IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 8 Issue 2, February 2021
ISSN (Online) 2348 – 7968 | Impact Factor (2020) – 6.72
www.ijiset.com

Pest, Disease Incidence and Deficiency Symptoms on Immature Oil Palm (Elaeis Guineensis) At the Njala University Clonal Garden Sierra Leone

Emmanuel alpha, Dr. Saffa B. Massaquoi & Anthony Kamara
Agriculture and Forestry, Eastern Polytechnic College,Kenema, Sierra Leone
Corresponding Author E-MAIL: alpha.emmanuel@yahoo.com

ABSTRACT

A total of eight thousand, four hundred and sixty (8,460) pre-heated oil palm seeds selected from twenty –two (22) different clones were imported into Sierra Leone from Malaysia. They were breeding materials from the Common Wealth sponsored oil palm production project implemented jointly by Njala University and the Ministry of Agriculture, Forestry and Food Security. The materials were nursed in Njala and later transplanted in the Njala University clonal garden as immature oil palms in July 2005. The aim of the study was to evaluate pest, disease incidence and deficiency symptoms on immature oilpalms to identify superior clones for use as breeding materials to make crosses in the improvement of oil palm production in Sierra Leone. The experimental Design consisted of the Randomized Complete Block design with twenty two (22) clones as the treatments. Three sets of five immature oil palms were randomly selected and tagged from each clone which formed the samples for three replications used. Data were collected on pest, disease incidence and deficiency symptoms on immature oil palms. The data were subjected to statistical analysis. Results obtained indicated significant differences among clones for pest, disease and deficiency symptoms. Further examination of the mean for each clone revealed various levels of resistance, whilst others were highly susceptible to pest and disease attacks. This confirm that there is sufficient variability among the clones to lend themselves to selection and be used to make crosses to produce superior high yielding pest and disease resistance Tenera hybrids. Consequently, the planting of such hybrids by farmers could improve fields significantly thereby contributing to the achievement of Food Security in Sierra Leone.

INTRODUCTION

This project forms part of the study of assessing pest,disease incidence and deficience symptoms on immature oilpalms of twenty-two(22) genotypes planted in the field at Njala University clonal garden.

The Oil palm (Elaeis guineensis) is one of the major oil producing plants of the World, surpassing other group in yield of oil per hectare (Asiedu, 1922) and taking second place after Soya bean in the World market as a producer of vegetable oils. The fresh fruit bunch yield per hectare of oil varies from 10t/ha/yr in parts of W/A to over 35t/ha/yr under the more favourable conditions such as in the Sandakan area in Sabah, Malaysia and North Suma. Fluctuations in climatic factors, especially rainfall, also influences the cropping pattern and yield of oil palm in a particular locality (Corley,1976; Oil et al, 2004). In the humid region 4.5 tons of oil per hectare per year (Asiedu 1992) have recorded for oil palm yield. It is estimated that by 2020,the palm oil project in Malaysia will cover approximately 12 million hectares.

The original home of the oil palm is most likely the tropical rainforest region of West Africa, and it occurs in throughout all areas where the influence of man has caused the disappearance of the virgin tropical rainforest. The oil palm is not a forest specie, as it needs abundant light for its growth and production. It is most commonly found in the light secondary bush or farmlands, which has now largely replaced the original forest vegetation

The most outstanding suggestion is that it originated from the fresh water swamps along the coast of West Africa (Waterson,1953). It is generally accepted; however, that is only through human activity that oil palm has spread over such large areas. The oil palm occurs in an almost continuous belt extending from Senegal in West Africa through the Belgian

Congo in Central African. The major palm oil producing countries in the belt are Sierra Leone, Ivory Coast, Benin Republic ,Nigeria, Cameroon, Belgian Congo and Angola. In these countries, palm oil is vital edible oil for the indigenous people, while in some, it is also the major export producer for countries like Southern Benin Republic ,Eastern Nigeria and thereby plays a dominate role in the national economy.

On the global basis, oil palm is cultivated in extensive plantation in Malaysia, Central America , Indonesia , Brazil, Columbia and Peru. According to Season (1988), between 1960 and 1984, the world production of palm oil increased from 1.5 million tones to over 6 million tones.In1987,slightly in excess of 7.5 million tons of palm oil were produced. The major contributing countries were Malaysia, Indonesia and Nigeria.

According to FAO, the extensive development of oil palm Industries in many countries in the tropics has been motivated by its extremely high potential productivity. The oil gives the highest yield of oil per unit area compared to any other crop and produces two distinct oils- palm oil and palm kernel oil both of which are important in the World. Both palm oil and palm kernel are used in the manufacture of margarine,cooking fat and soap.The proportion in which the oils are used for these purpose depend on their quality and the supply of other vegetable oils.In the manufacturing industry,oils and fats are very largely interchangeable and if an oil used for a certain purpose is in short supply,another oil may be substituted and used for that purpose(Chestire,1965).In recent years there has been substantial changes in the usage of oilpalm in the United Kingdom(Chestire,1965) .Usage in three traditional outlets;soap,margarine and compound cooking fats decline .The main reason for this decline has been the substitution of animal fats,in the case of soap and lard,also in the case of edible products.The substitution of marine oils also contributed to the decline.The sharp decline in the use of palmoil for soap making is of course,partly attributed to the improve quality of

West Africa oil which has made it suitable for edible products.Other new outlet absorbing the remaining supply of palm oil include additive to animal feeding stuffs,the potato crisp industry,baking biscuit and ice cream traders(Moolayil ,1976).Other outlets for palm kernel oil,particularly in the manufacture of detergents,have compensated for its reduced usage in the main edible products(Moolayil,1976).Byerlee,et al(1977) observed that substancial percentage of the annual average rural house hold expenditure is spent on palmoil.Other sources it serve as a major source of vitamin A,important for the development of normal vision,bone and teeth formation.Palm wine,another product,is of nutritional importance because of its high content of vitamin B-complex and its chemical association with carbohydrate and fat metabolism(Corley R.H 1973).

Modern high-yielding varieties developed by breeding programmes, under ideal climatic conditions and good management are capable of producing in excess 20 tons of bunches per hectare per year. This is equivalent to a yield of 5 tons oil per hectare per annum. However, such high yields are rarely achieved in practice because climatic conditions are usually less than ideal . Rainfall is erratic in Central West/Africa and hence the tree suffer water related stresses. So far, most successful new plantations and small holdings have been developed in the wet tropics where there is a suitable environment with sunshine and regular rain throughout the year. According to Piggott C.J (1995), the optimum environment for oil palm production would have .

a)At least 150 mm of rain each month of the year, ideally falling mostly at night.

b) A day temperature of 30-35^0 C and night temperature never falling below 20^0 C.

c)A relative humidity of 75-100%.

d) Atleast 2000 hrs of sunshine a year and only thin clouds at other times

e)Regular gentle winds but not tropical storms

f) Deep well –drained soil with a good nutrient reserve and a pH between 5.5 -7.0

g)Flat or very gentle undulating terrain.

In Sierra Leone,these characteristics are found in the Southern Coast,Northern plains,the riverain grassland areas and the upper Moa Basin.

These regions meet the soil requirements for the successful growth of oilpalm with light sandy clay soils.

Most of the palm oil and palm kernels produced in West Africa ,whether for local consumption or for export,comes from the wild palm groves,which covers millions of acres of the coastal belt.WAIFOR(1954) reports observed that although there are plantations covering about 40,000 acres in Nigeria and the Cameron,and a few smaller ones in the Gold belt of Sierra Leone,their plantation did not amount to more than 5%.

For half a century,Indonesia and Malaysia have accounted for the vast majority of the World's export of oilpalm.But now investors are flooding to West Africa to secure land for rival plantation .Environmentalist say forest of South/East Asia have been massively despoiled and are warning West Africa governments not to follow suit.

The wild oilpalm groves of Central and West Africa consist mainly of a thick-shelled variety with a thin mesocarp called Dura.Breeding work particularly crosses between Dura and a shell-less variety (pisifera),leads to the development of the hybrid with a much thicker mesocarp and a thinner shell termed Tenera.All breeding and planting programs now use this better type, fruits of which much higher content of palm oil than the Dura type.

Following the elucidation of shell thickness inheritance and hybrid nature of tenera (Beernaert and vanderweyen 1941) , commercial cultivation at present is based on quality. Dura x pisifera, or DxP as the planting materials.

African and American oil palm species are sexually compatible (Hardon and Tan 1969). F_1 hybrid show vegetable vigour and mid parent stem growth increment (Corley and Tinker, 2003).

Research on Oilpalm improvement started in Sierra Leone with the establishment of WAIFOR station clonal garden.This was established with breeding materials planted in blocks in an area of about 100 hectares.Planting the varieties made provision for control pollination to produce tenera hybrids in dura x pisifera crosses.However,the expertise and facilities to undertake this breeding programe were not available .Hence selections from open pollinated population were often sold to farmers as planting materials.Tenera were however imported from other countries including Ivory Coast and Malaysia and sold to farmers through integrated agriculture development projects.The end of the civil war in 2002 saw renewed interest in oilpalm establishment to provide jobs for the youths.

In Sierra Leone , the wild Palm which grows in many parts of the country are found in parts of Kailahun and Kenema Districts in the East, Bo, Pujehun and Bonthe Districts in the South and the Western parts of Kambia and Port Loko districts in the North.

In 1956, the government of Sierra Leone began the development of oil palm plantation and the establishment of Waterloo plantation near Freetown and the Masanki Plantations 65km East of Freetown . Between 1960 and 1967, Sierra/Leone Producing Marketing Board (S.L.P.M.B) established nine additional plantations in different parts of the country. Planting materials used in these plantation were Deli dura seeds from West Africa Institute of Oil palm research , Nigeria with substation established at Njala in 1955.

These seeds were known as Extension Worker Seeds (EWS) and were expected to yield better than the wild oil palm.

During 1967, after exhaustive study on the performance of these plantations, it was observed that their yields were not high enough for
industrial plantations. Yields of the plantations established after 1967 in
which high yielding Tenera seeds were planted and found to be superior to Deli dura seeds. To date , Tenera seeds have been used to plant in both industrial and small holder plantations.

Studies on deficiency symptoms showed that leaf chlorosis and foliar symptoms attributable to nutrient deficiency were found most extensively on soils of low nutrients status in Nigeria and Zaire,and the work on deficiency symptoms date from a classic experiment at Nkwelle in Nigeria(Hala,1940).The connection between leaf potassium content and bronzing or orange spotting of leaves was established.In his experiment at Nkwelle,an application of 17tons of wood ash per hectare applied over a three years period restored affected palm to health and increased their yield five holds.Later dressing of sulphate of potash in the same showed that the response to ash were attributable to its potash content.This results stimulated an interest in deficiency symptoms and in the following 15 years,considerable amount was gained both in Africa and Asia.The knowledge was obtained by three methods;the correlation of symptoms with leaf nutrient content and with yield(Broeshart,Bull 1954),leaf injection and spraying chlorotic leaves and the inducement of symptoms in sand culture of oilpalm requires copious quantities of certain nutrients including nitrogen,phosphorus and potash to grow healthily.lacking the correct amount of nutrients results in the expression of deficiency symptoms such as leaf chlorosis and foliar symptoms.

Manual trials with the oilpalm were begun in Sumatra for fertilizer uptake of oilpalm.It was not long,however before it was realize that oilpalm makes heavy demand on the nutrients supplies if the soils are deficient in nutrients(Broeshart H 1955).Nutrients uptake is an important physiological process connected with manuring.The immobilization of nutrients taken up by the course of dry matter production now be considered(Hartley,1977).The nutrient requirement indicated by the chemical composition of the plant has not been generally accepted.But it has been claimed that soil analysis has some value when the crop is bulky as in oilpalm,and the long term nutrient supplying power of the soil is poor, as in some many tropical
soils(Hartley,1950).In a study in Nigeria,the palms analysed were aged 7,10,14,20 and

22 years,and was taken from a forest-felled area where no clear responses of nitrogen,phosphorus,calcium or magnesiumin adjoining fields had been obtained and where potassium has only become deficient in later years(I.R.H.O 1954 and Hartley,1950).Nitrogen has very little variation with age in percentage nitrogen or phosphorus content,but potassium percentage decreases with age of palm while there is a corresponding increase in magnesium and calcium uptake. Nitrogen uptake follows similar patterns to that of phosphorus,but proportion is remove from the bunches(Belgrave and Hartley 1935 and 1950). Field experiments with fertilizer are the primary means of detecting and determining nutrient needs but these may be greatly assisted by several other methods using plants and soil analysis.(Belgrave,1935).

Until the time of the second World War,it was true to say that the oilpalm was largely free from serious diseases and pests although crown disease was known and a number of bud and stem rots had been reported.Since that time however,there has been serious devastating out breaks of diseases in several parts of the World.Of greatest has been the devastation caused by Fusarium wilt and bacterial bud rot in southern Zaire.The considerable losses sustained through Dry Basal Rot in Nigeria and through Ganoderma Trunk Rot in old and replanted areas in Asia,and the sudden and devastating attacks of bud rots and sudden appearance within new plantations in Columbia,Peru and Central America(Wood B.J 1974).Attack by one pest,the Hispid coelaenomenodera elaedis(Waterson J.M 1953) have grown more serious in West Africa with caterpillar and bagworms of various species in Malaysia and Southern America have cause sporadic defoliation with greatly increase areas under oilpalm.Vertebrate pest especially rats and birds have assumed much greater importance in recent decades,particularly in Asia and America.This was only to be expected since oilpalm plantations have moved into new areas in these continent and have presented opportunities for certain species to adapt to and even increase in a new environment(Wood,1969).

The research forms part of a study of assessing pests and disease incidence , and deficiency symptoms on immalure oil palms of 22 genotypes planted in the field at Njala University Clonal garden.

Statement of the problem

A wide range of variability exists among immature oilpalms in the field growing. These differences may be expressed as variation in vegetative growth and morphological characters between the seedlings.

Furthermore, other variations relate to differences in susceptibility to pest diseases. Identifying such variations is an initial step in identifying better clones for making crosses to produce pest and disease resistance hybrids.

Aim and Objective

The general aim of this study was to evaluate pest and disease incidence and deficiency symptoms on immature oil palms and to identify superior clones for use as breeding materials in the improvement of oil palm in Sierra Leone.

Specific Objectives

- Assess the deficiency symptoms of nitrogen on immature oil palms at the Njala university Clonal garden.
- Assess the level of pest attack on immature oilpalms at the Njala university clonal garden
- Assess the level of diseases incidence attack on immature oilpalms at the Njala University clonal garden

10.

Justification of the study

Research on evaluating immature oilpalm trees for pest,disease and deficiency symptoms in the field is necessary for several reasons.

Firstly, the information is needed to identify suitable parents for Breeding Programes.

Secondly, crosses between such parents would produce pest and disease resistant Tenera hybrids.

Finally, these hybrids would be grown by farmers for poverty alleviation and food security promotion in Sierra Leone.

METHODOLOGY

Study Area: The area where these immature oil palms were planted is located in the southern province of Sierra Leone, Moyamba District at the Njala University clonal garden. Njala is situated at 8°07 North latitude and 12° 05 West longitude. The climate of Njala is humid tropical with district wet and dry Seasons. The dry season lasts from November to April while the rainy season with a monomial pattern extends from May to October. Average rainfall is 2770mm and minimum mean temperature of 31°C and 22°C respectively.

The site or area where these immature oil palms are planted is on hilly undulating area with a moderate slope close to a swamp. The soils in Njala are Njala upland series, as described in soil survey of the Njala area by van vuure et al (1974), the soil is gravely loam on the surface. It is well to moderately well drained and never water logged.

Description of the clone(progeny) groups

The immature oil palms are planted in plots,with clone occupying a plot and each plot having about 160 oilpalm trees.

Treatment and Experimental Design

The number of immature oil palms forms the population. Each clone was planted in an identified plot. A set of five (5) immature oil palms were randomly selected from each clone and marked with black cellotape that form a sample for treatment in replication one (1). Another set of five immature oil palms were randomly selected from the same clone and marked with yellow and black cellotape that formed a sample for treatment in replication two (2). A third set of five (5) immature oil palms were randomly selected from the same clone and marked with cellotape that formed a sample for replication three (3). These immature oil palms were then subjected to scoring for disease and pest; where 1 is highly resistant and 5 is poor and highly susceptible in terms of pest and disease incidence, deficiency symptoms on immature oil palms.This depicts that the research was carried-out in a Randomised Complete Block(RCB) design.

Population and Sample Size

The immature oil Palms were assigned into plots. Each plot contains a clone containing 160 immature oil palms forms the population. The five(5) randomly chosen oil palm trees form the experimental plot. Each clone forms a treatment unit. The twenty-two(22) clones therefore means, there are twenty-two(22) treatments.

Data Collection

Data were collected on the following:

Deficiency symptoms, invertebrate pests, vertebrate pest and Disease incidence.

Deficiency symptoms- Nitrogen: Uniform paling and yellowing of the entire leaf area of the immature palm.

1= Both old and new leaves are uniformly green, no damage or high tolerance /resistance.

5 =Yellowing of the entire leaf area severe damage or high susceptibility.

12.

Vertebrate Pest (Rattus spp)

Rats gnaw through the lower fronds and bore to eat the soft inner bud tissues. Death of immature palm almost also occur either from the initial damage or from secondary infection of the damage area.

1= Clean,no infection

5=Severely damaged by rats.

Invertebrate Pest (Tussock moth Pest infections) Oria commentaries Scoring was done for hole in fronds of immature palm and the presence of caterpillars.

1= clean , no infection ; 5 severely diseased

Disease Incidence - Curvularia blight (Curvularia spp)

Leaves of immature palms show small , dark brown spots with a distinct yellow or brown colour which may lead to entire leaf drying up. 1-clean, no infection;

5 = severely infected .

Disease Incidence - Blast (Pythium spp)

Leaf disease causing necrosis (death of old fronds of immature palm, younger fronds become full olive green with necrotic tips;

1= clean, no infection

5= severely infected.

Disease Incidence – Corticum leaf spot (Corticum spp)

Older leaves of immature palms show rows of brown lesions that dry out , leaving grey to grayish white fronds with purplish margin;

1=clean ,no infection

5 =severely infected.

Statistical Analysis

The research was done in Randomised Complete Block design (RCB) with twenty-two (22) clones as the treatments.

Subjected to scoring for diseases and pest; where 1 is highly resistant and 5 is poor and highly susceptible in terms of Pest and disease incidence, deficiency symptoms an immature oil palms. This depicts that the research was carried out in a Randomised Complete Block (RCB) Design.

RESULTS AND DISCUSSION

The results and discussion shall follow the objectives of this research.

Assess the deficiency symptoms of Nitrogen on immature oil palms at the Njala University clonal garden

Figure I illustrates the percentage levels of Nitrogen deficiency of immature oil palms.

In between these two extreme scores, three categories of nitrogen deficiency scores were observed; the least deficiency scores were observed ;the least deficient, moderate and highly deficient groups. The least nitrogen deficient group had mean scores ranging 1.00-2.00 while the highly deficient scores ranging 3.10-3.60. The moderate had mean scores of 2.10-3.00. Rating of the 22 clones on percentage basis, the least nitrogen deficient category had 27.36% while the moderately deficient had 50%. The highest nitrogen deficient category had 22.73% of the clones.

The results revealed that the treatments showed highly significant differences for Nitrogen deficiency at the 5% level. There were significant differences among the clones. Clone (Y_{26456}) with a mean score of 1.60 displayed the highest level of tolerance to nitrogen deficiency. At the same time, clone 18 (Y_{26655}) with a mean score of 3.6 showed the highest level of susceptibility to nitrogen deficiency.

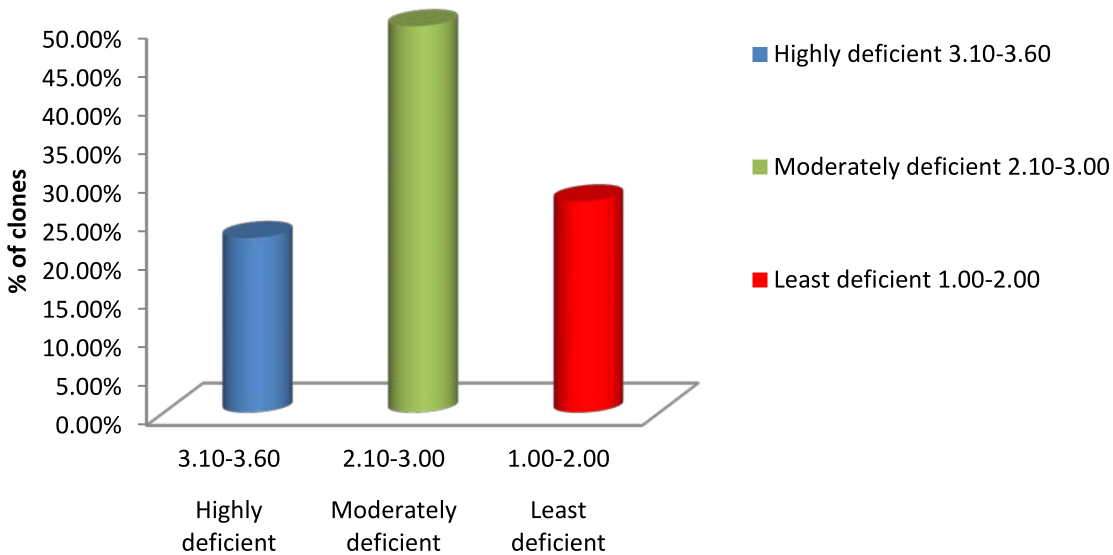

figure 1: percentage distribution of clones for nitrogen deficiency of immature oilpalms measured in the field

Assess the level of Pest attack on immature oilpalms at the Njala University clonal garden

Figure 2A shows percentage of clones and levels of pest attack for 22 clones of immature oil palms. Among the 22 clones of immature oil palms,highly susceptible of 9.09% of immature oil palms fall between mean ranging from 1.69 -2.00 which emerge as the lowest clone and these include Y26517 progeny A and Y26475 progeny A. The susceptible category fall between the range from 1.34-1.68 and accounted for 13.64% for the clones these include Y_{26475} progeny C , Y26666 progeny A and Y26470 progeny A. The 77.27% which were highly resistant category ranging from 1.00-1.33 which include Y_{26456} progeny A ,Y26517 progeny B,Y26517 progeny C,Y26655 progeny A,Y26423 progeny D,Y26423 progeny A,Y26711 progeny A,Y26568 progeny B,Y26526 progeny A,Y26655 progeny B and Y26526 progeny B.
progeny D, Y26423 progeny A, Y26711 progeny A, Y26568 progeny B, Y26526 progeny A, Y26655 progeny B and Y26526 progeny B.

This means that variation exists among the clones in terms of pest attack and some clones were highly resistant whilst others were susceptible than the others.

16.

These means reveal that, there are categories which are susceptible, highly susceptible and highly resistant.

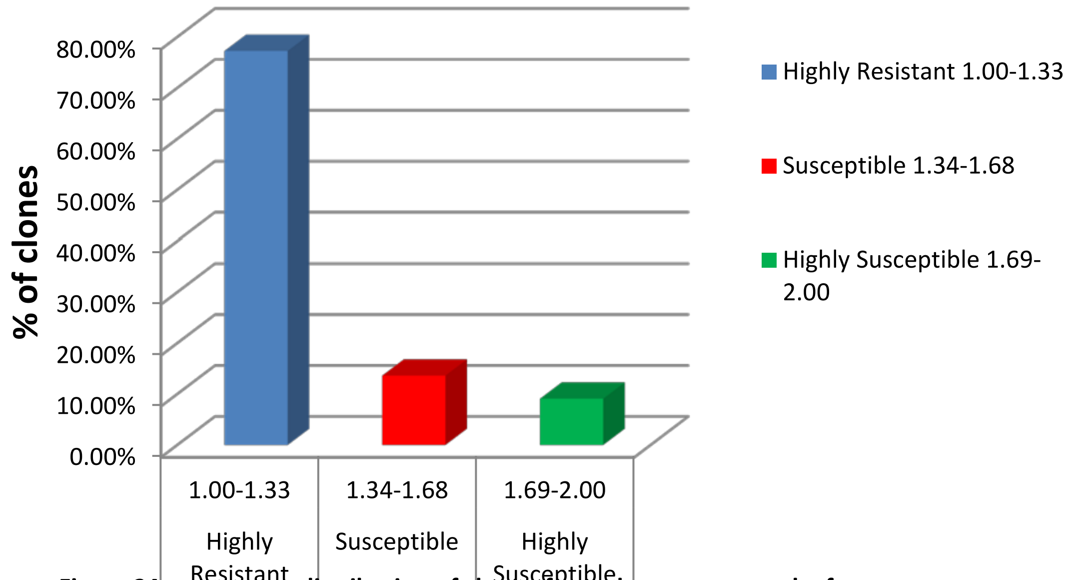

Figure 2A percentage distribution of clone of vertebrate pest attack of immature oil palms

Figure 2B Shows percentage of clones and levels of invertebrate (moth) pest attack for 22 clones of immature oil palms. . The first category;highly resistant with mean scores ranging from 2.00 to 2.50 had minor infections and accounted for 45.5% of the clones. The second category;resistant with mean scores ranging from 2.51-3.00 had mild infection and accounted for about 36.4 percent of the clones. The third category; highly susceptible with scores ranging from 3.10-3.33 was severely infected group.This accounted for 18.2% of the clones.

The analysis of variance for invertebrate pest showed significant variation among the treatment. This means that the immature oil palm clones do have real differences among them in terms of reaction to tussock moth pest infestations. This means for invertebrate pest attack on 22 clones of immature oil palm confirmed the existence of wide variation among the immature oil palms. According to the means, there were three categories of clones. clones 2 and 11 were the least affected and therefore very highly resistant.

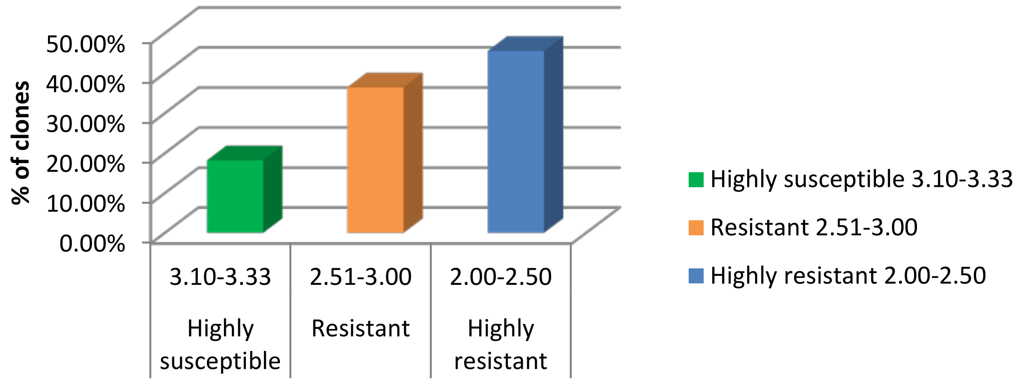

figure 2B percentage distribution of invertebrate pest attackof immature oilpalm

Assess the level of disease incidence attack on immature oilpalms at the Njala University clonal garden

Figure 3A shows percentage of clones and levels of Corticum leaf spot (Corticum spp) disease incidence categories on 22 clones of immature oil palms. The means were in three categories; category one (1); highly resistant had means ranging from 2.00 to 2.50 which accounted for 36.36% percent of the clones. The second category; resistant had means ranging from 2.51 to 3.00 affecting 40.91% of the clones. The last category;highly susceptible had means ranging from 3.10 to 3.33 and affected 22.73% of the clones. Clone 21 was the most severely diseased and highly susceptible to disease attack.

The means for disease incidence on the 22 clones had mean score of 1; a score for clones that all are clean and highly resistant. Clone 12 and 20 had the least scores of 2.13 indicating mild infection. clone 21 scored the highest mean of 3.33 meaning it was the most infected.

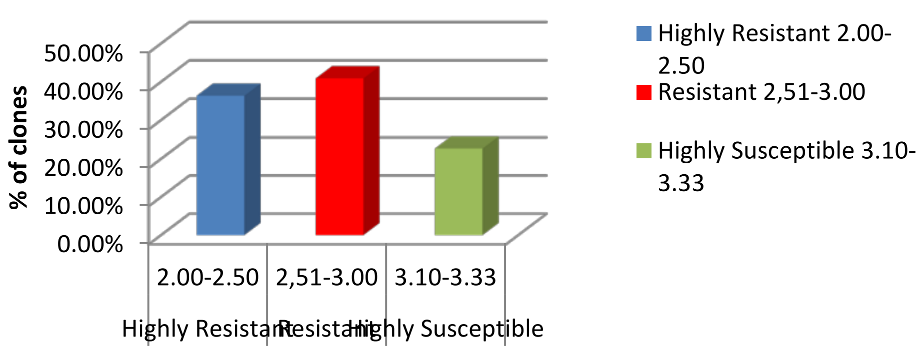

Figure 3A percentage distribution of clones of Corticum leaf spot attack on immature oilplms

Figure 3B illustrates percentage of clones and levels of incidence categories of Blast (Pythium spp) attack on 22 clones of immature oil palms.Three categories of clones were identified. The first category of highly resistant clones to Blast had scores ranging from 1.00 to 2.50 which accounted for 36.36% of the clones. The second category of susceptible Clones had mean score ranging from 2.51 to 2.90 which accounted for 40.91% of the clones. The third category of highly susceptible clones had scores ranging from 2.91 to 3.50 and accounted for 22.73% of the clones.

These means revealed that clone 6 had the least mean of 1.80 and had minimal infection and therefore highly resistant. Clone 15 had a mean of 3.40 the highest . Clone 15 had the most severe infection and therefore the most susceptible to Blast disease.

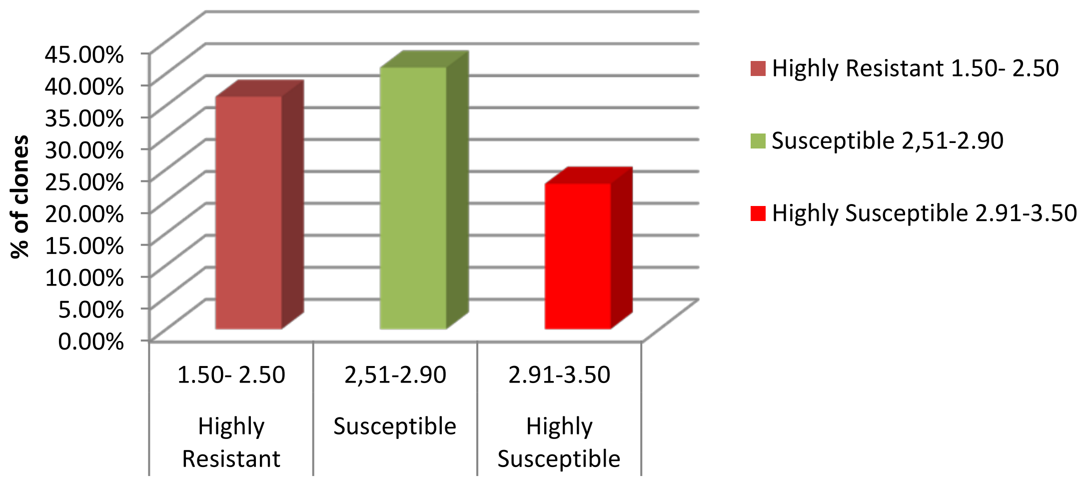

figure 3B percentage distribution of clones of Blast attack on immature oil palms

Figure3C illustrates percentage of clones and levels of disease incidence categories curvularia Blight (Curvularia spp) on 22 clone of immature oil palms. There were three categories of disease incidence of Clones. The highly resistant group had scores ranging from 2.00 to 2.50,which accounted for 40,91%.The second category with mean scores ranging from 2.51 to 2.90 could be described as susceptible and accounted for 40.91% of clones. The last category had mean scores ranging 2.91 to 3.51 could be described as highly susceptible which accounted for 18.18%.

The means of disease incidence for 22 clones of immature oil palms confirmed the existence of variation among the immature oil palms. These means revealed that clone 12 had the least mean score of 2.00 therefore the most resistant to Blight. Clone 20 had the highest mean of 3.77 and therefore the most susceptible to Blight.

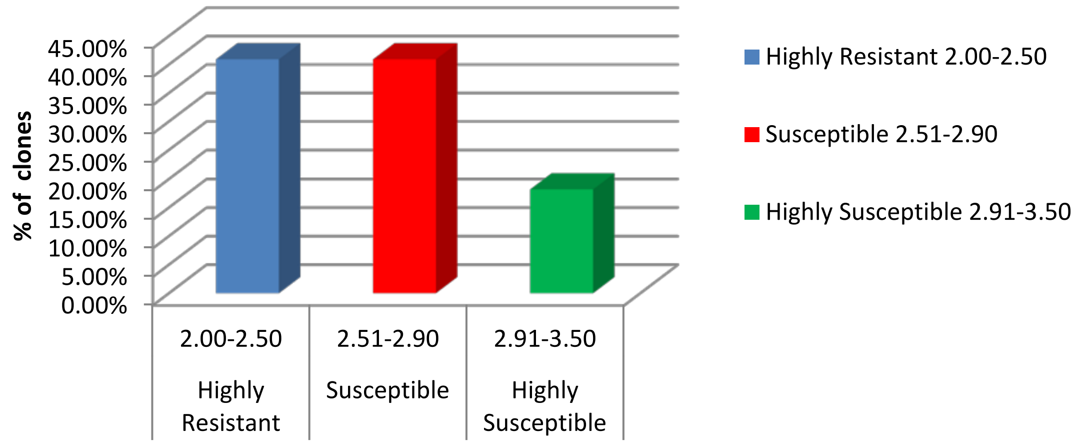

figure 3C percentage distribution of clone of Bight incidence on immature oil palms

CONCLUSION AND RECOMMENDATION

The explosive growth of the human species has produced an acute food shortage in many underdeveloped nations of the world. The shortage has produced widespread malnutrition and starvation. In an effort to produce more food, the world use of fertilizer increase tremendously in recent years.

Based on the findings of this study, the following conclusion are drawn.
The most important ingredient of fertilizer is nitrogen in the form of nitrates . Nitrogen is a critical element in building proteins molecules. Therefore the element is important as a great stimulator for rapid growth of plants.

The results for the 22 clone of immature oil palms clearly displayed three distinct groups of deficient , moderately nitrogen deficient and highly nitrogen deficient groups. The division reveal the inherent abilities of certain clones to grow and produce more leaves than others over the period of years.

The best most desirable nitrogen use efficient clones an potential in a long term breeding program to produce tenera hybrids that performs with minimal levels of nitrogen.
The issue of vertebrate pest (Rattus Spp) attack on immature oil palm trees deserves special attention as whole farms may be lost if adequate measures are not put in place. The observation of considerable variation among clones in their response to vertebrate pest attack is desirable.
The detection of clones that are highly susceptible to vertebrate pest attack is useful information that could be used to avoid the growing of such clones as it may bring about total crop failure.

On the contrary, the identification of clones highly resistant to vertebrate pest attack is good information that could be used to select good planting materials. Most oil palm growers in Sierra Leone are poor and cannot provide enough money to fence large plantation. For this category of farmers, oil palm clones that are resistant to vertebrate pest attack are preferred.

Invertebrate pests especially moths do bore holes in the ground if immature oil palm trees thereby reducing the leaf area available for photosynthetic activity. The activities of large members of caterpillars on the leaves of oil palm trees render them severely disease. About half of the clones had minor infections indicating that materials resistant to invertebrate pest attack would be identified relatively easily.

Disease incidence on the leaves of immature oil palm trees may occur in many forms including Corticum, Curvularia and Blight. These disease may lead to the entire leaf having a clean appearance or may be severely infected with all parts of the leaf drying up.

RECOMMENDATION

Based on the findings and conclusions of this research the following recommendations are made:

1. The identified and selected clones should be included in hybridization programmes
2. The research should be continued on the breeding materials in the field.
3. Lastly, this research should be conducted at another site for further investigation to pest,disease incidence deficiency symptoms on immature oil palms.

REFERENCES

1.Asiedu JJ (1992) Processing Tropical Crops-A Technological approach Macmillian Publisher PP 167-168

2.Beernaert,A and Vander weyen,R (1941) -In Hartley, CWS (1977). The Oil Palm (E,guineensis Jacq). London Scientific and technical Publication Second edition pp37-67

3.Blaak,G. (1965) Breeding and inheritance in the oil palm 11 yield selection and inheritance J.W. African institude oilpalm Research 4, 262

4.Byyerdee, Derck , Carl, K. Ekher and Dunstan S.c Spence (1977) “Rural Employment in Tropical Africa. summary of Findings. African Rural Economy program , working paper no. 20 Dept of Agric Economics, Michigan State University.

5.Cheshire, PC (1965). The market for oilpalm products with particular reference to the United kingdom market. Oilpalm conference ,London 1965.

6.Chimera -Annual report (1968/69) Oilpalm Research Station Malaysia

7. Garot ,A and Subadi (1960). In Hatley, CWS (1977). The Oil palm (E. Guineasis Jasq.)longman Scientific and technical Publication Second edition pp 593-594

8. Godding R. (1930). In Hartley (1977) the oil palm London Scientific and technical Publication Second edition Pp15-60

9. Mackie,Jr(1939) - Annual report of the Agric Dept. 1937,Nigeria.

10.Moolayil,J(1976) -Uses of Palm oil, Malaysian Int. Symposium on Palmoil processing and Marketing Pp23.

11. Piggott.C J (1995)-Growing oilPalms -An illustrated guide. The incorporated society of planters, Malaysia Pp2-3.

12.Sasson ,A (1988) Biotechnologies and development Published in 1988 by the UNESCO Pp 33-35

13. Spranaaiji, LD (1957). Mixed Cropping in oil Palm cultivation. J W African Institution Oil Palm research 2, 244.

14. Van Vuure; Odel, R.T.J Dijmerman, JC; Mested, SW.Beaves, A.H. Sutton , P.M. ;Kurtz, L.T; and Miedema,R. (1974) - Characteristics, Classification and Adaptation of Soils in S/L.West African bulletin 748 Np5,1974

15.Waterson ,J.M. (1953). Observation on the incidence of some ecological factors on the incidence of oil Palm disease in Nigeria J.W. Agric. Inst.for Oil palm research 1,124.

16. Hale J.B(1927) Mineral composition of Leaflet in relation to the chlorosis and bronzing of oilpalms in W/African.Jagnc sci. 37,3,236 -244