Effects of Four Okra Varieties in Management of Plant Parasitic Nematode in Sudan and Northern Guinea Savannah, North Eastern Nigeria

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ABSTRACT

Experiments were carried out during the 2013 cropping season to investigate the effect of four varieties of okra (Abelmoschusesculentus L. Moench) in managing plant parasitic nematode. The experiment was conducted at two locations. At Teaching and Research Farm University of Maiduguri and at Lassa, AskiraUba local government area, Borno State. The experiment was carried out in a split plot design replicated three times. Each block had four okra varieties (Lady's finger, Utonkon, Alau and Eklenson) treatment. Data collected included shoot height, fruit weight, fresh and dry shoot weight, root length, fresh and dry root weight, gall index, initial and final nematode population. The result indicated that nematode population was suppressed by 67.79 % with a reduction factor of 0.32 under Eklenson okra variety in Maiduguri, while in Lassa Alau variety suppressed the nematode population by 79.51 % with a reproduction factor of 0.20. In Lassa and Maiduguri, Alau and Eklenson variety of okra respectivelyrecorded the highest shoot height, root length, shoot weight and lowest number of galls in both locations. Alau and Eklenson varieties of okra produced the highest fruit weight in Lassa and Maiduguri, respectively. It was observed that Alau and Eklenson okra varities in this agro-ecological zones gave the higher economic gain.

Keywords: Okra variety,plant parasitic nematodes, management

INTRODUCTION

Okra, *Abelmoschusesculentus* (L) Moench, known in many English-speaking countries as lady's fingers, is a flowering plant in the mallow family. The plant is cultivated in tropical, subtropical and warm temperate regions around the world (Rashid *et al*., 2002; NRC, 2006). It is among the most heat and drought tolerant vegetable species in the world and will tolerate soilswith heavy clay and intermittent moisture but frost can damage the pods.Okra has huge potential for enhancing livelihoods in urban and rural areas and to several stakeholders (NAP, 2006). It offers a possible route to prosperity for small-scale and large-scale producers alike and all those involved in the okra value chain, including women producers and traders. Small-holder tropical farmers grow okra for export under contract production arrangements or for local consumption (Ameer-Zareen*et al*., 2001). In Nigeria, okra is one of the most important vegetable and its cultivation is very common but the bulk of the okra produced is consumed locally. The crop is valued for its edible green seed pods. The tender unripe seed pods (fruits) are used as vegetable, and have a unique texture and sweet flavour.

Okra is subjected to attack by many insects and pathogens including fungi, viruses, mycoplasmas and nematodes (Hussain*et al*., 2011; Ahmad *et al*., 2012; Arain*et al*., 2012; Iqbal*et al*., 2012; Srivastava*et al*., 2012). The most widespread and economically important are the root-knot nematodes (*Meloidogyne*spp.). In Nigeria, Sikora and Fernandez, (2005) reported severe attack of root-knot disease caused by *Meloidogyne*spp. on okra and root knot nematodes are responsible to cause yield losses up to 27 % in okra.

Nematodes are generally regarded as silent enemies, they account for an estimated 14 % loss of yield on worldwide basis and root-knot nematodes are the most common and destructive to crop plants (Jackson *et al*., 2003). Nematodes are probably the major obstacle to the production of sufficient food and fibre crops in Nigeria and many developing nations (Mohammed and Umar, 2012).Nematode management is complicated and difficult and at present chemical control is employed in many crops to maintain their populations below economic threshold levels (Eapen*et al*., 2005). Recently, the control of plant parasitic nematodes by using conventional nematicides has declined internationally because of the inherent toxicity of many existing synthetic pesticides to non-target organisms and their persistence in the environment. There is increasing need to find more acceptable alternatives. The use of various parts of indigenous plants as botanical extracts has become important in pest management in recent years following the environmental hazards caused by chemical control measures (Mangala and Mauria, 2006).Use of resistant plant cultivars is limited because there are only a few and their nematode resistance is very specific. Because resistance is specific, accurate identification of the nematode species and race is necessary before the proper cultivar can be selected. Crop resistance is ideally combined with a long-term crop rotation schedule and the best management practices available to favor vigorous and healthy plant growth.

MATERIALS AND METHODS

The experiment was conducted at the Teaching and Research Farm, University of Maiduguri, Maiduguri (Latitude 11^{o} 15' and Longitude 13^{o} 51' E) Borno State, Nigeria and Lassa, AskiraUba Local Government Area, (Latitude 10^{o} 63$'$ N and Longitude 12^{o} 87$'$ E) in Borno State, Nigeria. In Maiduguri, Sudan Savannah, the selected land was previously cropped with tomatoes, onion, carrot, garden egg, okra and cowpea and the soil of the area was found to be sandy loam with a pH of 6.8 and the temperature was 26.4^{o}C with a low average annual rainfall of 657.3mm and prolong dry season. Sustain fewer trees and shorter grasses than the northern guinea savannah Sowumin and Kintola, (2010). In Lassa, Northern Guinea Savannah, the average annual temperature and rainfall of 27.3^{o}C and 1051.7mm, respectively where the wet season last for 6-8 months (Sowunmi and Kintola, 2010). In northern guinea savannah the soil was clay-loam. It has a moderate pH values (6-6.7). The selected land for the experiment in Lassa was previously cropped with tomatoes and cowpea.

The initial (before application of treatments) and final (after crop harvest) nematode population was determined by taking three core samples with a soil auger to a depth of 20 cm in a zig-zag pattern from each experimental plot, bulked and labeled. The soil samples collected from each plot was analyzed in the laboratory to determine the plant parasitic nematode population. The White-Head and Hemming, (1965) method of nematode extraction was used.

Five plants per plot were randomly selected for determination of growth and yield parameters. The parameters that were measured included shoot height (cm), fresh shoot weight (g), root length (cm), fresh and dry root weight (g) and fresh fruit weight (kg) per unit area.

All data collected (except on nematode population) were subjected to Analysis of Variance (ANOVA) appropriate to split-plot design using Statistix Version 9.0. Difference between means was determined using the least significant difference (LSD) Statistic ($P \leq 0.05$).

Gross margin was determined by employing partial farm budget analysis as adopted by Okoruwa*et al*. (2005), the mathematical expression of which is given as:

$$Gm = TR - VC$$

Where Gm = Gross margin

TR = total revenue

VC = Variable cost

RESULT AND DISCUSSION

The effect of varieties on the soil nematode population results (Table 1) shows that all the varieties suppressed the nematode population in both locations. The nematode population was suppressed by 67.79 % and 24 % with a reduction factor of 0.32 and 0.75 under Eklenson and Alau okra varieties, respectivelly in Maiduguri, while in Lassa Alau and Lady's finger suppressed the nematode population by 79.51 % and 35.80 % with a reproduction factor of 0.20 and 0.64 respectively.There was significant (P≤ 0.05) effect on root galls of different varieties of okra (Table 2). The higher number of galls was observed in Lady's finger and Alau in Lassa and Maiduguri, respectively while less galls was observed in Alau and Eklenson in Lassa and Maiduguri, respectively.Table 3 shows that there was significant (P≤ 0.05) effect on root length of different varieties of okra. The longest root length was observed in Alau variety and the shortest was observed in Lady's finger in Lassa while the longest root length was observed in Eklenson and the shortest was observed in Alau in Maiduguri.The results in Table 4 show that in Lassa okra variety Alau had the tallest shoot height while in Maiduguri okra variety Eklenson had the highest shoot height. The shortest shoot height was observed in untreated control plots.Alau and Eklenson varieties of okra produced the highest fruit weight in Lassa and Maiduguri, respectively (Table 5). The lowest fruit weight was recorded in Lady's finger and Alau okra variety in Lassa and Maiduguri, respectively. The Table6 shows that in Lassa, the economic gain for the tested okra varieties ranged from N17, 330.00 for Lady's finger to N26, 900.00 for Alau.The gross margin of the okra varieties in Maiduguri were N28, 510 for Eklenson, N24, 790 for Lady's finger, N18, 910 for Alau and N7, 930 for Utonkon. The four cultivars of okra used were found to suppress the plant parasitic nematode population in both locations; this may have been due to the resistance of the okra cultivars against plant parasitic nematode. There is plethora of literature available on the screening of different varieties/cultivars of various crops and vegetables for their resistance against nematodes. Darekar and Sharma (1990) found that 3 cultivars of okra viz. 92/82-2, 118/82-74 and IC-52314 showed resistance to race-3 of *M. incognita* while the reaction of the rest of 142 cultivars was either highly susceptible or susceptible. Sheela and Shaiju(2006) screened 293 cultivars of okra for resistance to *M. incognita*. None of the cultivars accessions was highly resistant, 3 were resistant, and 123 were moderately resistant while the rest were susceptible and highly susceptible. Bansa and Sanjeev(2006) tested 300 accessions of cultivated germplasm of urdbean (*Vignamungo*) for resistance to *M. javanica*under field and reported that 11 genotypes showed resistant and 42 gave moderately resistant reaction.

Table 1: Effect of Neem Leaf Powder and Carbofuran on the Total Population of Soil Nematode in Maiduguri and Lassa during 2013 Wet Season.

Treatments	Intial Popalation (Pi)	Final Population (Pf)	Percentage Change in Popupalation	Reproduction Factor (RF) (Pf/Pi)
Maiduguri (A)				
Varieties				
Alau	74	56	-24.32	0.75
Eklenson	59	19	-67.79	0.32
Lady's finger	64	48	-25.00	0.75
Utonkon	52	27	-48.07	0.51
Lassa (B)				
Varieties				
Alau	83	17	-79.51	0.20
Eklenson	72	21	-70.83	0.29
Lady's finger	81	52	-35.80	0.64
Utonkon	80	45	-43.75	0.56

Values are means of three replicates
Percentage change in population + = Increase in population, - = Decrease in population

Table 2: Effect of Soil Amendment of NLP, NLP + Carbofuran and Carbofuran on Root Galls of Different Varieties of Okra in Lassa and Maiduguri during 2013 Wet Season

Treatments	Root galls Maiduguri	Lassa	Mean[1]
Alau	12.75[a]	6.58[d]	10.42[b]
Eklenson	5.67[d]	14.17[b]	9.92[b]
Lady's finger	8.25[c]	19.50[a]	13.83[a]
Utonkon	10.83[b]	11.33[c]	11.00[b]
SE±	0.53	0.69	0.60

Values are means of three replicates
Means followed by same letters in a column are not significantly different (P ≤ 0.05)
1 = Mean of combined data analysis of Lassa and Maiduguri

Table 3: Effect of Carbofuran, Carbofuran + NLP and NLP as Soil Amendment on Root Length of Different Varieties of Okra in Lassa and Maiduguri during 2013 Wet Season

Varieties	Root length (cm) Maiduguri	Lassa	Mean[1]
Alau	15.91[a]	16.48[a]	14.74[d]
Eklenson	14.13[c]	16.97[a]	17.46[a]
Lady's finger	13.75[d]	15.07[a]	16.40[b]
Utonkon	14.62[b]	16.22[a]	15.48[c]
SE±	0.14	1.43	0.2

Values are means of three replicates
Means followed by same letters in a column are not significantly different (P ≤ 0.05)
1 = Mean of combined data analysis of Lassa and Maiduguri

Table 4: Effect of Carbofuran, Carbofuran + NLP and NLP as Soil Amendment on Shoot Height of Different Varieties of Okra in Lassa and Maiduguri during 2013 Wet Season

Varieties	Shoot height (cm) Maiduguri	Lassa	Mean[1]
Alau	42.12[d]	42.04[a]	42.08[a]
Eklenson	46.63[a]	37.10[bc]	41.87[ab]
Lady's finger	44.05[b]	35.18[c]	40.15[c]
Utonkon	42.73[c]	39.02[b]	40.88[bc]
SE±	0.17	0.98	0.53

Values are means of three replicates
Means followed by same letters in a column are not significantly different ($P \leq 0.05$)
1 = Mean of combined data analysis of Lassa and Maiduguri

Table 5: Effect of Carbofuran, Carbofuran + NLP and NLP as Soil Amendment on Fresh Fruit Weight of Different Varieties of Okra in Lassa and Maiduguri during 2013 Wet Season

	Fresh fruit weight (kg)		Mean[1]
Varieties	**Maiduguri**	**Lassa**	
Alau	2.53[d]	3.32[a]	2.92[b]
Eklenson	3.33[a]	2.75[c]	3.04[a]
Lady's finger	3.02[b]	2.54[d]	2.78[c]
Utonkon	2.74c	3.01[b]	2.88[b]
SE±	0.03	0.02	0.01

Values are means of three replicates
Means followed by same letters in a column are not significantly different ($P \leq 0.05$)
1 = Mean of combined data analysis of Lassa and Maiduguri

Table 6: Total Cost, Revenue and Gross Margin of Using Okra Varieties and Nematicide on Okra Pods in Lassa

Varieties	Value of Output/ha (N)	Total Cost/ha (N)	Gross Margin/ha (N)
Lassa			
Alau	39, 840.00	13, 150.00	26, 690.00
Eklenson	33, 000.00	13, 150.00	19, 850.00
Lady's finger	30, 480.00	13, 150.00	17, 330.00
Utonkon	36, 120.00	13, 150.00	22, 970.00
Maiduguri			
Alau	30, 360	11, 450.00	18, 910.00
Eklenson	39, 960	11, 450.00	28, 510.00
Lady's finger	36, 240	11, 450.00	24, 790.00
Utonkon	19, 380	11, 450.00	7, 930.00

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