IMPACT OF WATER RELATED DISEASES ON CROP FARMERS PRODUCTIVITY EFFICIENCY.

By : bolu akinrinmola

IT IS ALL ABOUT THE EFFECT OF VARIOUS WATER RELATED DISEASES ON FARMERS HEALTH WHICH IN TURN HAVE IMPACT ON THEIR PRODUCTIVITY EFFICIENCY.

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IMPACT OF WATER RELATED DISEASES ON CROP FARMERS PRODUCTIVITY EFFICIENCY.

DEPARTMENT OF AGRICULTURAL ECONOMICS UNIVERSITY OF IBADAN.

THE IMPACT OF WATER RELATED DISEASES ON CROP FARMERSâ PRODUCTIVITY AND EFFICIENCY

EVIDENCE FROM OSUN STATE, NIGERIA.

MPHIL/PHD COURSE WORK

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1. INTRODUCTION

1. PREAMBLE

Agriculture in the context of the economy is tied with the various sectors and is essential for generating broad based growth necessary for development. Agriculture is fundamental to the sustenance of life and is the bedrock of economic development, especially in the provision of adequate and nutritious food so vital for human development and industrial raw materials for industry. Sustainable agricultural development is propelled by agricultural policy.

1. IMPACT OF AGRICULTURE ON HEALTH

Agricultural products and processes are linked to the two main causes of death and disease and thus also to the main ways of preventing them. The first main cause is the joint action (synergism) of infection, parasites, and malnutrition which is an important cause of mortality in children aged 0-5 years in the poorest one-fifth of families-mostly rural â in most countries of Africa, Asia, and Latin America. The great majority of families

in this situation work mainly in agriculture- mostly as private subsistence farmers in Africa, as communal subsistence farmers in China, as landless rural labourers in Asia, and as market â oriented smallholders in Latin America. Among all these vulnerable groups, the familyâ s farm output, income, and energy requirements for work largely determine what the children eat. As we shall see, the conditions of agricultural production also greatly affect risks of infection and parasitism. Farming circumstances are thus the main determinant of health among vulnerable groups in developing countries.

The second main cause of death and disease operates at present mainly in Australasia, Europe, and North America. It is also a synergism between the use of various agricultural products-some beneficial such as fibres, some dangerous such as tobacco â and other elements of the â lifestyleâ , such as stress, work conditions, and sedentary living. This synergism causes, or accelerates, a variety of severe, often fatal, diseases (chiefly among persons aged over 40 years): cancers, heart failure and stroke.

These effects of agriculture on health are mostly well documented. However, health personnel have so far has very little influence on the public â sector agricultural decisions that should modify these effects, i.e., decisions affecting the level, distribution and use of tobacco or butter in rich countries, and of basic food crops in poor countries.

There are also major feedback effects of health on agriculture: healthier farmers and workers are more productive and careful; if health and nutrition are secure, farm families are better able to risk experiments with new crops or methods; and bad health and inadequate health care are among the reasons why bright young people leave rural areas,

1. **HUMAN HEALTH EFFECTS ON AGRICULTURE**

Nigeriaâ s agricultural policy is the synthesis of the framework and action plans of Government designed to achieve overall agricultural growth and development. The policy aims at the attainment of self sustaining growth in all the sub sectors of agriculture and the structural transformation necessary for the overall socio economic development of the country as well as the improvement in the quality of life of Nigerian.

For more than 50yreas of Nigeriaâ s existence as an independent and agricultural nation, most agricultural research efforts and development strategies (past and present) are focused on the production of basic food crops and cash crops neglecting the effect of human health on agriculture.

Without sufficient calories and nutrients, the body slows down, making it difficult to undertake the work needed to produce food. Without good health, the body is also less able to make use of food that is available.

A hungry mother will give birth to an underweight baby, who then faces a future of stunted growth, frequent illness, leaning, disabilities and reduced resistance to disease. Contaminated food and water can cause illness, nutrient loss and often depth in children.

The HIV/AIDS pandemic has reduced food production in many affected countries as productive adults become ill or die. Lacking the labour, resources and know â how to grow staples and commercial crops, many households have shifted to cultivating survival foods or even leaving their fields, further reducing the food supply. Addressing health issues will improve utilization and availability of food.

World wide, just fewer than 900 million people lack reliable access to safe water that is free from diseases and industrial waste. And 40% do not have access to adequate sanitation facilities. The result is one of the worldâ s greatest public health crisis; 4,500 children die every day from water borne diseases, more than

from HIV- AIDS, Tuberculosis combined (WHO, 2010)

Water â related diseases exact a terrible toll on human health. These illnesses are of many types, but they are directly related to a need for clean water .Many diseases arise simply because of the lack of clean water for drinking and cleaning food. Others are spawned by inadequate facilities and poor personal hygiene practices that are directly related to a lack of clean water.

Water related diseases are one of the worldâ s most significant health problems and one that is largely preventable. Cholera and other water related diseases are responsible for some 1.8 million deaths each and every year. The poor of developing nations especially children are hardest hit. Water related diseases trap million in cycles of poverty and poor health, often rendering them unable to go work or go to school.

In the developing world, the cumulative of water â related disease stifles economics growth and stresses healthcare systems that are already overloaded.

1.4 WATER RELATED DISEASE

There are five main types of water- related infectious diseases

- Water- borne
- Water â washed
- Water â based
- Water â related insect vector
- Diseases caused by defective sanitation

Waterborne Diseases are spread when people drink contaminated water or eat food that has been prepared with contaminated water. Common waterborne illnesses include typhoid, cholera, dysentery, gastroenteritis, and hepatitis. These diseases result when human and animal wastes enter and contaminate water supplies.

Many waterborne illness are diarrhea diseases, including cryptosporidiosis and giardiasis. These intestinal disorders are caused by cryptosporidium and Giardia, which are microscopic parasites in water. In addition to severe diarrhea, they may also cause fever, cramps, nausea, weight loss and dehydration. These diseases can be life threatening for those who are already sick or for people like children and the elderly, who may have compromised immune systems.

Cholera is another waterborne disease, caused by bacteria, that spawns epidemics health problem in much of the developing world- especially in Asia and Africa. Cholera can cause deadly diarrhea and, though many people survive infection, it can be a particular dangerous for the malnourished.

Typhoid is a waterborne disease which affects some 17 million people each year. The ailment is caused by pathogenic bacteria in a victimâ s intestinal tract and bloodstream.

Typhoid Symptoms include a severe fever, Malaise, headache, constipation or diarrhea, chest spotting and an enlarge liver and spleen. Typhoid is spread by human waste, and by water contaminated with waste in locales where proper sanitation services are absent.

Water-Washed Diseases are infections that are caused by poor personal hygiene resulting from inadequate water availability. These ailments may be prevented if people have adequate supplies of clean water available for personal hygiene.

Typical water-washed diseases include Shigella; which causes dysentery, scabies, trachoma, yaws, leprosy, conjunctivitis, skin infections and ulcers.

Scabies is a highly contagious skin infection. It can be identified by an extremely itchy rash of pimple-like markings that appears on the hands elbows, knees breasts, shoulders, or elsewhere.

Scabies is caused by a microscopic, skin-burrowing mite known as Sarcoptes scabei. Scratching of the itchy scabies rash can cause open sores that may be infected by additional bacteria. Scabies is easily transferred through person-to-person contact and some 300 million people contract the disease each year.

Trachoma is an eye infection and the worldâ s foremost cause of preventable blindness. It is caused by a pathogenic bacterium and spreads easily from person-to-person through fluids discharged from infected eyes.

The disease typically infects children. It progresses over the years, often supplemented through frequent reinjectionâ s, until blindness or other servers symptoms appear later in life. Trachoma scars the inside of a victimâ s eyelids and causes the eyelashes to turn in. The lashes rub and scar the cornea, eventually causing severe vision loss and blindness.

More than six million people worldwide may be blind because of this disease, and some 150 million more await treatment.

Water-Based Diseases are transmitted by aquatic organisms, such as worm. They may penetrate the skin if unclean water is used for cleaning or bathing. Guinea worms may enter the body through contaminated drinking water.

Schistosomiasis may not be as well known as malaria, but it is second only to that dreadful disease as the worldâ s most destructive parasitic infection. The disease is caused by several species of flatworms, which can penetrate human skin to enter the body and lay eggs. It can be passed through infected human waste.

Symptoms include itchy rashes, fever, chills cough and aches. More serious effects include organ damage (bladder, liver and kidneys), nervous system impairment, and, in children, stunted growth and cognitive development.

Perhaps 200 million people have schistosomiasis and 20 million of them suffer severe effects. The disease is most common in sub-saharan Africa, where four of every five infected people live.

Large roundworms called Dracunculus medinensis cause guinea worm diseases-a painful, blistering infection. The worms are originally ingested as larvae hosted by water fleas present in contaminated water. After a year or so, the mature worm tries to emerge from the human body to reproduce. This exit, which is often through the leg, causes the painful blistering for which the disease is known.

Guinea worm disease can incapacitate its victims and leave them unable to work or attend school. Some people suffer complications like infection, arthritis, and even permanent stiffness of the limbs.

Many victims try to ease their discomfort by submerging guinea worm disease blisters in water. Unfortunately, this practice typically prompts the worm to release thousands of larvae into the water, starting the cycle all over again.

Thanks to a WHO-backed eradication campaign, incidence of guinea worm has dropped dramatically in recent years. Today, the disease is mostly confined to Sudan, Nigeria, and Ghana.

Water-Related Insect Vector Diseases are spread, as the name implies, by insects. The carrier insects, including mosquitoes and black flies, breed in or near stagnant water. For this reason the reason the disease they spawn are as related to water as those more directly transmitted by liquid.

Water-related insect vector diseases include malaria, filariasis, yellow fever, and river blindness.

Malaria is the most infamous of these diseases. It is caused by minute parasites, which are spread by mosquitoes. The insects bread in fresh or brackish water and, when they bite an infected human, suck in the malarial parasite along with the infected personâ s blood. The insects may then transmit the disease to the next person that they bite.

In humans, malarial parasites grow inside red blood cells and destroy them-a process that causes the fevers associated with malaria. Other symptoms are chills, head and muscle aches, fatigue, nausea, diarrhea and jaundice. In severe cases, malaria victims may experience convulsions, comas, or kidney failure.

The disease is a well-known killer particular among children. An estimated 300 to 500 million people contract malaria each year, one million of whom die from the disease. Malaria is most common in tropical and subtropical regions of developing Asia, Africa, and South America.

Some diseases, such as hookworm, are the direct result of **poor sanitation.** They may be contracted by with contaminated soil, which is polluted by human faeces in locales where no proper means of waste disposal exist.

Humans are infected with hookworm parasites to direct contact, such as walking barefoot, in soil that contain human faeces.

Hookworm larvae exist in soil and penetrate human skin to make their way into the small intestine. Once in the intestine the worms grow to adult size and produce thousands of eggs, which are passed in stool to begin their life cycle anew.

A minor hookworm infection may have no symptoms but others are signaled by itching and rash. The illness often causes diarrhea or cramps but it can become dangerous for children, pregnant women, and those who are ill or malnourished. These people may develop anemia protein deficiency, and retarded growth.

This largely tropical disease effects about one billion people one in every six on earth.

1.5 DEFINITION OF TERMS

DISEASES: - This can be said to imply a breakdown in adaptation by a living being. It occurs when a part / whole of human body fails to work properly. They are brought about by anything that causes the cells of the body to stop efficient working. It is a state of disease. It is the departure from normal bodily health i.e. illness of the body or mind or caused by infection or internal disorder. It is an overt display between the force of invasion and the force of reaction. Diseases could be communicable or non- communicable, acute or chronic and could be prevented or controlled. Incubation period is normally required before the onset of diseases and its prevention is always better than cure. Measures adopted at reducing occurrence include:

i. Surveillance

ii. Notification

iii. Contact tracing

iv. Isolation

Disease Prevention: This is the act of inhibiting the entrance of disease / infection to a location where it has not reached. They are those measures or actions put in place to prevent the onset of disease (s). The aim is to prevent disease occurrence. Method usually employed includes.

1. Chemoprophylaxis
2. Immunization
3. Environment Control
4. Health information
5. Health education

Disease control: These are the process or activities put in place to limit or regulate the occurrence / incidence of a disease / infection. It implies the process of applying measures / method to reduce the occurrence of a disease or limit its spread measures adopted at reducing transmission includes

i. Elimination of infective agents.

ii. Interrupting the mode of transmission

iii. Treatment of the sick person

iv. Health Education

VECTORS: This is a living thing (Biological agent) that carries or transmits disease causation agent. Vectors may be biological when a microorganism undergoes certain development in it. It may be mechanical wherein no development stage takes place in the vectors. Water and refuse are important for the breeding of vectors.

DISEASE CAUSATIVE AGENT: These are living organisms that lives in the body of another and multiples at the expense and detriment of host.

They cause disease (S) and they may be

1. Viruses e.g. yellow fever, poliomyelitis, meningitis, infection Hepatitis
2. Bacteria- Trachoma, Typhoid fever, cholera, Food poisoning,

Bacillary Dysentery

3. Ricketsia e.g. Ricketsia prowaseki
4. Protozoa â Amoebic Dysentery, Malaria fever, Trypanomiasis
5. Fungi â Ringworm of the foot and head, eczema.
6. Helminthes â Guinea worm, Onchocerciasis, Filariasis .

Measures adopted at reducing disease transmission includes

1. Elimination of the infective agents.
2. Interrupting the mode of transmission

2. Treatment of sick person

3. Health education

Disease could be transmitted through either of these routes

1. Biting / injection (ii) ingestion (food / water

(iii) Contact

ENDEMICTY: This is Constant presence of a disease or infectious agent in given geographical area. It could also be described as the usual prevalence of given disease within a geographical area.

EPIDEMICITY: This is the presence of a disease or infection in a population in excess of that usually expected.

PANDEMICITY: This is the incidence of a disease, which spreads to several countries and affecting a large number of people at a time, e.g. HIV/AIDS.

SPORADIC: This is a situation when a disease occurs in isolated cases and is apparently not connected with any epidemic.

2.0 STATEMENT OF THE PROBLEM

The African under development problem is commonly traced to inadequate food supplies and the inability to afford a comfortable living.

Government effort over the year have not yielded sufficient desired result as the country still witnessed increase high cost of food, generally high cost of living and perpetual poverty (Dittoh, 1994).

The food problem has been heightened by the relatively low level of productivity of resources used by the farmer in the country (Ojo, 2004)

Better health and nutrition, as relative to labour productivity or better organization can increase house hold income and economic growth. Poor health will result in a loss of days worked or in reduced worker capacity, which, when family and hired labour are not perfect substitutes or when there are liquidity constraints, is likely to reduce output. Many developing country governments are increasingly concerned with the basic needs of their population, and education health project account for rising public sector expenditure. Choice needs to be made where money is best spent.

Human capital expenditure can be more easily justified in terms of promoting economics development and, thus, generate a large increase in productivity (Behrman, 2000)

Water borne disease remain a major cause of death and illness in developing countries, the global spatial distribution show that Africa and Asia account for a large percentage of these disease, which includes cholera, typhoid fever, paratyphoid, bacillary dysentery, gastroenteritis and infective hepatitis (Lucas and Gilles, 1973) children less than five years are particularly affected adversely since they can experience as many as 10 episodes of diarrhea in a year. Among this age group,15-18% of mortality is attributed to diarrhea .

Nevertheless, adult are not spared the scourge of the same disease (USAID 2005).

The prevalence of these diseases is particularly linked to the dearth of potable water in most parts of the developing countries. According to USAID (2005) diarrhea diseases are largely caused by unsafe water, inadequate sanitation and poor hygiene among human population. Available potable water in most cities in developing countries is grossly inadequate to meet the increasing demands for water each year due to rapid population growth. Hence, the populace often results to sourcing water from questionable points.

Drawing from the observations made by snow (1894) to that of swerdlow (1992), it is clear that the environmental factor â waterâ and the problem of water borne diseases especially diarrhea diseases are linked up via two different mechanisms, through the supply of contaminated water and lack of water for personal hygiene.

It is hypothesized that a higher output will always lead to a higher income and a comfortable living: but one important issue often overlooked by farmers, policy makers and planners especially in Osun State in particular, is the hindering factor that the problem of lack of good potable water may pose to agricultural development. This may arise through ill-health cause by water related diseases.

Most of the rural and urban communities in Osun State lack good potable water supply, making it possible for water borne disease to be prevalent in certain areas of the state.

According to the knowledge, attribute and practice (KAP) studies done by the federal ministry of agric & water resources & UNICEF in 1995 and 1999, most communities listed water as their major problems. Access to safe water and sanitation in the state put at about 38%.

Osun State water corporation (OSWC) is a government parastatal that is statutorily responsible for water supply to both urban and semi urban settlement in Osun State. Presently OSWC manages 14 water schemes throughout the state. Out of the 14 water scheme 11 (78.6%) of the scheme have a current operate capacity below 50% while only 3 (21.4%) of the scheme have operating capacity of between 50% and 80%. All the 14 water scheme have varying degree of constraints which includes:

1. Aged plant and equipment
2. Faulty and inadequate distribution system
3. Unreliable power supply to the scheme
4. Low tariff
5. Weak institution framework
6. Inadequate water works, installed capacity arising from increase in demand.
7. Physical leakage of water mains, service, pipes, and appurtenances
8. Epileptics power supply to power the urban water scheme
9. Inadequate funding,

The combined effect of these constraints is that, only about 40% of urban settlements in Osun state are presently served by OSWC. The distribution networks which are mostly AC pipes are old and prone to frequent burst and illegal connections. In addition, plants and equipment in the water schemes are aged and have therefore lost their operating capacity, and as a result water rationing is common.

These problems lead to significant drop in water productions and are responsible for the acute shortage and contribute immensely to poor service coverage. As a result, OSWC resorted to rationing of water to its customer.

This study therefore intends to investigate the level of spread of water related diseases in Osun State and provide answers to the following questions.

- What is the level of spread of water related disease and most rampant of these diseases in the study area?
- What impact does the diseases has in relation to farmerâ s crop productivity and efficiency?
- What effect do the socio-economic and institutional factors have in relation to occurrence of these diseases?

These are some of reasons why awareness was created on provision of water and sanitation facilities, hygiene promotion campaign and total eradication of water and faecal borne diseases through RUWESA (Rural water supply and environmental sanitation Agency) set up through government intervention.

Inspite of all the efforts put in place, there is still the prevalence of water associated diseases in some parts of the state. Suspected cholera out break send tens to hospital in Osun. Not less than 20 people in Ede North and Ede South local government areas have been admitted in various hospitals in the state following outbreak of a water borne disease suspected to be cholera (News and Resources about influenza, infections diseases and public health August 25, 2010).

2.1 OBJECTIVES OF THE STUDY

The broad objectives of this study are to examine the impact of water related diseases on human health with the effect on agricultural productivity.

1. Describe the socio-economic characteristics of the farmers in the study area.
2. Examine the prevalence of water related disease and the most rampant water disease in the study area.
3. To determine the impact of water related diseases on human health and crop farmerâ s productivity efficiency.

2.2 JUSTIFICATION OF THE STUDY

Osun State, located in south-west Nigeria has rich agricultural and mineral resources as well as tourism. The major agric commodities are cassava, sweet potatoe, cocoyam, maize, rice, cowpea, groundnuts. Also, there are considerable potential for the production of cotton, kolanut, coconut, oil palm, raffia palm, cashew fruits and vegetables, livestocks, forest and fisheries products.

The mineral deposits include kaoline, granite, clay, gold, limestone, feldspar, cassiterite, columbite and mica. Some of tourism potentials include the renowned Oranmiyan staff and the ife museum, Osun Oshogbo shrine, Olumirin waterfalls, Erin Ijesha, Mbari- Mbajosusan Wenserâ s Art works center in osogbo (BECANS business Environmental Report (2007)

Among 36 states in Nigeria, Osun state was ranked number 14 in the list of Nigeria state contribution by GDP, 2007. Also in the south west Nigeria, osun state generated total revenue of N1.5 billion between 1999 to 2004. Osun State Forestry Department has the highest percentage revenue contribution (32.92%) to MANR while Lagos has the lowest (10.07%) (Faleyime et al, 2010)

In realization of all these, the industrial policy seeks to accelerate industrial development through the provision of enabling environment for private sector industrial investment. The strategies include the facilitation of land acquisition for agriculture and industrial development, privatization of industrial estates. Presently, 2 industrial estates are being developed, one in Osogbo and the other in Ilesa. There are 2 loan schemes namely: the small-scale industries, credit scheme and industrial development fund.

In recent times, most focus and intervention programmes in sub-saharan Africa have been on sustainable and increased food production, employment and poverty eradication embodied in the poverty reduction strategies and the Millennium Development Goals (MDGâ s) to reduce the number of people by the year 2015.With less than five (5) years away from the deadline of achieving the MD goals of reducing hunger, starvation and poverty, the situation still remains a daunting challenge. Central to all these challenges is the issue of impact of water related diseases on farmers health and productivity.

Presently in Nigeria, there are no substantial studies on human health effect on agricultural productivity and there is need for detail information on the specific cause for or endogeneity of health effects in relation to agricultural productivity. Attempts have only been made in regions to study the link between agricultural productivity and health and nutrition status of peasants. This is more specialized than it is in the efficiency wage literature. Indeed, instead of considering the global link between wage (or consumption or nutrient intakes) and productivity, focus was on an intermediate stage in the causation chain, namely that consumption, including nutrient intakes, influences health and nutrition status, which in turn affects labour productivity.

However, it is important to understand whether investments in nutrition and health are to be viewed as ends in themselves or also as investments in higher levels of productivity. It is useful to distinguish the health status, often associated with illness or injuries, from the nutritional status, more directly related to nutritional intakes. With regard to the health to productivity link, R. Baldwan and B. Wesbrod link house hold health indicators to labour productivity (measured by weekly and daily earnings.)

Weisbrod and Helmmoak consider the impact of parasitic disease on labour productivity, but they do not find and strong evidence of a link. These studies have been criticized for not allowing for the endogeneity of health.

These are the issues which the study seeks to address which will help in creating the awareness and stepping up production to meet various economic and social needs of the study area and Nigeria at large.

However, it is reasonable to think that positive effects of health on productivity are necessary conditions for wage efficiency mechanisms. Thus large elasticity of labour productivity with respect to health status would benefit the implementation of policies related to the wage efficiency framework, such as food aid or land redistribution as instruments to increase production and lower unemployment. As mentioned above, the implication of strong elasticity goes beyond this framework. They open the way to policies designed to increase production levels and indirectly to improve the welfare of populations.

2. **LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

Cholera cases and deaths were officially reported to WHO, in the year 2000, from 27 countries in Africa, 9 countries in Latin America, 13 countries in Asia, 2 countries in Europe and 4 countries in Oceania. Control of cholera is a major problem in several Asian countries as well as in Africa. In year 2000, some 140,000 cases resulting in approximately 5000 deaths were officially notified to WHO. Africa accounted for 87% of these cases. After almost a century of no reported cases of the disease, cholera reached Latin America in 1991, however, the number of cases reported has been steadily declining since 1995 (Water Sanitation And Health Unit WSH, WHO, 2001) .

The effect of farmily morbidity on farm profits was considered. Although, no statistically significant health effects was found. The fact that no significant health indicators have been found in most of these studies,

although there exists a strong prior intuition in favour of positive effects, may stem from specification errors in the estimated models or merely from poor or incomplete data do not allow accurate estimation of these effects in particular, important missing variable are secondary agricultural inputs (Fertilizers, tools, etc), land quality steepness, and nutritional status. Moreover, inefficiency may occur in the production process and this is not accounted for (Pitt and Rosebzweig 2000).

However, more recent studies address this issue. L.F LEE, using U.S data, estimates a wage equation, and finds that the health of adults has a significant effect on their wages.

Diarrhea occurs world-wide and causes 4% of all deaths and 5% of health loss to disability. It is most commonly caused by gastrointestinal infections which kill around 2.2 million people globally each year mostly children in developing countries.

The use of water hygiene is an important preventive measure but contaminated water is also an important cause of diarrhea. Cholera and dysentery cause severe, sometimes life threatening forms of diarrhea (WHO, 2001).The impact of nutrition on labour productivity has been analyzed by a number of authors, either by estimating production functions or wage equations. First, we consider the literature using the production function approach. The production function is augmented by considering calories intake or anthropometric measures as a measurement of nutritional status, which reflects worker effort and effectiveness. Using cross section data on hoe- cultivating farm households in Sierra leone, J Stauss finds that â effective family labourâ which is a function of actual labour and per capital daily calories intake, is a significant input in production. Using panel data from South Inda, AB, Deolalikar test for alink between the total value of output and â effective labourâ where the latter is a function of actual labour daily calories intake, and weight for height of a farm family farm workersâ . He finds that weight for height is significant, but calories intake is not.

PRODUCTION EFFICIENCY IN AGRICULTURE

Production is defined in terms of the efficiency with which inputs are converted to outputs within the production process (Cowing and Stevenson 1981, capalbo and Antle 1988). The role of efficiency in increasing agricultural production has been widely investigated and the concept of efficiency are of two types namely:- technical efficiency and allocative efficiency. Xu and Jeffrey defined technical efficiency as the ability to produce a given level of output with a minimum quantity of inputs under a given technology.

A firm is said to be technically efficient, if it produces as much output as possible from a given set of inputs (Atkonso and Cornwell, 1994). Allocative efficiency is the ability to choose optimal input levels for a given factor prices. The product of technical and allocative efficiency is what is referred to as economic efficiency while the degree of achieving them is termed production efficiency. The productivity of resources and the outcome of a production decision can not be predicted with complete accuracy because the relevant production varables in the production process lie outside the control of he decision maker and input prices and return for output vary overtime.

The determination of technical efficiency uses two main methods namely, the deterministic approach and the stochastic approach. In the deterministic approach all the farm firms share the same production frontier technology, in which case any deviation from the established production frontier may be attributed to inefficiency in resource use which is referred to as technical inefficiency.

The stochastic frontier function takes care of production which deviates from the production frontier not necessarily because of inefficiency but due to factors beyond the farmers control, measurement errors and

used white noise. The stochastic frontier as used in this study is consistent with those proposed by Battase and Coelli (1995), Jondrow et al (1982) and that of Aigner et al (1977). Following Coelli (1999) the structure of the stochastic frontier is stated as:

Yi = f (xi, ß) + ei â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦. (1)

ei = (vi â μi)

Where Yi represent the value of output which is measured in naira (₦)

Xi represents the quantity of the input used in the production.

f(xi, ß) = Frontier production function, which is a measure of maximum potential output for any particular vector of inputs.

ß = vector unknown production function parameter

ei = error term made of two components vi and μi which cause actual production to deviate from the frontier. The vi is a random error assumed to be independent and identically distributed having normal N(0, Ï 2V)distribution and independent of the i. It is associated with the random variability in production that cannot be influenced by the farmer, for example environmental factors such as temperature and moisture.

The μi is the technical inefficiency effects, which is assumed to be non-negative truncation of the half normal distribution N(μ, Ï 2μ). The random variable is associated with the farm specific factors which lead to the ith farm not attaining maximum efficiency of production.

If the farmer is technically inefficient, then he operates below the stochastic frontier which implies an equi-proportionate over utilization of production inputs.

Schmidt and Lovell (1979) pointed out that one of the serious limitations of the stochastic frontier is that it can only detect one of those sources of inefficiencies in the production process. Since estimation of production frontier in a carried out with observations on inputs and outputs only without their prices then it cannot provide the evidence on the matter of allocative efficiency which indicated that the farm operate off its least cost expansion path. Thus it cannot be used to draw inference about the total or economic efficiency.

The technical efficiency of individual farmers is defined in terms of the ratio of observed output to the corresponding frontiers output. Conditional on the level of input used by the farmer, hence the technical efficiency of the farmers is expressed as

TE = Yi/ Yi* = f (xi, ß) exp (vi â μi) / f(xiß) exp Vi = exp (-μ) ---------- (2)

Where Yi is the observed output and Yi* is the frontiers output. The TE ranges between 0 and 1 that is 0 and 1.

Following Bravo-Ureta and Rieger (1991) the production frontier is assumed to be self dual and the corresponding cost frontier can be stated in the general form as required:

C = h (P, Y) ---------- (3)

Where C = the minimum cost of the production outputs Y

P = a vector of inputs prices then the error term (Ïμ) takes the form v-μ

V is assumed to be identically and independently distributed as N-(O, Ï 2 V). It permits random variation in output due to factors outside the control of the farmer while μ is the non negative disturbance factor reflecting technical inefficiency (Aigner et al 1977) Meeusenn and Van Den Broek 1997). The technical efficiency assumed that each farmer is technically and allocatively inefficient. It permits the farmer to operate off the least cost expansion path. Allocative inefficiency also permits the cost minimizing condition not to hold exactly.

According to Farrellâ s (1957) technical efficiency (TE) is associated with the ability of a firm to produce on the isoquant frontier while allocative efficiency (AE) refers to the ability of a firm to produce at a giving level of output using the cost minimizing input ratios. Thus defining economic efficiency (EE) as the capacity of the firm to produce a predetermined quantity output at a minimum cost for a giving level of technology (Bravo et al, 1997).

n

However, over the years Farrellâ s methodology has been applied widely, while undergoing many refinement and improvement. And of such improvement is the development of stochastic frontier model which enables one to measure firm level technical and economic efficiency using Maximum likelihood estimate (MLE) a corrected form of ordinary least square (COLS). The estimation function proposed by Schmidt and Lovell (1979) and Aiegnel et al (1977) in MLE makes equation 3 to be in the log-linear form as in

i=1

lnY = Î± + â Î±i Xi,+ (vi â μi) ---------- (4).

Having the density function of the addition of asymmetrical normal and a half normal variable and supporting the production function is linear, they elaborate the likelihood function that must be maximized.

The density function of Ïμ = v - μ is f(Ïμ) = 2/ Ï f* (Ïμ / Ï) X /1-f*

(ÏμÊ Ï -1) / - â â ¤ Ïμ â ¤ â â ¦â ¦â ¦â ¦(5)

Where: Ï 2 = Ï u2 + Ï v2 ; Ê = Ï u / Ï v

When the constant term is corrected by adding the mean of μ,

the method is referred to as COLS(corrected OLS) and was developed by J. Richmond and it is of the form

Ï 2u = [Ï /2 (Ï / Ï -4) µ3] 2/3

The log likelihood function if there are N observations can be stated as:

n

n

i=1

i=1

lnL (y/ Î±,Ê ,Ï 2) = Nn 2/Ï + NlnÏ -1 + â ln [1-f* (Ïµ1,Ê Ï -1)] â 1/2Ï 2 â Ïµ1â ¦â ¦â ¦(6)

Where c = 1 â ¦â ¦â ¦â ¦â ¦â ¦â ¦â ¦.. n

With the Ê and Ï parameters then the Ï u and Ï v can be calculated.

Given the assumptions on the distribution of vi and ui, Jondrow et al shows that the conditional means of U given Ïµ is equal to

E (µi / Ïµ) = Ï uÏ v [f*(Ïµ1 ð) _ Ïµi Ê]

Ï 1- F* (Ïµi Ï) Ï ----------(7)

W here i = 1 â ¦â ¦â ¦â ¦.. n

Where F* and f* are, respectively, the standard normal density and distribution functions evaluated at Ïµi Ê / Ï and Ï 2 = Ï 2u Ï 2v / Ï 2. We refer to this as NHN (normalâ halfâ normal) model. This specification was first suggested by Aigner, Lovel and Schmidt.

The model used in this study is based on the one proposed by Battese and Coelli (1995).

The stochastic frontier production function model of Cobb â Douglas functional form is employed in this study due to a limited sample size.

The production relation is written as:

Y = F(X, L, M)

n

Where X is a matrix of agricultural inputs, and L and M are farm size and morbidity respectively. The Cobbâ Douglass specification saves degrees of freedom because of the small number of parameters to estimate.

Therefore, the equation we estimate is:

ln Yi = ßo + ßi ln x1i + ß2 ln x2i + ßLQ ln LQi +

ßLlnLi + ßwAln WAi + ßM ln Mi + ßLSIlnLSi

+ ßEdu ln Edi + ßA ln Ai + ßENVENVi + åßk Duk + Ïµis

Where i = 1, â ¦â ¦â ¦.. 44 is the index of the household and ß is a vector of parameters

Production function variables

Y = The total value of output measured in Naira

X1 = Inputs incorporating (seeds and chemicals)

X2 = Size of farmland (in Acres)

LQ = Measure of land quality (good = 1, mediocre = 2, poor =3).

L = Person days use for ploughing, weeding, planting and harvesting

WA = Water availability, Time of one- way trip to the usual source of good water, in minutes,

M = Percentage of members of the household engaged in agriculture (includes members doing domestic work) who have great difficulty (by their own assessment) in transporting a bucket with 20 litres of water for 20 metres, a measure of strength and endurance as well as an indicator of morbidity in the household

Ed = Education level: Primary 1, Secondary and above 2, None= 0

A = Age of farmers in years

Ls = Measure of steepness of the land (degrees used were(flat = 1) (moderate incline = 2), Steep incline = 3

ENV = Dummy, number 1 if crop suffered from

(a) Low temperatures (b) Wind or storm (c) flooding or water logging) 0 otherwise.

Duk = Dummies for the k sites for farm implement assessments e.g (Hoes, cutlasses and others) Dummy number 1 with sufficient farm implements and 0 otherwise

The error term is Ïµ = v â u, where v is a symmetric component that captures exogenous shocks such as weather, supply shocks, an un-observed heterogeneity of households plus measurement error.

The term â uâ is one â sided (positive) term that captures technical inefficiency equation (2), therefore, represents a stochastic frontier production function, as suggested D.J. Aigner, C.A.K. Lovell.

Two sets of stochastic frontier agricultural production frontier, incorporating farm size, health status and other inputs were estimated. This is to assess the robustness of the results of the specification of the inefficiency term. These are presented in table 1. The distribution of residual technical efficiency (TE), after including the various agricultural inputs including health, water availability (WA) was also examined.

3.0 METHODOLOGY

3.1 THE STUDY AREA

Osun State is one of the 36 states making up the Nigeria federation and is located in the South West geographical zone of Nigeria. It covers an area of approximately 14,875km2 and it lies between longitude 04 00E and 0505â and Latitude 05 558â and 08 07â . The 2006 National Census put the population of Osun State at 3,423,535 million. The male population is about 51%, while the female population is about 49% of the total population of the state.

3. DATA SOURCES AND SAMPLING TECHNIQUE

The study adopted the used of primary data. The study was conducted in Osun state of south â western Nigeria that is made up of three agro â ecological zones, chacteristics of some of the south â western state of the federation. The state has 6 administration zones and 30 local government areas. The predominant farming system in area is shifting cultivation with mixed cropping and crop rotation.

Crop cultivated includes maize, yam, cassava, cocoyam, cocoa, kolanut, citrus and vegetable. A multi- stage sampling procedure was adopted in selecting 20 respondents from Iwo (Savannah zone) 20 respondents from Osogbo (Derived Savannah zone) and 20 respondents from Ife â Ijesa (Rain forest zone) of the state. Out of the 60 questionaires administered, 44 were found to be useful for the study. Personal interview is adopted with questionaires administration to farmers. The primary data collected were coded and subjected to both descriptive statistics and stochastic production frontier analysis.

3.3 METHODS OF DATA ANALYSIS

The descriptive statistics used are frequency, mean and percentage distribution to describe the socio-economic characteristics of the respondents while the stochastics production frontier approach was adopted in analyzing farmersâ productivity efficiency in relation to the indirect effects of water related diseases.

3. DATA LIMITATION

This study witnessed some problems ranging from finance, time and improper record by the ADP in the state.

Food crop production decisions as mentioned earlier are made and executed by the farmers who mostly reside in the rural areas, hence the proper study of these farmers in their areas. The rural area designated as village farming communities or farm settlements in this study. The nature of the study required the collection of data on impact of water related on productivity, cost of inputs, prices and yields of foods crops in the in the previous years in the study area. This information were not sufficient available in the record stateâ s ADP. In spite of these, some useful analytical techniques (means) standard deviation, frequency, coefficient of variation, Cobb Douglas function could not be appropriately adopted.

Production activity record keeping was generally very low among the farmers; therefore much reliance had to be placed on farmersâ memory for information such as prices of output, cost of input, disaster or risk issues (disease, pests), farmersâ health for both the current year of survey as well as the previous. Personal interview with farmers was also conducted study.

4.0 RESULTS AND DISCUSSION

About 69.8% of the sampled farmers are between 16-48 years of age, showing that they are in active age brackets. The mean age is 46.81. The gender distribution of the farmers depicts more male (94.01%) than female owning farms. This result conforms with the cultural setting in the study area, where male have more access to land than female.

Also the main occupation of most of the sample farmers is farming and larger proportion (84%) of them depends on crop production for daily existence. This result has effect on the level of cropping pattern and intensive, in which the agricultural land is used. Majorities (95.10%) of the respondents are married, 4.3% are single and just 0.3% each are widowed and divorced.

Most of the farmerâ s households (85.5%), male and female have at least a primary education. Those households with tertiary education probably constitute the civil servants, who engaged in part-time farming in the area. This expected in line with a priori expectation, to have signification impact on productivities income earning opportunities, nutritional status and farmers to effectively adopt better management practices. The results of the household questionnaire survey reveals popular water related diseases sources among sampled farmers are 61.2% Malaria fever, 23.4% Dysentery and 15.5% Typhoid fever.

Cases were mostly reported among the age group 20-29 years followed by 30-39 years and then 40years and above.

The estimates for the COLS, NHN models of the stochastic frontier are relatively close for most of the coefficients and are presented in table 1.

In order to correct for endogeneity problems, the independent endogenous variable L, WA, M) were replaced by predicted values obtained by using the set of instruments indicated in table 1. Beyond the exogenous variables included in the production frontier, primary identifying instruments include age and education of the head and of members and land steepness.

The most important f