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Comparative effects of some sanitation methods on growth and yield of false horn plantain in Ekiti State, Nigeria

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Abstract

Plantain (Musa paradisiaca) is highly susceptible to attack by the larvae of banana stem borer which feeds by creating tunnels through the plant. The borer causes loss of plant vigour and reduction in plantain yield. Several cultural practices are deployed towards ensuring the root health of plantain and also reduce occurrence of this root and corm pest. Farmers in Ekiti State are largely unaware of the presence of this devastating pest and possible measures against it. This study was carried out to determine the effects of some precautionary measures (boiling water, red acalypha plant extracts and furadan) against banana stem borer infestation in newly cultivated field in relation to growth and yield of plantain. The field experiment was conducted at the Teaching and Research Farm, Ekiti State University, Ado-Ekiti and arranged in a randomized complete block design of four treatments and three replicates. The treatments include boiling water, red acalypha plant extracts, furadan and a control. Growth data collected include the height and girth of the pseudostem, length and width of the youngest leaf, number of functional and leaf area. The number of days to inflorescence, number of days to harvest, number of hands per bunch, number of fingers per hand and bunch weight made up the yield parameters. These data were subjected to analysis of variance and the differences between treatments were separated using Duncan Multiple Range Test. Vegetative growth was best enhanced among red acalypha treated plants. Highest bunch yield was also obtained from red acalypha treated plots followed by boiling water treated plots. The control plots produced the lowest bunch yield. Dipping of suckers in either red acalypha plant extracts or boiling water as a precautionary measure against stem borer attack is an adaptable, less expensive technique recommended for adoption by Ekiti State plantain farmers.

Keywords: Comparative effects, Sanitation methods, False horn, Plantain growth and yield.

Introduction

Plantain (*Musa paradisiaca*) is an important staple food for farming rural and non-farming urban populations in Nigeria. Among plantain producing countries in Africa, Nigeria as the largest producer turns out about 2.74 million tonnes annually[1]. As a perennial ratoon crop, plantain occupies a strategic role in rapid food production. It ranked third after cassava and yam as a major source of carbohydrate for majority of Nigerian populace. It serves as a source of income for many rural dwellers and as raw materials for local industries in many parts of Nigeria. Plantain dried peels are used for soap production, the dried leaves, sheath and petioles are also used as tying materials, sponges and roofing material[2].

Farmers obtain their planting materials from existing old fields which are already becoming unproductive as a result of depletion of soil nutrients and infestation by pests.

This practice encourages widespread infestation on the newly established orchards as a result of movement of planting materials infested with immature pest stage. Thus, plantain yield is hampered by decline soil fertility and a complex of pests and diseases of which stem borers are of great importance.

The plantain stem borer, *Cosmopolites sordidus* is a major insect pest of plantain that is associated with yield losses up to 50% and even 100% in a severe infestation leading to total crop failure[3]. The borer lays its eggs near the corm and hatches to become the larvae or grub which attack the underground part of the plant, feeding on the corms and tunneling in it. Continuous feeding and tunneling causes the corm to become a blackened mass of decaying tissue. Infected plants show symptoms of stunted growth, delayed fruit maturation, production of reduced number of suckers, reduced sucker vigour, drastic yield reduction and snapping of the pseudostem.

Oso *et al.*[4] identified snapping of plantain indicated by breaking of pseudostem as a major problem mitigating against plantain production in Ekiti State. They noted that the state has a rolling topography of hills and plains and more open landscape in which winds move at greater speed. Since most of the feeding roots of plantain are concentrated on light- textured surface soil, they become flaccid during dry season and easily snap under heavy wind. Farm management practices embark upon by farmers in Ekiti State focused majorly on maintenance of old orchards through husbandry protocols such as use of adequate plant spacing, desuckering, weeding, pruning of leaves, mulching, earthening-up, manure application and propping of

fruiting plantain[5]. Little attention has been given to dis-infestation of planting materials before planting them into newly acquired orchards. Hence, this study was carried out to compare the effects of some dis-infestation methods against banana stem borer attack in newly cultivated field in relation to growth and yield of plantain.

Materials and methods

Study area and field layout: This experiment was conducted at the Teaching and Research Farm of Ekiti State University, Ado Ekiti. The experimental trial was arranged in a randomized complete block design of four treatments replicated three times. The treatments were the different sanitation methods (boiling water, red acalypha leaves extracts, carbofuran and control) used to disinfest the suckers before planting. The spacing used was 2.5 m between rows, 2.5 m within the rows and 3.0 m between the replicates.

Sources of suckers and red acalypha leaves: False horn suckers used for this study were obtained from an established plantain orchard within the Ekiti State University Teaching and Research Farm. Red acalypha leaves were also collected from the T & R Farm.

Preparation of sanitation procedures: The red acalypha leaves were sun dried and milled. 90 grams of milled acalypha leaves were soaked in 10 litres of water for 20 minutes. This was done to ensure adequate suspension of the milled leaves in water. Suckers were pared and dipped in the acalypha solution for 20 minutes after which they were removed and allowed to dry for another 10 minutes before planting was done. For the boiling water procedure, water was put in a one sided opened drum which was placed over an open fire.

The water was allowed to boil before dipping pared suckers for 20 seconds. At the expiration of the set time the suckers were removed and allowed to access fresh air for an hour before planting. For the Chemical procedure, 3 gram of furadan (a.i. carbofuran) was mixed with the same quantity of sand and applied into the dug holes before planting the suckers.

Data collection: Growth parameters taken from the above ground part of the plants at a month interval starting from the first month include the height of the pseudostem measured from the soil line to the point of emergence of the youngest leaf (PH), the pseudostem girth (PG) at the point of 10 cm from the soil line, the length of youngest leaf (LYL), the width of youngest leaf (WYL), the number of functional leaf (NFL). A leaf is considered functional when at least 75% of the leaf area is green. The leaf area (LA) was calculated as length of the youngest leaf x width of the youngest leaf x 0.83 (a constant) x number of leaves on the plant[6]. The number of days to inflorescence, number of days to harvest, number of hands per bunch, number of fingers per hand and bunch weight made up the yield parameters.

Figure-1: Suckers in boiling water.

Figure-2: Suckers in acalypha extract.

Data analysis: Both the growth and yield data collected were subjected to analysis of variance (ANOVA) and the differences between their treatments means were separated using Duncan Multiple Range Test.

Results and discussion

Effects of sanitation methods on plantain growth: Table-1 shows the effects of sanitation methods on plantain establishment at one month after planting. Control treated plants produced significantly taller plants, thicker girths and larger leaf area when compared with the other treatments. This was followed by acalypha leaves treated plants. However, no significant differences were observed for pseudostem height, pseudostem girth and number of leaves between the boiling water and carbofuran treated plants except the leaf area.

Table-1: Effects of sanitation methods on plantain growth at 1MAP.

Treatment	PH (cm)	PG (cm)	LA (cm^2)	NFL
Control	43.42a	15.89a	7490.40a	4.67a
Acalypha leaves	36.75b	13.37a	5311.10b	5.00a
Boiling water	17.50c	7.83b	1720.10d	4.17ab
Carbofuran	18.90c	8.58b	3407.50c	3.17b

Data followed by the same letters do not differ significantly (P≤0.05) according to Duncan Multiple Range Test.

Table-2 shows the effects of sanitation methods on plantain establishment at third month after planting. Control treatment produced the highest vegetative grown plants. There were no significant differences in the growth parameters measured between acalypha treated plants and boiling water treated plants. Carbofuran treated plants recorded the least performance.

Table-2: Effects of sanitation methods on plantain growth at 3MAP.

Treatment	PH (cm)	PG (cm)	LA (cm^2)	NFL
Control	63.72a	20.28a	24156.00a	10.50a
Acalypha leaves	56.58ab	17.96b	19862.00b	10.00a
Boiling water	54.92b	18.03b	20986.00ab	10.17a
Carbofuran	34.25c	11.97c	9683.00c	7.67b

Data followed by the same letters do not differ significantly (P≤0.05) according to Duncan Multiple Range Test.

Table-3 shows the effects of sanitation methods on plantain establishment at fifth month after planting. Control treated plants gave the best performance in terms of pseudostem height and girth, leaf area and number of leaves. Nevertheless, the plants were not significantly taller than acalypha and boiling water treated plants. Acalypha treated plants were not significantly taller and thicker than boiling water treated plants, but produced significantly larger leaf area. However, the least vegetative growth were recorded in carbofuran treated plants.

Table-3: Effects of sanitation methods on plantain growth at 5MAP.

Treatment	PH (cm)	PG (cm)	LA (cm^2)	NFL
Control	116.38a	34.80a	83802.00a	15.67a
Acalypha leaves	107.73a	28.75b	68108.00b	14.17b
Boiling water	108.45a	30.08ab	66424.00c	13.00bc
Carbofuran	82.07b	23.92c	43256.00c	12.67c

Data followed by the same letters do not differ significantly (P≤0.05) according to Duncan Multiple Range Test.

Table-4 shows the effects of sanitation methods on plantain establishment at seventh month after planting. There were no significant differences among acalypha, boiling water and the control treated plants. Carbofuran treated plants produced the least vegetative growth.

Table-4: Effects of sanitation methods on plantain growth at 7MAP.

Treatment	PH (cm)	PG (cm)	LA (cm^2)	NFL
Control	129.68a	34.70a	87033.00a	15.67a
Acalypha leaves	121.55a	32.73ab	95194.00a	16.17a
Boiling water	115.73ab	30.08b	86261.00a	14.83a
Carbofuran	90.62c	24.40c	53738.00b	12.33a

Data followed by the same letters do not differ significantly (P≤0.05) according to Duncan Multiple Range Test.

Table-5 shows the effects of sanitation methods on plantain yield. All treated plants flowered after a year of establishment. However, Acalypha treated and boiling water treated plants had the shortest days to flowering and to harvest. The shortest day to fruit filling, as well as highest number of fingers and highest bunch yield were recorded among acalypha treated plants. The lowest bunch yield was recorded in the control plants.

Table-5: Effects of sanitation methods on plantain yield.

Treatment	Days to Inflorescence	Days to Harvest	Days to fruit filling	No of fingers	No of hands	Bunch weight (kg/bunch)
Control	450.00a	533.00a	83.00a	12.00b	4.67a	3.00c
Acalypha	410.00b	482.00b	72.00b	22.00a	5.00a	6.50a
Boiling water	402.00b	493.00b	91.00a	16.00ab	5.00a	5.30ab
Carboburan	420.00ab	503.00ab	83.00a	14.00b	5.00a	4.40b

Discussion: In order to reduce risks of transmission of pests and disease organisms from existing orchards to new orchard, sanitation of propagules through exposure to heat for relatively long time[7], immersion of propagules in boiling water for 30 seconds[8] as well as paring and dipping of propagule in red acalypha plant extract for 20 minutes[9] have been strongly recommended. The use of pest free propagules in the establishment of new plantain orchards, replacement of lost stands in existing fields and expansion old plantation accrues a lot benefits to farmers[10] and also promote healthy rooting system for better plant development and crop yield[11]. It was noted in this study that the growth parameters measured among the control treated plants differed significantly from the boiling water and acalypha treated plants. The delay in growth among the boiling water and acalypha treated plants might be an indication of harsh heat treatment and stress due to wound from paring. It is noteworthy that at later establishment phase, both treatments competed with the control treated plants and no significant differences were observed in their growth. Tenkuano *et al.*[8] earlier noted that the mean number of leaves per plant between boiling water- treated suckers was not statistically different from untreated suckers. Plantain yield was greatly enhanced in acalypha and boiling water treated plants. Both treatments had shortest days to flowering and fruit filling, highest number of fingers and highest bunch yield. In a phyto-chemical test, Madziga *et al.*[12] reported the presence of carbohydrate in the leaf extract of acalyha. Carbohydrate is noted to have numerous roles in living cells such as the storage and transport of energy (starch and glycogen) and structural components (cellulose) in plants. Similarly, Hauser[13] in a study on plantain bunch yield and root health response to combinations of physical, thermal and chemical sucker sanitation measures had earlier noted that boiling-water treatment contributed to faster growth, reduced incidence and severity of pests and diseases as well as physiological stimulation of plantain growth. All of these culminated into greater bunch yield.

Conclusion

The prospects of implementing sucker sanitation technology are very high. The technology is environmentally safe, less capital intensive and boosts income generation. Hence, it is recommended for wide coverage adoption by peasant farmers in all plantain growing areas in Ekiti State.

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