Survey Of Plant-Parasitic Nematodes Associated With Yam Field In Kogi State, North Central Guinea Savanna Area Of Nigeria

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Abstract: A survey was conducted to determine the types, frequency of occurrence and population of plant parasitic nematodes associated with the soils of yam (Dioscorea spp.) in twelve Local Government Areas of Kogi State namely Kabba/Bunu, Ijumu, Yagba/East, Ankpa, Dekina, Bassa, Ogori/Mangogo, Ajaokuta, Okehi, Olamaboro, Ofu and Idah using random sampling for soil, using pie pan and modification of Baerman funnel method for plant parasitic nematodes extraction. Nematodes were assessed from surrounding soil for five yam cultivars belonging to; *Dioscorea rotundata*, *D. Alata and D. Cayenensis* at survey. Plant parasitic nematodes recovered included *Meloidogyne spp; Pratylenchus spp; Helicotylenchus spp, Hoplotylus spp., and Gracilacus spp* which were most widely distributed with population rating of 10,15,20,25, 30,35,40 and50 respectively in soil samples from the twelve Local Government Areas of Kogi State. *Hoplotylus* spp. and *Gracilacus* spp recovered from soil sample are not most widely distributed in all the Local Government Areas except in Kabba/Bunu and Yagba/East L.G.As of Kogi State.

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Key words- Yam (*Dioscorea spp);* type; frequency; parasitic nematodes

Introduction

Yam (Dioscorea spp.) constitute one of the most important food crops in the tropics and most important group of staple foods especially in the yam zone (25^0N and 25^0S) of West Africa (Coursay, 1967). There are between 300 and 600 species of Dioscorea, of which only a few are edible. The four most commonly cultivated are the water yam (D.*alata* L.), yellow yam (D. *cayenensis* Lam.), Chinese yam (D.*esculenta* [Lour.] Burk.) and the white yam (D.*rotundata* poir). D. *Cayenensis* and D. *rotundata* are indigenous to West Africa, D.*alata* and D. *esculenta* are native to Asia. *D. rotundata* is the most important species of Yam in Africa, followed by *D.cayenensis*.

The bulk of the global Yam production is concentrated in West Africa, with Nigeria producing the largest proportion followed by Ghana and Cote d'lvoire (FAO-STAT 2004). Yam is the second most important root and tuber crop in the World after Cassava in terms of production, and contributes more than 200 dietary calories per day for 60 million people in the yam zone (Nweke et al., 1991).

In Nigeria, yam production is undertaken mainly in the South- Eastern zone, the South- West zone, the area South of River Benue and East of River Niger, which stretches from humid forest to the sub- humid guinea savannah ecological zones (Nweke et al., 1991) where the soil fertility and rainfall permit their production.

Yams require rainfall ranging between 1168.4 and 2500mm per annum. Yam productions are expand annually but realized are usually considerably lower than potential yields.

Plant-parasitic nematodes damage is an important factor in quality reduction and yield loss in yam, in the field and storage. A large number of plant-parasitic nematodes associated with yam cultivation have been reported from various yam producing areas of the world (Ayala and Acosta, 1971, Bridge, 1972., Caveness, 1982., Hahn et al., 1989., Green and Florini, 1996., Thompson et al., 1973 Adesiyan and Odihinn, 1977., Agbaje et al, 2002., 2003., Adegbite et al, 2005).

These are the yam nematodes, *Scutellonema bradys*, the root-knot nematode, *Meloidogyne s*pp. and the lesion nematode *pratylenchus* spp., which are all field and post harvest pests (Caveness., 1982., Hahn et al., 1989., Agbaje et al., 2002., 2003., Adegbite et al., 2005). However, plant parasitic nematodes associated with yam in the selected nine Local Government areas of Kogi State, spreading across the Agricultural Development Programme (ADP)

structure in Kogi State have not been fully investigated.

This survey was therefore conducted to update available information on plant parasitic nematodes of yam in the selected Local Government Areas of Kogi State and also to determine the types, their relative abundance and frequency of occurrence.

Materials And Methods

The Study Area

The study was conducted in the four zonal districts of Kogi State Agricultural Development Programme structure namely, Zone A, Zone B, Zone C and Zone D. Three Local Government Areas were selected in each of the Zonal districts for the study areas, namely Kabba/Bunu LGA at 7^0 84'N, 6^0 07'E, Ijumu LGA, 7^0 84'N, 5^0 92' E and Yagba/East LGA 8^0 29'N 5^0 81' E in zone A.Ankpa LGA. Dekina LGA located at Latitude 7^0 35' N, 70 12' E and Bassa LGA located at Latitude 7^0 54'N, 7^0 03 E in Zone B. Okehi LGA at 7^0 58' N, 6^0 26' E, Ogori/Mangogo LGA at 7^0 33'N, 7^0 83'E, Ajaokuta LGA, 7^0 36'N, 6^0 65' E in zone C. Olamaboro LGA located at Latitude 7^0 11' N, 7^0 34' E, Ofu LGA 7^0 65' N, 7^0 13' E, Idah LGA 7^0 12' N, 6^0 73'E in zone D.

The survey was carried out in twelve Local Government Areas of Kogi State spreading across four Zonal Districts of Agricultural Development Programme (ADP) structure in Kogi State between February and June, 2013.

Soil samples were collected at different points in each of the selected LGAs of Kogi State where yam production is been cultivated to identify the different types of nematodes present in the soil, and also to determine their relative abundance in yam plantation. Soil sample were collected from the four Zonal districts in Kogi State ADP. Three LGAs were selected from each of the Zonal district making a total of twelve LGAs.

From each of the LGA, five towns were also selected having ten farms each and ten soil sample from different locations were collected within the farms making a total of one hundred and twenty soil samples from the twelve LGAs of the four zonal districts. The soil samples collected were taken at a depth of 15-30cm at the base of each plant in order to cover as much of the rhizosphere as possible using soil auger/hand trowel.

Sample (soil) from each farm where pooled and sealed in plastic bags and protected from the sun (Ricka and Barker, 1992). The samples were properly labeled and taken to International Institute of Tropical Agriculture (IITA), Ibadan-Nigeria for extraction, identification and quantification of plant parasitic nematodes.

Plant parasitic nematodes were extracted from the soil using the pie-pan modification of the Baerman funnel method (Southey, 1986). After the extraction, five different genera were identified when viewed under stereomicroscope; these are *Meloidogyne, Helicotylenchus, Pratylenchus, Hoplotylus and Gracilacus*.

Results

The result of the survey of yam parasitic nematodes associated with yam field in kogi state of Nigeria is summarized in the table below .The result of this investigation shows that 5 nematode genera are associated with yam field in all the local government area in kogi state with variation in frequency and relative abundance. Meloidogyne genera has the highest frequency of occurrence and widely distributed throughout the state and more abundant than the other general recording about 62.79% of the nematodes observed in the area indicating that it is the most abundant nematode general in kogi state of Nigeria.

Heliocotylenchus genera is the next most abundant nematode genera in the state. It ranked next to Meloidogyne on the frequency of occurrence, however it was not observed in some local government areas. Examples of such area with no record of Heliocotylenchus are; kabba-bunu,Ijumu,Ajakuta,Okehi and Idah local government area. In terms of relative abundance, it ranked next to Meloidogyne recording about 23.64% among the observed genera.

Pratylenchus ranked next to Helicotylenchus with lower frequency of occurrence compared with Meloidogyne and Helicotylenchus. It was isolated in kabba-bunu, Ijumu, Yagba East, Ankpa Idah and Ofu local government areas of kogi state.In terms of relative abundance, it ranked next to Heliocotylenchus recording about 8.91% of the observed nematode genera in kogi-state.

Hoplotylus ranked next to pratylenchus in terms of frequency of occurrence and relative abundance though the occurrence was noticed in just 1 out of the 12 local government area of kogi-state. Kabba-bunu local government is the only area where this nematode genera was observed with a low percentage of 2.71%

Gracilacus genera ranked lowest in frequency and relative abundance in all the local government areas of kogi-state.Yagba east is the only local government area that recorded the presence of Gracilacus genera of nematode with a percentage abundance of 1.94%.

Summary of survey of soil samples, extraction, identification and quantification of Nematodes associated with Yam field in all the twelve Local Government Areas of Zone A, B, C and D in Kogi State Agricultural Development Project Structure showing the L.G.As, types of nematodes, frequency of occurrence and nematode population/100 ml and Percentage

	Meloidogyne		*Helicotylenchus*		*Pratylenchus*		*Hoplotylus*		*Gracilacus*	
L.G.A	**Fo**	**nP/100mls**	**Fo**	**nP/100mls**	**Fo**	**nP/100mls**	**Fo**	**nP/100mls**	**Fo**	**nP/100mls**
Kabba/Bunu	5	110	-	-	1	15	2	35	-	-
Ijumu	5	100	-	-	1	10	-	-	-	-
Yagba/East	5	90	3	45	1	10	-	-	1	25
Ankpa	3	30	2	25	1	10	-	-	-	-
Dekina	2	45	2	30	-	-	-	-	-	-
Bassa	2	45	2	30	-	-	-	-	-	-
Ogori/Mangogo	4	70	5	110	-	-	-	-	-	-
Ajaokuta	3	35	-	-	-	-	-	-	-	-
Okehi	2	25	-	-	-	-	-	-	-	-
Olamaboro	2	40	2	25	-	-	-	-	-	-
Idah	4	70	-	-	1	20	-	-	-	-
Ofu	7	150	3	45	3	50	-	-	-	-
Total	44	810	19	305	8	115	2	35	1	25
Percentage (%)		62.79		23.64		8.91		2.71		1.94

Key: Fo = frequency of occurrence, nP/100 mls = nematode population/100 ml soil.

Discussion

The result of this research work showed that different parasitic nematodes are associated with yam in all the Local Government Area of Kogi State of Nigeria where the research work was conducted. This will be an update and addition to the findings of caveness (1965) which was carried out in south west of Nigeria. .

This nematode association with yam brought about yield and quality reduction. A large body of research reporting nematode damage to crops has supported this claim (codet and floret 1999. Adekunle and Akinsanmi 2005, Ayala and Acosta, 1971, Bridge, 1972, Caveness, 1982., Hahn *et al*., 1989., Green and Florini, 1996., Thompson *et al*., 1973 Adesiyan and Odihinn, 1977., Weber *et al*., 1995; Agbaje *et al*, 2002., 2003., Adegbite *et al*, 2005). These nematodes do not attack plant alone but generally constitute multi pathogenic population in which this component species interact continuously under field condition (Powel 1971). There is a need to factor in nematode suppressive strategies into the cultural practices utilized in the entire yam producing nematode endemic area if optimum yield is to be realized.

Incorporation of nematode suppressive crops into the rotation programme in yam production will be an effective means of reducing nematode damage level to yam. Plant such as marigold (*Tagete patula*), African marigold (*Tagete erecta*), which exude nematode-toxic substance, from their root into the soil may confer some degree of protection to yam growing under such medium. However the economic value of this crop is very low but it can be grown as chicken feed to improve egg yolk color as done in Central America (Powers et al 1994). Other organic materials that have shown antinematode properties include, African marigold (*Tagetes erecta*), rattle weed (*Crotolaria retusa*), basil (*Ocimum gratissimum*), lemon grass (*Cymbopogon citratus*), neem (*Azadirachta indica*), siam weed (*Chromolaena odorata*) and sugar cane bagasse and brime tree stone (*Morinda lucida)* (Saravanapriya and Sivakumar, 2005; Abolusoro 2006; Hayat *et al*., 2012; Onyeke and Akueshi, 2012.

Organic manure should be used to amend soil in this area as this organic amendment has negative impact on plant parasitic nematodes via population reduction due to toxic by-product of decomposition. Ammonia and urea were shown to suppress several nematode species (Rodriquez-Kabana 1986, Saravanapriya and Sivakumar, 2005). Other strategies that farmers can manage properly should be introduced to the study area. Such methods include crop rotation with non-susceptible crops, used of nematicides such as Carbofuran, solarisation and other cultural methods.

This wide spread distribution of plant parasitic nematodes have been known to cause plant debility and poor yield in Nigeria. It could be a factor in low yam production in the study area. The insidious nature of damage cause by plant parasitic nematode make their damage potential to be underestimated and mistaken for damage caused by other pathogens. It is therefore imperative that awareness be created for farmers on the damaging effects of plant parasitic nematode damage to yam.

Conclussion

The result from this study showed that *Meloidogyne, Pratylenchus, Hoplotylus, Helicotylenchus* and *Gracilacus* are the species of nematode associated with yam in kogi state of Nigeria. The wide spread distribution of this nematode species can cause plant debility, poor yield and quality. This however is a factor of serious concern as it is capable of bringing about low yield and poor quality of yam in the area. It is therefore recommended that sustainable nematode management strategy be factored into yam production program in the study area to enhance yield and quality.

Recommendations

Enlightenment programme for the yam farmers should be embarked upon by the State Agricultural Development Programmes in the zones to inform the farmers of the presence of plant parasitic nematodes in their farms and attendant implications, so that management decision can be taken to overcome the menace of the nematode.

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