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Farmer's Perspective on Cassava Mosaic Diseases in South East/ South Geopolitical Zone, Nigeria

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Abstract
Cassava has been identified as one of the most staple food crops in Nigeria, and cassava mosaic disease (CMD) is one of the major constraints limiting its production in Nigeria; caused by *Cassava mosaic viruses.* Most farmers recognize CMD, but do not realize how the disease can affect yields or its spread, it is therefore important to train farmers going forward. This study sought to ascertain farmer's perspective on CMD and the sampling was carried out in the farmer's field in South East/South geopolitical zones of Nigeria in 2015. Farmer's fields were assessed for CMD incidence and severity. Information on farmers' knowledge of CMD was collected using semi-structured questionnaires. A total of 249 farmers were interviewed and their fields assessed. Results show that the CMD incidence and mean severity ranged between 19.8 - 61.8% and 2.09 - 3.19 respectively. Only one farmer was unable to recognize CMD in the photos provided during the survey. However, all the farmers indicated that they did not know the cause, vectors of CMD and the control strategies. Only 1.6% had the knowledge of the disease effect. Farmer's ability to identify CMD on photographs may be because they have seen the disease on their fields but do not know that what they have seen is a disease. Some believed that the mosaic pattern is associated with a particular cultivar. This clearly indicates that increasing farmers' awareness on the cause and nature of the disease and possible control measures will ensure their participation in the eradication of the diseases.

Keywords: Cassava, Cassava mosaic viruses, perspective and control

Introduction

Cassava, a vital staple food crop in Nigeria serve as a valuable source of energy which can be boiled or processed in different ways (Aduni *et al*., 2005) . It has been reported that every part of the plant can be consumed in some countries (Kehinde, 2006). The advantages of cassava compared to other food crops are the flexibility in its planting, harvest times and its tolerance to drought (Kombo *et al*., 2012). It can thrive; produce high yields in conditions where cereal crops would fail (Robooni *et al*., 2014). Cassava is found in a wide range of markets in its different forms and it serves as a stable source of income and food to many households. Cassava mosaic disease (CMD) is one of the devastating cassava diseases in Nigeria. Cassava mosaic geminiviruses (family *Geminiviridae*, genus *Begomovirus*) are the causes of CMD, transmitted by the whitefly vector, *Bemisia tabaci* (order Hemiptera, family Aleyrodidae), and through the use of infected cuttings during vegetative propagation (Chikoti *et al*., 2016). CMD are prevalent in most cassava fields. The symptoms of CMD include; distortion of leaf lamina, chlorotic mosaics, mottling and an overall reduction in plant size compared to healthy leaves. Among the obvious symptoms usually present in the field are the mosaic pattern on the leaves, the colouring (which can range from pale green to whitish yellow). The extent of chlorotic spots on the leaf surface can vary between <5% to almost 100%. Another common feature observed in cassava fields is the extreme narrowing of the leaf near the base of the leaflets. However, symptoms can vary by both season and cultivar. Symptom expression in plants is influenced by the virus species infecting cassava plants and environmental factors. Fondong *et al*. (—2000) and Pita *et al*. (-2001) showed that symptoms can be severe in plants that have mixed virus infection. Knowledge about how Cassava mosaic viruses are transmitted and their infection cycle is important in the control of the spread of these diseases. Farmers are urged and encouraged to adopt resistant varieties and cultivars, but the presence of preferred traits among the available cultivars usually determines the successful adoption. Most times, farmers reject the recommended varieties because they do not correspond with farmers' preferences. (Tumuhimbise *et al*., 2012).

This study is to understand and evaluate the farmer's knowledge of CMD; it is therefore important to understand their perceptions about how CMD affects cassava yields, and their current method of this disease management. Building farmer's knowledge on CMD is probably one of the most important strategies for controlling CMD and the first step in building this knowledge is to understand the current state of farmers' perspective on CMD.

Material and Methods

Sampled areas

The sampling was carried out in the farmer's field in South East/South geopolitical zones of Nigeria in 2015 (Table 1). The sampling routes were predetermined using the road map of Nigeria.

Assessment of Disease incidence and severity

Farmer's fields were assessed for CMD incidence and severity. In each farmer field selected, a maximum number of 30 plants were accessed along two diagonal transects, 15 from each diagonal. The parameters accessed were CMD severity and symptoms observed (Mupenda and Walangululu, 2016). The severity of disease symptoms by visual observation was assessed using the 1 to 5 scale that indicates the extent of symptom development: 1 - indicating no symptoms, 2 - slight mosaic covering less than 20% of leaf area without leaf distortion or size reduction, 3 - mosaic covering less than 50% of the leaf area without obvious size reduction but with some distortion, 4 - mosaic covering most of the leaf surface with leaf distortion and some leaf reduction, and 5 - the most severe symptoms with leaf distortion and stunting of plants.

Sampling and data collection

The data obtained include; gender, age, marital status, educational level and years of experience in cassava production (Table 2). Information on farmers' knowledge of CMD was collected using semi-structured questionnaires; Open-ended questions that gave farmers the freedom to give their opinions were also used (Gnonlonfin *et al.,* 2011). All interviews were conducted in the local language of the villages to encourage farmers to explain their views appropriately. Some questions were in some occasions rephrased to enable farmers understand and respond as fully as possible.

Data analysis

Data was analyzed using descriptive statistics and multiple linear regression models.

The linear regression model is expressed thus:

$$Y = \alpha + \beta x + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + e$$

Where

Y = Recognition of CMD symptoms on photo

α = intercept

β, β_1, β_2, β_3, β_4 and β_5 = coefficients

X_1 = gender of the respondents

X_2 = age of the respondents

X_3 = marital status of the respondents

X_4 = educational qualification of the respondents

X_5 = experience of the respondents

e = error term

Results and Discussion

Results

Socio-economic factors of surveyed farmers

Table 2 shows the socio-economic factors of the 249 farmers interviewed and they were all cassava farmers. Most farmers surveyed were male (67.1%) and majority (61.0%) were < 50 years of age. About 69.1% of these farmers were married, while 51.4% had no schooling. About 47.0% of farmers reported that they had at least 30 years of experience in cassava production.

Incidence and severity of CMD

Cassava mosaic disease mean incidence ranged between 19.8% and 61.8% with the highest value recorded in Ebonyi State, while the lowest was recorded at Delta State (Figure 1). The mean severity ranged between 2.09 and 3.19 which were recorded in Enugu and Anambra States respectively (Figure 2).

Recognition of cassava mosaic disease

Only one farmer out of the 249 farmers interviewed was unable to recognize CMD in the photos provided during the survey. However, all the farmers indicated that they did not know the causes/vectors, the disease effect and the control strategies of CMD (Table 3). The low R^2 (1%) on Table 4 explained a very low **proportion of variance in the recognition of CMD symptoms on photo that can be explained by the** gender, age, marital status, educational qualification and the experience of the respondents. The result model showed that though there is no significant relationship (P>0.05) between gender, age, marital status, educational qualification and the experience of the respondents on their recognition of CMD symptoms on photo, but there is a positive relationship between gender, marital status and experience of the respondents on their recognition of CMD symptoms on photo. Age and educational qualification of the respondents has negative influence on their recognition of CMD symptoms on photo. This simply means that the recognition of CMD did not depend on a farmer's gender, age, marital status, education level and years of experience with cassava production. Farmer's ability to identify CMD on photographs was due to the fact that they have seen the disease on their fields, but do not know that what they have seen is a disease. Some believed that the mosaic pattern is associated with a particular cultivar.

Discussion

The respondents generally lack critical knowledge about CMD, transmitting vectors and the control strategies. We believe this lack of knowledge constitutes

the major obstacle for CMD control in Nigeria. There was no specific management of CMD by the respondents since they were not aware of the disease. Based on these results, farmers should be sensitized and trained by researchers on the symptoms of CMD which will give them the ability to take proper action in controlling the diseases in their own fields and minimize its spread to neighboring fields. These observations were in accordance with the report by Chikoti *et al.* (2016) who also found that the lack of CMD knowledge by farmers requires researchers and extension agents to sensitize and train farmers. Most farmers frequently use planting materials from previous seasons or nearby fields, which in turn, facilitate the spread of these diseases. CMD is a systemic infection, once it infects a cassava plant, it proliferates and all plants from its infected cuttings will be affected or diseased (Ntawuruhunga *et al*., 2007). Farmers who are not aware of the presence of this disease in their fields further spread CMD by sharing cuttings with neighboring farmers. Consequently majority of farmers do not have the knowledge of the impact of CMD on cassava yields nor do they know that some of the crops or weeds can serve as a reservoir to these viruses; thus making the spread more rapid.

Conclusion

The study analyzed Farmer's Perspective on Cassava Mosaic Diseases in South East/ South Geopolitical Zone of Nigeria**.** Cassava mosaic disease has remained the most important biotic constraint limiting cassava production in Nigeria. Since most farmers can recognize CMD, but do not realize how the disease can affect yields or its spread, increasing farmer's awareness on the cause and nature of the disease and possible control measures will ensure massive participation in the control of this disease.

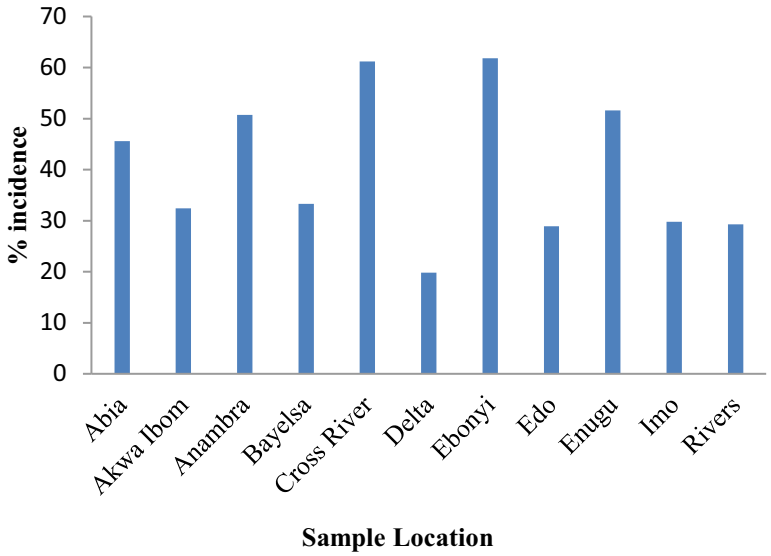

Figure 1: Incidence of cassava mosaic disease in South East/South geopolitical zone, 2015

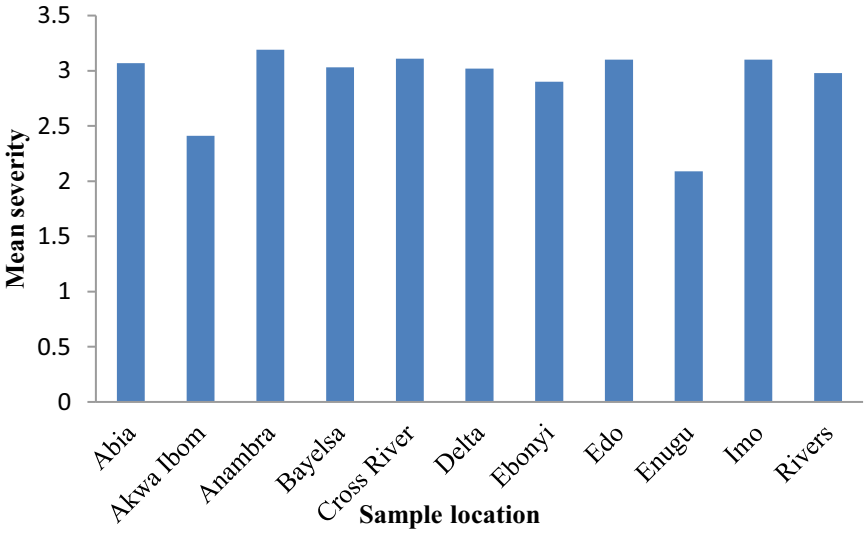

Figure 2: Mean Severity of cassava mosaic disease in South East/South geopolitical zone, 2015

Table 1: Number of Farmers interviewed by State

States	Field/Farmers interviewed
Abia	16
Akwa Ibom	21
Anambra	32
Bayelsa	10
Cross River	25
Delta	41
Ebonyi	13
Edo	30
Enugu	19
Imo	37
Rivers	15
Total	249

Table 2: Socio economic factors of respondents

Socio economic factors	Modality	Percentage (%)
Gender	Male	67.1
	Female	32.9
Age	≤ 30 years	1.6
	30 – 50 years	37.4
	< 50 years	61.0
Marital Status	Married	69.1
	Single	30.9
Education level	Primary	34.9
	Secondary	13.3
	Tertiary	0.4
	No schooling	51.4
Experience in production	≤ 15 years	19.7
	15 – 30 years	33.3
	< 30 years	47.0

Table 3: General knowledge of CMD in the South East/South South Geopolitical zone in Nigeria

Farmers knowledge on CMD	Percentage (%)
Recognition of CMD symptoms on photo	99.6
Knowledge on the causes/vector	0.0
Knowledge on the disease effect	0.0
Control strategies	0.0

Table 4: Regression estimates of recognition of CMD

Regression Statistics	
Multiple R	0.9490
R Square	0.9007
Adjusted R Square	-0.01138
Standard Error	0.0637
Observations	249

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	5	0.008971	0.001794	0.441725	0.819075
Residual	243	0.987013	0.004062		
Total	248	0.995984			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.987012	0.023661	41.71548	9.1E-113	0.940407	1.033619	0.940407	1.033619
gender	5.87E-18	0.033045	1.78E-16	1	-0.06509	0.065092	-0.06509	0.065092
age	-5.02E-18	0.018659	-2.7E-16	1	-0.03675	0.036754	-0.03675	0.036754
ms	0.0129	0.029413	0.441544	0.659212	-0.04495	0.070923	-0.04495	0.070923
edu	-6.62E-18	0.006423	-1E-15	1	-0.01265	0.012651	-0.01265	0.012651
exp	5.56E-19	0.011876	4.68E-17	1	-0.02339	0.023393	-0.02339	0.023393

$Y = 0.987 + 5.874E\text{-}18X_1 - 5.023\ E\text{-}18X_2 + 0.013\ E\text{-}13X_3 - 6.624\ E\text{-}18X_4 + 5.561\ E\text{-}19X_5$

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