Adoption Scale Analysis of Improved Cocoyam Production, Production and Storage Technologies across Gender in Enugu North Agricultural Zone of Enugu State Nigeria

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ADOPTION SCALE ANALYSIS OF IMPROVED COCOYAM PRODUCTION, PROCESSING AND STORAGE TECHNOLOGIES ACROSS GENDER IN ENUGU NORTH AGRICULTURAL ZONE OF ENUGU STATE NIGERIA

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Abstract
This study was undertaken to determine the adoption of improved cocoyam production, processing and storage technologies among small-holder cocoyam farmers in Enugu-North Agricultural Zone in Enugu state. A multi-stage random sampling technique was used to select 120 cocoyam farmers disaggregated into 60 males and 60 female in 2008. Adoption scale analysis was employed to analyze the level of adoption of cocoyam technologies as well as percentages, means and frequency distribution. The results show that most of the technologies were not adopted and unaware by both farmers. Technologies that scored 3.0 and above were adopted but those below 3.0 were rejected. Both farmers adopted technologies like time of planting, use of fertilizer and left un-harvested and heaping on the floor after harvesting. Technologies such as time of planting, May- June(3.0), fertilizer application NPK 20.20.10 (3.3), storage facilities like treating with fungicide (3.1), and left un-harvested (3.08) were adopted by male farmers; while time of planting (3.05), use of mulching material (3), use of fertilizer(3.08), crop mixture with arable crops (3.57) harvesting at 81-12 months after planting (3.25), storage methods like left underground (3) and heaping on the flour (3.38) were adopted by the female farmers. The study calls for policies to ensure women's entitlement to productive resources and to target women in the extension delivery system.

Keywords: Adoption Scale, Cocoyam Production, Processing and Storage Technologies and Gender

Introduction

Nigeria is the world's largest producer of cocoyam. The average production figure for Nigeria is 5,068,000mt which accounts for about 37% of total world output of cocoyam (FAO, 2007). There are two main edible types of cocoyam in Nigeria viz *Colocasia exculenta* (L) scholt otherwise known as taro and Xanthosoma saggittifoluim also known as tannia. The former is by far more popular than the later. Both are members of Araceae family. Taro (*Colocasia* spp) is a member of the grown throughout the southern belt of Nigeria for its edible corms, cornels and leaves as well as for its traditional ceremonial uses. It is believed to have originated from India and other parts of South East Asia (FAO 1988).

Cocoyam is a tuber crop used mainly for human food. It is commonly grown amongst small scale farmers who operate within the subsistence economy. In the past, it is regarded as a lowly important crop which cultivation and consumption lie within the less privileged farmers. Eleje (1987) had observed that as far as 1975, the Nigeria Academy of Science has campaigned against the derogatory perceptions of cocoyam and predicted that the crop may not be a 'poor man's or "woman crop" after all but rather a crop with promising economic values. However, he also observed that despite the campaign and predictions, cocoyam production, research and development have not received appreciable attention when compared with other root crops like yam and cassava.

Cocoyam can be processed into several forms such as flour for soup thickening is a common practice in the food systems of South-Eastern households. Presently, the flour is finding its way into the supermarkets in beautiful packages as an emerging globalized food. It can also be consumed as chips prepared by deep fat frying like the popular potato chips. Cocoyam chips are so much delighted by children and youths as school snacks & take away. Similarly, several confectionaries such as biscuits, chinchin, flakes and balls have been produced from flours of cocoyam through various value addition technologies developed by NRCRI Umudike, Nigeria. By so doing, the consumption of cocoyams has been diversified and increased while new market frontiers are being opened.

The most important determinant of the effectiveness of research results is the level of adoption of innovations that it generates, and on their profitability (Caswell *et al.*, 2001). In addition, the faster the research can be completed, the higher the turnover of benefits. Moreover, the more evident research results are, the easier it is to justify the implementation of, and continued investment in research programs. A common problem for many individuals and organizations is how to speed up the rate of diffusion of a research program's innovations (Rogers, 1995).

Methodology

The study was carried out in Enugu North Agricultural Zone of Enugu State. Enugu North Agricultural Zone is made up of eight (8) blocks which include Nsukka I, Nsukka II, Igbo- Etiti, Igbo-Eze South, Igbo-Eze North, Uzouwani I, Uzouwani II and Udenu. Within the zone, two blocks (Nsukka I and Igbo- Eze South) were purposively selected for the study based on cocoyam cropping intensity. Multi-Stage random sampling techniques were adopted for the study. In the first stage, two blocks were selected. Three (3) circles were randomly selected from each block. One sub-circle was selected from each circle selected, and finally 10 female and 10 male farmers were interviewed. This gave a total of 120 farmers or respondents. Data were collected from the respondents using structured interview schedule which was distributed to small-holder farmers. Descriptive statistics like frequencies, means, percentages, and tables were used to analyze the socio-economic characteristics of the farmers. Adoption scale analysis was employed to analyze the level of adoption of cocoyam technologies. Level of adoption of the technologies in cocoyam production was used using the 7point likert scale; unaware (0), aware (1), interest (2) evaluation (3), trial (4), accept (5) and reject (6). Farmers with adoption score of 3.0 and above were regarded as having reached average score of technology i.e. they are at evaluation stage while farmers with adoption score of less than 3.0 were either at unaware, aware, and interest stages.

To determine the mean of the adoption level = xs = $\frac{\sum x}{n}$ the mean score. Xs of each item was computed by multiplying the frequency of each response pattern with its appropriate nominal value and dividing the sum with the number of respondent to the items. This can be summarized with equation below.

XS = $\sum$ fn/n

Where Xs =mean score

$\sum$ = summation

F = frequency

N = likert nominal value

Nr = number of the respondents

$$XS = \frac{0 + 1 + 2 + 3 + 4 + 5 + 6}{7} = \frac{21}{7} = 3$$

Results and Discussion

Socio-economic characteristics of the respondents

Table 1 shows that, majority of the male farmers (76.7%) were married, 20% were single and 3.3% were divorced while 66.7% of the female farmers were married, 16.7% were single and 16.70% were divorced. This implies that married people dominate in agricultural activities in the study areas. More than 56.7% of the female respondents were within 25-53 years old and 43.3% were above 53 years old. About 70% of the male respondents were between 25-53 years old and 30% were above 53 years old. Age is said to be a primary latent characteristic in adoption decisions. However there is contention on the direction of the effect of age on adoption (Bonabana-Wabbi, 2002). Nwaru (2004) found out that the ability of a farmer to break risk, be innovative decreases with age. About 37% of the male farmers had no formal education while 63.3% had formal education. About 10% of the female farmers had no formal education, while 90% of them attained formal education. This implies that male illiterate farmers dominate in the study area. Educated farmers are expected to be more receptive to improved farming techniques, while farmers with low level of education or without education would be less receptive to improved farming techniques (Okoye *et al.*, 2004). About 37% of the male respondents had less than 4 years of farming experience and 68% had more than 4 years of farming experience while 70% of the female respondents had more than 4 years of farming experience; and 30% had less than 4 years farming experience.

Table 1. Distribution of Small-Holder Male and Female Cocoyam Farmers according to Socio-Economics Characteristics.

Socio-Economic characteristics	Percentage	Percentage
Marital status	**Male**	**Female**
Singled	20.0	16.7
Married	76.7	66.7
Divorced	3.3	16.7
Age (years)		
25-30	3.3	3.33
31-36	5.0	6.7
37- 42	21.6	16.7
43- 48	21.6	13.3
49-53	18.5	16.7
> 53	30.00	43.3
Educational level		
No schooling	36.7	10.0
Primary	11.7	33.3
Secondary	26.6	26.7
Tertiary	25.0	30.0
Farming experience (years)		
< 4	36.7	30.0
4-8	8.3	33.3
9-12	23.3	13.3
13-17	30.0	23.3
>17	1.7	0.0
Farm Size (Hectare)		
0.2-0.6	11.7	10.0
0.7-1.2	45.0	50.0
1.3-1.8	6.67	6.7
1.9-2.4	25.0	16.7
2.5 and above	10.0	16.7
Household Size		
0-4	31.7	26.7
5-8	38.3	46.7
9-12	18.3	26.7
>12	11.7	0.00
Occupation		
Full-time farmer	75.0	40.0
Part-time farmer	25.0	60.0

Source: Field Survey, 2008.

With more experience, a farmer can become less averse to the risk implied by adopting a new technology. Majority of the male respondents (57%) had cocoyam holdings of less than 1.2 hectares. The female respondents (60%) had cocoyam holdings of less than 1.2 hectare, and about 40% had farm size of more then 1.2 hectares. The result, indicate that cocoyam production in the study area is dominated by small-holder scale producers. Farm size affects adoption costs, risk perceptions, human capital, credit constraints, labor requirements, tenure arrangements and more. With small farms, it has been argued that large fixed costs become a constraint to technology adoption (Abara and Singh, 1993) especially if the technology is costly. A large percentage (68.3%) of the male respondents had household size of 5 persons and above and 31.7% had household size of less than 5 persons. On the other hand, majority of the female respondents (73.3%) had household size of 5 persons and above while 26.7% had less than 5 persons. A larger household size would be expected to increase the probability of adoption of innovations. Effiong (2005) reported that a relatively large household size enhance the availability of labour. The table also showed that 71% and 40% of the male and female farmers

respectively were full time farmers. Full time farmers are expected to have higher adoption rate of weed control technologies.

Table 2 shows, the different level of adoption of technologies in cocoyam by male and female farmer,

Table 2. Percentage Distribution of Male and Female Respondents by Stages of Adoption of the Technologies in Cocoyam Production, Processing and Storage

	Unaware		Aware		Interest		Evaluation		Trial		Adoption		Reject		Adoption Score	
Production Technologies																
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	11.7	15	35	28.3	16.7	21.7	13.3	3.3	10	5	10	11.7	3.3	15	2.35	2.5
2	3.3	6.7	31.7	26.7	8.3	10	3.3	8.3	13.3	15	31.7	26.7	8.3	6.7	3.2	3.05
3	10	13.3	31.7	25	16.7	16.7	60	15	6.7	15	25	11.7	5	3.3	2.6	2.42
4	11.7	13.3	26.7	25	16.7	10	10	10	5	20	23	18.3	6.7	3.3	2.67	2.67
5	25	5	33.3	36.7	1.7	6.7	3.3	5	3.3	6.7	23	31.7	10	8.3	2.34	3
6	6.7	5	30	23.3	5	15	8.3	15	11.7	8.3	30	23.3	8.3	10	3.3	3.08
7	11.7	16.7	25	26.7	28.3	10	13.3	6.7	13.3	16.7	5	21.7	11.7	1.7	2.4	2.65
8	13.3	16.7	31.7	28.3	5	10	10	5	11.7	15	6.7	5	21.7	18.3	2.81	2.76
9	5	16.7	43.3	16.7	26.7	13.3	6.7	10	3.3	8.3	13	8.3	1.7	23.3	2.06	2.88
10	1.7	5	50	16.7	8.3	21.7	1.7	16.7	10	16.7	23	30	5	5	2.58	3.57
11	33.3	10	18.3	15	16.7	16.7	10	6.7	3.3	10	11.7	3.3	6.7	18.3	1.93	2.35
12	26.7	13.3	20	48.3	15	11.7	6.7	11.7	6.7	16.7	3.3	1.7	21.7	3.3	2.43	2.15
13	13.3	6.7	33.3	31.7	6.7	16.7	6.7	10	11.7	13.3	23.3	15	3.3	3.3	2.58	2.43
14	15	10	21.7	28.3	10	3.3	8.3	6.7	3.3	5	16.7	10	8.3	33.3	2.13	3.25
15	45	13.3	6.67	15	13.3	16.7	5	6.7	15	10	11.7	13.3	3.3	10	1.87	2.35
Processing Technologies																
16	20	13.3	20	16.7	5	13.3	6.7	10	16.7	11.7	23.3	10	8.3	11.7	2.8	2.27
17	21.7	28.3	30	33.3	8.3	15	3.3	13.3	15	13.3	15	13.3	6.7	6.7	2.31	2.5
18	36.7	8.3	28.3	30	3.3	16.7	6.7	13.3	3.3	3.3	6.7	15	21.7	6.7	2.25	2.65
Storage Technologies																
19	8.3	41.7	25	8.3	8.3	6.7	5	5	6.7	13.3	23.3	16.7	16.7	23.3	3.1	2.35
20	3.3	5	36.7	36.7	6.7	6.7	5	6.7	5	8.3	30	31.7	10	8.3	3.08	3
21	10	10	38.3	36.7	3.3	1.7	18.3	11.7	18.3	11.7	15	13.3	3.3	6.7	2.25	2.48
22	40	26.7	16.7	15	10	15	1.7	15	10	8.3	6.7	6.7	11.7	6.7	1.73	2.08
23	13.3	1.7	23.3	40	5	15	3.3	8.3	8.3	11.7	23.3	33.3	15	26.7	3.2	3.38
24	13.3	15	23.3	31.7	5	6.7	3.3	18.3	3.3	11.7	23.3	16.7	15	8.3	3.18	2.12

Where,

TEC= technologies ranging from 1-24

Production Technologies

1. 22g sett of cocoyam; 2. time of planting (may-june); 3. spacing adopted (60cmx60cm); 4. 50cmx50cm for mixed cropping; 5. use of mulching materials; 6. NPK 20:10;10 fertilizer; 7. planting depth (10-50cm); 8. pest control; 9. weed control; 10. crop mixture (arable crops); 11. crop mixture (tree crops); 12. use of manure; 13. side dressing application; 14. harvesting (8-12 months after harvesting); 15. control of CRRBC;

Processing Technologies

16. starch; 17. flakes; 18. flour

Storage Technologies

19. treat with fungicide; 20. left unharvested; 21. packing on spot; 22. dusted with wood ash; 23. heaping on floor; 24. arrange on raised platform.

The result shows that spacing of 50x50cm had the highest evaluation (60%) for the male farmers only while 15% of the female farmers were at evaluation level. Arranging of cocoyam on raised platform had highest evaluation (18.3%) for the female farmers while that of the male farmer had 3.3%. The result also shows, that time of planting, use of NPK 20:10:10 fertilizer, and left un-harvested as storage method were at adoption stage had 31%, 30%, and 30% respectively for the male farmers while use of mulching material, crop mixture with arable crops, left un-harvested and heaping on floor as storage method had the adoption score of 31.77%, 30%, 31.7% and 33.3% respectively for female farmers. Technologies like control of CRRBC, dusting cocoyam with wood ash, crop mixture with tree crops and use of manure had 45%, 40%, 33%, and 26.7% respectively were at unaware level for the male respondent while treating cocoyam with fungicide, (41.7%)

processing cocoyam to starch, (28.3%) and dusting cocoyam with wood ash, (27%) were at unaware level for the female respondents. About forty-eight percent of the female farmers were at awareness stage for the use of manure while that of the male farmers had 33.3% of the same technology. Generally, the findings depict that majority of the technologies were at interest stage for both male and female farmers. Furthermore, technologies like time of planting (may- June), use of NPK20:10:10 fertilizer, left un-harvested, heaping on floor, arranging on raised platform had adoption score of 3(three) and above for the both farmers. This implies that they are at evaluation stage. Technology like treating cocoyam with fungicide, and arranging cocoyam on raised platform were at evaluation stage for the male farmers only while harvesting after 8-12 month of planting, crop mixture with arable crops, use of mulching material were at evaluation level for the female farmers only. This indicates that most of the technologies were within interest and evaluation stages and have not gone beyond evaluation stage.The findings also show that crop mixture with tree crops, dusting of cocoyam with wood ash as storage method, and controls of CRRBC had the mean score of 1.93, 1.73, and 1.87 respectively and were at awareness stage for the male farmers only, where that of the female respondents were at interest level. This concludes that female farmers were receptive of most technologies than the male farmers.

Conclusion

The study revealed the need for creating awareness of cocoyam technologies in the zone. Technologies such as time of planting, time of harvesting, left underground and heaping on the flour and crop mixture with arable crops were still at evaluation level for the female farmers. Technologies like treatment with fungicide, left un-harvested, heaping on flour, arrangement on raised plat form and time of planting, use of fertilizer were at evaluation level for the male farmers. The results calls for policies aimed at scaling up the adoption of cocoyam technologies in the zone by the extension system.

References

Abara, I. O. C. and S. Singh. (1993) "Ethics and Biases in Technology Adoption: The Small Farm Argument." *Technological Forecasting and Social Change.* 43 : 289-300.

Banabana-Wabbi, J (2002) Assessing Factors affecting Adoption of Agricultural Technologies: The Case of Integrated Pest Management (IPM) in Kumi District, Eastern Uganda. Unpublished M.Sc Thesis, Dept. of Agricultural and Applied Economics, Virginia Polythecnic Institute and State University USA.

Caswell, M., K. Fuglie., C. Ingram., S. Jans and C. Kascak (2001). *Adoption of Agricultural Production Practices: Lessons learned from the US. Department of Agriculture area studies Project.* Washington DC. US Department of Agriculture. Resource Economics Division, Economic Research service, Agriculture Economic Report No. 792. January 2001.

Effiong, E.O. (2005) Efficiency of Production in Selected Livestock Enterprises In Akwa-Ibom State, Nigeria. Unpublished Ph.D Dissertation. Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike.

Eleje I. (1987) Cocoyam, a Major National Carbohydrate Stale for the Future in Nigeria. Proceeding of 1st National Workshop on Cocoyam held at NRCRI, Umudike Nigeria August 5 –21, P11.

FAO (2007) FAOSTAT Statistics Division of the Food and Agriculture Organization, http://faostat.fao.org

Food and Agriculture Organization (1988) Root and Tuber Crops, Plantain and Bananas in Developing Countries; Challenges and Opportunities. Serial Paper No. 87. Pp. 11-13.

Nwaru, J.C. (2004) Rural Credit markets and Arable Crop production in Imo State of Nigeria. Unpublished Ph.D Dissertation Michael Okpara University of Agriculture, Umudike, Nigeria.

Okoye, B. C., Okorji, E. C and Asumugha, G. N (2004) Outlook on Production Economics of Paddy Rice under Resource constraints in Ebonyi State. Proc. of the 38th Annual Conference of the Agricultural Society of Nigeria. (ASN), 17- 21 Oct. 2004, Lafia Nasarawa State. Pp 337-342.

Rogers, E.M (1983) *Diffusion of Innovations.* 3rd Edition. New York: The Free Press, 1983.__4th Edition. New York