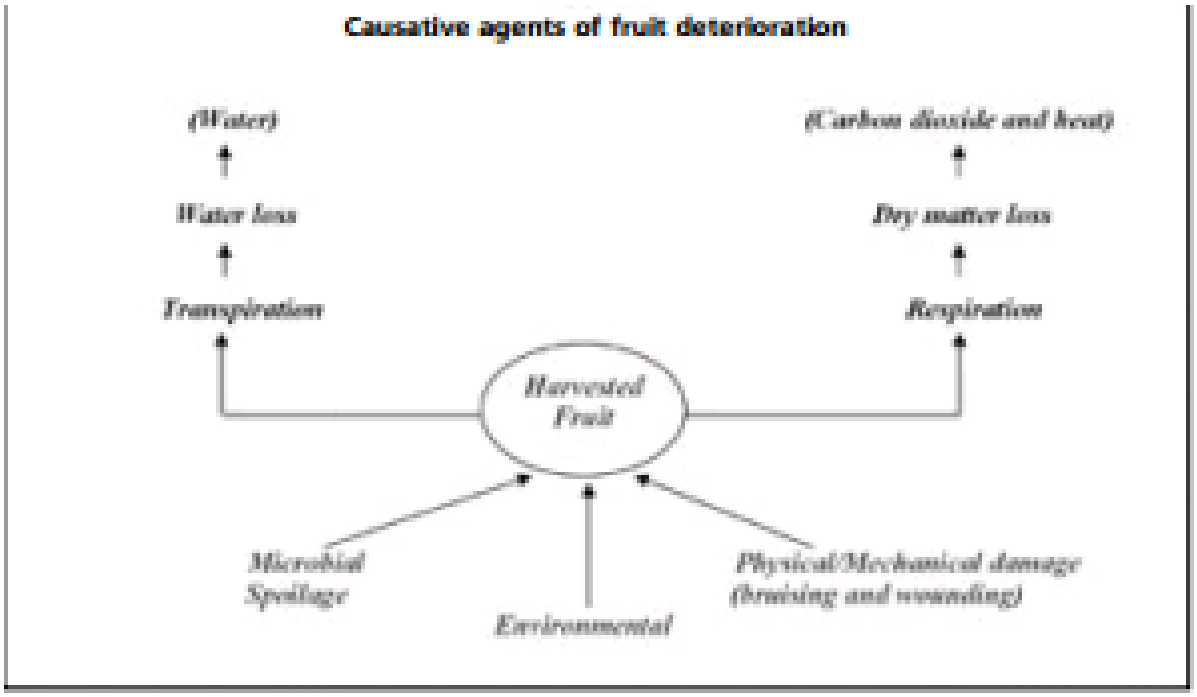
Pest and parasites: Citrus Canker: Citrus canker is a highly contagious bacterial infection of citrus trees causing yellow halo-like lesions or scabs on the fruity leaves and twigs of citrus trees. Severe infections can cause blemished fruit, fruit drop and die back. The canker bacterium like Aphids spreads easily and quickly on air current, insects, birds and on humans by means of clothing and infected implements. As a result of this, there is low productivity since a wholesome portion of the oranges are affected by these pest and parasites attacks.

No proper disposal of the wasted orange fruits: The disposal of wasted oranges is very necessary. However if there is no proper disposal of these wasted oranges, this can lead to the exposure of other

environmental degradations like water pollution and air pollution which may be harmful to the environment. This is for the reason that when they sweep and get a heavy weight of wasted oranges, they end up burning the wasted oranges in the same place they live and the smoke from these burnt leaves gets to spread to the whole environment.

Post-Harvest Losses: Both quantitative and qualitative losses occur in tree fruits at various stages of the post-harvest handling chain in Akyease. Quantitative losses in tree fruits during post- harvest operations in Akyease are estimated at around 30-35 percent of the total annual production. Improper packaging, rough handling and overloading of vehicles during transportation from production to consumption areas, account for approximately 20 per cent of losses within the post-production chain. Improvement of post-harvest handling practices to minimize these losses will not only contribute to increasing the income of rural farmers, but would also ensure the availability of superior quality produce to the consumer at a reasonable price. Harvested fruits are 'living' entities. They, therefore, continue to perform metabolic functions in the post-harvest state. Quality deterioration of harvested fruits is the result of a combination of physiological, mechanical, microbiological and environmental factors and conditions.

The causative agents of fruit deterioration are summarised in Figure 4



Preserving the safety, quality and freshness of fruits necessitates proper temperature and relative humidity management and care during post-harvest handling operations in order to slow respiration rates and minimize microbial contamination and mechanical and physical injury

FIGURE 5: Post- Harvest loss

And other effects can be;

At a point in time, the growing of orange trees will be in extinction and will be very uncommon to see these trees in some time to come.

The rise in other bad environmental factors like bad odour and creation of filth

FIGURE 6: Poor disposal of waste generated.

3.3 Programme of study

3.3.1 Chemical Engineering

Chemical engineering is a branch of engineering that applies the nature or experimental sciences (eg. chemistry and Physics) and life sciences (eg. Biology, Microbiology and Biochemistry together with Mathematics and Economics to produce, transform and properly use chemicals, materials and energy.

It is developed from its initial base around the reactions and producing liquids and gases to that of biological materials and solid like materials of all kinds. Chemical engineers provide and improve chemical processes and devices which are environmentally sound. Modern chemical engineers are concerned with processes that convert raw materials or chemicals into more useful or valuable forms. They are also concerned with pioneering valuable materials and related techniques which are often essentials to related fields such as Nano technology, fuel cells and bioengineering.

SCOPE OF CHEMICAL ENGINEERING

Chemical engineering is a discipline course influencing numerous areas. It covers a wide scope which includes the following;

- Polymers
- Petrochemical plant
- Petroleum refining plants
- Pharmaceuticals
- Plastics
- Paint and dyes
- Paper
- Pulp and paper
- Material based industry
- Micro electronics
- Synthetic fibre unit
- Specially chemicals
- Refineries
- Recycling metals
- Textiles
- Nuclear energy
- Fuel combustion technology
- Fertilizers

- Food processing
- Health care
- Biotechnology
- Chemical industries
- Water and its treatment
- Oil and gas
- Design and construction
- Electronic and advanced materials
- Business services
- Environmental health and safety industries

Within these industries, chemical engineers rely on their knowledge of mathematics and science particularly chemistry to overcome technical problems safely and economically.

And of course they draw upon and apply their engineering knowledge to solve any technical challenges they encounter. Their expertise is also applied in the areas of law, education, publishing, finance and medicine specifically; chemical engineers improve food processing techniques and methods of producing fertilizer to increase the quantity quality of available food. They also construct the synthetic fibres that make our cloths more comfortable and water resistant; they develop methods to mass produce drugs, making them more affordable and they create safer , more efficient methods of refining petroleum products, making energy and chemical sources more productive and cost effective.

3.4 How my program of study will help in solving the problem

Since engineering is the application of scientific knowledge in other to improve and maintain materials, my engineering field will enable me to develop an alternative means of preserving and adding value to the wasted oranges, also to the inhabitants of the town, the other hidden importance of the orange trees especially the stems (trunks) and branches. If all these all taken into consideration it will help minimize the rate at which the oranges gets rotten and trees been wasted to the barest minimum just as mentioned above, chemical engineering will help equip me with the necessary knowledge and skill to be able to convert both the oranges and their tress which are raw materials into a valuable and more useful products.

CHAPTER FOUR (4)

4.0 Solutions, Recommendations and Conclusions to the problems

4.1 Solutions to the problem

The overall effect of the problem is that, the inhabitants of Akyease lose a lot of oranges they harvest annually because these oranges end up falling down or getting rotten and sometimes mismanaged.

Considering the problem at hand, there is the need to put in place a mechanism to check the rotting of the oranges and aside the prevention of this mismanagement, find ways to solve the wasting of the trees and oranges. This means that the oranges produced should be preserved so as to prevent both the fruits and trees from going bad. Therefore there is the need to develop an economical, efficient and simple preservation method. There exist numerous methods of preserving oranges. Some of these methods are canning, freezing, and sometimes drying.

According to the American Heart Association, eating higher amounts of a compound found in citrus fruits like oranges and grapefruits may lower ischemic stroke risk for women. And as well, one orange provides a range of vitamins and minerals; a staggering 130 percent of your vitamin C needs for the day.

Then this means orange fruits are of great importance to us humans and so shouldn't underestimate the power of these oranges and their trees as well.

4.2 METHOD OF HARVEST

The method of harvest can significantly impact upon the post- harvest quality and shelf life of fresh fruits. Mechanical injuries such as bruising, surface abrasions and cuts can accelerate loss of water and allow rotting fungi and bacteria to penetrate the produce, thus causing rapid deterioration. It is, therefore, important to prevent injury to produce during harvest.

• Minimize impact of the drop of fruit to the ground:

– By using harvesting tools

– By hand picking

4.3 HARVESTING TOOLS

Since harvesting is a labour intensive operation, not only does the use of properly designed harvesting tools prevent undue mechanical damage to produce but it also appreciably reduces the cost of production of tree fruits. Some simple harvesting tools for tree fruits are shown in Figures 8 to 12.

FIGURE 7: some examples of harvest tools

STORAGE

4.4 FACTS ABOUT FRESH FRUIT STORAGE

Fresh fruit:

• keep better under refrigerated conditions;

• shrivel or wilt under dry air conditions due to moisture loss;

• are damaged by freezing.

4.4.1 COLD STORAGE

Temperature control is one of the main tools for extending the post- harvest life of fresh fruit.

Low temperatures slow the rate of produce metabolism and the growth of microorganisms responsible for quality deterioration. Low temperature, in addition, minimizes the vapour pressure between the produce and the external environment, reduces water loss and thereby contributes toward maintaining freshness.

The susceptibility of a fruit to chilling injury is influenced by the species, variety and conditions under which it is grown. High humidity conditions are required in order to prevent moisture loss and to preserve the freshness of fruit during low temperature storage. Given the fact that most fungi cease to grow under relative humidity conditions of less than about 90 per cent and only a few can grow at 85 per cent relative humidity, a relative humidity of 90 per cent is usually the best compromise condition for the storage of fruit.

4.5 DESIGN AND CONSTRUCTION OF A COLD STORAGE FACILITY

A cold storage facility is a large, thermally insulated box, with doors for entry and some means of cooling the interior. Cool stores for fruit have special requirements when compared with other refrigerated stores. These include a high cooling capacity, temperature control, and the maintenance of relative humidity conditions of around 90 per cent. A common minimum design criterion is to provide capacity to cool a daily intake of 10 per cent of the capacity of the store at an initial rate of not less than 0.5 °C per hour.

The relative humidity of the air stream within the cold store can be increased by spraying water as a fine mist. The addition of water vapour to a cool store can be automatically controlled with the use of a humidistat. Wetting the floor of the cool store or the storage of open containers of water within the cool store also increases relative humidity.

4.5.1 GOOD PRACTICE FOR THE COLD STORAGE OF FRESH FRUITS

– Never expose harvested produce to direct sunlight; keep in cool, shady places with adequate ventilation;

– Store only good quality fruit: i.e. produce that is clean, mature and free from disease and injury;

– Store tropical fruits that are susceptible to “chilling injury” at temperatures above 10 °C for non-chill sensitive produce: 0–5 °C);

– Store ripe fruits separately from unripe ones;

– Do not mix fruits of different kinds in one cold store (This could lead to the absorption of off flavors, as well as to rapid deterioration of ethylene sensitive fruits);

– Store fruit in containers that can withstand stacking without getting deformed or without injuring the commodity;

– Fruits must be stored in clean containers

– Place containers of produce on pallets to avoid direct contact with the floor;

– Allow adequate clearance between the walls and floor of the storage container so as to allow for ventilation, air circulation and cleaning

– Use an organized system for managing inventory within the cold store. Codes and inventory rotation are important in minimizing the time that the commodity is stored and to facilitate, recall, should problems arise later in the food chain;

– Do not store chemicals, trash, waste or odorous materials in the vicinity of produce.

– Maintain the cold store in a hygienic condition by systematically and periodically cleaning the walls, floors and ceilings to avoid contamination with filth.

– Remove produce from cold storage during the cool part of the day in order to prevent “sweating,” i.e. moisture condensation on the commodity, which provides a good environment for microbial growth

4.6 APPROPRIATE TECHNOLOGY FOR COOLING FRUIT – A SOLAR ASSISTED COOLING CHAMBER

The solar assisted cooling chamber (figure 13) is an appropriate level of technology for the temporary storage of fresh fruits at the farm level. The hollow walls of the chamber are constructed from porous clay bricks and are kept moist by a water source. As moisture evaporates from the outer surfaces of the walls due to solar energy carried by the wind, the temperature within the chamber falls below that of ambient temperature by 4–5 °C. The moist walls of the chamber in the interim, maintain a relative humidity of 85–90 per cent within the chamber.

The storage life of fresh fruit can be prolonged by 2–3 weeks within the chamber. Design specifications for the construction of a solar assisted cooling chamber are shown below;

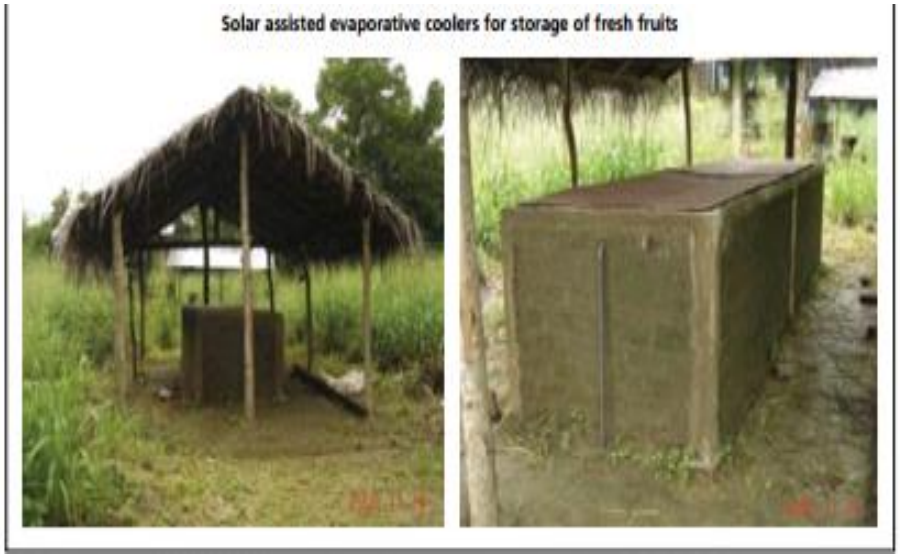


Figure 8; solar assisted evaporative colours for storage of fresh fruits like oranges.

CHAPTER 5

RECOMMENDATION

1. **Sensitization of the people**; People should be sensitized on the other hindered benefits of the varieties of these oranges. Farmers in Akyease should be educated on the need to have oranges around each and every day and the benefits it brings to our health

2. **Enforcement of environmental regulations;** The law enforcement agencies such as the officers of the Environmental Protection Agency(EPA)should ensure that the burning of orange trees , leaves and fruits in the environment is reduced drastically.

3. **Putting ups of new and proper dumping sites;** Proper disposal of spoilt fruits should be put up in the environment at a place a bit far from people to prevent the bad smell and smoke from coming to our homes and also to help people stop burning all these in their houses.

4. **The exposure to proper harvesting tools;** It is quite obvious that farmers of Akyease are not been exposed to more efficient and effective harvesting tools. The most common method used by them during the harvest is the use of sticks for plugging and sometimes the hand. So if they are been exposed to these productive ones, the output will always be great and hence productivity will be increased.

5. **The introduction of safe use of fungicides and insecticides;** Pests and parasites affect these orange trees and sometimes brings about the spoilage of these trees and their fruits. So if people are been exposed to better and good quality fungicides, it will help their work become easy and therefore reduce the post-harvest losses every year.

CONCLUSIONS

Orange farmers in Akyease cannot continue losing a third of their oranges annually. Therefore there is the need to put in place measures to arrest the situation and also ways to better these situations. These methods will help improve upon the livelihoods of the farmers and it will also serve as an employment avenue for the youth in the town which will in turn reduce the rate of rural-urban migration. Everything that has advantages has its own disadvantages. These solutions given are time consuming and require that farmers uphold high sanitary standard which are quite hard to maintain. But as the late Nelson Mandela once said, “everything seems impossible until it is done”.

As to how these solutions will help reduce this ungodly waste done on the orange trees and fruits, there is a clear and enough evidence that if the above suggestions concerning the solution of the problem are taken into consideration, this societal canker can reduce to its minimum.

On the other hand, it shows vividly that the stated advantages of these practices outweigh the disadvantages. So if others have been able to do this, and so as the people of Akyease can also do it.

Therefore all the objectives set for the study have been achieved and are obviously the key factors affecting orange waste in Akyease. It is therefore important that the recommendations above are implemented to help solve this canker.

It will only take perseverance and hardwork and as the saying goes, “where determination exists, failure can never dismantle the flag of success.

With the Almighty God on our side, with his blessings and guidance, this problem can be dealt with.

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APPENDICES

QUESTIONNAIRE ABOUT THE EXTREME WASTE ON ORANGE TREES AND FRUITS

Introduction

"Hello, Good morning, please my name is Vincentia Pokuaa Kyeremateng and I'm a second year chemical engineering student of the Kwame Nkrumah University of Science and Technology to complete a course named "Engineering in Society", which is designed for purely academic purposes and how to extend it to the solutions of the problems in the society. I'm undertaking a project and therefore I appeal to you to be honest with me to make this work easier.

You are not required to give your names so you will not be connected to the answers provided.

Please tick [#] in the appropriate box and fill the blank spaces where appropriate.

I .BACKGROUND CHARACTERISTICS OF RESPONDENTS.

1. Sex male [ ] female[ ]
2. Educational background.

a) Basic school [ ]
b) Secondary school [ ]
c) No formal education [ ]
d) Other (specify) ……..

3. How long have you stayed here?
   a. A year or more [ ]
   b. Few months or recently [ ]
   c. Other (specify) ……
4. How did you get the land for the orange farm?
   a. By inheritance [ ]
   b. By outright purchase [ ]
   c. Leasehold [ ]
   d. By hiring [ ]

e. Family land [ ]

5. How did you obtain start-up capital for the orange farm.

a. loans from banks [ ]

b. Help from friends [ ]

c. Personal savings [ ]

6. What is the average size of the orange farm?

   a. 1-10 acres [ ]

   b. 11-20 acres [ ]

   c. 21-50 acres [ ]

   d. 51-100 acres [ ]

   e. Above 100 acres [ ]

7. How do you obtain labor and machinery for land preparation?

   ……

   ……

8. What do you do when you wake up in the morning, just to find out majority of the leaves, branches and fruits are on the floor?

   …….

   ……

   ……..

9. Are you able to manage the farm well as expected?

   Yes [ ] b. No [ ]

10. How long have you been in this farming activity?

    a. 1-5 years [ ]

    b. 6-10 years [ ]

    c. 11-20 years [ ]

    d. Above 20 years [ ]

11. How do you obtain the orange seedlings?

    …….

    …….

12. What orange varieties are on your farm?

a. Common oranges
b. Navel oranges
c. Blood oranges

13. Do you intend selling the oranges after every harvest?

A. Yes [ ] b. No [ ]

14. What are three major factors hindering orange production in the area?

…..……..

……

……

15. To whom do you sell the oranges to?

a. Traders only [ ]
b. Open market only [ ]
c. Other (specify) …….

16. How do you store oranges on your farm?

a. In open air [ ]
b. Enclosed room [ ]
c. Freezing [ ]
d. Canning [ ]

17. How long do you store the oranges in days?

……

18. Do you get post- harvest losses after storage?

a. Yes [ ] b. No [ ]

19. If YES, quantity in percentage.

a. 0-5% [ ]
b. 6-10% [ ]
c. 11-15% [ ]
d. 16-20% [ ]
e. 21% and above [ ]

20. Are you aware the oranges can be preserved to help reduce post- harvest losses?

a. Yes [ ] b. No [ ]

21. If YES, give three of the preservation methods that you know.

……

……

…….

22. Which preservation method do you prefer and why?

    …….

    Reason …….

23. Will you be willing to accept and practice the other preservation methods and enjoy the other benefits of these oranges and trees?

    a. Yes [ ] b. No [ ]

This brings us to the end of my survey and thank you so much for your time. Would you be willing to provide your phone number in case we need to follow-up for clarification?

Respondent's phone number …….

Address ……...

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Our Ref: CoE-PO/ENG 291/ Date: May 23, 2017

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION

The bearer of this note is a First-Year Engineering student of the College of Engineering conducting a project in a course titled "Engineering in Society".

The overall aim of the course is to inculcate in students, an appreciation of the fact that the purpose of Engineering is to solve societal problems. This course is aimed at encouraging students early in their programmes of study to draw a link between their chosen field of Engineering and the application of this field to the issues that confront the day to day lives of people.

We should, therefore, be most grateful if you could facilitate his data collection and provide any other assistance that he may need.

Counting on your usual cooperation in such matters.

Yours Sincerely,

ING. PROF. MARK ADOM-ASAMOAH
Provost
College of Engineering