Adoption Levels And Sources of Soil Management Practices in Low – Input Agriculture

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Abstract: Socioeconomic characteristics as they affect adoption level and sources of soil management information were investigated in Owerri Agricultural Zone, Southeastern Nigeria in 2005. Structured interview was used as instrument of data collection. Data were subjected to percentage, mean and multiple regression analysis. Results showed that farmers were relatively young, literate and profit-oriented. Agricultural extension agents were the chief sources of information to the arable farmers. Adoption level was highly related with education ($t = 2.82; P \leq 0.05$), age ($t= 2.56$; $P \leq 0.05$) and income ($t= 2.48$; $P \leq 0.05$) Greater information dissemination is suggested through integration of selected arable farmers into Agricultural Development programme (ADP) as "contact" farmers for multiplier effects. [Nature and Science. 2007;5(1):39-45].

Keyword: Adoption level, change agent, humid tropics, low-input farming soil management, soil survey information,

Introduction

Soil survey information is an essential input in the efficient use and sustainable management of soil and soil-related resources. It is required for use in development planning and in eliciting support for policies that favour sustainable natural resources use. Such information should be usable and seen in terms of its value, status, use, accessibility and applicability (Okedi, 1999). He noted that soil information should include description, classification, mapping and evaluation of soils, slope classes and physiographic units of topography , land units; land ownership records; land cover and land use; and environmental requirements of crops. Soil survey information helps soil managers to recommend appropriate management practices. Soil data are scanty (Onweremadu 2006) but fundamental in minimizing food insecurity (Smith et al., 2006). Its scantiness could be responsible for slow progress in combating rural poverty (Jansen et al., 2006).

Lal and Ragland (1993) observed that the available soil data are not translated into problem solving technology. In addition to this, the language of delivery of soil survey information is so complex that physical scientists, social scientists and other land users who need it find it difficult to avail themselves of the information (Akamigbo, 2002). Again, where farmers and other land users are aware of several constraints on-farm, their perception of urgent ones may be at variance with the researchers (Mutsaers *et al.,* 1997). Yet, indigenous knowledge of farming community is rarely considered and incorporated in modern packages for sustainable land use (Oweremadu *et al.,* 2007), hence farmers persist on traditional technologies (Tanko 2003). These and other reasons could be why soil data are rarely used (Smith *et al.,* 2004). In addition to the above Isife *et al.* (2006) reported that low participation and adoption of technologies by farmers is among other things caused by poor field contacts between extension agents and farmers. Where the agricultural extension agents are available poor technical knowledge may hinder communication necessary for effective delivery (Nwachukwu, 2003; Matthews – Njoku et al., 2006).

Efficacy of any agricultural extension is judged by the level of mass adoption and spread of modern and scientific practices among farmers in the rural neighbourhood. In his study of the factors affecting adoption of improved practices by goat farmers in Southeastern Nigeria, Ajala (1992) reported that age, sex, education, herd size, nature of farming, organizational participation, experience and management system were positively related to adoption. Apart form the above, information is relevant in adoption (Minot et al., 2006) in particularly designing geographically targeted programmes for addressing disparities. Information sources are stimulants for adoption (Rogers, 1995), implying hopes for greater adoption in this era of information and communication technology (Venkatesan, 1994; Spore, 2006).

Unfortunately, the results of applying Green Revolution technologies have been slow with yields significantly lower and less uniform (World Resources Institute, 1994; Nerlove et al., 1996). Based on the above and on the need to apply scientific information in sub-Saharan Africa (Wilson, 2001), the major objective of this study was to investigate levels of adoption and information sources available to farmer in Owerri agricultural zone, Southeastern Nigeria.

Materials and methods

Study area: The study area is Owerri agricultural zone of Imo State, Southeastern Nigeria, lying between, latitude $5^0 15^1$ and $5^0 45^1$ N, and longitudes $6^0 45^1$ and $7^0 30^1$E. It has a humid tropical climate. The land area is about 3000 Km^2 and comprises eleven local government areas namely Aboh Mbaise, Ahiazu Mbaise, Ezinihitte Mbaise, Ikeduru, Mbaitol Ngor Okpala, Oguta, Ohaji Egbema Owerri North, Owerri Municipal and Owerri West.

The population density of the agricultural zone is over 500 persons/ km^2 (Agulanna , 1998) and agriculture is the major socio-economic activity, and mainly for the production of staple food crops (Asiabaka; 2005).

Sampling: Field studies were conducted in 2005. Three local government area were purposively selected based on intensity of farming activities. From each of the three local government areas, two towns were randomly selected, as follows: Awara and Umuokanne from Ohaji –Egbema, Agwa and Izombe from Oguta; and Emeabiam and Oforola from Owerri West. Ten arable farmers were randomly selected from each town from a list of 'big' farmer in the local government area. A big farmer is one that has about one hectare or more of arable farmland and duly registered with the Agricultural Unit of the Local Government Area. Thus, 60 arable farmers constituted the sample size for the purpose of the study.

Structured interview schedule was used to elicit information from the farmer.

Validation of interview schedule was done, using content validity method, which is a way of determining the relevance and suitability of items included in the study (Chuta, 1992) .Following the jury method as used by Ajayi (1996), items contained in the draft interview schedule for the research work were subjected to thorough examination and criticism by three lecturers in the Department of Agricultural Extension, Federal University of Technology, Owerri, Nigeria. The relevance and suitability of items determined by lecturer experts formed the basis for the development of final interview schedule which was used collect data for the study. In this study, the following socioeconomic characteristics were investigated: age, educational status, membership of social organizations farm size and estimated income. Adoption levels were estimated using 7 stages of adoption, which include unaware (UA) aware (A), interest (1), evaluation (E), trial (T), adoption (AD) and discontinuance (D).

Data analyses: Frequency distribution, mean and percentages were used in analyzing data collected. Adoption level (dependent variable) was regressed to socioeconomic attributes (independent variables).

Model used is as follows:

$$Y = a+b_1X_1 + b_2X_2 + b_3X_3 +b_4X_4 + b_5X_5 +e\ldots 1$$

Where Y = adoption level of soil management practice
a = Intercept
b_1-b_5 = regression coefficients
X_1 = age
X_2 = education
X_3 = membership of social organization
X_4 =farm size
X_5 = estimated income
e = error term

Results

Table 1 reveals the socio-economic attributes of the arable farmers. Most of the respondents (50.0%), were within 31-40 years showing that farmers are relatively young although a good umber (30%) of the farmers were more than 41 years old.

Only 5% of the respondent had no formal education while a majority (50%) had secondary education, indicating that the enterprise had a good proportion of literate people. Farmers belong to 3 to 4 social organizations, showing high social participation, which serve as a forum through which farmers could exchange ideas about new farm practices (Onu 1991 2005). Eighty-three percent of farm size ranges from 1.1 to 3.0 hectrares and with an estimated average income of N72, 000.00.

The distribution of farmerson different stages of adoption of soil management practices information is shown in Table 2. Organic fertilization, mulching, inorganic fertilization and minimum tillage are highly adopted in the study site while biomass transfer, liming and use of planted fallow are yet to gain grounds in the rationality of farmers. Many farmers are aware of crop rotation practice and herbicide application but are unwilling to adopt them.

In Table 3 are sources of soil information with agricultural extension agents playing a substantial role in informing farmers about soil resource. The ranking shows that least information on soil come to farmers through their children (students) who are in schools (7.08%).

Adoption level related with socio-economic characteristics as given in Table 4. Education had the highest relationship with adoption level ($t = 2.82$), followed by age ($t=2.56$) and estimated income ($t=2.48$). These results are consistent with the findings of Onyebinama (2000) that personal characteristics, especially age and education influence adoption level.

Discussion

Only 2% of the respondents were above 50 years, implying that majority of them were still in their active years, thus vibrant in carrying out farm work. Similar findings were made by Agwu and Chukwu (2006) that only 19% of rice farmers in Aninri local government area of Enugu State, Nigeria were above 50 years old. This is an advantage for adoption and spreading of sustainable soil management practices.

A very good number of the farmers were literate, especially at primary (28 13%) and secondary (50.20%) levels and this enhances transfer of soil management practices and other soil survey information. Rapidly increasing unemployment in industries, ministries and government parastatals has caused many school leavers to opt for agriculture and other menial jobs to sustain life. The literacy level of these farmers is capable of promoting local innovation, particularly in the area of framer led research and extension (FRE) and this will certainly reduce food insecurity.

Majority of the respondents belonged to an average of 3 social organizations since such social organizations may provide a forum for exchange of idea. However, farmers in the study area are communalistic and traditionally would like belong to many social groups as that is indicative of social status. Nonetheless, farmers frequently suggest that other farmers are an important source of information about farming.

With an average of 2.5 hectares of farmland, farmers were able to make N72,000.00 (mean value) under rainfed agriculture. Larger farms may attract more adoption tendencies since no farmer would like entertain crop failure. Further adoption and diffusion of soil management practices and information is likely when high income expectations are projected. Total and near total adoption of organic fertilization, mulching, inorganic fertilization and minimum tillage is not surprising. With the exception of inorganic fertilization others originate from indigenous practices hence their adoption. Adoption of inorganic fertilizers (98%) could be due to decreasing yield resulting form shortened fallow length since fertility regeneration is by fallowing. Although biomass transfer, planted fallows (CTA, 2002) and liming are sound soil management technological packages, farmers are not confident hence low adoption (2%) in each of them. Low adoption of crop rotation despite awareness (40%) and trial (30%) is possibly due to the rural setting of the study site, having relatively large expanse of farmland.

Tremendous impact of agricultural extension agents as information sources compared with other is attributable to the great emphasis of the present government on agriculture at all levels and that may have influenced more literate people choosing farming for livelihood. Contact farmers and/or contact groups receive the technologies first hand from extension agents and other farmers copy from project farmer (Aaji, 2002). But mass media did not contribute much in formation delivery to farmers possibly due to commercialization of mass media stations, which according to Arokoyo (1998) compels extension services to pay exorbitantly for air time. Education ($t = 2.82$), age ($t = 2.56$) and estimated income ($t = 2.48$) were significantly ($P \leq 0.05$) found to be related to adoption level. Training is an added input which enhances good performance and adoption (Meenambigai and Seetharaman, 2003). An educated farmer understands an innovation that may appear complex to an illiterate farmer as the latter prefers to adopt simple technologies (Cary and Barr, 1992). Age had a significant negative relationship ($P < 0.05$) with adoption

level, indicating that older farmers adopt less soil management practices. Results of this study agree with the findings of Ajala (1992), and this suggests that older farmers still hold tenaciously to traditional practice. Farming subcultures influence adoption process (van der Ploeg, 1993). Significant relationship between adoption level and estimated income suggests that farming to the respondents is profit – oriented thus are likely to adopt more technologies so long as income increase. Under the classical model of adoption of commercial innovations the more an innovation will provide concrete economic benefits, the greater the rate of adoption although farmers under certain circumstances do not act in an economically rational way (Van clay, 1992), especially if it is environmentally unfriendly.

Table 1. Distribution of respondents according to socio-economic characteristics (n = 60)

Socio-economic characteristics	Percentage	Mean
Age (Years)		
21-30	15.00	
31-40	50.00	35.0
41-50	28.00	
51-60	2.00	
Educational status		
No formal education	5.33	
Primary education	28.13	
Secondary education	50.20	
Post –Secondary education	13.33	
Membership of Social Organizations	40.33	
1-2		
3-4	53.00	3.0
5-6	6.67	
Farm size (Hectares)		
1.0	10.00	
1.1-20	38.33	
2.1-3.0	45.00	2.5
> 3.1	6.67	
Estimated Income (N)		
60,000,00- 65,000,00	10,00	
65,001,00 -70,000,00	15.33	
70,001.00 – 75,000.00	34.67	72,000.00
75,001.00 – 80,000.00	13.00	
80,001.00 – 85,000.00	8.00	
85,001.00 – 90,000.00	19.00	

(Source: Field Survey, 2005)

Table 2 Distribution of respondents according to stages of adoption (n =60)

	Adoption	Stage						
Soil management practice	UA	A	I	E	T	AD	D	Total
Inorganic fertilization	-	-	-	-	-	98	-	100
Organic fertilization	-	-	-	-	-	100	-	100
Liming	83	-	6	6	3	2.0	-	100
Mulching	-	-	-	-	-	100	-	100
Herbicide application	20	42	30	5	1	2	-	100
Pesticide application	-	2	-	-	10	88	-	100
Minimum tillage	-	5	2	-	3	90	-	100
Use of planted fallow	82	-	10	-	6	2	-	100
Crop rotation	-	40	10	10	30	10	-	100
Biomass transfer	83	7	-	5	3	2	-	100

UA = unaware , A = aware, I = interest , E = evaluation, T – trial AD = adoption,
D= discontinuance
(Source: Field survey, 2005)

Table 3. Sources of soil information for soil management by rank (n= 60)

Source of soil information	Percentage
Agricultural Extension Agents	30.05
Dealers on agrochemical	18.70
Farmers organizations	17.45
Mass media	16.49
Agricultural Exhibition/shows	10.25
Students	10.25
	7.08

Source: Field Survey, 2005).

Table 4. Multiple regression analysis on the relationship between adoption level and socio-economic attributes (n =60)

Independent variable	Coefficient	SE	T-value	F-ratio	R^2
Constant	4.83	0.51	10.09*	2.98	0.4
Age	-0.08	0.02	-2.56*		
Education	0.09	0.01	2.82*		
Membership of soil organization	0.43	0.16	0.88 NS		
Farm size	-0.06	0.01	-0.68 NS		
Estimated income	0.32	0.02	2.48*		

SE = Standard error, * Significant at $P < 0.05$
NS = not significant

Conclusion

This study revealed that arable farming was dominated by relatively young and educated people who can taken enhance adoption and soil management technological transfer. Results also indicated that farmers are exposed to a wide range of impersonal sources of soil information and have potentials of disseminating such soil information to neighbouring farmers. Again, age, education and income dictate adoption status in the study area.

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References

1. Agulanna EC. The Mbaiseness of Mbaise 1-0 Publishers, Owerri, Nigeria 1998.
2. Agwu AE, Chukwu PC Intra-household roles and constraints in rice cropping systems in Aninri local Government Area of Enugu State, Nigeria International Journal of Agricultural and Rural Development 2006, 7:1-9
3. Ajala AA Factors associated with adoption improved practices by goat producers in Southeastern Nigeria. Research mimeograph no 5, Department of Agricultural Extension, University of Nigeria, Nsukka, Nigeria 1992; pp. 14
4. Ajala AA. Factors associated with adoption of improved practices by goat producers in Southeastern Nigeria. Research mimeograph No. 5 Department of Agricultural Extension, University of Nigeria, Nsukka Nigeria 1992; pp. 14
5. Ajayi AR. Changes in behaviour and social status as perceived by participating farmers in agricultural development projects in Ondo and Enugu States, Nigeria. Agro-Science 2002; 3: 47-54
6. Akamigbo for. Applications of soil survey information for agriculture and environment in Nigeria. Paper presented at the 5 –day Us- Nigeria Technical Assistance Programme, 2nd Soil Survey Workshop, NRCRI Umuahia 2002; pp. 11.
7. Arokoyo T. Agricultural technology development and dissemination: A case study of the Ghana and Nigeria experiences. The Netherlands Technical Centre for Agricultural and Rural Cooperation (ACP-EU) Wageningen 1998.
8. Asiabaka CC. Agriculture in Imo State: Its Policy Status and the way forward. Paper presented at the 2005 Imo State Council on Agriculture. 7th March, 2005.
9. Cary J, Barr N. The semantics of forest cover: How green was Australia ? In: Lawewnc G. Vanclay, Furze B (Eds). Agriculture, environment and society, Macmillan, Melbourne 1992.
10. CTA Agroforestry in Malawi and Zambia. Summary report of a CTA/MAFE study visit CTA Wageningen, The Netherlands 2002, pp.32.
11. Isife BI, Emah GN, Akahome Al. Evaluation of the agricultural extension programmes of Shell Petroleum Development Company in Rivers State, Nigeria. International Journal of Agriculture and Rural Development 2006; 7: 12-120
12. Jansen HGP, Pender J, Damon A, Shipper R. Rural development policies and sustainable land use in the hillside areas of Honduras: A quantitative livelihoods approach. Research Report 147 International Food policy Research Institute, Washington DC, 2006. pp 103
13. Lal R., Ragland J. Agricultural sustainability in the tropics. ASA Special Publications 1993; 56:16
14. Matthews-Njoku EC, Asiabaka CC, Adesope OM. Extension agents technical knowledge requirements for effective extension work. International Journal of Agriculture and Rural Development 2006; 7: 121-124
15. Meenambigai J, Seetharaman RN. Training needs of extension personnel in communication and Transfer of technology. Agricultural Research and Extension Network Newsletter No 48 2003; pp 19
16. Minot N, Baulch B, Epprcht M. Poverty and inequality in Vietnam: Spatial patterns and geographic determinants. Research Report 148, International Food Policy Research Institute Washington DC 2006; pp. 72.
17. Mutsaers HJW, Weber GK, Walker P, Fischer NM. A field guide for on-farm experimentation. International Institute of Tropical agricultural/CTA/ISNAR 1997; pp 235.
18. Nerlove M, Vosti S, Basel W. Role of farm-level diversification in the adoption of modern technology in Brazil. Research Report 104, International Food Policy Research Institute, Washington DC 1996; pp. 53
19. Nwachukwu I. Agricultural communication: Principle and practices. Lamb House Publishers Umuahia 2003.
20. Okedi J.Y. Information support for natural resources management policy formulation in Uganad. Proceedings of a CTA Workshop on Information Support for Natural Resource management Policy, Wageningen, The Netherlands, 26-29 January 1999, pp. 131 -144.

21. Onu DO. Analysis of factors influencing farmers' adoption of alley farming technology under intensified agriculture in Imo State, Nigeria, using a Qualitative choice model: Agro forestry systems International 2005; 29 (4): 76-187.
22. Onu DO. Factors associated with small scale farmers adoption of improved soil conservation technologies under intensified agriculture in Imo State, Nigeria. Ph.D These of the University of Nigeria, Nsukka, Nigeria 1991.
23. Onweremadu E.U. Application of geographic information system on soil and soil-related environmental problems in Southeastern Nigeria. Ph.D) Thesis of the University of Nigeria, Nsukka, Nigeria. 2006 pp 472
24. Onweremadu EU, Asiabaka CC, Adesope AM, Oguzor NS. Application of indigenous knowledge on land use activities among farmers in Central Southeastern Nigeria. Online Journal of Earth Sciences 2007; 1: 47-50
25. Onyebinama UAU. Technology adoption and food security: The role of the Nigeria agricultural insurance scheme. Agro- Science 2000; 1:1 -4
26. Rogers EM. Diffusion of innovations. Fourth edition. The Free Press, New York 1995; pp. 21-45
27. Smith J Paper S. Holderness M Knowledge –based soil health sustainable agriculture. CABI Science, U.K. 2004; pp 2-3.
28. Smith L.C. A Duayom D. Food insecurity in Sub-Saharan Africa: New estimates from household expenditure surveys Research Report International Food Policy Research Institute, Washington DC 2006, pp 122.
29. Spore. Creating a virtual community, Information for agricultural development in ACP Countries , CTA December 2006; pp 4-5
30. Tanko L. Optimum combination of farm enterprise in Kebbi State, Nigeria: A linear programming approach. A Ph.D Dissertation of the Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike Abia State Nigeria 2003.
31. van der Ploeg JD. Rural sociology and the new agrarian question: A perspective from the Netherlands, Sociologia Ruralis 1993; 33:240-260.
32. Venkatesan V. The World Bank's experience with training and visit to Africa: Issues for future agricultural extension in Africa. Proceedings of an International Workshop held in Cameroun, October 10-14, CTA Publications 1994; pp. 28
33. Wilson E. Applying science to sub – Saharan Africa's food needs. In: Pinstrup – Andersen, P, Pandya-Lorch R. (Eds). The Unfinished agenda. International food policy research Institute, Washington D.C. 2001; pp. 165-169
34. World Resources Institute. World resources 1994-95 database, World Resources Institute, Washington DC 1994.