Full Length Research Paper

Study of citrus disease prevalence on four citrus varieties at the National Institute of Horticultural Research (NIHORT) Mbato, Okigwe, Imo State, Nigeria

Ezeibekwe, I. O.

Imo State University P. M. B. 2000, Owerri, Imo State, Nigeria. E-mail: innocentezeibekwe@yahoo.com.

The studies were conducted to determine the prevalence of diseases on four varieties of citrus. These are sweet orange (*Citrus sinensis),* tangelo (*Citrus paradise X Citrus reticulate*), grape (*Citrus paradise*) and lemon (*Citrus limon).* The study showed that, tangelo and sweet oranges were more susceptible to fungal attack than grape and lemon. The disease symptoms commonly observed included dieback on the four species of citrus: tangelo (65%), sweet orange (60%), grape (55%) and lemon (40%). An effective integrated management practice including the use of resistant varieties is recommended.

Key words: Study, citrus, disease, prevalence, Okigwe, Imo State, Nigeria.

INTRODUCTION

There has remained a persistent decline in citrus growth and productivity which is associated with high level of chlorosis, and shoots dieback at the National Institute of Horticultural Research (NIHORT), Mbato Okigwe. There is therefore an urgent need to revamp the citrus industry in Nigeria, in view of its numerous uses and demand for both local consumption and exportation.

Citrus, a tropical and subtropical crop belongs to the family Rutaceae of the tribe Citrae. All the members are fruit bearing, possessing juice filled vesicles known as hesparidium. They are thorny aromatic shrubs or small trees with leathery evergreen leaves. The white or purple flowers are often very fragrant (Plate 1).

According to Okwulehie (1998), citrus may have originated from the history of the cultivated species and it is cultivated from 15°N to 35°S between sea level and 1000 m. They also require 100 cm of rainfall. Citrus plants include large varietal collection of sweet orange (*Citrus sinensis*), tangerine/mandarin (*Citrus reticulate)*, grape (*Citrus paradisi)*, lemon (*Citrus limon)*, lime (*Citrus auvantifolia)* and pumelo (*Citrus grandis*).

Citrus is one of the most important fruit tree crops in Nigeria utilized for fresh consumption and for fruit industry. It surpasses all other fruits as raw materials in fruit drink industry. The total world population of citrus is estimated at 36 metric tons with Nigeria producing 0.3 metric tons of the world's production.

In spite of the high demand of citrus fruits in Nigeria, its production level is low due to pests and diseases. Many microorganisms have been known to cause various diseases of citrus trees (IITA, 2003; NIHORT, 2003). These include many genera of fungi, bacteria and viruses. In the last five years or more, the decline of citrus trees at the National Institute of Horticultural Research (NIHORT) has drastically reduced the yield of these crops.

The symptoms of the decline include chlorosis of leaves, wilting, roots rots and diebacks. The canopy first thins out and as the diseases progress, the foliage turns yellow and permanent dieback of twigs occurs. Any new growth is weak and the affected trees may die quickly or make periodic attempts of regrowth (Bertus, 2002). Bertus (2002) showed that, the diseases of citrus in New South Wales were caused by various species of the fungus *Phytophthora* and these diseases include root rot, collar rot and brown rot of fruits. The author concluded that, the symptoms manifest firstly, as thinning out of the canopy and as the disease progresses, foliage turns yellow and permanent dieback of twigs occur.

Most citrus trees are budded on a rootstock. Most of the rootstocks are more resistant to fungal diseases than the scions (tops); so it is necessary to keep the bud union

Plate 1. A citrus tree.

Table 1. An assessment using scales and ratings in percentage class infections on the citrus varietal crops.

Class	Range (%)	Scale
0	0	Apparently healthy
1	0-25	8 – up to 25% affected
2	26-50	12 – up to 50% affected
3	51-75	18 – up to 75% affected
4	76 - 100	22 – up to 100 trees affected

at least 4 to 5 cm above the soil line at planting especially in controlling the *Phytophthora* disease. Bud wood sources used by nursery men should be certified free from pathogen (Olsen et al., 2000).

Some citrus varieties are used as rootstocks in budding as they offer a good measure of resistance to pathogens when compared to other types of citrus. Wutscher (1998) reported that, with regard to varietal reaction, all sweet oranges and tangelo varieties, Mandarin and sweet orange hybrids were severely affected in some districts and did better in others. All varieties of citrus stocks are

not subject in the same degree of gum and foot rot disease (Brlansky et al., 2003). The main objective of this study is to find out which of the varieties of citrus under investigation is more susceptible or less resistance than the other. It is hoped that, the result will enable the farmers better understand the varieties for proper handling and management.

MATERIALS AND METHODS

National Institute of Horticultural Research (NIHORT) Mbato Okigwe, Imo State is situated at longitude 7°2'E and latitude 5°55'N of Okigwe with mean annual range of rainfall 80 to 375 mm; mean relative humidity of 79% and mean temperature of 22.7 to 34°C (NIHORT, 2003).

Surveys were conducted at the citrus orchards of NIHORT on four varieties of citrus namely; sweet orange, grape, tangelo, and lemon to asses the prevalence of diseases on the varieties. Disease incidence was also assessed for the four varieties put together in four plots A, B, C and D according to year of planting; 1976, 1978, 1983 and 1988. Each variety occupied an area of 2,500 square meters with 100 varietal crops on each plot on 7 x 7 m espacement.

The experimental design was carried out on randomized complete block arrangement represented by the four different varieties of citrus and four replications represented by the locations of the citrus plantations. 30 marked crops of each variety were assessed for disease incidence and severity twice a year (during rainy and wet seasons) in three sampling years (2005, 2006 and 2007). The data recorded were on the average of three determinations. Disease incidence was calculated as follows:

$$\text{Incidence} = \frac{\text{Total number of diseased plants}}{\text{Total number of plants observed}} \times 100$$

While disease severity was calculated as an assessment using scales and ratings in percentage class infections on the citrus varietal crops (Table 1) as follows:

$$\text{Severity} = \frac{\text{Sum of numerical ratings}}{\text{Total number of plants observed}} \times 100$$

Data collected in this study were subjected to analysis using percentages.

RESULTS AND DISCUSSION

Dieback syndrome has largely devastated the orchards (Plates 2, 3, 4 and 5). The symptoms of the decline include chlorosis of leaves, yellowing of leaves, wilting, root rot and dieback. Results of the field survey showed high incidence of the diseases. Symptoms were especially shown on sweet orange (60%) followed by tangelo (65%) and relatively lower in grape (55%) and lemon (40%) (Table 2). The high percentage of disease severity followed the same trend as in disease incidence (Table 3).

Plate 2. Beginning of citrus (sweet orange) decline with yellowing of leaves.

Plate 3. Advanced stage of citrus.

Plate 4. Citrus trees showing decline advanced stages of declining and retarded growth.

Plate 5. Fully declined grape tree.

Table 2. Incidence of diseases on varieties of citrus.

Variety	Incidence (%)
Sweet orange	60
Tangelo	65
Grape	55
Lemon	40

Table 3. Severity of diseases on varieties of citrus.

Variety	Severity (%)
Sweet orange	40
Tangelo	48
Grape	30
Lemon	22

Table 4. Disease incidence on the citrus varieties in the sample plots.

Year	% incidence
1976	77%
1978	67%
1983	63%
1988	46%

The high percentage disease incidence in four plots by year of planting 1976, 1978, 1983 and 1988 of the four citrus varieties put together showed high disease occurrence in 1976 plot (77%), 1978 (67%), 1983 (63%) and 1988 (46%) (Table 4).

The incidence of diseases was high in tangelo (65%), sweet orange (60%) as against 55% for grape and 44% for lemon. The percentage severity of disease symptoms showed the same trend with tangelo (48%), sweet orange (40%), grape (30%) and lemon (22%). The results showed that, lemon may be more resistant to diseases followed by grape. This could be the reason why some species of lemon are used as root stocks in budding. The least resistant of the varieties observed was tangelo followed by sweet orange.

The observed differences in the incidence and severity of diseases among the varieties could have been due to different resistant capabilities in the citrus species. This is in line with the work of Wutscher (1998) who worked on varietal reactions of citrus, which showed varietal resistance and also proved that, fungi inoculated into the seedlings were more pathogenic or caused more extensive diseases on citrus previously infected or weakened by an agent than on healthy plants. Wutscher

(1998) also said that, the reasons for differences in disease resistance between varieties of a single plant species remain largely obscure; that resistance often resides in a physiological or biochemical differences between the resistant and susceptible varieties.

The percentage of disease occurrence in the four sample plots; 1976, 1978, 1983 and 1988 on the four citrus varieties was highest in 1976 plot (77%) and least in 1988 plot (46%); it is likely that, age could have contributed to the observable differences in percentage disease occurrences in the sample plots.

NIHORT (2003) showed that, varietal resistant studies at NIHORT farms indicated that, disease resistance and susceptibility may be summed as follows: Sweet oranges are not attacked by citrus scab, but lemons, grape and tangelo are affected by the dieback and structural decline syndrome just like sweet oranges; though grape and tangelo are not affected by scally bark, grape is easily attacked by shoot dieback.

On varietal reaction, Fraser (1967) reported that, all sweet orange and tangelo varieties and mandarin hybrids were severely affected by dieback. Grape fruit reaction was classified as severe. It was thought that, root stocks in budding especially budding on rough lemon may have reduced damage caused by root rotting fungi; rather, imparting resistance to dieback.

In the light of these discussions, it is recommend that, apart from efficient management practices, farmers should plant more resistant varieties budded on more resistant stocks and adopt a comprehensive integrated approach to disease control involving biological, cultural and chemical agents.

REFERENCES

Bertus AL (2002). Phytophthora disease of Citrus (root rot, collar rot, brown rot). New South Wales Agric. Bull. Univ. Florida, 9: 2-5.
Brlansky RH, Derrick KS, Robert PD, Timmer LM (2003). Florida *Citrus* management. Coop. Ext. Service Series, Univ. Florida, 43: 180.
Fraser I (1967). Citrus Dieback in India. Report to Dept. of External Affairs, Canberra Australia, p. 95.
IITA (2003). International Institute of tropical Agriculture Information Support for Agric. Growth in Nigeria, p. 30.
NIHORT (2003). Nigerian Institute of Horticultural Research. Commercial Crop production Guide Series in Nigeria, 8: 10.
Okwulehie IC (1998). A Handbook to Tropical Permanent Crops in Nigeria. Alphabet Publishers, Owerri, p. 212.
Wutscher HK (1998). Soil Acidity and Citrus Blight, U.S Dept. Agric. Res. Service, 22: 10.