EVALUATION OF POST HARVEST RESIDUE GENERATION AND MANAGEMENT IN SELECTED LOCAL GOVERNMENTS OF NIGER STATE

BY

HARRY, DAFE PHIDO
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DECLARATION

1 hereby declare that this project work is a record of research work that was undertaken and written by me. It has not been presented before for any degree, Diploma or Certificate at any university or institution. Information derive from personal communication, published and unpublished work of other were duly reference in the text

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Harry, Dafe, Phido Date

CERTIFICATION

This is to certify that the project entitled "Evaluation of Post Harvest Residue Generation and Management in Selected Local Governments of Niger State" by Harry, Dafe Phido meets the regulations governing the award of the degree of Bachelor of Engineering (B.ENG.) of the Federal University of Technology, Minna, and it is approved for its contribution to scientific knowledge and literary presentation.

Mr. Peter Adeoye Supervisor	15/12/2010 Date
Engr. Dr. A. A. Balami Head of Department	15/12/10 Date
External Examiner	10/12/2010 Date

DEDICATION

I dedicate this work to the Almighty God for only in him can we gain solace, to my immediate family for their never ending support, and to My Father Mr. Edward.K.Phido (May his soul rest in perfect peace).

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ABSTRACT

Post harvest residue generations in selected local government areas of Niger state was evaluated this is with a view to knowing the types, quantity and strength of these resides. The method adopted was investigative approach. Questionnaire was administered and results collected. From the study, maize, groundnut and rice are being produced in large quantity in the place visited. Average grain-straw ratio for maize was 1.34:1, grain-straw husk ratio for rice was 1.28:1 while nut to shell ratio for groundnut was 3.07:1. For maize alone in twelve local governments, 3,421,38 tonnes of waste is produced, 3,481,92 tonnes for Rice and 1,742,51 tonnes of groundnut waste is produced. The major management measure adopted now is burning which is not environmentally friendly. The results gotten from the study can be used to design waste management plants for these local governments.

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CHAPTER ONE

1.0 INTRODUCTION

Waste can be defined as something useless produced by the same action that produces something useful or a by-product of industrial, agricultural municipal and mining activities.

Man has continually sought to improve the quality of life, transforming nature to provide more food, better living conditions and long life. Agricultural mechanization and technology has helped to accomplish this transformation and to achieve many of man's goals. It has however, left a profusion of environmental problems in its wake. Indeed, in many respects agricultural mechanization and modern technology is becoming too costly to human society in terms of economic and social values anti in terms of future implications. The question today is whether technology and good waste management can solve the environmental; problems which agricultural mechanization and technology has helped to cause. But in order to answer in a more practical way, technological evaluation activities should be expanded and more thought devoted to determining hat method is needed to solve today's pressing problems as regards waste management in a mechanized farm. Attention has been mainly focused on problems connected with treatment of wastes at the end of the production line. (Edward, 1980).

This change in agricultural practices have altered the traditional concept of agricultural production from small - scale to large- scale production both in animal and crop production. The agricultural mechanization may as well as be interpreted in several ways. To some, it is synonymous with tractorization, while others take it to imply crease in production per worker and per hectare of land cultivated. The fact that modern has made possible the cultivation of large hectares of land for growing crops, raising of large number of livestock and other agricultural activities on the farm such as processing, storage, irrigation and drainage through the use of machineries and equipment on the farm. Mechanization of agricultural production has reduced time of operations, removal of drudgery in farming operations enhances performance and efficiency on the farm, and increased farm incomes. [Anthony and Ezedinma, 1985].

The method used in handling, treating and disposing farm waste should be put into consideration. As waste dumped into storm drainage channels, creeks, lagoons and other water impoundment points create serious environmental problems which can adverse effect on air, water and soil conditions, and maybe or constitute a nuisance to those who dwell nearby. The devastation of lives and property which occurred due to the 1982 floods was attributed partly to an accumulation of refuse (waste) which blocked these cities' drainage channels. The ineffectiveness of contemporary municipal and agricultural solid waste management practices, which culminates in a number of health and environmental problems, has promoted the need to find an effective and pragmatic solution to agricultural waste management problems in Nigeria. (Hofenk, G. 1986)

Poor management of waste can as well bring about other adverse environmental such as: excessive nutrients from farm lands used for crop production or waste disposal that unbalance natural ecological systems and increase unbalance natural cal systems and increase eutrophication, micro-organisms in waste discharges that may impair the use of surface waters for recreational use, impurities in ground water from land disposal of waste contaminants that complicate treatment, depletion of dissolve oxygen in surface water causing deaths of fish and septic condition, and odours from concentrated waste storage and disposal.

1.1 Objectives

The objectives of this project are:

(i) To assess the various types of agricultural post- harvest waste generated from some parts on Niger State

(ii) To study the environmental impacts associated with these wastes being generated and evaluate various methods of handling and disposal of these farm wastes.

1.2 Statement of Problems.

The problems associated with farm waste management are numerous; environmental problems (pollution) which can escalate into disastrous situations resulting from improper waste management. Lack of proper education and adequate information on amount of waste generated, handling, treatment and disposal of waste on the farms and hence the allocation of cost of handling farm waste will not be known. Most of the facilities and equipments for collecting, spreading and treating waste are capital intensive, handling is also laborious and therefore the knowledge of types and quantity of waste generated has to be known.

1.3 Justification

Proper management and effective utilization of farm waste to reduce or completely eradicate environmental pollutions calls for this project. The improved waste management processes will enable the farm managers or operators to control environmental impacts that the waste generated would have caused. The farm managers will be afforded alternative ways of treating their farm wastes. The understanding and knowledge of the quantities of waste generated will help the farm managers to plan on how the wastes can be adequately managed.

1.4 Scope of Study

This project intends to find out various types of waste generated and their utilization on the farms. It will also assess the effect of waste generated and their treatment or disposal on the environment where the farms are located. It will identify the different types of wastes, sources and quantities of wastes generated on the various farms base on the harvested output.

CHAPTER TWO

LITERATURE REVIEW

2.1. Definitions

Waste is unwanted materials left over after completion of a process. Waste could exist either as solid, liquid or gas. When released as a liquid or gas, waste is referred to as emissions. Identifying waste is a subjective matter and waste is only defined as such when perceived as such. Some see waste as a negative externality, but it can also be viewed as a potential resource as in industrial ecology. (Kelvin, 1984)

Farm wastes are excess of wanted agricultural products that has been effectively utilized. This consists of solid and liquid wastes. Crop and field residues, agricultural chemical losses, dead livestock, food processing waste and obsolescent vehicle, equipment and building (Raymond 1987). Also farm waste can be defined as organic residues which remain as vegetal biomass in harvesting plant products and in preparing these to maintain and enhance safe and healthy environment have been directed towards problems caused by urban centres and industrial operations. Had agricultural production practiced remained static, environment problem caused agricultural productivity in recent decades (after World War II) to meet the increasing world demand for food and fibre (Kelvin 1994). Farmers have concentrated on intensive production of field crops or on livestock production which has led to the generation of large quantities of vegetal wastes (Tables 2.1).

Table 2.1 Plant and Vegetables Wastes in United Kingdom

Sources of materials	Quantity(million of tons of dry matter)	Metabolisable energy (MJ* 10^6)
Straw	9.30	60450
Arable	0.85	8460
Sugar beat	0.50	6000
Brewery	0.24	2640
Potato	0.20	1800
Vegetable	0.5	178
Spent mushroom compost	0.02	1,300

Hill. (1992)

The millions of tons of waste much of which cannot be treated or disposed of adequately where there is no enough land or facilities for treatment can lead to Nitrate concentration in the soil and as a result affect crop production. Also in North central part of Nigeria, the chaffs and straws from threshed rice are in range of millions of tonnes

Organic material forms 50-90% of the waste in mechanized farms. The organic fraction include raw kitchen waste generated in preparation and consumption food and leftovers, rotten fruits , vegetables , leaves and crop residues. This manure produces not only ammonia gas (NH_3) to pollute the atmosphere and damage vegetation but also nitrates that are washed into streams. The manure concentrates heavy metals into the soil at toxic levels.

These heavy metals such as copper, cadmium and zinc which are in high concentration were originally added to the animal feed to increase their growth. The animal however discharges these metals in their excrement (New scientist, 1988) When the Manure is used as the fertilizer or stock piled the metal s may then leach out of it and end up in the steam and ground water. Large amount of these heavy metal may be retained in the soil and can lead to the death of the earth worms that are so essential for the breakdown and aeration of the soil.

2.2 Environmental Effect on Agricultural Practices.

2.2.1 Nitrate.

World Health Organisation (WHO,1984) produced evidence that nitrate was responsible for 'blue baby' birth (methaemoglobinaemia). In this disease, nitrate reacts with bacteria in the gut and depletes the blood 0xygen level , which then affect the brain and heart muscle. It has even been suggested that some form of stomach cancer result from nitrate poisoning. In Britain, the EC identified 52 areas where concentrations exceeded permitted nitrate levels and it was estimated that some 1.3 million people were affected. Mothers were told to use bottled water for their babies because boiling water does not remove nitrate (Kelvin 1994).

The quantity of artificial nitrates used on land in attempt to improve agricultural yield has increased considerable over the last 20 year. In the U.K, for instance ,1.3 million tones of nitrate were used in 1986, twice that of 1966. Natural fertilizers also produce large quantities of nitrates as can be seen in animal husbandry. This is often leaked or intentionally released into water supplies in order to dispose of the large quantities produced by animal husbandry. Soil itself will naturally produce nitrate through the microbial activity of nitro fixing bacteria by supplying nitrogen as nitrates directly to the plant when the plant decays nitrates are deposited in the soil.

Therefore, the standards set by the EC and WHO put an acceptable limit of 50 and 100mg per litre of nitrate concentration in public water supplies. These recommended levels of nitrate are exceeded by the agricultural activities.

2.3 Waste Characteristics.

Waste produced in the wild is reintegrated through natural recycling processes, such as dry leaves in a forest decomposing into soil. Outside of the wild these wastes may become problematic, such as dry leaves in an urban environment. The highest volume of waste outside of nature comes from human industrial activity: mining waste, industrial waste, post-consumer waste, and so on. Most manufactured products are destined to become waste at some point in time, with a volume of waste production roughly similar to the volume of resource consumption

When one considers that every product ends up as waste, it might be a good idea to analyze matter entering the production cycle, rather than analyzing waste that are usually diluted as a result of the process. For example, a consumer buying products containing heavy metals in small quantities will probably not detect these heavy metals in the resulting waste. An analysis of products entering the production system, and a guarantee form the final pollution (example: a farmer receiving sewage sludge to land fill on some of his more likely to reveal the pollution than the soil itself after a couple of years) (also post-consumer waste is the same produced by the end-user (the garbage one puts outside in the trash can). This is the waste people usually think of. But though the most visible, this is very small compared to the waste created in the process of mining and production.

An understanding of the waste characteristics permit judgment on the type of treatment and disposal that may be effective. According to (Hammer, 1968) as reported by (Weber, 1968) that agricultural waste are characterized mainly by compounds carbohydrates, fats, proteins, celluloses, hemi celluloses and lignin. The waste is suitable for being degraded by micro organisms except lignin which is resistant to microbial decay and only decomposable after pretreatment.

Parameter such as BOD (Biochemical Oxygen Demand) chemical oxygen demand (COD) ratios and total or suspended solid ratio are used to estimate feasibility of biological waste treatment process with specific waste. With a liquid waste containing dissolved organic solids, biological treatment is appropriate. Solid waste with a high organic content is amendable to composting or incineration.

2.3.1 Biochemical Oxygen Demand

The BOD is of the most widely applied analytical methods in waste treatment and water pollution control. The tests attempts to determine the pollution control. The test attempts is to determine the pollution strength or a waste in terms of microbial oxygen demand and is an indirect measure of organic matter in the waste. Thus, the BOD measures the amount of oxygen necessary to stabilize the decomposable organic matter in the sewage or waste.

A long period of time, probably 100 days or more is required for complete stabilization of all the organic matter in sewage. The oxygen is taken up rapidly at first, then more slowly. Since it is actual work to utilize tests that require more than a few days for reliable results. it is costmary to make BOD tests at a standard of 20oc for a period of 5 days. It has been determined experimentally that the 5 the 5 day BOD is about 68 percent of the ultimate when the reaction velocity coefficient of 0.10 is used.

2.4 Methods of Waste Handling, Treatment and Disposal

The practise of reusing waste in food cultivation in Nigeria is not new. Most parts of the country have traditionally utilized various types of organic materials, to maintain and improve the productivity, tilt and fertility of agricultural soils. The indigenous kitchen garden, compounds and community garden systems of the south western part of Nigeria has made extensive use of organic materials.

Farm waste generally is suitable for biological treatments because their essential components are protein, carbohydrates and fats. By biological treatments, farm wastes can be converted in to different products which are suitable for use in agriculture.

Ponds and lagoons are among the simplest treatment systems available, they are widely used in treating agricultural waste. The major types of ponds and lagoons can be classified into aerobic, facultative, aerated and anaerobic.

2.5 Disposal of waste

Open dumping is the most common method of waste dumping in the African region. in the Nigerian sub continent, especially in the small cities and towns, there is direct dumping of waste, sometimes with sparse cover and sometimes combined with partial burning in the dry season. Wastes are illegally bumped in water bodies of all kinds when settlements are denied municipal collection service. More solid wastes reach the sea after being dropped illegally in the rivers and canals.

2.6 Waste disposal on the farm

2.6.1 Burning

1. Burning yard wastes originating from the farm may be disposed by use of an open burning. In addition waste accumulated from grubbing and construction activities may be burned. At least burning must be from an area one quarter mile from any residence.
2. Dead animals may be incinerated on site. No permit is required from DNR.emmision of particulate must be controlled. Equipments are available commercially which should ensure compliance with emission standards is sized operated and maintained local ordinances may be more resistive.
3. Paper and plastic containers (except those formally contain organic forms of mercury, lead beryllium, selenium, calcium or arsenic. And seed corn bags resulting from farming activities on the premises can be burnt. Such burning is limited to those areas et least one quarter mile away from any residential building, livestock wild life area and water

course..The amount of bags or containers should not exceed one day's accumulated or 50 pounds which is less.

2.6.2 Burying

1. If farm machinery, vehicles or equipments used on the farm land cannot be recycled they may be burned on the site. All vehicle fluids including solvents and batteries should be removed

2. Ashes from the burning of trees and weed may be buried.

3. Farm buildings may be buried provided they are emptied of any content not authorized for burial.

4. Dead animals may be buried on site on any given acre per year in the following quantities; 7 slaughter or feed cattle, 44 swine [butcher or breeding], 73 sheep or lambs, 400 poultry carcasses. All other species will be limited to 2 carcasses per acre. Animals which die before 2 months of birth may be buried without regard to number.

5. All waste must be buried moderately well to excessively drained soils as defined by the county soil survey published by the US soil conservation service. Other soils may be useful if artificial drainage is installed to maintain a water level of 2 facts below the carcasses. The depth of the burial pit shall not exceed 6 feet. Buried waste must immediately be covered with a minimum of 6 inches of soil and finally be covered with about 24 to 30 inches of soil.

2.6.3 Incineration Method of Garbage Disposal

This is a controlled combustion process for disposing off combustible waste and liquid and released to the air. Incineration method has an advantage over land fill method in land conservation. Incineration plants are tailor made to suit the type of garbage required to be handled. They could be fixed with a refractory hearth or moving grates, the air could be supplied by an air blower or by an exhaust.oil firing equipment is also to be installed so as to maintain a constant temperature, sophisticated devices are also required to make sure that the flue gas is free of pollutants. The smoke is cleaned by cyclonic or spray system or electro precipitators. The boiler system utilizes flue heat and the furnace heat tom convert water into steam turbine run generator to produce power. Garbage banks empty their contents into a receiving bunker; hydraulic cranes lift this up and deposit it into the incinerator furnace hoppers. In some designs garbage is processed before going into the furnace so as to removed non combustible material,

The advantages of incineration are

a. Volume reduction is 90 percent

B. very small area of land is required compared to the land fill method.

C. can be located in the vicinity of the garbage location area to reduce transportation cost.

D .it remains the most hygienic method of waste disposal allowing for control of air, temperature and a smoke cleansing environment.

Energy generation from incinerations is not usually applicable to developing countries where kitchen waste makes up a higher percentage. The moisture content of refuse in developing countries ranges between 40 to70 percent compared to the 20 to 40 percentage waste moisture in industrialised countries. As a reply incineration would require supplementary fuel and result in a net energy deficit. Even Japan who has more incineration plants than any other country in the world is reported to have recovered little useful energy for sale due to the high moisture contents of its refuse. Nevertheless, recent development in separation technology if practised may eventually offer an economical way to separate the dryer co bustle portions from the rest of the waste. A refuse incineration cum powder generation plant, for pilot research, development and demonstration was installed in 1987 at Timarpur, Delhi, .this programme is aimed at the disposal of 300 metric tonnes of garbage from Delhi and the generation, of 3.75 MW power. The plant could not succeed mainly due to the mismatch between the plant design and quality of garbage available. However, the Delhi government has of late shown keen interest to operate the plant by suitable organising waste management's segregation and pre processing

2.6.4 Pyrolysis

In this process waste is heated indirectly from an external heat source and is charred in the absence of air. This is a very recent modern method utilized as energy recovery method from waste. The process incorporated a system of decomposing organic compounds in waste through an application of heat, it is the process of destructive distillation carried out in a closed vessel carried out in an oxygen free environment . Pyrolysis in a proven method for uniform organic matter like wood, but as agricultural waste is heterogeneous in nature only about 50 per cent is of the input gets processed leaving almost 50 percent discarded needing alternate disposal.

fill gases.

2.6.5 Bio Mechanisation

This involves the segregation of solid mater present in solid waste. it is then fed into a bio reactor, the organic matter ferments due to the presence of the mechanogenic bacteria. The bio gas is used to drive power.

For several decades tremendous attempts have been made in converting farm waste into bio gas and many communities' plants have gone to work in the rural areas. Laboratory studies are being conducted to tap bio gas by treating municipal waste with some modifications in the techniques.

2.6.6 Pelletisation

Pelletisation is the production of fuel of fuel pallets from solid wastes. Pallets can be used for heating plants boiler and for the generation of electricity. They also act as a perfect substitute for coal or wood used in home or industries. Pelletisation offers the possibility of decentralised garbage treatment facilities.

Integrated Waste Management (IWN) in Mumbai, 1989 did a prototype pellesitation plant of 1.50 to 2.00 tonner per hour per steam in two parallel strings, design and commissioned solid waste after segregation of undesirable ingredients was used for processing. Addition of bio-mass to the extent of fifty per cent of plants output was ensured to enhance the calorific value of the fuel pallets. Various sub-system components and process parameters were concurrently improvised during its commissioning and trial period to perfect the technology package.

The fuel pallets are found to have tremendous market potentials and can be used in all kinds of boiler made to improve upon availability of the entire project. Pellesitation technology has the following advantages:

I Callorific value of a product is close to that of coal and can substitute coal or wood in home or industry.

Ii Decentralised garbage treatment is possible.

Iii Markets exists for pallets.

Iv Revenue/profitability is relatively high.

2.6.7 Vermiculture

Vermicomposting uses earthworms to decompose organic waste, and has been demonstrated in small scale projects. In Manila, vermicomposting is being promoted as a means of recycling at the source and thereby reducing the overall cost of agricultural waste collection. Waste segregation is done in separate containers provided. The earthworms reduce the waste by up to fifty per cent, and their castings consolidate the nutrients originally found in the waste. The casting can be either marketed as soil enhancer or used in the pots to raise selected vegetables and herbs.

2.6.8 Composting

Composting can be defined as the biological decomposition of the organic constituents of waste under controlled conditions. This process can take place in the presence or absent of oxygen.. Aerobic composting, if efficiently carried out, can rapidly produce a pathogen free product, anaerobic composting requires more time and is seldom free of pathogen or odour problems. There are two main types of mechanical composition processes, window process and close cell process.

2.6.8.1 Window Process

In the window process garbage is laid in long heaps above the ground and oxidation and fermentation is carried out by regular turning thereby air, moisture and temperature under control till it gets stabilised.

2.6.8.2 Close Cell Process

In the close cell process, garbage is fed through a close rotating drum where air, moisture and temperature are controlled and composed comes out at the end which gets matured in stock piles.

2.7 Health impact

Environmental problem faced by communities leaving near the garbage dumps (agricultural wastes) and marshy lands include air pollution, fires, smoke, flooding Another health problems, accentuation by flies vectors and rodents dehydration, diarrhoea, dysentery and worms are common among adults as well as children. Other problems that are not directly treated in include scabies, dental problems, ear aches, eye infections and genealogical problems colds, coughs, flew and boils are abscesses and sores too cannot be ruled out.

Long term held problems like as asthma, bronchitis, hepatitis, jaundices, malaria, elephantiasis and typhoid too have been faced by communities. Maximum number suffers from anaemia, women been the worst affected. Secondary health hazards of farm waste are fire and explosions when dry waste such as paper, wood or plastic catches fire.

2.8 Human Exposure Control

Of the health protection measures in agricultural wastes management, only human exposure control is not dealt with in greater depth in most work. The objective with this approach is to prevent the population groups at risk from coming into direct contact with pathogens in the wastes or to prevent any contact with the pathogens leading to disease. Four groups are at risk in agricultural reuse of farm residue, agricultural workers and their families crop handlers consumers of crops, meat and milk and - those living near the areas where the farm is sited. Therefore, different methods of exposure control might be applied for each group.

Control measures aimed at protecting agricultural field workers and crop handlers include the provision (and insistence on the wearing) of protective clothing, the maintenance of high levels of hygiene and immunization against (or chemotherapeutic control of) selected infections. Examples of these measures are given in the WHO (1989) Technical Report mentioned. Risks to consumers can be reduced through cooking the agricultural produce before consumption and by high standards of food hygiene, which should be emphasized in the health education associated with wastewater use schemes. Local residents should be kept fully informed on the use of wastewater in agriculture so that they, and their children, can avoid these areas. Although there is no evidence to suggest that those living near the fields are at significant risk, sprinklers should not be used within 100 m of houses or roads.

Special care must always be taken in slurry wastes use schemes to ensure that agricultural workers or the public do not use wastewater for drinking or domestic purposes by accident or for lack of an alternative. All watercourse nearby, pipes and outlets must be protected from the slurry. Wherever possible, outlet fittings should be designed/selected so as to prevent misuse.

2.9 Overcoming Toxicity Hazards

A toxicity problem is different from a salinity problem in that it occurs within the plant itself and is not caused by water shortage. Toxicity normally results when certain ions are taken up by plants with the soil water and accumulate in the leaves during water transpiration to such an extent that the plant is damaged. The degree of damage depends upon time, concentration of toxic material, crop sensitivity and crop water use and, if damage is severe enough, crop yield is reduced. Common toxic ions in irrigation water are chloride, sodium, and boron, all of which will be contained in sewage. Damage can be caused by each individually or in combination. Not all crops are equally sensitive to these toxic ions. Some guidance on the sensitivity of crops to sodium, chloride and boron are given in Tables 23, 24 and 25, respectively. However, toxicity symptoms can appear in almost any crop if concentrations of toxic materials are sufficiently high. Toxicity often accompanies or complicates a salinity or infiltration problem, although it may appear even when salinity is not a problem.

The toxic ions of sodium and chloride can also be absorbed directly into the plant through the leaves when moistened during sprinkler irrigation. This typically occurs during periods of high temperature and low humidity. Leaf absorption speeds up the rate of accumulation of a toxic ion and may be a primary source of the toxicity.

However, urban wastewater may contain heavy metals at concentrations which will give rise to elevated levels in the soil and cause undesirable accumulations in plant tissue and crop growth reductions. Heavy metals are readily fixed and accumulate in soils with repeated irrigation by such wastewaters and may either render them non-productive or the product unusable. Surveys of wastewater use have shown that more than 85 % of the applied heavy metals are likely to accumulate in the soil, most at the surface. Any wastewater use project should include monitoring of soil and plants for toxic materials.

2.10 Land and Soil Management

Several land and soil management practices can be adopted at the field level to overcome salinity, sodicity, toxicity and health hazards that might be associated with the use of crop residues;

2.10.1 Land Development

During the early stages of on-farm land development, steps can be taken to minimize potential hazards that may result from the use of wastes. These will have to be well planned, designed and executed since they are expensive and, often, one time operations. Their goal is to improve permanently existing land and soil conditions in order to make residue reuse easier. Typical activities include levelling of land to a given grade, establishing adequate drainage (both open and sub-surface systems), deep ploughing and leaching to reduce soil salinity.

2.10.2 Land Grading

Land grading is important to achieve good uniformity of application from surface methods and acceptable efficiencies in general. If the residue is toxic, it is very important that the irrigated land is appropriately graded. Salts accumulate in the high spots which have too little water infiltration and leaching, while in the low spots water accumulates, causing water logging and soil crusting.

Land grading is well accepted as an important farm practice in irrigated agriculture. Several methods are available to grade land to a desired slope. The slope required will vary with the irrigation system, length of run of water flow, soil type, and the design of the field. Recently, laser techniques have been applied to level land precisely so as to obtain high irrigation efficiencies and prevent salinization.

2.10.3 Deep cultivation

In certain areas, the soil is stratified, and such soils are difficult to fertilise. Layers of clay, sand or hard pan in stratified soils frequently impede or prevent free movement of water through and beyond the root zone. This will not only lead to saturation of the root zone but also to accumulation of salts in the root zone. application efficiency as well as manure movement in the soil can be greatly enhanced by sub-soiling and chiselling of the land. The effects of sub-soiling and chiselling remain for about 1 to 5 years but, if long term effects are required, the land should be deep and slip ploughed. Deep or slip ploughing is costly and usually requires the growing of annual crops soon after to allow the settling of the land. Following a couple of grain crops, grading will be required to re-establish a proper grade to the land.

2.11 Crop Management and Cultural Practices

Several cultural and crop management practices that are valid under saline water use will be valid under crop residue reuse. These practices are aimed at preventing damage to crops caused by salt accumulation surrounding the plants and in the root zone and adjusting fertilizer and agrochemical applications to suit the quality of the residue and the crop.

2.11.1 Placement of Seed

In most crops, seed germination is more seriously affected by soil salinity than other stages of development of a crop. The effects are pronounced in furrow-irrigated crops, where the water is fairly to highly saline. This is because water moves upwards by capillarity in the ridges, carrying salts with it. When water is either absorbed by roots or evaporated, salts are deposited in the ridges. Typically, the highest salt concentration occurs in the centre of the ridge, whereas the lowest concentration of salt is found along the shoulders of the ridges. An efficient means of overcoming this problem is to ensure that the soil around the germinating seeds is sufficiently low in salinity. Appropriate planting methods, ridge shapes and irrigation management can significantly decrease damage to germinating seeds.

2.11.2 Desirable Site Characteristics

The features which are critical in deciding the viability of a land disposal project are the location of available land and public attitudes. Land which is far distant from the compost plant will incur high costs for transporting compost to site and will generally not be suitable. Hence, the availability of land for residue reuse should be considered .These sites should not be close to residential areas but even remote land might not be acceptable to the public if the social, cultural or religious attitudes are opposed to the practice. The potential health hazards associated with effluent irrigation can make this a very sensitive issue and public concern will only be mollified by the application of strict control measures. In arid areas, the importance of agricultural use of treated effluent makes it advisable to be as systematic as possible in planning, developing and managing effluent irrigation projects and the public must be kept informed at all stages.

The ideal objective in site selection is to find a suitable area where long-term application of treated effluent will be feasible without adverse environmental or public health impacts. It might be possible in a particular instance to identify several potential sites within reasonable distance of the sewered community and the problem will be to select the most suitable area or areas, taking all relevant factors into account.

The characteristics of the soil profile underlying a particular site are very important in deciding on its suitability for effluent reuse and the methods of application to be employed. Among the soil properties important from the point of view of are physical parameters (such as texture, grading, liquid and plastic limits, etc.), permeability, water-holding capacity, pH, salinity and chemical composition. Preliminary observation of sites, which could include shallow hand-auger borings and identification of vegetation, will often allow the elimination of clearly unsatisfactory sites. After elimination of marginal sites , each site under serious consideration must be investigated by on-site borings to ascertain the soil profile, soil characteristics and location of the water table.

2.12 Environmental Protection

Care should always be taken when applying these wastes to land to prevent any form of adverse environmental impact. The sludge must not contain non-degradable materials, such as plastics, which would make land disposal unsightly. Movement of sludge by tanker from sewage treatment plant to agricultural land can create traffic problems and give rise to noise and odour nuisance. Vehicles should be carefully selected for their local suitability and routes chosen so as to minimize inconvenience to the public. Access to fields should be selected after consultation with the highway authority and special care must be taken to prevent vehicles carrying mud onto the highway.

Odour control is the most important environmental dimension of waste slurry application to land. Enclosed tankers should be used for transporting treated sludge, which tends to be less odorous than raw sludge. Discharge points for sludge from tankers or irrigators should be as near to the ground as is practicable and the liquid sludge trajectory should be kept low so as to minimize spray drift and visual impact. They should be injected under the soil surface using special vehicles or tankers fitted with injection equipment.

Great care is needed to prevent slurry running off onto roads or adjacent land, depending on topography, soil and weather conditions. On sloping land there is the risk of such runoff reaching watercourses and causing serious water pollution. Sludge application rates must be adjusted accordingly and, under certain circumstances, spreading might have to be discontinued. In addition to the problem of surface runoff, pollution may arise from the percolation of liquid sludge into land drains, particularly when injection techniques are used or liquid sludge is applied to dry fissured soils. In highly sensitive water pollution areas, sludge should be used only in accordance with the requirements of the pollution control authority as well as of good farming practice. Sludge storage on farms can optimize the transport and application operations but every effort must be made to ensure that storage facilities are secure.

CHAPTER THREE

MATERIALS AND METHODS

3.1 GENERAL

The methodology adopted in this study is the investigative approach, this includes: mechanized farms visitation and administering of questionnaires to the management of these farms in north central geo-political zones of Nigeria. Also journals, textbook, and experienced personnel in related fields of environmental management were consulted, this is to enable one to get information relevant for this study. In the course of this investigation, the total of six villages were visited and ten questionnaires were administered to each farm visited (that is to the management to each in farm). Pictures were also taken in each of the farm visited.

3.2 Description of the Study Area

Niger State is located between latitude $8^0,20^1$ and $11^0,3^1$ and longitude $3^0,30^1$ and $7^0,20^1$. Agricultural activities form the major occupation of the people because about 80% of the population engaged in farming either directly or indirectly. The State experiences two distinct seasons,, the annual rainfall is about 1600mm. The duration of the rainy season is about 150 to 160 days with highest temperature hovering over $32^{0.}$

3.3 Soil and Vegetation

Three major soil types can be found in the state .They include the ferruginous tropical soil, hydromorphic soil and ferrosol. The most predominant soil type is the ferruginous tropical types which are ideal for the cultivation of guinea corn, maize, millet, rice and groundnut.

3.4 Procedure for Data Collection

The state under study was divided into three for this study and four Local Governments each were visited in each division ,they are; Shiroro, Munyan, Paiko and Bosso in Shiroro zone.Kontagora, Wushishi, Magama and kagara in Kontagora side and Bida,Gbaiko,Lavun and Edati in Bida side. A total of five questionnaires were administered in each of these Local Government.. All the farms were privately owned and the activities of the farms .Most of the farms has situated far away from the cities or in the outskirt of towns. Niger State Agricultural Development Headquarter in Minna was also visited and two questionnaire were also administered there.

3.5 Administration of Questionnaires

A total of sixty two questionnaires were administered to the places visited. The questionnaire consists of the following sections:

Section A: It contains questions on the name, location, of the Local Government.

Section B: This section deals with the types of crop under cultivation in the villages that make up the Local Government, the output per year for each crop.

Section C: This section deals with information about post harvest residue. Their usage and threat they pose to environment if left untreated or used.

The questions asked in these sections are structured to give precise answers to the problem under investigation. This provides information on the type of wastes generated, sources, and problems associated with the time of waste generated in relation to the environment , and how these wastes are managed to abate the pollution tendencies of the wastes. Also, questions are asked on the performance of the organizations in terms of their efficiency and rating in managing wastes in line with the specification of environmental protection agencies .Appendix 1.

3.6 Method of Analysis

The nature and type of data required to achieve the objects of this study, determines the use, the choice and the type of analysis and also the method of presentation. This data are in general terms pieces of information and facts which makes up the raw materials of the subject to which they relate. Some information provided is other then qualitative on the subject under study. Data on research shows certain characteristics such as relationships, associations' variations, frequencies, trend and patterns. This characteristic can be seen or observed when described and summarized in statistical forms, diagrammatical forms, and graphical illustrations.

3.7 Determination of Grain-Straw Ratio

The method used by Ogunniran, 2005 was used to determine the grain-straw ratio, grain-husk-straw ratio and groundnut-shell ratio. The method involve collecting samples of crop stand at different points on one meter square area. The grain and the straw at each stand are separately weighed. The process is repeated six times at different points on the one meter square area. The average ratio of weight of grain to weight of straw for the six samples is the grain-straw ratio. The same method was used to get groundnut-shell ratio.

3.8 Problems Encountered

Some of the farms are located in areas not frequented by commercial vehicles and even if they are, the transport fare is high. Sometimes motorcycles are hired to take one to some of the farms.

Although in view of the importance attached the investigating study or the project, one was patient devoted to the work so the studies were carried out.

In all the farms visited and questionnaires issued, none gave a complete response or information about their operations and some misunderstood the questions as it was thought that it is a way of exposing their problems and negligence so they were not willing to give out information. Also, some questions that were not attended to in the questionnaires were due to non participation of some establishments in these activities.

More so, in some instances one was not allowed entrance into the premises, even when relevant letters from the school was presented to the farmers. The questionnaires administered were not completed immediately and a date for collection was fixed, this was not a guarantee that on the date scheduled on, one will get the questionnaire filled, and this makes the journey to such farms to be more than once before collection was possible. In some instances, another questionnaire had to be administered due to the replacement or incorrect filling. Lack of documentation on the activities of the farms interviewed. The operations, waste quantities and management practices in the selected farms in the North-central parts of Nigeria make the task an uneasy one.

CHAPTER FOUR

RESULTS AND DISCUSSION

The following are the findings of the the questionnaires administered in the selected area.

4.1 Information on Respondents and Activities of the Farms

The farms visited are all private owned establishment and all the farmers are not having formal education. However, much information were got from Niger State Agricultural Development Programme (NSADP). Five major crops were being propagated on large scale basis in Niger state. But the way and manner they are being grown vary and spread across the state. The crops are; groundnut, maize, yam, sorghum and rice. The distribution of the crops in the selected local Governments that fall within the three zones are as presented in Figures 4.1, 4.2 and 4.3.

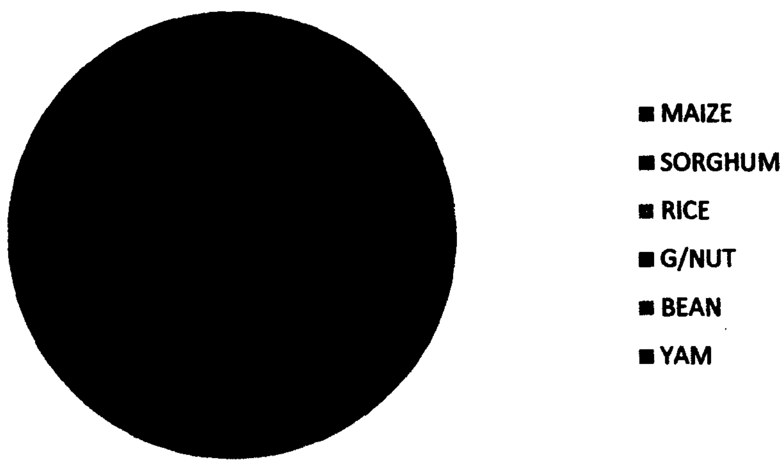

Figure 4.1: AVERAGE CROP PRODUCTION PER YEAR IN KONTAGORA ZONE

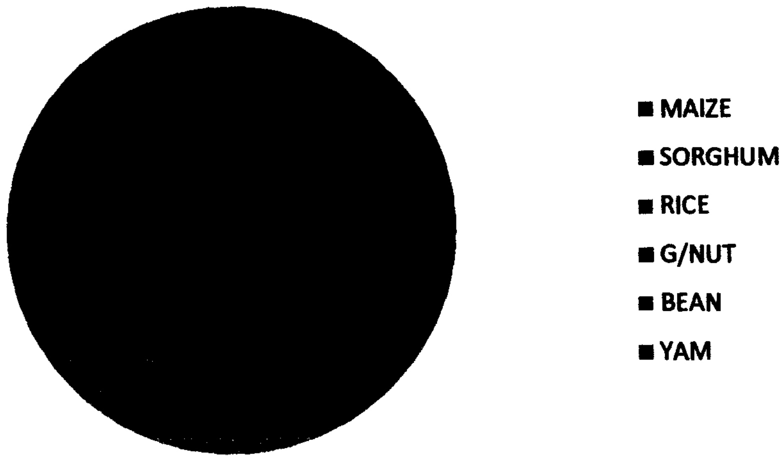

Figure 4.2: AVERAGE CROP PRODUCTION PER YEAR IN BIDA ZONE

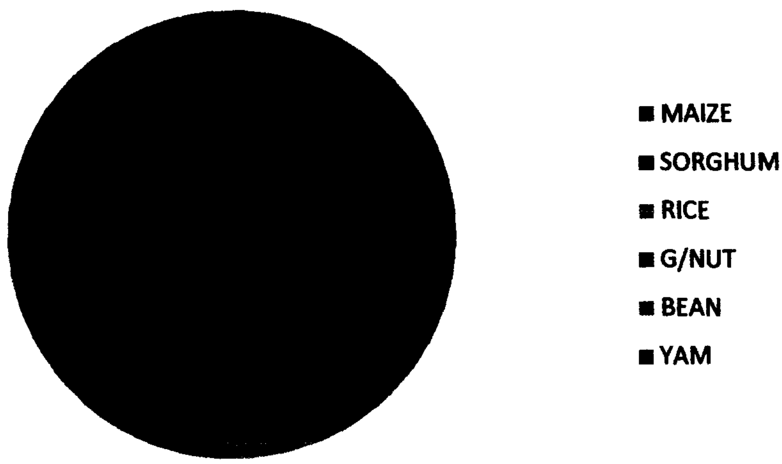

Figure 4.3: AVERAGE CROP PRODUCTION PER YEAR IN SHIRORO ZONE

From the figures, it can be seen that crops that has largest percentage in Kontagora Zone is groundnut and rice is taking the lead in Bida zone. In Shiroro zone, maize and yam are having percentage very close to each other (30% and 28% respectively). However, when post-harvest wastes of maize and yam are compared, yam gets to final consumer almost without undergoing much post-harvest handling. That makes its post-harvest residue to be close to negligible. Therefore maize was taken to be studied in Shiroro zone. The information about average output of the four selected crops as extracted from questionnaire administered in NSADP are summarized in Tables 4.1 below. The outputs are for the year between 2005 and 2009 for the 12 selected local Governments.

TABLE 4.1: Average Output Of Selected Crops from 2005-2009

Local Government	Maize (Tonne/year)	Rice (Tonne/year)	Groundnut (Tonne/year)	Sorghum (Tonne/year)
Bosso	480	239	236	233
Munyan	410	278	218	268
Shiroro	430	298	312	269
Paiko	421	301	298	302
Kontagora	344	187	736	311
Kagara	322	202	675	309
Magama	392	215	612	326
Wushishi	403	304	567	246
Edati	519	613	349	254
Bida	354	710	332	332
Gbaiko	332	654	387	314
Lavun	367	665	401	269

SOURCE: Niger State ADP Office and Returned Questionnaire Forms

The output confirms the distribution of the crops. It can also be seen from table 4.1 that groundnut production is more in the four local Governments that makes up Kontagora zone while more of rice was recorded in Bida zone. Maize is produced in larger quantity in Shiroro zone.

The results of grain –straw ratio for maize, grain-straw-husk ratio for rice and nut-shell ratio for groundnut determined are presented in tables 4.2,4.3 and 4.4 respectively.

TABLE 4.2: Grain- Straw Ratio Of Maize Test Plots

Sample	Weight of grain (g/m^2)	Weight of straw (g/m^2)	Grain- straw ratio
1	549.6	433.2	1.27:1
2	630.2	456.3	1.38:1
3	657.6	552.2	1.19:1
Average	612.5	480.6	1.28:1

TABLE 4.3: Grain- Straw-Husk Ratio Of Rice Test Plots

Sample	Weight of grain (g/m^2)	Weight of straw+ Husk (g/m^2)	Grain- straw- Husk ratio
1	355.30	255.6	1.39:1
2	439.22	310.66	1.41:1
3	544.33	433.20	1.26:1
Average	446.28	333.15	1.34:1

TABLE 4.4: NUT- SHELL RATIO OF GROUNDNUT TEST PLOTS

Sample	Weight of groundnut (g/m^2)	Weight of shell (g/m^2)	Nut- shell ratio
1	289.3	98.3	2.94:1
2	302.0	102.1	2.96:1
3	321.0	96.4	3.33:1
Total	304.1	98.9	3.07:1

From the tables average grain to straw ratio for maize is 1.28 to 1, grain-straw-husk ratio for rice is 1.34 to 1 while nut to shell ratio for groundnut is 3.07 to 1. Ratio of that of groundnut is small because the weight of shell to nut are far from each other, however, groundnut shell , though lighter in weight, occupies more space than rice husk and maize straw. This is evident in the heaps of groundnut shell in Mariga village plate 1, and rice husk heaps in Doko village .Plate 2.

PLATE 4. 1: Groundnut Shell heap in Mariga, Niger State.

he information here is used to estimate the quantity of wastes being generated from these crops n the Local Governments under consideration. This is presented in table 4.5.

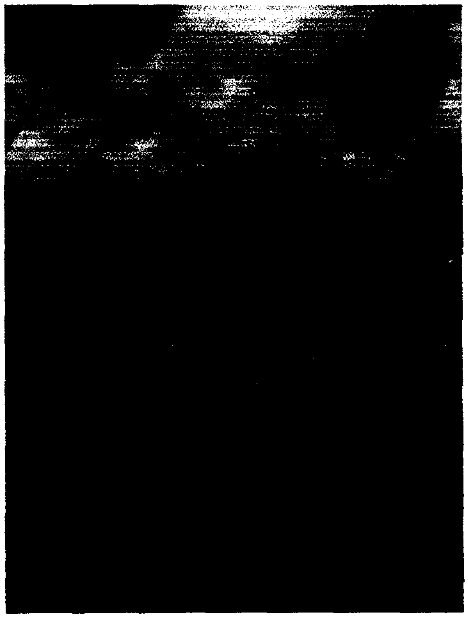

PLATE 4.2: Rice Husk heap in Doko, Niger State.

ABLE 4.5 Estimate Crop Waste Produced Based On Calculation For Maize

ocal overnment	Crops	Grain Straw ratio	Total crop output (tonne)	Total crop waste(tonne)
osso	Maize	1.28:1	480	375.00
Munyan	Maize	1.28:1	410	320.30
Shiroro	Maize	1.28:1	430	335.94
Paiko	Maize	1.28:1	421	328.91
Kontagora	Maize	1.28:1	344	268.75
Kagara	Maize	1.28:1	322	251.56
Magama	Maize	1.28:1	392	306.25
Wushishi	Maize	1.28:1	403	314.84
Edati	Maize	1.28:1	519	405.47
Bida	Maize	1.28:1	354	276.56
Gbaiko	Maize	1.28:1	332	259.38
Lavun	Maize	1.28:1	367	286.72
TOTAL			4774	3,421.38

TABLE 4.6: Estimate Crop Waste Produced Based On Calculation For Rice

Local	Crops	Grain-Straw-	Total crop	Total crop

Government		Husk ratio	output (tonne)	waste(tonne)
Bosso	Rice	1.34:1	239	178.36
Munyan	Rice	1.34:1	278	207.46
Shiroro	Rice	1.34:1	298	222.39
Paiko	Rice	1.34:1	301	224.63
Kontagora	Rice	1.34:1	187	139.55
Kagara	Rice	1.34:1	202	150.75
Magama	Rice	1.34:1	215	160.45
Wushishi	Rice	1.34:1	304	226.87
Edati	Rice	1.34:1	613	457.46
Bida	Rice	1.34:1	710	529.85
Gbaiko	Rice	1.34:1	654	488.06
Lavun	Rice	1.34:1	665	496.27
Total			4666	3,481.92

TABLE 4.7 Estimate Crop Waste Produced Based On Calculation For Groundnut

Local Government	Crops	Nut-Shell Ratio	Total crop output (kg)	Total crop waste

so	Groundnut	2.94:1	236	80.27
nyan	Groundnut	2.94:1	218	74.15
iroro	Groundnut	2.94:1	312	106.12
aiko	Groundnut	2.94:1	298	101.36
ontagora	Groundnut	2.94:1	736	250.34
Kagara	Groundnut	2.94:1	675	229.59
Magama	Groundnut	2.94:1	612	208.16
Wushishi	Groundnut	2.94:1	567	192.86
Edati	Groundnut	2.94:1	349	118.71
Bida	Groundnut	2.94:1	332	112.93
Gbaiko	Groundnut	2.94:1	387	131.63
Lavun	Groundnut	2.94:1	401	136.39
TOTAL			51243	1742.51

It can be seen from Tables 4.5- 4.7 that the quantity of post –harvest residue generated in ten local Government area of Niger State is very high for the three crops considered. About 1745 tonnes of groundnut shell are produced while about 3,480 tonnes of rice husk is produced and 3420 tonne of maize straw are produced. This may be linked to the types of soil that dominate the farms in the study area which support cultivation of grain and shallow rooted crops. The output of a groundnut farm in Kontagora Local Government is shown in plate 3. The state is therefore a major producer of food crops. However when this is being done, the attendant effect of waste production and management should also be considered.

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Plate 4. 3: Groundnut Output in a Farm

4.2 Residue Management

From the in-situ inspection done and the reposes to the questionnaire administered, all the farm visited are not having definite waste management practice. The residues are just left on the soil to degrade and in some area; they have formed heaps where weeds grow (plate 4) and become another threat to the nearby farms. In some places, they are subjected to burning. Burning, apart from its bad environmental effect of depleting oxone layer, is also harmful for soil micro-organisms. It may also pose health hazard to the nearby villagers that inhale the smoke from this combustion process.

Plate 4. 4: Weeds growing on a Farm Residue Heap

4.3. Waste Handling

The following measures can be taken to reduce the menace of these farms residues;

(i) They can be converted into particle boards that will be used in farm buildings

(ii) Since they are autothermic, they can be subjected to incineration and the hot gas emitted from it be used for turbine to generate electricity.

(iii) Many researchers have tested these farm residues and it has been discovered that they have high calorific values; they can be converted into briquettes to be used as fuel.

(iv) Very fine ones among them if treated can be used as part of filter in a slow –sand filtration plant. This has been tested to have capability of reducing amount of nitrogenous pollutant in the water filtered with it.

(v) Rice and maize straw can be mixed with earth materials and used as lining materials for canal for irrigation purposes in farms as adopted in Kenya through the intervention of Food and Agricultural Organization (FAO). Plate 5.

Plate 4.5: Mixture of Rice Straw and Earth Materials Used as Lining for Irrigation Canals

(vi) Large percentage of it can be worked into the soil to serve as manure. This will add to organic content of the soil and at the same time reduce the concentration of these residues on soil.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

onclusion

study has provided a base for which waste selected farms can be estimated, the type of crops ue on these farms and various management adopted by these farms have been studied and ible suggestion have been proffered on how to curb the menace of this waste. It is therefore ssary that these wastes are taken care of in view of their increasing magnitude on these farms he desired for increase agricultural production is achieved through farm mechanisation.

Recommendations

The problems of enormous quantity of crop waste (residue) in the l farms can be solved if the op waste are prepared as hay and silage to feed the animals. The management of these farms iould be well informed of the types of waste they will generate from their farm operations and repared to deal with it.

his write up is not an exhaustive literature but can serve as guide and reference to a study on waste management in selected farms in Niger state. The waste (crop residue) from these farms can be prepared and sold (Source of income to the management) especially to the cattle rearers (mostly Fulani nomads) who are always experiencing Shortage of feeds during the dry season period. Waste management should be integrated as part of the farm production System. So that it can be cared for as much as the farms product in order to avoid any environmental consequences resulting from poor waste management.

, this project work only focused on three crops in twelve Local Governments of Niger more work should be done to cover other food crops like, soy bean, sorghum, millet, :a etc. This study should also be extended to cover the remaining fifteen Local Governments : state so that a proper record can be kept on crop residue generation and management in r State.

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