

EFFECTIVENESS OF *OCIMUM GRATISSIMUM*, *JATROPHA CURCAS* AND *CHROMOLAENA ODORATA* POWDER IN THE MANAGEMENT OF *SCUTELLONEMA BRADYS* INFECTING FIVE YAM VARIETIES IN KOGI STATE NIGERIA

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Abstract

Scutellonema bradys, a phyto-parasitic nematode is reputed for its symptomatic infections in many varieties of yam. Colossal losses have been attributed to its infection on yam where the land is endemic with *S. bradys*. Studies were conducted on the effects of *Ocimum gratissimum*, *Jatropha curcas* and *Chromolaena odorata* in the management of *Scutellonema bradys* infecting five yam varieties in the study area in 2014 and 2015 cropping season. The trials involved three organic material treatments (powders of *Ocimum gratissimum*, *Jatropha curcas*, *Chromolaena odorata*) and the control was factorially combined with the five yam varieties and inoculation of *Scutellonema bradys*. The cultivars used as test crops were Okunmodo, Kerege and Sebukere as (white yam), Ewura (Water yam) and Olo (Yellow yam). The yam nematode, *Scutellonema bradys* caused lateral lesions, necrosis and dry rot of yam on the white yam, water yam and yellow yam. The results of this research showed that white yam is susceptible to *S. bradys*, while water yam and yellow yam cultivars proved to be resistant to *S. bradys*. The findings indicated that *S. bradys* in screenhouse and field experiments significantly affected yam growth and yield. All the plant materials; powdered leaf of *Ocimum gratissimum*, *Jatropha curcas*, and *Chromolaena odorata* had significant bio-pesticidal effects on *S. bradys* as they caused reduction in population both in the screenhouse and field experiments compared to the control. It is therefore advised that yam growers should not plant white yam cultivars on areas of land that are endemic to *S. bradys*.

Keywords: Nematode, Yield, *Jatropha*, *Chromolaena*, *gratissimum*

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Introduction

The crop yam (*Dioscorea spp*) is one of the common food crops in the tropics and plays vital roles in food security as a staple food in the regions where it is being cultivated (Maroya *et al*, 2012). *Dioscorea spp* occur in Asia, East Africa, the Caribbean, India and Tonga Kingdom, south pacific as well as West Africa (Okigbo, 2004). Maroya *et al*. (2012) estimated that yam consumption yearly is over a 48 million tonnes globally. Out of the 48million tons of yam (95% global supply) that are produced on 4million hectares annually, Nigeria alone produces 67.7% of the global yam supply (FAO, 2010). Yam is the most predominant basic starch in sub-saharan Africa specifically called West African Belt (Fu *et al*; 2011; Demuyakor *et al*; 2013). This makes Nigeria the highest consumer of this staple crop after Cassava and Maize. However, demand for this commodity is increasing as

incomes increase consumers shift from substitutes to yam especially when the price of yam relative to price of its substitutes declines (Maroya *et al.*, 2012). Yam plays an outstanding function in the

social cultural lives of some producing regions like the celebrated Moon festival and also the popular Yam festival in West Africa, a well-observed act. In Nigeria for instance, the meals offered to 2 deities and associates consist mainly of mashed yam (Ogunleye, 2005). Yam storage in comparison with some other staple crops has a relatively longer life span, so stored tuber symbolizes stored wealth, which can be sold throughout the year by the marketers. Also, tuber yam in West Africa particularly Nigeria can be converted into different staple transitional and end product forms (Okaka and Aajekwu, 1990; Okaka *et al.*, 1991) which can be consumed by human beings and animals, used as the essential ingredient of snacks and flour that is now used in instant puree making (Okaka and Okechukwu, 1987). Yam can be eaten in a variety of ways as it can be roasted, fried, grilled, baked, barbecued, smoked and most commonly boiled. Yam is also used as food for livestock. Tuber yam can be dried, ground into flour and stored for use.

However, in Nigeria, a country known to produce a large percentage of yam around the globe, it is believed that the supply of yam tuber is lower than its high demand, a problem currently facing the country (Ogundana, 1971; Okigbo *et al.*, 2000; Okigbo and Emoghene, 2004; Okigbo and Ogbonnaya, 2006). Tuber yam, among many other staple foods, is susceptible to postharvest diseases caused by bacteria and fungi under poor storage conditions. In Nigeria, pathogens constitute the major factor to rot in yam production (Nari, 2004). Losses caused by pathogens attack vary from 20-30% generally in some crops (Park *et al.*, 2008). The presence of plant-parasitic nematode could constitute serious impediments to the growth and yield of yams in Kogi State. Plant-parasitic nematode infection is an important factor that affects the quality and yield of yam in both field and store. These nematodes especially the *Scutellonema bradys* are capable of causing lateral lesions, necrosis, cracking of yam tuber and dry rot of yam on the white yam, water yam and yellow yam (Coyne *et al.* 2007). In a survey carried out in twelve Local Government Area of Kogi State, Nigeria, soil-borne nematodes *S. bradys* caused a great reduction in size and qualities of yam produced on infected soil and even caused great damage to the inner part of yam (Hinmikaiye., *et al.*, 2016). The objective of this study is therefore to determine the effectiveness of *Ocimum gratissimum*, *Jatropha curcas* and *Chromolaena odorata* in the management of *scutellonema bradys* infecting five yam varieties.

Materials and Methods

The experiment was carried out in a section of the Teaching and Research Farm of Kabba College of Agriculture, Ahmadu Bello University, Nigeria during the cropping seasons of 2014 and 2015. The site is located on the latitude of 07° 35'N and longitude 06° 08'E and is 435m above sea level, in Southern Guinea Savanna Agro-Ecological Zone of Nigeria. Rainfall spans between April to November with the peak in June. The dry season extends from December to March. The mean annual rainfall is 1570mm per annum with an annual temperature range of 18°-32°. The mean relative humidity (RH) is 60% (College of Agriculture Meteorological data, 2011). The major soil under within the experimental site is Ultisoils (Babalola, 2010; Ajiboye and Ogunwale, 2010). The main vegetation of the area is; tall grasses, shrub, some trees, plantains, oil palm, etc. Some parts of the site are used such as cowpea, cassava, maize and tomato being planted.

Screenhouse and field experiment

Seeds of five different yam types were bought from Kabba/Bunu Local Government Areas of Kogi State. The experimental design was a 5x4x2 factorial experiment fitted into Randomized Complete

Block Design (RCBD). This involves five yam varieties. White yam (Okunmodo, Kerege and Sebukere), water yam (Ewura), and yellow yam (Olo); the plant materials (powdered leaf of *Ocimum gratissimum*, *Jatropha curcas*, *Chromolaena odorata*), control and nematodes treatment (i.e.

Scutellonema bradys). This means three factors (i.e. yams, plant materials and nematodes). A total of 40 treatment combinations were replicated three times each (120 observations).

Experimental procedure

In the screen house, five yam types between 120-130g were planted in April 2014 in 11 litres capacity experimental pots. Each white yam, water yam and yellow yam was inoculated with 44.4g of *S. bradys* infected yam peel containing 1000 *Scutellonema bradys* juveniles. At the field, 12 heaps of 0.5 by 0.5m and about 1m high were made per plot. The size of each plot is 10 by 4 m; the experimental heaps in each of the five different yam varieties were inoculated with 181.8 g of infected yam peel containing 2000 *S. bradys* at the adult stage which were carried out in the field. Each white yam, water yam and yellow yam were inoculated at sprouting stage. Mulching, staking and weeds were controlled through manual hoeing and subsequently by hand pulling as the yam vines spread and covered the pots and heaps to thus suppress weed growth. Initial and final soil nematode population was taken for nematode bio-assay test

Data collection

Data were collected from the experimental pots in screenhouse and field 2 months after planting. Subsequently, data were collected at monthly interval based on the following parameters: Number of leaves per plant, vine length and stem girth, Stem girth was measured at 5cm above the ground level in the screenhouse/field using vernier calliper. At harvest (10 months after planting) data were collected on number of tubers, weight of tubers, number of edible tubers and number of rotten tubers. Symptoms manifested on parts below ground and above ground level were also observed.

Data analysis

Data collected from both screenhouse and field experiments were subjected to the analysis of variance (ANOVA) using the SPSS version 21 and where there was a significant difference in their means. The New Duncan's Multiple Range Test (NDMRT) was used to separate them at a 5% level of significance.

Results

Effects of species, inoculum type and plant materials on growth Parameters of yam in Screenhouse/field experiment

Results of the effects of treatments on growth parameter of yam are presented in Tables 1 to 3 which shows the main effects of variety, inoculum and plant materials used on the vine length, number of leaves and stem girth at 5% level of significance of the treated plant for the two years 2014 and 2015 cropping season. Table 1 shows that there is significant difference in the vine length of yam varieties. Vine length was significantly taller in *D. cayenensis*, (yellow yam) throughout the months of the experiment for 2014 and 2015 respectively. *D. rotundata* (white yam) (wk), (wo) and ws are significantly different from each other in terms of vine lengths during 2014 cropping season but not significantly different in vine length during 2015 cropping season. The result shows that all yam varieties used in the fieldwork were significantly taller in vine length compared to the screenhouse experiment.

Table 2 shows the effect of species, inoculum type and plant materials used on mean of number of leaves revealed that yam variety *D. rotundata* white yam (wk) and (wo)) respectively was significantly higher in number of leaves both in the screenhouse and field regardless of nematode infection. *D. rotundata* white yam (wo, ws and wk) are not significantly different from each other in

number of leaves in 2014 and 2015 cropping season respectively, but significantly higher in number of leaves compared to non amended yam variety.

Table 3 shows effect of species, inoculum type and plant materials used on mean stem girth of yam shows that *D. rotundata* (wk) was significantly thicker in stem girth throughout the five months of the study in the screenhouse, while *D. cayenensis* (ca) (2.23cm) was significantly thicker in stem girth in August in the field experiment. The result revealed that stem girth in the field study was significantly thicker compared to that of screenhouse experiment.

Table 4 presented the effect of variety, inoculum type and plant materials on selected yield attributes of yam for both 2014 and 2015 cropping season respectively. Table 4 revealed that in all the growth parameters studied the best performance in terms of number of tubers was recorded in *D. rotundata*, white yam(wo) Okunmodo and white yam (wk) kerege having the values of 1.33 and 1.44 for both 2014 and 2015 respectively compared to other yam varieties. Table 4 further shows that *D. alata*; water yam (al) ewura was significantly different among other yam varieties in terms of weight of tubers with the values of 229.78g and 260.01g for both 2014 and 2015 cropping season. All the yam varieties in terms of number of edible tubers are not significantly different from each other in the 2014 screenhouse experiment, while *D. rotundata* white yam(wk) (1.44) was significantly different from other yam varieties in the number of edible tubers in fieldwork. Table 4 further shows that *D. cayenensis*, yellow yam (olo) was significantly different from other yam varieties in terms of the number of rotten tubers in the 2014 cropping season meaning that only *D. cayenensis* was rotten. All yam varieties are not significantly different in terms of the number of rotten tubers in 2015 fieldwork indicating that there was no rotten tuber in all the yam varieties.

Table 5 shows the effects of variety, inoculum type and plant materials used on mean final number of nematode (*Scutellonema bradys*) population on yam for 2014 and 2015 cropping season. Table 5 shows that among all the yam variety, *D. cayenensis*, yellow yam (ca) (olo) was significantly different with (20.14) value meaning that *D. cayenensis* was susceptible to nematode infection in 2014 screenhouse experiment. Table 5 further revealed that *D. alata*, water yam (al) (Ewura) was significantly different from other yam varieties having (120.53) value for the 2015 field experiment. This implies that *D. alata* was susceptible to nematode infection.

Table 6 Shows the results of the phytochemical screening of *Jatropha curcas*, *Ocimum gratissimum* and *Chromolaena odorata* shows the phytochemical analysis which contains the following constituents. The result shows that *Jatropha curcas* has the presence of constituents in high concentration in alkaloids, saponnin, flavonoid, moderate concentration in phenols, low concentration in tannin, and absence of constituents in steroid, phlobatannin, terpenoid and anthraquinone. This is followed by *Ocimum gratissimum*, which has the presence of constituents in moderate concentration in tannin, presence of low concentration in saponnin, phlobatannin, flavoid and absence of constituents in alkaloid, steroid, terpenoid, cardiac glycoside, phenols and anthraquinone. *Chromolaena odorata* has the presence of constituents in low concentration in tannin,

saponnin, terpenoid, flavonoid and absence of constituents in alkaloid, phlobatannin, cardiac glycoside and phenols.

Discussion

The findings of this study showed that both growth and yield parameters were significantly increased in treatments with plant materials whether infected or not with *Scutellonema bradys* compared to the plant that were untreated with botanicals. The study supports the findings of other researchers who

reported the importance of various soil amendments in reducing plant-parasitic nematodes population to build up resulting in an increase in plant yield (Abolusoro and Oyedunmade, 2008; Izuogu *et al.*, 2015, 2016). This type of observation could be due to the possibility that the powdered leaf of

Ocimum gratissimum, *Jatropha curcas* and *Chromolaena odorata* added to the soil nutrient upon biodegradation, which the plants then used for better growth and yield.

The finding of the study indicated that *Scutellonema bradys* caused a considerable reduction in growth and yield as well as a quality reduction (roughness and rottenness) of unamended tubers with *Ocimum gratissimum*, *Jatropha curcas* and *Chromolaena odorata* both in screenhouse and field (Karssen, 2002).

The study revealed that all the plant materials used had significant bio-pesticidal effects on *Scutellonema* as they caused a reduction in population both in the screenhouse and field compared to control. This is in line with the reports of some earlier researchers who reported an effective reduction in nematode population by botanicals. Some of the organic materials of botanical origin that showed antinematode properties includes; *African marigold*, *Ocimum gratissimum*, *Azadirachta indica*, *Chromolaena odorata* and Sugar cane bagasse (Saravanapriya and Sivakumar, 2005., Hayat *et al.*, 2012., Onyeke and Akueshi, 2012).

Conclusion

Scutellonema in the screenhouse and field experiments was found to significantly affect yam growth and yield as they caused reduction to non amended yam variety. All organic materials i.e., powdered leaf of *Ocimum gratissimum*, *Jatropha curcas* and *Chromolaena odorata* have significant bio-pesticidal effect on *Scutellonema* as they caused reduction in their population both in screenhouse and field in 2014 and 2015 cropping season respectively compared to the control. The efficacy of the dry powdered form of *Ocimum gratissimum*, *Jatropha curcas* and *Chromolaena odorata* in the management of *Scutellonema bradys* infecting yam has been established from this study. We therefore recommend that the active chemicals in these botanicals be synthesized by agro-chemists as portable, durable and easily applied forms that will be accessible to farmers. Where population density is high, use of *Ocimum gratissimum*, *Jatropha curcas* and *Chromolaena odorata* will provide a better option for obtaining higher yield. Besides, further research should also be carried out based on the phytochemical analysis of various plant materials at various seasons, localities and at different soils to ascertain their effective range of bioactive agents.

Table 1. Main effects of variety, inoculum type and plant material used on mean vine length (cm) of yam (*Dioscorea* spp) 2014/2015 cropping season in screenhouse/field

Variety	2014 2014 VltJu n	2014 2014 VltJul g	2014 VltAu g	2014 VltSep	2015 VltOc t	2015 VltFe b	2015 VltMa	2015 VltAp	2015 VltMa y	2015 VltJu n	2015 VltJul	2015 VltAu g
Al	77.75 ab	100.58 b	123.6 4b	140.22 bc	153.1 4d	119.6 7b	178.78 b	196.4 4b	209.3 6b	217.7 8b	224.3 6b	226.3 3b
Ca	78.86 a	114.69 a	137.9 4a	155.58 a	171.0 6a	209.8 6a	258.67 a	270.4 4a	282.7 5a	293.1 1a	299.6 1a	298.6 7a
Wk	73.78 ab	96.97b	119.9 4bc	140.92 b	159.1 9b	123.0 0b	177.14 b	188.7 5b	203.6 4b	211.0 0b	217.1 9b	218.6 1b
Wo	66.78 c	98.03b	123.9 9a	141.17 b	158.8 3bc	139.8 3b	175.92 b	186.8 1b	199.0 8b	207.8 6b	214.2 2b	215.6 7b
Ws	72.64 b	95.72b	117.2 8c	135.97c	154.6 4cd	118.7 5b	170.81 b	183.9 2b	196.1 9b	207.4 4b	312.5 6b	214.0 8b
SE	1.87	2.07	1.82	1.62	1.50	6.98	6.05	6.05	6.11	6.24	6.15	6.41
Inoculum	-	-	-	-	-	-	-	-	-	-	-	-
Sc	78.07 a	109.82 a	131.4 8a	149.43 a	165.4 2a	128.2 0b	184.22 b	196.3 2b	208.6 0b	219.4 2b	224.1 7b	224.3 0b
Nn	74.02 a	101.57 b	126.1 7b	146.30 a	162.3 5a	145.5 0a	188.25 b	199.5 3b	211.4 7b	219.87 b	226.3 2b	227.9 5b
SE	1.45	1.61	1.40	1.25	1.62	5.41	4.69	4.68	4.73	4.83	4.76	4.97
Material	-	-	-	-	-	-	-	-	-	-	-	-
Co	80.44 a	115.02 a	138.3 6a	157.02 a	176.1 6a	170.5 1a	225.33 a	237.4 4a	249.5 6a	258.4 0a	265.1 1a	264.3 3a
Jc	76.36 ab	103.09 b	129.3 8b	148.62 b	164.2 2b	164.8 7a	223.04 a	233.6 0a	246.1 1a	256.4 4a	260.4 4a	262.3 8a
Og	75.09 b	101.29 b	127.2 2b	146.47 b	162.9 6b	160.7 8a	211.93 a	224.0 4a	236.2 9a	245.1 8a	252.4 2a	253.9 1a
Non	63.95 c	84.40c	102.4 9c	118.98 a	134.1 6c	72.73 b	113.53 b	126.0 0b	140.8 7b	149.7 3b	156.3 8b	158.0 7b
SE	1.67	1.86	1.62	1.45	1.34	6.24	5.41	5.41	5.46	5.58	5.50	5.73

Means with the same letter(s) in any one segment of a given column are not significantly different at p=0.05

Key: Al – *Alata*, Ca – *Cayenensis*, Wk – White yam Kerege, Wo – White yam Okunmodo, Ws – White yam Sebukere, Mi – Sc – *Scutellonema*, Nn – No nematode, Co – *Chromolaena odorata*, Jc – *Jatropha curcas*, Og – *Ocimum gratissimum*, Non – Control, Vlt- Vine length

Table 2. Main effects of variety, inoculum type and plant material used on mean number of leaves of yam (*Dioscorea* spp) 2014/2015 cropping season in screenhouse/field.

Variety	2014 2014 VltJu n	2014 2014 VltJul	2014 VltAu g	2014 VltSe p	2014 VltOc t	2015 2015 VltFe b	2015 2015 VltMa	2015 VltAp	2015 VltMa y	2015 VltJu n	2015 VltJul	2015 VltAug
Al	33.75 d	60.58 d	90.44 c	102.1 1d	111.7 2d	63.49 c	169.8 9a	184.8 1a	197.5 0a	209.3 6a	223.0 0a	224.81a
Ca	38.08 cd	71.72 c	101.1 9c	116.7 5c	124.2 8c	71.75 bc	146.6 4b	160.2 8b	175.6 4b	192.4 4b	205.0 6b	206.97b
Wk	57.17 a	99.92 a	153.3 1a	154.5 6a	158.6 7a	82.19 b	164.3 9a	178.6 4a	194.4 2a	206.4 4a	217.8 9ab	218.14ab
Wo	47.64 b	86.22 b	122.6 9b	143.4 2b	148.6 9b	96.11 a	176.5 3a	190.0 0a	204.5 0a	215.1 1a	226.2 8a	226.39a
Ws	43.17 bc	91.72 ab	129.6 9b	142.6 7b	151.4 2b	72.78 bc	167.1 4a	179.3 1a	192.9 7a	206.3 3a	217.4 7ab	219.33ab
SE	2,32	3.33	5,72	2.48	2.48	4.35	4.66	5.04	4.82	4.48	4.49	4.45
Inoculum	-	-	-	-	-	-	-	-	-	-	-	-
Sc	45.50	75.55 b	111.5 3b	130.3 8b	135.7 7b	83.23 b	162.0 0a	178.0 0a	188.2 5a	202.1 8a	213.7 3b	216.63a
Nn	42.05	87.80 a	131.9 5a	138.4 5a	145.1 3a	72.13 a	163.8 2a	175.9 0a	193.3 3a	204.4 7a	215.6 7ab	215.48a
SE	1.79	2.58	4.43	1.92	1.92	3.37	3.61	3.90	3.73	3.47	3.48	3.45
Material	NS	-	-	-	-	-	-	-	-	-	-	-
Co	47.11 b	86.64 a	130.4 7a	139.1 1b	146.2 7a	90.82 a	191.7 3a	205.6 9a	218.9 8a	232.0 7a	243.6 7a	244.82a
Jc	53.73 a	94.53 a	129.1 8a	143.0 0ab	149.6 7a	88.02 a	185.8 0a	199.9 1a	211.4 7a	224.9 3a	236.7 8a	237.62a
Og	43.91 b	87.24 a	129.9 8a	147.0 0c	152.7 6a	89.49 a	190.2 7a	204.6 9a	219.6 4a	230.8 4a	241.6 0a	242.91a
Non	31.09 c	59.71 b	88.24 b	98.49 c	107.1 3b	49.09 b	91.87 b	104.1 3b	121.9 3b	135.9 1b	149.7 1b	151.16b
SE	2.07	2.98	5.12	2.22	2.22	3.89	4.17	4.51	4.31	4.01	4.02	3.98

Means with the same letter(s) in any one segment of a given column are not significantly different at p=0.05

Key: Al – *Alata*, Ca – *Cayenensis*, Wk – White yam Kerege, Wo – White yam Okunmodo, Ws – White yam Sebukere, Sc – *Scutellonema*, Nn – No nematode, Co – *Chromolaena odorata*, Jc – *Jatropha curcas*, Og – *Ocimum gratissimum*, Non – Control, Vlt- Vine length

Table 3. Main effects of variety, inoculum type and plant material used on mean stem girth (cm) of yam (*Dioscorea* spp) 2014/2015 cropping season in screenhouse/field

Variety	2014 2014 VltJun	2014 2014 VltJul	2014 VltAug	2014 VltSep	2015 VltOct	2015 VltFeb	2015 VltMar	2015 VltApr	2015 VltMay	2015 VltJun	2015 VltJul	2015 VltAug
Al	0.61b	0.69ab	0.80c	0.79d	0.75c	0.64b	0.84c	1.07c	1.39c	1.76b	2.08bc	2.09b
Ca	0.64a	0.676a	0.91ab	0.94ab	0.85b	0.61b	0.88c	1.29a	1.61a	1.88a	2.21a	2.23a
Wk	0.64a	0.72ab	1.00a	1.03a	0.79a	0.78a	0.96b	1.18b	1.45b	1.77b	2.02cd	2.08b
Wo	0.68a	0.77a	0.84bc	0.90bc	0.82bc	0.85a	1.05a	1.23ab	1.47b	1.74b	1.98d	2.01c
Ws	0.55b	0.67b	0.76a	0.82cd	0.81bc	0.78a	0.99ab	1.21b	1.51b	1.81ab	1.10b	2.13b
SE	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.03	0.02	0.02
Inoculum	-	-	-	-	-	-	-	-	-	-	-	=
Sc	0.56b	0.66b	0.83	0.87	0.82	0.69b	0.90b	1.14b	1.45b	1.77a	2.04b	2.05b
Nn	0.64a	0.73a	0.87	0.91	0.86	0.76a	0.94ab	1.22a	1.51a	1.81a	2.11a	2.14a
SE	0.02	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Material	-	-	NS	NS	NS	-	-	-	-	-	-	-
Co	0.72a	0.82a	0.79a	1.01a	0.96a	0.78a	1.03a	1.31a	1.61a	1.92a	2.19a	2.22a
Jc	0.65b	0.76a	0.93a	0.96a	0.90a	0.81a	1.05a	1.28a	1.56a	1.86a	2.16a	2.19a
Og	0.67ab	0.78a	0.96b	0.99a	0.92a	0.80a	1.05a	1.32a	1.59a	1.87a	2.18a	2.20a
Non	0.45c	0.52b	0.60b	0.62b	0.58b	0.55b	0.66b	0.88b	1.18b	1.52b	1.78b	1.82b
SE	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.02	0.02	0.02	0.02

Means with the same letter(s) in any one segment of a given column are not significantly different at p=0.05

Key: Al – *Alata*, Ca – *Cayenensis*, Wk – White yam Kerege, Wo – White yam Okunmodo, Ws – White yam Sebukere, Sc – *Scutellonema*, Nn – No nematode, Co – *Chromolaena odorata*, Jc – *Jatropha curcas*, Og – *Ocimum gratissimum*, Non – Control, Vlt- Vine length, NS – Not significant

Table 4. Main effects of variety, inoculum type and plant materials on selected yield attributes of yam (*Dioscorea spp*) 2014/2015 cropping season greenhouse/field

	2014		2014		2015		2015	
2014 Variety	Mean number of tuber/s	Mean weight of tuber/s (g)	Mean number of edible tuber/s	Mean number of rotten tuber/s	Mean number of tuber/s	Mean weight of tuber/s (g)	Mean number of edible tuber/s	Mean number of rotten tuber/s
Al	1.22a	229.78a	1.17a	0.00b	1.28ab	260.01a	1.28ab	0.00a
Ca	1.00b	120.22b	0.58b	0.31a	1.00c	223.00b	1.00c	0.03a
Wk	1.19ab	210.67a	1.19a	0.00b	1.44a	221.13b	1.44a	0.00a
Wo	1.33a	199.28a	1.22a	0.06b	1.14bc	231.12b	1.22abc	0.06a
Ws	1.14ab	225.31a	1.08a	0.06b	1.17bc	218.21b	1.14bc	0.00a
SE	0.07	12.21	0.08	0.04	0.09	0.08	0.08	0.02
Inoculum	-	-	-	-	-	-	-	-
Sc	1.18ab	214.50a	1.18a	0.03a	1.17a	2.21b	1.17a	0.03a
Nn	1.28a	215.65a	1.07ab	0.10a	1.25a	2.45a	1.27a	0.00a
SE	0.06	9.46	0.07	0.03	0.07	0.8	0.06	0.02
Material	-	-	-	-	-	-	-	-
Co	1.24a	205.87	1.13a	0.09a	1.20a	2.74a	1.22a	0.00a
Jc	1.24a	222.18a	1.18a	0.04a	1.24a	2.75a	1.27a	0.04a
Og	1.16a	212.73a	1.00ab	0.07a	1.20a	2.89a	1.18a	0.00a
Non	1.07a	147.42b	0.89b	0.13a	1.18a	0.84b	1.20a	0.02a
SE	0.06	10.92	0.08	0.03	0.08	0.07	0.07	0.02

Means with the same letter(s) in any one segment of a given column are not significantly different at p=0.05

Key: Al – *Alata*, Ca – *Cayenensis*, Wk – White yam Kerege, Wo – White yam Okunmodo, Ws – White yam Sebukere, Sc – *Scutellonema*, Nn – No nematode, Co – *Chromolaena odorata*, Jc – *Jatropha curcas*, Og – *Ocimum gratissimum*, Non – Control, Vlt- Vine length

Table 5. Main Effects of variety, inoculum type and plant materials on initial and mean final nematode population in Screenhouse/field for 2014/2015 cropping season

Variety	2014 Initial nematode population in the pots	2014 Final nematode population number /100mls of soil	2015 Initial nematode population in the pots	2015 Final nematode population number /100mls of soil
Al	1000	15.11b	2000	120.53a
Ca	1000	20.14a	2000	109.61b
Wk	1000	15.17b	2000	99.78c
Wo	1000	12.50b	2000	73.61d
Ws	1000	15.42b	2000	103.00bc
SE	-	1.58	-	3.31
Inoculum	-	-	-	-
Sc	1000	17.73b	2000	164.95a
Nn	0.00	0.00c	0.00	0.00c
SE	-	1.23	-	2.57
Material	-	-	-	-
Co	1000	16.49b	2000	73.56b
Jc	1000	11.18c	2000	58.27c
Og	1000	11.29c	2000	69.13b
Non	1000	23.71a	2000	204.27a
SE	-	1.42	-	2.96

Means with the same letter(s) in any one segment of a given column are not significantly different at p=0.05

Plants	Alkaloids	Tannin	Saponnin	Steriod	Phlobatannin	Terpenoid	Cadiac Glycoside	Phenols	Anthtro quinone
<i>Jatropha curcas</i>	+++ve	+ve	+++ve	-ve	-ve	-ve	-ve	++ve	-ve
<i>Ocimum gratissimum</i>									
<i>Chromolaena odorata</i>	-ve	++ve	+ve	-ve	+ve	-ve	+ve	-ve	-ve
	s-ve	+ve	+ve	+ve	-ve	+ve	-ve	-ve	+ve

Table 6. Results of the phytochemical screening of *Jatropha curcas*, *Ocimum gratissimum* and *Chromolaena odorata*

Key: Al – *Alata*, Ca – *Cayenensis*, Wk – White yam Kerege, Wo – White yam Okunmodo, Ws – White yam Sebukere, Sc – *Scutellonema*, Nn – No nematode, Co – *Chromolaena odorata*, Jc – *Jatropha curcas*, Og – *Ocimum gratissimum*, Non – Control, Vlt- Vine length

N.B: +++ve = Presence of constituents in high concentration

++ve = Presence of constituents in moderate concentration

+ve = Presence of constituents in low concentration

-ve = Absence of constituents

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