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Full Length Research Paper

Management Strategies of Plantain Suckers against Parasitic Nematodes and Banana / Plantain Weevil for Optimum Vegetative Growth

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Plant parasitic nematodes and stem borers have been implicated as the two main biotic factors responsible for yield decline in plantain orchard. Nematodes distort the transport of nutrients and water from roots to the plantain stem, while stem borers feed on the corm and create tunnels that cause weakening and subsequent toppling of the plant. Preparation of suckers through proper hygiene and good cultural practices reduces the occurrence of nematodes and stem borers in newly established orchards. A field experiment was carried out at the Teaching and Research Farm, Ekiti State University, Ado-Ekiti to investigate the comparative effects of different cultural strategies on the establishment of two plantain cultivars. The trial was arranged in a split-plot design of four treatments replicated three times. Two plantain cultivars (False horn and True horn) served as the main plot while the different sanitation methods (boiling water, red acalypha leaf extract, furadan and control) were the sub-plots. Data collected include pseudostem height and girth, length and width of youngest leaf, number of functional and non- functional leaves. Data collected were subjected to analysis of variance and the differences between treatments were separated using Duncan Multiple Range Test. Boiling water treatment produced the best vegetative growth followed by red acalypha leaf extract. Treatment of suckers with furadan was least in performance among the cultural strategies used. Results indicate that boiling water and red acalypha leaf extract have great potential for use by farmers in decontaminating infested suckers and other planting materials as well as promoting the vegetative growth of plantain.

Keywords: Plantain suckers, parasitic nematodes, stem borers, management strategies.

INTRODUCTION

Plantain is a perennial ratoon crop, which in Nigeria, occupies a strategic position in bridging the hunger gap, as well as providing income for farmers. In most part of West Africa, plantain was grown in compound gardens or backyards that were very rich in organic matter and nutrients. Increasing demand and attractive price for this crop have necessitated farmers' quests for expansion in their production from backyards to the fields. In most cases however, such fields-grown plantains are poorly maintained (Oso and Longe, 2015).

Expansion of plantain fields are limited by yield reduction constraints such as declining soil fertility, weeds, pests and diseases infestation (Shaibu *et al.,* 2012). This precarious situation forces the farmers to abandon their fields in

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A bunch of plantains.

A ripe plantain

search of new areas. The newly established fields are also for most parts, if not entirely, planted with the untreated suckers obtained from existing fields. Consequently, suckers used for the newly planted fields are invariably infested with the plant parasitic nematodes, stem borers and other soil-borne pests and diseases inherent in the old sites; as the contaminated transferred suckers were poorly prepared before planting in the new fields. Sucker preparation, according to Oso *et al.,* (2015), is an effective sanitation practice used for preventing or delaying the development of nematode and stem borers' infestations in plantain fields; while sucker sanitation induces faster crop cycling, reduces weeding requirements and facilitate fields fallow.

A number of techniques have been developed to decontaminate infested plantain suckers and to reduce re-infestation of fields. These include hot water treatment, pesticides and local wood ash treatments (Hauser, 2006). Oso *et al.,* (2016), in their study, which investigated the nematicidal effects of red acalypha leaf extract on plant parasitic nematodes and subsequent yield of plantain reported that this technique has potential for nematode control as well as promoting healthy root system for better plant development and crop yield.

In an experiment carried out by Coyne *et al.,* (2005) to assess the effects of sucker size and duration of thermal treatment on plantlet emergence and growth, suckers ranging from < 20 cm to > 60 cm circumference were immersed for 0, 10, 20, 30, 40, and 50 seconds and planted at two locations in Cameroon. They reported that neither corm size nor duration of thermal treatment had any effect initially (eight weeks after planting), on the emergence rate or the mean number of leaves per plant of plantain; but later observed, after an unusually severe drought spell, that plots established with suckers that had been immersed in boiling water for 30 seconds had the highest survival rate. That led to their recommendation of a 30 second exposure of plantain suckers to hot or boiling water before planting. This was in contrast to Colbran (1967), which recommended a sanitation technique that was based on exposure of suckers to heat for a relatively long time. However, this study compares the effects of boiling water, red acalypha leaf extract and furadan on the establishment of two plantain cultivars.

MATERIALS AND METHODS

Experimental Site

The study was carried out at the Teaching and Research Farm (T&R) of Ekiti State University, Ado- Ekiti (7^0 31N and 5^0 13E).

Description of Experimental Set-up

The experimental field was laid out in a randomized complete block design of four treatments replicated three times with a spacing of 2.5 m by 2.5 m. The total land area used was 323.75 m^2. The treatments comprising of four sanitation methods include; boiling water, red acalypha leaf extract, furadan and a control with no treatment. Plantain suckers and the red acalypha leaves used for the study were obtained from an established orchard within the T & R farm. 90 grams of milled acalypha leaves was soaked in 10 litres of water for 20 minutes to ensure adequate suspension of the leaves in water. Pared suckers were later dipped in the acalypha suspension for 20 minutes, allowed to dry for another 10 minutes before planting was done in the field. Suckers were also dipped in boiling water for 20 seconds and later allowed to access fresh air for an hour before planting in the field. Furadan was also mixed with the same quantity of soil and applied into dug holes at the rate of 3 g per hole before planting suckers in such holes.

Data Collection

Growth parameters measured for a period of seven months include, height of the pseudostem taken from the ground

surface to the point of emergence of the youngest leaf (PH), pseudostem girth taken at the point of 10 cm from the ground level (PG), length of the youngest leaf (LYL), width of the youngest leaf (WYL), number of functional leaves (FL) and the number of non- functional leaves (NFL). The leaf area was calculated as length x width x 0.83 (constant) x number of leaves on the plant (Obiefuna and Ndubuzi, 1979).

Data Analysis

Data collected were subjected to analysis of variance and differences between the treatment means were separated using Duncan Multiple Range Test.

RESULTS

Plantain establishment between false horn and true horn cultivars

Figures 1-4 compare plantain establishment between false horn and true horn cultivars for a period of seven months. False horn cultivar produced significantly taller, thicker and broader plants than true horn cultivar. However, no significant differences were observed for number of leaves between the two cultivars during the same period under study.

Effects of cultivars and sanitation methods on plantain establishment

Tables 1 show the effects of cultivars and sanitation methods on plantain establishment at 1 to 5 months after plating (MAP). The two cultivars control treatments (TH-CTR and FH- CTR) had the best performance at one month after planting. They produced significantly taller plants with thicker girths and larger leaf areas. False Horn cultivar treated with red acalypha plant extract (FH- AC) was next in performance. However, the least performed treatment combination was True Horn- Boiling Water.

At third month after planting, a noticeable change in trend of development was observed. False Horn - Boiling Water plants were taller with thicker girths and larger leaf areas. Nevertheless, False Horn - Control plants keenly competed with the Boiling Water plants. This was followed by False Horn Acalypha plants. The least performed treatment combination was True Horn Carbofuran.

Effects of cultivars and sanitation methods on plantain establishment

Tables 2 show the effects of cultivars and sanitation methods on plantain establishment at 5 to 7 months after plating (MAP). At the fifth month after planting, False Horn -Control plants had thicker girths and larger leaf areas. Nevertheless, False Horn - Boiling Water plants keenly competed with the control and they were taller. This was followed by False Horn Acalypha plants. The least performed treatment combination was True Horn Carbofuran.

The best growth performance at the seventh month after planting was measured among the False Horn - Boiling Water treated plants. They produced taller plants which had thicker girths and larger leaf areas. False Horn-Control ranked second in terms of pseudostem height but third in leaf area measurement while False Horn - Acalypha ranked third in terms of pseudostem height but second in leaf area measurement. However, the least performed treatment combination was True Horn Carbofuran.

DISCUSSION

This study has shown that False-horn cultivar had a higher vegetative growth than True horn cultivar. False horn cultivar has a circumference of 60 cm and produces many shoots and highly prolific. It is reported to be widely distributed in Nigeria because of its ability to tolerate poor soil condition (John and Marshal, 1995). On the other hand, True-horn cultivar has a characteristic longer and stouter fruits but not as prolific as False horn. This probably may be the reason for its slow development.

The initial delay in vegetative growth recorded for all sanitation methods except the control treatment at one month after planting may be due to exposure of planting materials to stressful and harsh conditions such as paring and dipping in boiling water. Tenkouano *et al.,* (2006) reported the reduction in growth parameters of plantain when subjected to hot water treatment may be due to the initial heat shock experienced by suckers.

Subsequent significant increase observed at the third, fifth and seventh months among Boiling Water and Red Acalypha Leaf extract treated plants for pseudostem height and girth, as well as in leaf area measured is an indication that these treatments might have cleansed the suckers of pre infestation by nematodes and stem borers thereby, preventing their build-up. There is also the possibility of activation of buds within the plantain corms which produced good vegetative growth (Kwa, 2003). The least performed sanitation method was treatment of suckers with Furadan. This probably may be due to high toxicity nature associated with synthetic chemicals.

CONCLUSION

Dipping of suckers in either boiling water or red acalypha extracts as sanitation measures against nematode and stem borer attack has been shown to be a promising, simple and inexpensive technology. This technology if adopted by our resource-poor farmers will promote

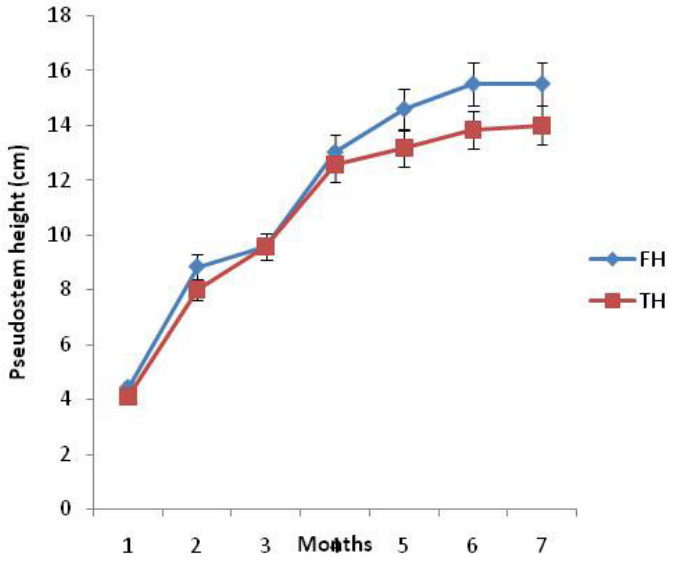

Figure 1: Pseudostem height between false horn and true horn cultivars at 1-7 MAP

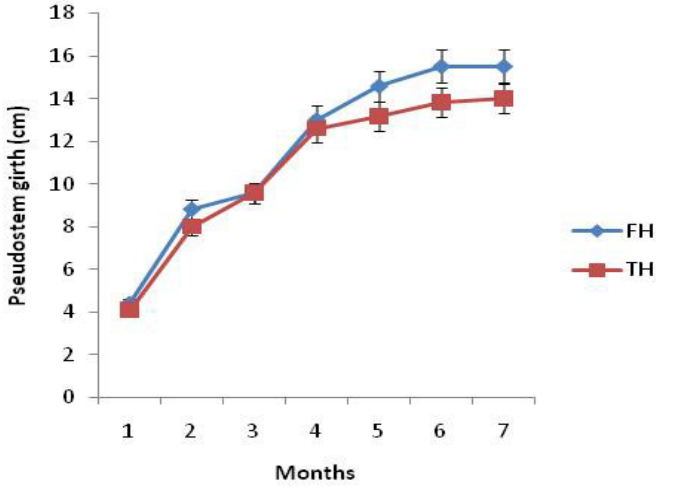

Figure 2: Pseudostem girth between false horn and true horn cultivars at 1-7 MAP

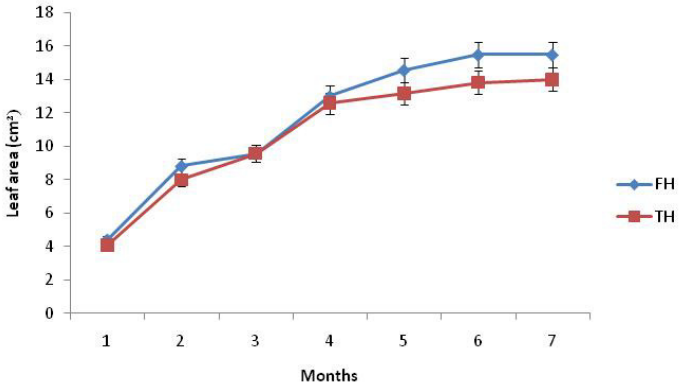

Figure 3: Leaf area between false horn and true horn cultivars at 1-7 MAP

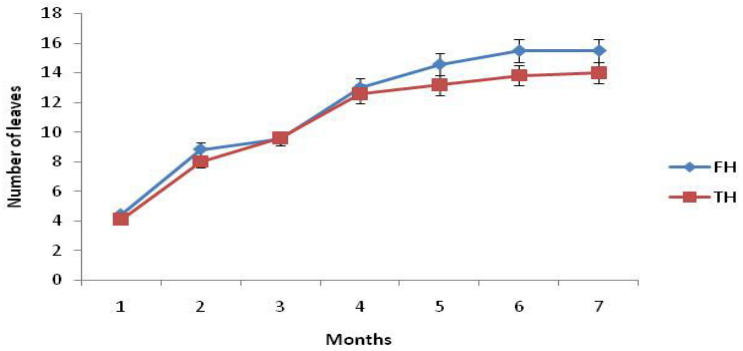

Figure 4: Number of leaves between false horn and true horn cultivars at 1-7 MAP

Table 1: Effects of cultivars and sanitation methods on plantain establishment at 1 and 3 MAP

1 MAP					3 MAP			
Treatment	PH(cm)	PG(cm)	LA(cm^2)	NL	PH(cm)	PG(cm)	LA(cm^2)	NL
TH-CTR	43.83a	16.27a	7711.30a	5.00a	64.37b	20.69a	20158.10c	10.67ab
FH-CTR	43.00a	15.50ab	7269.50a	4.33ab	63.07c	19.90a	28153.90a	10.33abc
TH-AC	31.83c	11.73c	3914.10e	5.33a	48.47d	15.80b	16704.70d	9.67bc
FH-AC	41.67b	15.00b	6708.10c	4.67a	64.70b	20.13a	23020.00b	10.33abc
TH-BW	6.67g	3.33f	1566.40g	3.00c	43.33e	15.77a	13697.70e	9.33cd
FH-BW	28.33d	12.33e	5248.70d	5.33a	66.50a	20.30a	28274.40a	11.00a
TH-CB	13.67f	6.97e	1148.10h	3.00c	35.00f	12.87c	9938.10f	8.67d
FH-CB	24.13e	10.20d	3392.10f	3.33bc	33.50g	11.07d	9428.00g	6.67e

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

Key:

TH-CTR - True Horn Control
TH-AC - True Horn Acalypha
TH- BW - True Horn Boiling Water
TH- CF - True Horn Carbofuran
FH- CTR - False Horn Control
FH- AC - False Horn Acalypha
FH- BW - False Horn Boiling Water
FH- CB - False Horn Carbofuran

Table 2: Effects of cultivars and sanitation methods on plantain establishment at 5 and 7 MAP

5 MAP					7 MAP			
Treatment	PH(cm)	PG(cm)	LA(cm^2)	NL	PH(cm)	PG(cm)	LA(cm^2)	NL
TH-CTR	115.47c	32.23c	82079.50c	16.00a	127.13d	33.77a	80044.10e	16.00a
FH-CTR	117.30b	37.37a	85525.40a	15.33ab	132.23b	35.63a	94021.60c	15.33ab
TH-AC	99.63d	26.00d	57507.20e	13.00cd	112.60e	29.73b	82346.30d	15.33ab
FH-AC	115.83c	31.50c	78708.70d	15.33ab	130.50c	35.73a	108041.40b	17.00a
TH-BW	86.00f	24.30e	48803.10g	12.30de	91.13g	24.27d	57949.80g	13.67b
FH-BW	130.90a	35.87b	84044.70b	13.67cd	140.33a	35.90a	114571.40a	16.00a
TH-CB	68.47g	20.60f	30915.00h	11.33e	78.53h	21.37e	46700.40h	11.00c
FH-CB	95.67e	27.23c	55597.20f	14.00c	102.70f	27.43c	60776.10f	13.67b

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

Key:

TH-CTR - True Horn Control
TH-AC - True Horn Acalypha
TH- BW - True Horn Boiling Water
TH- CF - True Horn Carbofuran
FH- CTR - False Horn Control
FH- AC - False Horn Acalypha
FH- BW - False Horn Boiling Water
FH- CB - False Horn Carbofuran

vegetative development of plantain, greater yield and finally translate to higher income.

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