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USAGE OF AGROBIODIVERSITY CONSERVATION PRACTICES AMONG FARMERS IN NIGER STATE, NIGERIA

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Abstract. The use of agrobiodiversity practices is a key strategy in adapting to climate change. This study determined the level of use of agrobiodiversity conservation practices, assessed the benefits of using them and identified the constraints to doing so. A three-stage sampling technique was used to select 150 respondents who then took part in a structured interview. Data analysis was performed using descriptive statistics and Pearson's Product Moment Correlation. The results showed that the use of animal fertiliser and plant residues as bio-fertilisers ($\bar{x}$ = 3.78) was a common biodiversity practice among farmers. 82.5% of the farmers used such practices to a minor extent. High production costs ($\bar{x}$ = 2.56) and the lack of knowledge on using biodiversity practices ($\bar{x}$ = 2.51) were major constraints to their use. Age, as well as the years of formal education and years of farming experience were significantly related to the level of usage of agrobiodiversity practices. The study concluded that the farmers' agrobiodiversity practice usage level was low and was influenced by their socio-economic characteristics. It is recommended that the government and other stakeholders provide the necessary facilities for using such practices. Extension agents should also familiarise farmers with the usefulness of agrobiodiversity solutions.

Keywords: agrobiodiversity, usage, level, farmers

INTRODUCTION

Biodiversity refers to the variety of life forms living on Earth, including plants, animals and microorganisms, as well as their genes and the entire ecosystem they form (Theela, 2009). The concept of agrobiodiversity is a vital subset of biodiversity, which forms the basis for sustainable resource management and rural development. Agrobiodiversity encompasses the variety of animals, plants and microorganisms used directly and indirectly for food and agriculture, the diversity of species that support production (soil biota, pollinators, predators, etc.) and those in the wider environment that support agroecosystems (agricultural, pastoral, forest and aquatic) and their diversity (FAO, 2008).

While Nigeria is rich in biodiversity due to many varieties of plant and animal species found in its forests and grasslands, there is a mounting body of evidence that its biodiversity is decreasing at an alarming rate – primarily due to man-made factors, such as increasing population, cultural practices, rising demand for forest products and economic policies. These activities cause climate pattern fluctuations all around the globe. In most rural areas of the Niger state, local plant and animal diversity is being sacrificed to ensure sustained economic development. Agrobiodiversity reduces the impact of agriculture on vulnerable environments, especially forests and other areas inhabited by endangered species; in some developing countries, small scale farmers practice agrobiodiversity as an integral part of their livelihood strategies. However, Blaide and Broodfield (2007) reported that agrobiodiversity is lost when it suffers a reduction in intrinsic qualities or a decline in its capabilities or

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complete extinction resulting from "a causative factor or a combination of factors which reduce its physical, chemical or biological status, hence restricting its productive capacity". There is a need to increase the use of agrobiodiversity conservative practices among farmers due to the effects of climate change, which has become a global phenomenon, as well as its impact on agricultural activities in our communities which is increasing at an alarming rate.

A major way of coping with the impact of climate change on food security is maintaining animal and crop plant diversity. IPCC (2014) reported that climate change may cause heat stress and reduce feed intake of farm animals, which can cause a reduction in breeds that supply 90% of the world's livestock and production needs due to such breeds being more susceptible to heat stress. According to FAO (2010), climate change is likely to be an additional threat to agrobiodiversity, as based on its predictions climate change may cause up to a 10% reduction in staple crop and a 37% reduction in grain crop output by 2050 due to extreme weather events.

Adegnandjoe et al. (2017) have identified the use of agrobiodiversity practices as a climate change adaptation strategy. Understanding how to use agrobiodiversity conservative practices will allow agricultural stakeholders to provide adequate facilities for applying such practices to sustain agriculture.

Hence, this study aimed to determine the level of use of agrobiodiversity conservation practices in the study area and the benefits of adopting them, as well as to identify the constraints to agrobiodiversity conservation.

HYPOTHESES OF THE STUDY

HO1: There is no significant relationship between the socio-economic characteristics of the respondents and their agrobiodiversity conservation usage level.
HO2: There is no significant relationship between the respondents' agrobiodiversity conservation usage level and the perceived benefits of agrobiodiversity conservation.

LITERATURE REVIEW

Agricultural biodiversity improves resilience to climate change and is critical for food security throughout the world (Dunja et al., 2012; Lori, 2020). It also plays a major role in sustainable production (Altieri, 2002; FAO, 2010), providing enhanced nutrition (Beaglehole and Yach, 2003; Yenagi et al., 2010), environmental benefits (Perrings et al., 2006; Jackson et al., 2007), improving livelihoods of smallholder farmers (Keatinge et al., 2009; Jackson et al., 2010) and increasing resilience to climate change (Padulosi et al., 2011; Ortiz, 2011a; Guarino and Lobell, 2011). Crop and crop variety diversification is essential for reaping the full benefits of agrobiodiversity. Agricultural biodiversity includes biological diversity components relevant to food and agriculture, as well as those that constitute an agro-ecosystem (Emile et al., 2011). Agrobiodiversity contributes to supplying, regulating and supporting cultural ecosystem services (Millennium Ecosystem Assessment, 2005) and small-scale farmers in many developing countries use it as an integral part of their livelihood strategies. The use of agricultural biodiversity conservation practices reduces biological and ecological degradation of the environment, which also reduces the impact of climate change – a major threat to Nigeria's farming communities, as reported by Midglay and Bond (2015). Padulosi et al. (2009) also reported that agrobiodiversity-rich approaches can enable improved climate change adaptation.

Study area

The study was conducted in Niger, which is the largest state in Nigeria in terms of land area. It covers about 86,000 km² (or about 8.6 mln ha), representing about 9.3% of Nigeria's total land area and is the second-largest state after Borno (Annual Abstract of Statistics, 2009); its estimated population was 3,950,249 in 2006. The majority of Niger's inhabitants work as farmers. Its primary agricultural products include millet, sorghum, cassava, onion, rice and cowpea, with camels, goats, sheep and cattle being the main animals reared for livestock production. Fish farming is also practised in Niger. These agricultural activities make it convenient to introduce agrobiodiversity practices in the state (Muhammad, 2019).

Sampling procedure and sample size

The study population comprised all farmers that practise agrobiodiversity conservation in the Niger state of Nigeria. A farmer directory obtained from the Niger State Agricultural Development Programme (NSADP) was adopted as the sampling frame for the study.

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A three-stage sampling technique was used to select respondents for the study: stage one involved a random selection of 20% of the Local Government Areas in the Niger state (it has 25 Local Government Areas); as a result, 5 Local Government Areas were selected, i.e. Bosso, Chanchaga, Agala, Gbako and Kotangora. The second stage involved a random selection of 20% out of the total number of communities from the Local Government Areas selected: Bosso – 14 Communities, Chanchaga – 47 Communities, Agala – 35 Communities, Gbako – 43 Communities and Kotangora – 79 communities. Finally, 150 respondents across all communities were randomly selected and used as a sample. The justification for using percentages at each stage was the need to obtain a sample of manageable size while ensuring equal distribution across the sample frame.

Data collection and the analytical technique

Primary data used for the study was collected through an interview schedule. Only 137 of the interview schedules were deemed useful for the analysis, giving a response rate of 91.33%.

Descriptive statistics such as frequency, percentage, mean, standard deviation and weighted mean score were used to determine the socio-economic characteristics of the respondents while the agrobiodiversity practice usage level among farmers was measured using a 4-point Likert-type scale. Agrobiodiversity practices in the study area were carefully itemised based on the available literature on agrobiodiversity. The scale used was as follows; often = 3, rarely = 2, never = 1. Individual respondent ratings based on the agrobiodiversity practices used were aggregated and a mean score was generated for each practice. Any farmers whose score was below the mean were categorised as a low users, those with scores within the mean were categorised as average users, and those with scores among the mean were deemed high users of agrobiodiversity practices. They were categorised into three categories based on a 1–3 scale range: < 2.00 – low usage level; 2.00–2.99 – average usage level; > 2.99 – high usage level. The perceived benefits of using agrobiodiversity were also measured using a four-point Likert-type scale. Various reasons for practising it were listed and the respondents were required to rate their reason on a 1-4 scale: strongly agree = 4, agree = 3, disagree = 2, strongly disagree = 1. Constraints to agrobiodiversity conservation were measured using a three-point Likert scale. Various constraints associated with agrobiodiversity conservation were listed and respondents were required to rate their level of constraints on a scale of one to three: very serious = 3, serious = 2, not serious = 1. A Pearson Product Moment Correlation (PPMC) was used as inferential statistics to test the hypotheses of the study.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondents

Table 1 shows that the mean age of the respondents was 34.92 years and that 75.2% of them were male and 24.8% were female; this shows that males are more often involved in agrobiodiversity conservation practices. The result contradicts the findings of Lahia (2000), who stated that women in Nigeria participate in most farming activities more often than men. Furthermore, the analysis of the respondents' marital status shows that 72.3% were married – with a household size of five persons (5) – which may suggest that agrobiodiversity conservation practices are a viable method of generating income to satisfy family needs. Also, the mean of years of schooling was 13.89, with 62% of respondents having obtained certification from a tertiary education institution. This shows a high level of literacy among respondents practising agrobiodiversity, which can help enhance their disposition towards using agricultural technologies and hence improve agrobiodiversity practices. The mean annual income of the respondents was found to be N102.000, which is quite low when compared with the average national minimum wage of N30,000. This may be due to a lack of funding opportunities; this would concur with the findings of Olawepo (2010), who stated that both limited capital base and poor accessibility of funding are likely to blame for the small scale of farm holdings and result in a circular flow of poverty among farmers. Years of experience cannot be underestimated in agricultural practices because experience leads to specialisation. The average farming experience of the respondents in the study area was ten (10) years. This implies that respondents practising agrobiodiversity conservation were highly-experienced and specialised in conservation practices.

Table 1. Distribution of respondents according to their socio-economic characteristics (*n* = 137)

Variables	Frequency	Percentages	Mean	SD
Age (years)				
≤25	11	8.1	34.92	10.42
26–35	55	40.1		
36–45	44	32.1		
46–55	20	14.6		
>55	7	5.1		
Sex				
Male	103	75.2		
Female	34	24.8		
Marital status				
Single	27	19.7		
Married	99	72.3		
Divorced	2	1.4		
Widowed	9	6.6		
Household size (persons)				
1–5	92	67.2	5	
6–10	31	22.6		
11–15	10	7.3		
>15	4	2.9		
Years of schooling				
0	15	10.9	13.89	5.45
1–6	16	11.7		
7–12	21	15.3		
Above 12	85	62.0		
Annual income (₦)				
<50,000	12	8.8	₦102,000	
50,000–100,000	33	24.1		
>100,000	92	67.1		
Farming experience (years)				
<10	83	55.3	10 years	
11–20	33	36.1		
21–30	8	8.8		
>30	13	11.2		

Source: field survey, 2019.

Socio-economic characteristics

Agrobiodiversity conservation practice usage level

The results in Table 2 show the agrobiodiversity conservation practice usage level among the respondents. Using manure and plant residues as bio-fertiliser had the mean score of 3.38, which also ranked first (1st) because every farmer typically uses manure and plant residues as fertiliser both to avoid spending money on inorganic fertilisers and due to other benefits, including low application costs, safety and ease of use, boosting plant growth etc. Using some animals and plants part for medical purposes ranked second (2nd), with a mean score of 3.09; this is because the majority of people in the study area are farmers, and as such, they typically still rely on the local medical practices. Using animal blood and bones as blood and bone meal for poultry and fish, as well as using sewage waste from fish ponds as a source of irrigation water ranked third (3rd) and fourth (4th), with a 2.20 and 2.02 mean score, respectively. Using manure to produce biogas ranked seventh (7th), with a mean score of 1.21 while using burnt grass as fertiliser ranked last (11th). The farmers' level of use of egg and snail shell as a source of calcium in animal feed was very low.

Table 3 shows the categorisation of respondents in the study area based on the agrobiodiversity conservation usage level. The low usage level (<2.00) has the highest percentage at 82.5% and is followed by the average usage level (2.00–2.99) at 17.5%, with the high usage level (>2.99) ranking last. The mean score for the usage level is 1.73, which falls within the scope of a low usage level. This indicates that the agrobiodiversity conservation practice usage level for an average respondent in the study area was low. Low level of agrobiodiversity usage implies that the impact of climate change is likely to increase, which is a major threat to both the environment and the local farming community.

The results in Table 4 show the perceived benefits of using agrobiodiversity conservation reported by farmers in the study area. Increasing productivity, food security and economic returns ranked first (1st), with a mean score of 3.78. Helping to maximise the effective use of resources and the environment ranked fifth (5th) and had a mean score of 3.54 while contributing to pest and disease control ranked last (9th), with a mean score of 3.23. This indicates that farmers benefit from using agrobiodiversity conservation practices.

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Table 2. Agrobiodiversity conservation practice usage level

Agrobiodiversity conservation practices	More often	Often	Rarely	Never	M.S.	Rank
	F (%)					
Using manure and plant residues as bio-fertiliser	111 (81.0)	20 (14.6)	5 (3.7)	1 (0.7)	3.78	1st
Using animals and plant parts for medical purposes	29 (21.2)	91 (66.4)	14 (10.2)	3 (2.2)	3.09	2nd
Using blood and bone as poultry and fish feed	12 (8.8)	30 (21.9)	29 (21.2)	66 (48.1)	2.20	3rd
Using sewage waste from fish ponds as a source of irrigation water	20 (14.6)	11 (8.0)	30 (21.9)	76 (55.5)	2.02	4th
Using poultry carcasses and intestines to feed fish	8 (5.8)	21 (15.3)	23 (16.8)	85 (62.1)	1.82	5th
Using natural enemies as bio-pesticides	7 (5.1)	14 (10.2)	20 (14.6)	96 (70.1)	1.34	6th
Using manure to produce biogas (e.g. methane gas)	0 (0)	3 (2.1)	23 (16.9)	111 (81.0)	1.21	7th
Using plant parts as livestock feed	6 (4.4)	5 (3.6)	2 (1.5)	124 (90.5)	1.16	8th
Using some plants parts as snail feed	7 (5.1)	5 (3.6)	6 (4.4)	119 (86.9)	1.06	9th
Using egg and snail shells as a source of calcium in animal feed	14 (10.2)	5 (3.6)	9 (6.6)	109 (79.6)	1.05	10th
Using burnt grass as fertiliser	0 (0)	2 (1.5)	4 (2.9)	131 (95.6)	1.04	11th

*Multiple responses.
Source: field survey, 2019.

Table 3. Respondent categorisation based on the agrobiodiversity conservation practice usage level

Categorization	Frequency	Percentage	Mean
Low (<2.00)	113	82.5	
Average (2.00-2.99)	24	17.5	1.73
High (>2.99)	0	0	

Source: field survey, 2019.

Constraints in agrobiodiversity conservation mentioned by the respondents.

The results in Table 5 show the constraints encountered by farmers practising agrobiodiversity conservation in the study area. They were ranked using the mean score to determine the level of severity of each constraint, as indicated by the respondents. High production costs (mean = 2.56) ranked first (1st) and were regarded as the most severe constraint faced by farmers practising agrobiodiversity conservation; the lack of knowledge on using agrobiodiversity conservation (mean = 2.51), inadequate and ineffective conservation facilities available to farmers (mean = 2.49), uncontrolled population growth (mean = 2.43), lack of adequate agricultural produce marketing outlets in rural areas (mean = 2.41), lack of well-coordinated conservation policies (mean = 2.38), lack of adequate means of transportation (mean = 2.32), inappropriate agricultural systems (mean = 2.22) and insufficient land area (2.06) ranked 2nd, 3rd, 4th, 5th, 6th, 7th, 8th and 9th and were regarded as serious constraints for the respondents in the study area. Culture and religion (mean = 1.84) ranked 10th and were regarded as an insignificant constraint for farmers practising agrobiodiversity conservation in the study area.

Table 4. Perceived benefits of the use of agrobiodiversity conservation practices

Perceived Benefits	Strongly agree	Agree	Disagree	Strongly disagree	M.S	Rank
	F (%)					
Increasing productivity, food security, and economic returns	96 (70.1)	34 (24.8)	2 (1.5)	5 (3.6)	3.78	1st
Improving nutrition and being a source of medicine and vitamins	89 (64.9)	37 (27.0)	6 (4.4)	5 (3.6)	3.62	2nd
Conserving soil and increasing natural soil fertility and health	85 (62.0)	32 (23.4)	16 (11.7)	4 (2.9)	3.61	3rd
Conserving the ecosystem structure and the stability of species diversity	89 (64.9)	31 (22.6)	14 (10.2)	3 (2.2)	3.56	4th
Helping maximise the effective use of resources and the environment	80 (58.4)	48 (32.8)	10 (7.3)	2 (1.5)	3.54	5th
Making farming systems more stable, robust and sustainable	78 (56.9)	50 (36.5)	5 (3.6)	2 (1.5)	3.53	6th
Diversifying products and income opportunities	87 (63.5)	25 (18.2)	18 (13.1)	7 (5.2)	3.50	7th
Reducing the pressure of agriculture on fragile areas, forests and endangered species	76 (55.5)	46 (33.6)	12 (8.7)	3 (2.2)	3.42	8th
Contributing to sound pest and disease control	44 (32.1)	56 (40.8)	19 (13.9)	18 (13.1)	3.23	9th

*Multiple responses.
Source: field survey, 2019.

Table 5. Constraints to the use of agrobiodiversity conservation practices

Constraints	Very serious	Serious	Not serious	M.S	Rank
	F (%)				
High production costs	87 (63.5)	43 (31.4)	7 (5.1)	2.56	1st
Lack of knowledge on the usage of ABCP	85 (62.0)	39 (28.5)	13 (9.5)	2.51	2nd
Inadequate and ineffective conservation facilities available of farmers	83 (60.6)	42 (30.7)	12 (8.8)	2.49	3rd
Uncontrolled population growth	81 (59.1)	39 (28.5)	17 (12.4)	2.43	4th
Lack of adequate agricultural produce marketing outlets in rural areas	73 (53.3)	50 (36.5)	14 (10.2)	2.41	5th
Lack of well-coordinated conservation policies	59 (43.1)	68 (49.6)	10 (7.3)	2.38	6th
Lack of adequate means of transportation	60 (43.8)	49 (35.8)	28 (20.4)	2.32	7th
Inappropriate farming system	52 (37.9)	57 (41.6)	28 (20.4)	2.22	8th
Insufficient land area	37 (27.0)	58 (42.3)	42 (30.7)	2.06	9th
Cultural and religious beliefs	19 (13.8)	68 (49.6)	50 (36.5)	1.84	10th

*Multiple responses.
Source: field survey, 2019.

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H1: There is no significant relationship between the socio-economic characteristics of the respondents and their agrobiodiversity conservation usage level

The results of the Pearson Product Moment Correlation (PPMC) analysis presented in Table 6 revealed the relationship between the socio-economic characteristics and the agrobiodiversity conservation usage level. They show that age has a 1 per cent significance level ($r = 0.276$) while years of schooling ($r = 0.177$) and annual income ($r = 0.213$) have a 5 per cent significance level. Age, years of schooling and annual income all have a positive, significant influence on the farmers' agrobiodiversity conservation usage level in the study area. Education is highly significant in this case. Since agrobiodiversity conservation is a modern farming practice, farmers with a higher level of education are more likely to easily adopt innovations than farmers with a lower level of education. Based on an analysis of the relationship between the farmers' education and their agricultural efficiency in low-income countries, it was discovered that farmers with basic education were 8.7% more productive than farmers with no education (Gasperini, 2000). This finding also implies that the agrobiodiversity conservation usage level should increase along with an increase in age, years of education and annual income – and vice versa.

H2: There is no significant relationship between the respondents' agrobiodiversity conservation usage level and the perceived benefits of agrobiodiversity conservation

Table 6. Results of the correlation analysis showing the relationship between socio-economic characteristics and the agrobiodiversity conservation usage level

Socio-economic characteristics	*r*-value	*p*-value	Decision
Age	0.276**	0.002	Significant
Years of schooling	0.177*	0.048	Significant
Primary occupation	0.052	0.562	Not significant
Annual income	0.213*	0.017	Significant
Years of farming experience	0.038	0.676	Not significant
Household size	0.018	0.846	Not significant

*Correlation is significant at a 0.05 level (2-tailed).
**Correlation is significant at a 0.01 level (2-tailed).
Source: field survey, 2019.

Table 7. Results of the correlation analysis between the perceived benefits and the agrobiodiversity conservation usage level

XXX	Perceived benefit	Level of perceived usage benefits
Perceived benefit	1	0.033
Usage level	0.033	1

Source: field survey, 2019.

The results of the correlation analysis presented in Table 7 revealed a relationship between the perceived benefits and the agrobiodiversity conservation usage levels. They imply that the more the farmers use agrobiodiversity conservation practices, the more benefits these practices bring and hence their use should be encouraged.

CONCLUSION AND RECOMMENDATIONS

The agrobiodiversity conservation practice usage level among farmers in the Niger state of Nigeria was low due to such constraints as high production costs, lack of knowledge about the proper use of agrobiodiversity conservation practices, as well as inadequate and ineffective conservation facilities available to farmers. Additionally, the perceived benefits and agrobiodiversity conservation usage levels were significantly related, which indicates that the more the farmers practised agrobiodiversity, the more benefits it brought them.

The use of agrobiodiversity conservation practices should be further encouraged among farmers through government- and stakeholder-sponsored actions aimed at providing the necessary facilities. Extension agents should disseminate information on the usefulness of agrobiodiversity, especially since it reduces the environmental impact of climate change.

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