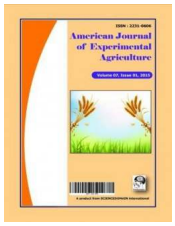

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Some Okra Production Decisions and Farmers' Awareness of *Meloidogyne* species Infection in Two Agro-ecologies, Ghana

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Authors' contribution

This work was carried out in collaboration between both authors. Author YD initiated and designed the study and wrote the first draft of the manuscript. Author CK reviewed the experimental design and all drafts of the manuscript. Both authors read and approved the final manuscript.

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Short Communication

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ABSTRACT

A survey was conducted among okra farmers in two agro-ecologies (forest guinea savanna transition and moist semi-deciduous forest) of Ghana between August and December 2014, to assess their production decisions and awareness of the *Meloidogyne* species infection menace in okra. There were 240 respondents and more males (58%) than females (42%). Thirty nine percent (39%) of the farmers had no formal education and 48% had basic education. Approximately 56% had been cultivating okra for up to 10 years. Sixty four percent (64%) did not treat their okra seeds before sowing. Eighty five percent (85%) cultivated okra on commercial scale level (>3 acres). About 65% practiced sole cropping. Whilst 45, 79, 15 and 47% of the farmers responded positively to the *Meloidogyne* species infection awareness in okra in the Atwima Nwabiagya, Wenchi, Atebubu Amantin and Kintampo North Districts respectively, none was aware of the infection in the Ejura Sekyedumasi and Offinso North Districts. All, 61, 88, 86, 95 and 72% of the farmers in the Ejura Sekyedumasi, Kintampo North, Atebubu Amantin, Wenchi, Offinso North and Atwima Nwabiagya Districts respectively did not manage the infection. This was first survey study in

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exploring farmers' awareness on *Meloidogyne* species infection in okra. Future studies need to be improved to include the nature of management strategies adopted if any to increase yields and reduce synthetic nematicides usage.

Keywords: Ghana; infection awareness; Okra; production practices; Meloidogyne species.

1. INTRODUCTION

This study is based on the fact that, *Meloidogyne* species infection is capable of devastating an entire okra field [1,2] and the menace constitutes a threat to okra production in Ghana. About US $100 billion annual crop yield losses worldwide have been attributed to *Meloidogyne* species infection [3]. Estimated 14.1 and 35% okra yield losses due to *Meloidogyne* species has been reported in India and Pakistan, respectively [4,5] .For a sustainable okra production, farmers' production practices must be ascertained for possible improvement to increase yield. National Agricultural Research Project [6] emphasized that, 10-15 t/ha of okra yield could be obtained under good management encompassing plant parasitic nematodes control. Information is lacking on farmers' awareness of *Meloidogyne* species infection in okra. If farmers are aware of the infection and appreciative of its damage potential, it would greatly facilitate adoption of recommended management strategies.

2. METHODOLOGY

2.1 Survey Sites

The survey was conducted in 6 districts within the Ashanti and Brong Ahafo regions between August and December, 2014. All the districts experience a bimodal rainfall pattern. Some geographic characteristics of the survey areas are presented in Table 1.

Farmer level questionnaires were designed and administered on 240 (40 per district; 120 per agro-ecological zone) active okra farmers. Opportunistic sampling technique was used by targeting only okra farmers who were known to the enumerators. Advocacy visits were made to the selected localities where the target farmers were engaged on the relevance of the study to gain their confidence to open up to the enumerators. The enumerators (Agricultural Extension Agents) were in close and regular contact with the farmers and were convinced that the target persons were active okra producers. To make sure reliable responses were given, questions asked were repeated later to test the veracity of the responses. Percentages (%) were used to analyze all the data collected during the survey.

3. RESULTS

Table 2 showed the bio--data of the respondents. There were more (59, 70, 79 and 53%) male farmers in the Kintampo North, Ejura Sekyedumasi, Offinso North and Atwima Nwabiagya Districts whilst females predominated (69 and 55%) in the Wenchi and Atebubu

Table 1. Edaphic description of survey areas

District	Localities	Predominant soils	Vegetation	District GPS location
Kintampo North[1]	Naaba-Akuraa Gyinapintin	Laterite/savanna ochrosols	FGST	8 ^{o} 11.157′N 01^{o} 34.194′W
Atebubu Amantin[1]	Duabone Adom	Laterite	FGST	7 ^{o} 45.646′N 01^{o} 02.047′W
Wenchi[1]	Awisa Akrobi	Savanna ochrosols/lithosols	FGST	7 ^{o} 47.813′N 02^{o} 06.599′W
Ejura Sekyedumasi[2]	Nkwanta Hiawoanwu	Amantin series-Chromic lixisol[3]	MSDF	7 ^{o} 28.003′N 01^{o} 17.919′W
Offinso North[2]	Abaka Apatam Sentiantia Nkubesa	Kumasi/Offinso series	MSDF	7 ^{o} 24.628′N 01^{o} 56.808′W
Atwima Nwabiagya[2]	Afari Nerebehi Kyereyaase	Bomso series-Ferric acrisol[4]	MSDF	6 ^{o} 41.345′N 01^{o} 47.116′W

[1]Brong Ahafo and [2]Ashanti regions, [3][7], [4][8]. FGST – Forest guinea savanna transition, MSDF – Moist semi deciduous forest

Amantin Districts respectively. Most (93%) of the farmers were not over 60 years old. Strikingly, none in the Ejura Sekyedumasi District was over 60 years old. Thirty nine percent (39%) had no formal education. Illiteracy rate was greater (56, 68 and 41%) in the Kintampo North, Ejura Sekyedumasi and Atwima Nwabiagya Districts respectively.

Most (83, 86 and 52%) farmers in three districts; Atebubu Amantin, Wenchi and Atwima Nwabiagya did not treat their okra seeds before sowing (Table 3). All the farmers in the Ejura Sekyedumasi district did not treat their okra seeds. Contrastingly, most (95%) of the farmers in the Offinso North District treated their okra seeds before sowing. In the Kintampo North, Atebubu Amantin, Wenchi and Ejura Sekyedumasi Districts; 57, 71, 58 and 59% of the farmers respectively cultivated okra primarily for cash income. Sixty one percent (61%) cultivated okra as food source in the Offinso North District. Farmers' experience in okra cultivation ranged from 1 to >20 years (Table 3). Majority (85%) of the farmers across the districts cultivated okra on commercial scale level (>3 acres) (Table 4).

In all the districts except Offinso North where 92% of the farmers cultivated okra as mixed culture with other food crops, majority of them practiced sole cropping (Table 4). In four districts (Kintampo North, Atebubu Amantin, Wenchi and Atwima Nwabiagya); 54, 76, 67 and 51% of the farmers respectively cultivated okra using their own seeds from the previous crop. But in the Ejura Sekyedumasi and Offinso North Districts, 62% and 93% sourced their okra seeds from other colleague farmers and the open market, respectively (Table 4).

None of the respondents was aware of root-knot nematodes infection in okra in the Ejura Sekyedumasi and Offinso North Districts. On the other hand, Fourty five (45), 79, 15 and 47% of the farmers were aware of the infection in the Atwima Nwabiagya, Wenchi, Atebubu Amantin and Kintampo North Districts respectively (Fig. 1).

In the Ejura Sekyedumasi District all the farmers did not manage the root-knot nematodes infection menace on their okra fields. Likewise, 95% in the Offinso North District did not manage the infection. Only 28, 14, 12 and 39% in the Atwima Nwabiagya, Wenchi, Atebubu Amantin and Kintampo North Districts respectively managed the infection (Fig. 2).

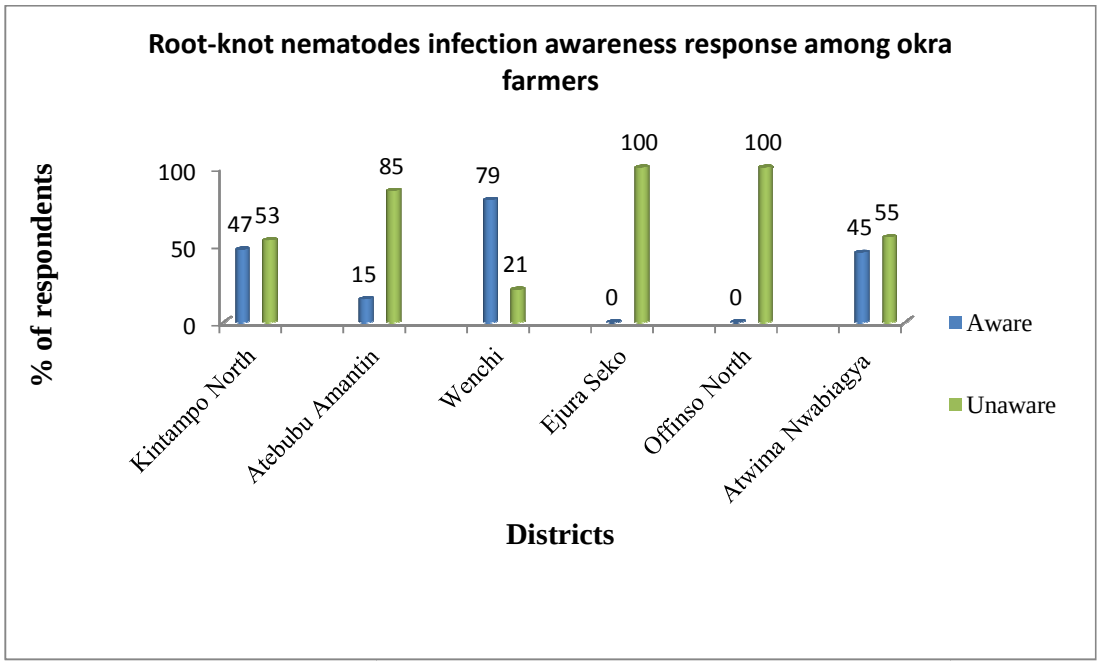

Fig. 1. Root-knot nematodes infection awareness response among okra farmers in six districts
(n = 40 farmers per district)

Table 2. Bio-data of sample okra farmers (%)

District	Sex		Age (yrs)				Civil status		Educational level		
	M	F	16-25	26-45	46-60	>60	Marr[4]	Sing[5]	Illiterate	Basic	Sec[3]
Kintampo North[1]	59	41	18	48	17	17	100	0	56	37	7
Atebubu Amantin[1]	45	55	7	67	24	2	72	28	26	38	36
Wenchi[1]	41	69	8	43	36	13	92	2	26	69	5
Ejura Sekyedumasi[2]	70	30	0	22	78	0	87	13	68	32	0
Offinso North[2]	79	21	0	56	39	5	93	7	17	74	9
Atwima Nwabiagya[2]	53	47	7	50	40	3	100	0	41	40	19
Total frequency	58	42	7	48	38	7	91	9	39	48	13

Source: Farmer level survey, 2014. [4]Married, [5]Single, [3]Secondary, M = male, F = Female, [1]Brong Ahafo and 2Ashanti regions. (n = 40 farmers per district)

Table 3. Responses of okra farmers to various questions (%)

District	Seed treatment		Reasons for the okra			Length of farming (years)		
	Yes	No	Cash crop	Food source	Ready market	1-10	11-20	>20
Kintampo North[1]	55	45	57	8	35	82	13	5
Atebubu Amantin[1]	17	83	71	27	2	69	29	5
Wenchi[1]	14	86	58	16	26	55	14	31
Ejura Sekyedumasi[2]	0	100	59	15	26	24	70	0
Offinso North[2]	95	5	22	61	17	50	24	26
Atwima Nwabiagya[2]	48	52	36	38	26	58	40	2
Total frequency	35.8	64.2	50.5	27.5	22.0	56.3	31.7	12.0

Source: Farmer level survey, 2014. [1]Brong Ahafo and [2]Ashanti regions. (n = 40 farmers per district)

Table 4. Responses of okra farmers to various questions (%)

District	Scale of operation		Cropping system		Source of seeds		
	Subsistence (1-3 acres)	Large (>3 acres)	Sole	Mixed	Self	farmer friend/s	Open market
Kintampo North[1]	14	86	88	12	54	28	18
Atebubu Amantin[1]	21	79	61	39	76	0	24
Wenchi[1]	10	90	8	92	67	26	7
Ejura Sekyedumasi[2]	30	70	73	27	20	62	18
Offinso North[2]	2	98	95	5	5	2	93
Atwima Nwabiagya[2]	13	87	62	38	51	27	22
Total Frequency	15	85	64.5	35.5	45.5	24.2	30.3

Source: Farmer level survey, 2014. [1]Brong Ahafo and [2]Ashanti regions. (n = 40 farmers per district)

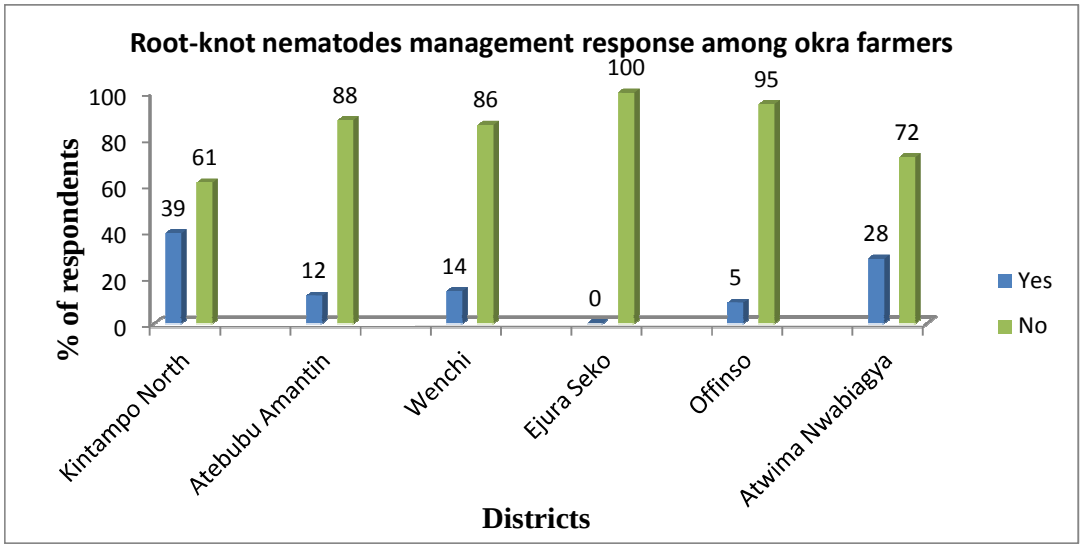

Fig. 2. Root-knot nematodes management response among okra farmers in six districts
(n = 40 farmers per district)

4. DISCUSSION

Meloidogyne species frequently infect okra plants and cause leaf yellowing, retard growth and fruit yield and photosynthetic pigments [9]. The relatively short life cycle (about 8 weeks) of the pest enables it to survive well in the presence of a suitable host. In susceptible plants such as okra, the pests' population builds up as the crop reaches maturity [10] and in some cases the plant dies prematurely [11].

Ninety three percent of the famers sampled for this study were not over 60 years old and only 9% were unmarried across the districts. These could be the reasons why majority (85%) operated on large scale (>3acres) level. They could also have benefited from family labour. Another reason could be the fact that, 50.5% the farmers cultivated okra for cash income. Approximately 28% cultivated okra solely as source of food whilst 22% cultivated it because it had ready market compared to other vegetables. Most (87%) of the farmers had either no formal or only basic education, yet they were managing large (>3acres) okra holdings. This positive development could be due to the fact that, they might have benefited from technical know-how disseminated by Agricultural Extension Agents (AEAs) in their respective localities.

This study showed that, most (71%) okra farmers were not aware of *Meloidogyne* species infection and did not manage (84%) the infection to improve their yields. Most farmers did not know about nematodes, let alone their damage effects or potential. The lack of awareness among farmers about nematode problems is a major hindrace for protecting vegetable crops from *Meloidogyne* species [3]. In a similar work [12] involving 60 yam farmers drawn from 6 yam producing localities, 92% the farmers did not know about nematodes and all (100%) of them were not treating their yam setts before planting.

Apart from managing the root-knot nematodes infection menace in okra to scale up production, a look must be taken at the genetic potential of the cultivars being used. Because most of the local culivars usually grown by peasant farmers are low yielding. Approximately 46% the farmers in this study used part of the previous season's seeds for sowing. Few (30%) obtained either improved or local seeds from the open market. It is grounded in research that, improved crop cultivars are essential for higher yields. Adoption of improved cultivars, sustainable agronomic practices and management of pest and diseases are a prerequisite for higher yields in okra production. Environmentally sound management strategies must be employed to curtail the root-knot nematodes infection menace in okra.

5. CONCLUSION

Most farmers have low educational background which could impact negatively on improved production practices adoption. However, the youthful farmer population is an insurance for farm labour. Farmers' unawareness of root-knot

nematodes infection in okra is unfortunate and could impact negatively on the crop's yield improvement. Conscious efforts must be made to create awareness of the infection in these areas so that sustainable management options would be devised and appreciated against the infectious agent.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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