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Farmers' perception of on-farm conservation of cassava biodiversity in Ogun State, Nigeria

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Abstract

Conservation of agrobiodiversity is a prerequisite for sustainable food production and this can be enhanced by improving farmers' positive perception of it. This study examined farmers' perceptions of the on-farm conservation of cassava biodiversity in Ogun State. Data collected from 160 cassava farming households using a multistage sampling procedure were analysed using descriptive statistics, weighted scores and means. Results show that the highest proportion of farmers (44.2%) strongly agree that the composition of cassava varieties has changed in the last five years owing to late maturity. Almost half of the farmers (49.3%) have abandoned local cassava varieties and "Gbego" cassava variety is the most abandoned variety. The perception of a typical farmer is that improved cassava varieties did not require more weeding than local ones but is undecided about fertilizer requirement and ease of harvesting. Improved cassava varieties are perceived to be bigger, early maturing, yield higher and are more disease resistant than the local ones. The farmers also perceive that improved varieties have more water content than local ones but was undecided on which had more tissue content. There is a close tie in the perception of the farmers about whether improved cassava tubers had higher market price, are more scarce to obtain or preferred to local varieties by processors than local varieties.

Introduction

The diversity of agricultural systems (agrobiodiversity) is the diversity in the number of crop species grown in an agroecosystem and the diversity of different varieties of these crops (UNEP, 2014). Agro-biodiversity can provide natural insurance to risk-averse farmers by reducing the variance of crop yield and to society at large by reducing the uncertainty in the provision of public-good ecosystem services such as CO_2 (Baumgartner and Quass, 2008). Agricultural improvements such as yield quality improvement, disease resistance and adaptation to climate changes rely upon the great diversity within crop plants without which genetic diversity, options for long-term sustainability and agricultural self-reliance are lost (Isundar, 2011). Agrobiodiversity also possesses utilitarian values in a number of ways especially in the processes of biochemical cycles and in providing more locally in protecting watershed, recycling nutrients, combating erosion, enriching the soil, regulating water flow, trapping sediments, mitigating pollution and controlling pest population (Bassey *et al*. 2011). Increased biodiversity leads to more productivity (Di Falco *et al*. 2010).

Despite the numerous benefits of agrobiodiversity, about three-quarters of the varietals genetic diversity of agricultural crops have been lost over the last century. Just twelve crops and fourteen animal species now provide most of the world's food (Isundar, 2011). Reduced genetic diversity implies vulnerability, increased economic risks, reduced food security, loss of resources for future adaptation, reduced and unsustainable agricultural growth opportunities and much of the agrobiodiversity remaining in situ today is found on the semi-subsistence farms of poorer countries and the small-scale farms or home gardens of more industrialized nations (Birol *et al.* 2006).

Crop diversity can be maintained through the management of agricultural ecosystems by farmers and this is essential for sustainability. However, advances in crop breeding has resulted into the introduction of sophisticated modern varieties which are often very uniform and less genetically diverse. Instead of replacing traditional varieties, modern varieties can be intercropped with traditional varieties and the former may facilitate the preservation and enhancement of the genetic diversity of traditional cropping systems. Interestingly, many subsistent farmers grow both traditional and modern varieties under high input technologies and landraces, under traditional management (Smale and Heisey, 1995; Wood and Lenne, 1997)

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Agrobiodiversity can be influenced by farmers' positive perception of it and the deliberate actions to attain farmers' social reproduction threshold. It is also the upshot of the technologies used and the crop diversity management within these farms (Cáceres, 2006; Sahai *et al*. 2009). Farmers' opinions about the drawbacks of traditional varieties, the question of whether farmers were willing to grow traditional varieties at all, perceived advantages of the traditional varieties and what farmers wanted as material benefits to grow traditional varieties were the subjects. When a farmer chooses to adopt a new variety and replace an older variety, it reflects the farmer's judgment that the new variety offers some net benefit or advantage (Evenson and Gollin, 2003). Wale (2011) found that farmers believed replacement of traditional varieties of crops led to the disappearance of traditional varieties owing to of yield differential and land-suitability. Majority of the farmers claimed that the loss of the traditional varieties of crops influenced their livelihoods. Farmers who thought otherwise believed in the superiority of improved seeds.

The conservation of genetic resources is a prerequisite for sustainable food production which is even more true for cassava being a major staple crop in Nigeria. In Nigeria, little is known in the literature about the socioeconomic studies on cassava biodiversity and significant gaps still remain in our knowledge about the perception of farmers on conservation of agrobiodiversity, especially cassava biodiversity, in Nigeria. Thus, understanding the perception of farmers about conservation of cassava biodiversity is an effective strategy for sustainable adoption and utilization of crop genetic resources and enhances the comparative advantage of the landraces. This study therefore assesses farmers' perception towards the replacement of local cassava varieties by improved ones.

Materials and Methods

The study was carried out in Ogun State of South West Nigeria. The state lies approximately within latitude 7◦ and 8◦ 27'E, has 20 Local Government Areas, a land area of 16,409.26sq.km and an estimated population of 3,728,098.(Federal Republic of Nigeria, FRN, 2009). Ogun state is divided into four zones by the Ogun State Agricultural Development Project (OGADEP) namely Abeokuta, Ikenne, Ilaro and Ijebu-Ode. The blocks are further divided into cells while the cells consist of many farming communities and the main crops grown in the area are yams, cassava, plantains, oil palms and bananas.

Data was collected in 2014 using a three-stage sampling procedure. The first stage was the random selection of two out of the four OGADEP zones (Abeokuta and Ikenne) owing to massive cassava production, processing and marketing activities in the zones. The second stage was the random selection of a block from each zone, out of which 8 cells were selected proportionate to sizes of the two blocks. The list of cells were obtained from OGADEP as the sampling frame and a total of two hundred farmers were selected proportionate to sizes of the cells. In all, about 160 of the farmers who gave consistent responses were used for analyses.

The study employed the use of descriptive statistics and likert scale to analyze the data. A 5-point likert scale was used to measure positive and negative response to statements on perception of individual to their perception on on-farm cassava biodiversity. The mean ranking for the perception statements was calculated from the perception index generated and the degrees of unfavourable and favourable disposition determined by the mean score above and below the benchmark respectively (Likert, 1932).

The 5 point likert scale has a critical advantage over every other type or method in that it does not expect a simple yes/no answer from the respondents, but rather allow for degrees of opinion, and even no opinion at all (i.e., it allows individual respondent to express how much they agree or disagree to a particular statement, with the neutral point being neither agree, disagree or undecided). Therefore, qualitative data enabled the use of likert scale with a relative ease (McLeod, 2008). The Mean Score (MS) is obtainable by summation of the product of rating points and observation divided by the total number of sample size. It is expressed as:

$$\text{Weighted scores} = \sum \text{frequency (strongly agreed to strongly disagreed)}$$

$$\text{Means score} = \frac{\sum \text{of weighted scores}}{\text{Total number of respondents}}$$

$$\text{Contribution} = \frac{\text{Weighted means}}{\text{Total weighted mean}} \times 100\%$$

Results and Discussion

Results in Table 1 shows that show that a typical cassava farmer is a 48-year old male, married and a Christian with five years of formal education. He has about seven members in the household and has access to about 1.76 hectares of land with 17years of farming experience. Results further shows that the highest number of cassava varieties cultivated by a

Table 1. Summary statistics of socio-economic characteristics of respondents (N=160)

Socioeconomic characteristics	Minimum	Maximum	Mean	Std deviation
Age of respondent(yrs)	20	85	47.72	13.20
Sex (1=M, 0=F)	0	1	0.56	0.50
Level of formal education(yrs)	0	16	4.56	4.05
HH size	1	15	6.66	3.00
Marital Status	0	4	1.51	0.96
Religion	1	3	1.325	0.51
Years of experience	0	50	17.42	11.75
Arable land size	0.2	8	1.76	3.82
Number of cassava varieties grown	1	5	2.0	2.1

Table 2. Socioeconomic profile of the cassava farmers

Age of household head	Frequency	Percentage
<30	2	1.25
31-40	18	11.25
41-50	42	26.25
51-60	72	45.00
>60	26	16.25
Total	160	100
Religion		
Christianity	111	69.37
Islam	46	28.75
Others	3	1.88
Total	160	100
Household size		
4-6	67	41.88
7-9	80	50.00
10-15	13	8.12
Total	160	100
Gender		
Male	125	78.12
Female	35	21.88
Total	160	100
Marital Status		
Single	4	2.5
Married	121	75.63
Divorced	9	5.62
Widowed	26	16.25
Total	160	100
Education		
None	59	36.88
Primary School	69	43.13
Secondary School	29	18.13
Tertiary School	3	1.88
Total	160	100.00
Years of farming experience (years)		
<8	10	6.25
8-15	67	41.88
16-22	44	27.50
23-29	15	9.37
30-35	24	15.00
Total	160	100.00

farmer is five but a typical farmer in the study area cultivates at least two cassava varieties.

Further description of the socio-economic characteristics of the cassava farmers (Table 2) show that a higher percentage of the farmers are male (78 %) and above 50 years old (61%). This suggests that a larger proportion of the farmers are above the mean age of 47 years and are not in their prime productive years. About two-fifth of the farming households had less than seven members which indicates the largeness of the cassava farming households. This may be a ploy to supply cheap family labour to the farm enterprise. Slightly above a third of the farmers had no formal education while the highest proportion

Table 3. Distribution of respondents by abandoned varieties and reasons for abandoning traditional varieties

Variety	Frequency	Percentage
Odongbo	21	13.13
Gbego	110	68.25
Odongbo and Gbego	7	4.38
Odongbo, Gbego, Ogunjobi	1	0.63
Ogunjobi and Okere	3	1.88
Ogunjobi , Dajoolowo	1	0.63
Ogunjobi, Gbego	2	1.25
Idileru	15	9.38
Total	160	100
Reasons for Abandoning Traditional Varieties	Frequency	Percent
Lower yield	28	17.50
Late maturity	79	49.38
Toxicity	40	25.00
Do not thrive well on marginal soils	10	6.25
Non acceptability in market	3	1.88
Total	160	100

Table 4. Distribution of farmers' perception towards the replacement of replacement of traditional varieties of crops by improved ones

	SA(%)	A(%)	U(%)	D(%)	SD(%)
The composition of cassava varieties in this village has changed in the last 5 years.	44.2	27.6	16	6.4	5.8
Improved cassava varieties require more weeding than local ones.	6.3	3.1	12.6	52.2	25.8
Improved cassava varieties require more fertilizer than local ones.	13.2	8.2	18.2	46.5	13.8
Improved cassava varieties are easier to harvest than local ones.	25.8	14.5	15.1	29.6	15
Improved cassava varieties yield higher than local ones.	41.5	34.6	15.7	6.9	1.3
Improved cassava varieties are bigger than local ones	54.1	27	10.1	6.3	2.5
Improved cassava tubers have more water content than local ones	28.8	31.4	20.5	16	3.2
Improved cassava tubers have more tissue content than local oness	33.1	21.2	15.2	16.6	13.9
Improved varieties mature earlier than local varieties	58.5	31.4	6.3	3.1	0.6
Improved varieties are more drought tolerant than local varieties	24.7	18.4	14.6	32.9	9.5
Improved varieties thrive better on marginal soils than local varieties	29.1	20.9	12.7	27.8	9.5
Improved varieties are more disease resistant than local varieties.	44.3	34.2	12.7	27.8	9.5
Improved cassava tubers have higher market price than local varieties	24.2	14	15.3	31.2	14.6
Improved cassava stems are more scarce to obtain than local varieties	31.0	19.6	15.8	20.3	13.3
Improved varieties are preferred to local varieties by processors	34.8	19.6	16.5	19	10.1
Improved varieties taste better than local varieties	29.1	10.8	21.5	28.5	10.1

SA = Strongly Agreed; A = Agreed; D = Disagreed; SD = Strongly Disagreed; U = undecided

Table 5. Mean scores and rank of farmers' perception towards the replacement of traditional varieties of crops by improved ones

	Weighted score	Mean score	Decision	Contribution(%)	Rank
The composition of cassava varieties in this village has changed in the last 5 years	335	2.09	A	4.73	13
Improved cassava varieties require more weeding than local ones	622	3.89	D	8.79	1
Improved cassava varieties require more fertilizer than local ones	545	3.41	U	7.70	2
Improved cassava varieties are easier to harvest than local ones	472	2.95	U	6.67	4
Improved cassava varieties yield higher than local ones	310	1.94	A	4.38	14
Improved cassava varieties are bigger than local ones	285	1.78	A	4.03	16
Improved cassava tubers have more water content than local ones	380	2.38	A	5.37	12
Improved cassava tubers have more tissue content than local ones	433	2.71	A	6.12	8
improved varieties mature earlier than local varieties	253	1.58	A	3.58	17
Improved varieties are more drought tolerant than local varieties	459	2.87	U	6.49	6
Improved varieties thrive better on marginal soils than local varieties	433	2.71	U	6.12	9
Improved varieties are more disease resistant than local varieties.	310	1.94	A	4.38	15
Improved cassava tubers have higher market price than local varieties	489	3.06	U	6.91	3
Improved cassava stems are more scarce to obtain than local varieties	429	2.68	U	6.06	10
Improved varieties are preferred to local varieties by processors	405	2.53	U	5.72	11
Improved varieties taste better than local varieties	452	2.83	U	6.39	7
The cultivation of local varieties is inevitable	463	2.89	U	6.54	5

A = Agreed; D = Disagreed; U = undecided;

of them have primary education. This shows that there is an urgent need to increase advocacy for the attainment of basic education in the rural areas, which is expected to enhance the adoption of improved agricultural technologies and consequently enhance the perception of the farmers about on-farm cassava biodiversity. The majority of the farmers had more than seven years of farming experience which indicates that most of the farmers are well experienced in the art of cassava farming which could facilitate increased on-farm cassava biodiversity.

The most abandoned variety is "Gbego", which has been abandoned by more than two-thirds of the farmers (Table 3). This variety is toxic to humans and animals if not properly processed. About 13% of the farmers have also abandoned Odongbo variety which matures in two years, which the farmers consider too long and prefer to opt for the early maturing ones. They also identify late maturity, toxicity and low yield as the main reasons for abandoning traditional varieties for improved varieties..

The highest proportion of farmers (44.2%) of the respondents strongly agree that the composition of cassava varieties has changed in the last five years while about half of them disagreed that improved varieties require more weeding than local ones (Table 4). About 46.5% of the respondents disagree that improved cassava varieties require more fertilizer than local ones. Close to a third of the farmers (29.6%) disagree that improved cassava varieties are easier to harvest than local ones. Most respondents strongly agree that improved cassava varieties yield higher than local ones. More than a half of the farmers strongly agree that improved cassava varieties are bigger than local ones than local ones while a larger proportion of the cassava farmers agree that improved cassava tubers have more water and tissue contents than local ones.

A majority of the farmers indicate that improved varieties mature earlier than local varieties while 32.9% disagreed that improved varieties are more drought tolerant than local varieties and that improved varieties are more disease resistant than local ones. About half of the farmers opine that improved varieties thrive better on marginal soils, are preferred by processors but their stems are more scarce to obtain than local varieties. However a higher proportion of the farmers believe that local varieties of cassava have higher market price than the improved ones. There seems to be no difference in the perception of tastes of both improved and local varieties by the respondents while a third of them strongly agree that the cultivation of local varieties is inevitable.

Figures in Table 5 show that a typical cassava farmer agrees that the composition of cassava varieties in the village has changed in the last five years and that improved cassava varieties does not require more weeding than local ones but was undecided about fertilizer requirement and ease of harvesting. He/she agrees that improved cassava varieties are bigger, mature earlier, yield higher and are more disease resistant than the local ones. Improved varieties are perceived to have more water

content than local ones but was undecided on which had more tissue content. This butresses findings of Agwu and Anyaeche (2007) who found that farmers abandoned traditional cassava varieties for improved varieties due to high yield, perceived low level of hydrocyanide in products, high product quality, pests/disease resistance, ability to shade off weeds and early maturity in preferred varieties. There is indecision among the farmers on whether improved cassava tubers had higher market price, are more scarce to obtain or preferred to local varieties by processors than local varieties.

Conclusion

Understanding farmer's perception of agrobiodiversity influences their choice of environmental-friendly farming system (Segnon *et al.* 2015). The perception of a typical farmer is that improved cassava varieties are bigger, mature earlier, yield higher and are more disease resistant than the local ones. This is because most of the traditional varieties are grown by less than 10 percent of the farmers and are more likely to be lost if conservation of the germplasm of these varieties are not applied. According to most of the farmers, the composition of cassava varieties in their village has changed in the last five years. Cassava biodiversity should be maintained on farm for sustainability and this study has confirmed that cassava farmers in the study area prefer the early maturing modern varieties to the late maturing traditional types. Consequently, any deliberate attempt at improving on-farm conservation of cassava biodiversity must take into cognizance the perceptions of farmers as major stakeholders.

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