

EFFECT OF NEEM EXTRACT AND INORGANIC FUNGICIDES ON THE INCIDENCE OF LEAF BLIGHT DISEASE OF COCOYAM (*Colocasia esculentum*) IN ISHIAGU, NIGERIA.

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ABSTRACT

This study was conducted at the Research and Teaching farm of the Federal College of Agriculture, IshiaguEbonyi State, Southeast Nigeria, during the 2017 and 2018 cropping seasons to evaluate the effect of organic and inorganic fungicides on leaf blight diseases of Cocoyam (Colocasia esculenta). Ishiagu is located in the agro-ecological zone of south eastern part of Nigeria. Neem leaf extract was used while inorganic fungicides used were X-force (Mancozeb) and Red-force (Metalaxy 1 – M6% + Copper II oxide). The control was water. 1 kg/liter of water of the neem extract was applied, while the Inorganic fungicides were applied according to the manufacturer's specifications of 100g/15L (0.01kg/0.015liter of water). Randomized complete block design (RCBD) was used for the experiments with three (3) replications. Collected data were subjected to combined analysis of variance for the two years while significant treatment means were separated using Fisher's least significant difference (F-LSD) at 5% level of probability. Parameters measured were Petiole height (cm), Number of leaves, Stem girth (cm), and Leaf area (cm²) at 6, 8 and 10 weeks after planting. Number and weight (kg) of Corms and Cormels at harvest and Disease Incidence. The results showed that the fungicides significantly (P<0.05) reduced the incidence of the disease. Results obtained showed that plots treated with Red Force significantly (P<0.05) produced the highest plant height, stem girth, number and weight of corms/cormels and low disease incidence. X-Force significantly reduced the disease incidence as well the neem extracts. This further proved the fungicidal properties of neem extract. They all proved better than the control in all the parameters evaluated in the two years. Any of them could be employed by cocoyam farmers.

Keywords: leaf blight; disease incidence; fungicides; cocoyam; farmers' income; scarcity

INTRODUCTION

Cocoyam (*Colocasia esculentum*), belongs to the family of *Araceae*. It constitutes one of the basic food crops of major economic importance in the south eastern Nigeria. It ranks the third after cassava and yam, in terms of total production land area under crop and consumption (Chukwu and Nwosu, 2008). It is a staple food for the people in the South-eastern Nigeria. It is also a food of West African people (Philips, 2008). Cocoyam is propagated using corms and cormels. As food for human consumption, the nutritional value of the various parts of cocoyam is primarily calories (Davies, 2008). Cocoyam is regarded as a major food crop in Nigeria, especially in female headed households. Nwabuzor, (2001) noted that cocoyam can be consumed in various forms such as boiled, fried, pounded or processed into chips. According to Asieduet al., (2006) cocoyam leaves are also used as vegetable for preparing soup in various parts of the world.

Despite the usefulness of cocoyam corms and leaves in human, its production and processing in Nigeria, is faced with a lot of challenges. Currently, *Colocasia esculentum* (Taro) is seriously threatened to extinction in South – Eastern Nigeria as a result of its high susceptibility to leaf blight disease. In Ishiagu, South-East Nigeria, cocoyam farmers'

incomes are reduced since the outbreak of the disease thereby discouraging farmers from further production and scarcity of the crop abound. Therefore, this study was undertaken to isolate and identify the potency of some selected fungicides and plant extract in the control of leaf blight of cocoyam.

MATERIALS AND METHODS

Study Area

The experiment was located at the research and teaching farm of Federal College of Agriculture, Ishiagu during the 2017 and 2018 cropping seasons. Ishiagu is located in the tropical region at latitude 05° 56'N and longitude 07° 4'E. The area has average rainfall of 1665 mm, average relative humidity of 88% and temperature of 28.5°C. (FCAI Meteorology Station, 2017)

Sample collection and preparation

Colocasia esculenta (Ede oku) corms were obtained from National Root Crop Research Institute Umudike. Poultry droppings were applied at 10t/ha as basal treatment two weeks before planting.

The plant material, neem leaves were collected fresh, washed and air dried. After drying, a portion was ground using manual grinder. 1kg of the powdered material was suspended in 1000ml of sterile water and cheese cloth was used to obtained filtrate (Stoll, 2000; Amadioha, 2003).

Treatments

The treatments used were X-force(active ingredients (a.i) *mancozeb*), Red-force (*metalaxy 1 – m6% + copper II oxide (a.i)*), Neem extract (1kg/L of water) and water (Control).

Agronomic Practices and Experimental Design

The experimental site was cleared, stumped and packed. Beds were made manually using hoe in April each year.

The experiment was arranged in a randomized complete block design (RCBD), consisting of four (4) treatments and three (3) replications. There were three blocks with 4 plots (2m x 2m) each. There was 1 m spacing between each block and 0.5m spacing between each plot. Cocoyam (*edeoku*) corm weighing 25 g was planted one per hole directly into the bed at 50 cm X 50 cm plant spacing.

The neem extract was applied at 1kg per liter of water while the inorganic fungicides were applied according to the manufacturers' specifications of 100g/15 liter (0.1kg/ 0.015 liter) of water.

Data Collection

Data were collected on the following parameters;

- a. Petiole height (cm) at 6, 8 and 10 weeks after planting (WAP).
- b. Leaf area (cm) at 6, 8 and 10 WAP.
- c. Number of leaves at 6, 8 and 10 WAP.
- d. Stem girth at 6, 8 and 10 WAP.
- e. Disease incidence at 6, 8 and 10 WAP.
- f. Number of corms/cormels at harvest.

- g. The weight (kg) of corms/cormels at harvest.

Disease Incidence

The disease incidence was determined as follows:

$$\text{Percentage (\%) diseases incidence} = \frac{\text{number of leaves affected}}{\text{total number of leaves sampled}} \times \frac{100}{1} \text{ and scaled as follows:}$$

- 0 = No infection,
- 1 = 1 - 10% of leaves infected = slight infection
- 2 = 11 – 20 % of leaves infected= mild infection
- 3 = 21 – 30 % of leaves infected = moderate infection
- 4 = 31 - 40 % of leaves infected = high infection
- 5 = 41 – 50 % of leaves infected = very high infection
- 6 = > 50 % of leaves infected = very very high infection

Data Analysis

The data collected were analyzed, using combined analysis of variance (ANOVA) averaged over the two years and significant means were separated at 5% level of probability using Fisher's least significant difference (F- LSD).

RESULTS

Results in Table 1, showed that the treatments significantly (P<0.05) influenced the petiole height at 6, 8 and 10 weeks after planting. Red Force gave the highest petiole height (112.13cm) at 6 weeks after planting. At 8 weeks after planting, Red Force gave the highest petiole height (119.83cm). While at 10 weeks after planting, Red Force produced the highest petiole height (178.78cm).

Table 1: Effect of Treatments on Plant Petiole Height (cm) of *Colocasia esculenta*.

| TREATMENTS | 6 WAP | 8 WAP | 10 WAP |
|---------------|--------|--------|--------|
| X-force | 98.5 | 119.83 | 170.83 |
| Red force | 112.13 | 133.96 | 178.78 |
| Neem extracts | 104.91 | 120.41 | 160.68 |
| Control | 89.64 | 104.83 | 118.63 |
| F – LSD 0.05 | 2.28 | 2.18 | 7.65 |

WAP = Week After Planting, F – LSD 0.05 = Fisher's least significant difference .

X – Force produced the highest number of leaves (94.00) at 10 weeks after planting (Table 2). Red force produced the highest number of leaves

(60.00) at 10 weeks after planting. At 10 weeks of planting, Neem extracts gave the highest number of leaves (56.00).

Table 2: Effect of Treatments on Number of Leaves of *Colocasia esculentum* at 6,8 and 10 WAP

| TREATMENT | 6 WAP | 8 WAP | 10 WAP |
|---------------|-------|-------|--------|
| X-force | 24.0 | 29 | 94 |
| Red force | 27.0 | 32 | 60 |
| Neem extracts | 25.0 | 38 | 56 |
| Control | 18.0 | 31 | 44 |
| F – LSD 0.05 | 1.91 | 1.91 | 5.47 |

In Table 3, the results showed that the treatments had significant (P<0.05) effect on the mean stem girth of *Colocasia esculentum*. Redforce produced the highest Stem girth (86.01 cm) at 10 weeks after

planting. At 10 weeks after planting, Neem extracts produced the highest Stem girth (65.90 cm), while X-force produced the highest Stem girth (75.16 cm) at 10 weeks after planting.

Table 3: Effect of Treatment on Mean Stem Girth (cm) of *Colocasia esculentum* at 6, 8 and 10 WAP

| TREATMENTS | 6WAP | 8WAP | 10WAP |
|-----------------------|-------|-------|-------|
| X-force | 40.83 | 50.3 | 75.16 |
| Red force | 53.5 | 60.51 | 86.01 |
| Neem extracts | 41.93 | 50.88 | 65.9 |
| Control | 33.91 | 43.3 | 49.35 |
| F-LSD _{0.05} | 0.95 | 0.47 | 2.37 |

The results in Table 4, showed that the treatments had significant (P<0.05) effect on the mean leaf area of *Colocasia esculentum*. From the present investigation, at 6 weeks after planting, the Neem extracts produced the highest leaf area

(1201.9cm²). At 8 weeks of planting, the highest mean leaf area (1432.8 cm²) was recorded on X-force treatment. Lastly, control gave the least mean leaf area (639.9 cm²).

Table 4: Effect of Treatments on Leaf Area(cm²) of *Colocasia esculenta* at 6,8 and 10 WAP

| TREATMENTS | 6 WAP | 8 WAP | 10 WAP |
|-------------------------|--------|--------|---------|
| X-force | 1201.9 | 1432.8 | 1305.3 |
| Red force | 959.5 | 1281.7 | 1145.4 |
| Neem extracts | 1056.5 | 1278 | 1141.28 |
| Control | 639.9 | 877 | 781.3 |
| F – LSD _{0.05} | 54.15 | 44.52 | 52.29 |

Results in Table 5, showed that the treatment had no significant (P<0.05) effect at 6 weeks after planting. At 10 weeks after planting, X-Force significantly (P<0.05) had the lowest disease

incidence of (1.00). Control recorded the highest disease incidence followed by Neem extracts, X-force and Red force.

Table 5: Effect of Treatment on Disease Incidence of *Colocasia esculentum* at 6,8 and 10 WAP

| TREATMENT | 6 WAP | 8 WAP | 10 WAP |
|-------------------------|-------|-------|--------|
| X-force | 0 | 1.23 | 1.00 |
| Red force | 1.2 | 2.14 | 3.04 |
| Neem extracts | 1.31 | 3.01 | 3.00 |
| Control | 1.34 | 5.32 | 6.00 |
| F – LSD _{0.05} | NS | 1.97 | 1.92 |

NS = Not Significant

In Table 6, the results showed that the treatment had no significant effect at the number of corms.

Table 6: Effect of Treatments on Number of corms / cormels at 14 WAP

| Treatments | Number of corms/cormels |
|-------------------------|-------------------------|
| X-force | 17.00 |
| Red force | 28.00 |
| Neem extracts | 22.00 |
| Control | 17.00 |
| F – LSD _{0.05} | NS |

Results in Table 7, showed that the treatments significantly affected the weight (kg) of corms at harvest. Red force showed the highest

significant effect when compared with other treatments.

Table 7: Effect of Treatments on Mean Weight (Kg) of Corms/cormels at Harvest

| Treatments | Weight (kg) of corms/cormels |
|-------------------------|------------------------------|
| X-force | 11.3kg |
| Red force | 18.5kg |
| Neem extracts | 13kg |
| Control | 6.8kg |
| F – LSD _{0.05} | 1.50 |

DISCUSSION

The growth parameters obtained at the control plots showed reduction in the parameters such as petiole height, number of leaves, leaf area and stem girth when compared with those obtained from the treated plots. This shows the potencies of the various fungicides applied. The treated plots did better than the control due to the suppression of the disease attacking the plant. The plant extract also showed effective protection of the crop suggesting an alternative to the inorganic fungicides. Ogwulumba, (2007) reported that plant extracts were used to control some foliar pathogens in the field of groundnut.

In the experiments it was observed that higher yield was recorded in the plots treated with Red Force (*mancozeb a.i*) and followed by Neem extracts. However, among the three formulations; *mancozeb*, Neem extracts and *metalaxyl – m6% + copper (II) oxide* recorded the highest yields. This portrays the adverse effects blight disease has on the yield of cocoyam when left unchecked as depicted on the yields obtained at the control plots. Higher disease incidence and lower yields were recorded in the control plots. Application of some fungicides on the leaves of cocoyam suppressed leaf blight and recorded a high yield as reported by Omeje *et al.*, (2015).

It was also noted that number of Corms and Cormels increased when the treatment is sprayed with *Mancozeb* and followed by Neem extracts. This work is similar to those reported by (Amadioha, 2003; John and James, 2004.). It was also noted that the plant extracts proved to be as effective as standard synthetic fungicides used in disease reduction, indicating that some natural anti-microbial active ingredients are indeed contained in these plant extracts (Stoll, 2000; John and James 2004). Opara and Obani (2010) made similar observation on bacterial blight of egg plant. Amadioha (2004) reported that the greater effectiveness of the extracts may be due to inherent chemical constituent.

CONCLUSION

From this study it was observed that leaf disease causes reduction in both growth and yield attributes of cocoyam as shown in the plants from the control plots. The plant extract and inorganic fungicides significantly improved the yield of corm and cormels further revealing the function of the fungicides against the leaf blight disease which resulted in the reduction of the disease incidence and increase in the growth and yield parameters of the crop as obtained from the plants in the treated plots. This further proved the fungicidal properties of neem extract and could be used as organic fungicide in the control of leaf blight disease of cocoyam. Neem extracts is recommended for the control of leaf blight disease of cocoyam in the absence of the expensive inorganic fungicides.

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