academicJournals

Vol.7(12), pp. 322-329, December, 2015
DOI: 10.5897/JAERD2015.0694
Article Number: C0C16AC56224
ISSN 2141-2170

http://www.academicjournals.org/JAERD

Journal of Agricultural Extension and Rural Development

Full Length Research Paper

Pattern of adoption and constraints to adoption of improved cowpea varieties in the Sudan Savanna zone of Northern Nigeria

J. J. Mbavai[1*], M. B. Shitu[1], T. Abdoulaye[2], A. Y. Kamara[2] and S. M. Kamara[1]

[1]Department of Adult Education and Community Services, Faculty of Education, Bayero University Kano (BUK), Kano State, Nigeria.
[2]International Institute of Tropical Agriculture (IITA), PMB 5320, Oyo Road, Ibadan, Oyo State, Nigeria

Received 13 April, 2015; Accepted 11 August 2015

A survey was carried out in 10 communities in Musawa Local Government Area of Katsina State to identify the pattern and constraints to adoption of improved cowpea varieties introduced by the Sudan Savanna Taskforce project. The survey was undertaken after three years of project intervention. Results revealed that 35.7% of farmers adopted the improved cowpea varieties, significantly higher than the number of farmers adopting prior to project interventions. Majority of the farmers who adopted improved cowpea varieties were male farmers (86.0%), participants in cowpea related activities (78.5%), farmers who had extension contacts (89.7%) and were young within the age bracket of 25-54 years (85.0%). Non-availability of seeds and fertilizer when needed, high cost of fertilizer, pests and diseases were revealed as the major constraints facing farmers in the study area. It was therefore recommended that Government together with other development agencies should encourage women participation in crop production and subsidize farming inputs so as to remove any barrier that will hinder their participation in farming. The Government should subsidize farm inputs like improved seeds and fertilizers so as to enable farmers afford and finally farmers should be sensitized on where to access the improved seeds and fertilizers.

Key words: Adoption, pattern, constraints.

INTRODUCTION

Cowpea (*Vigna unguiculata*), is one of the major crops grown in Katsina State. As a legume, it is important for nutrient cycling because of its tolerance to drought and soil acidity as well as its ability to fix nitrogen from the air. It is very well suited to where decline in soil fertility and drought are serious problems. It is a major staple food and cash crop in the State. The seeds are a major source of plant proteins and vitamins for man, feed for animals, and also a source of cash income. According to Bressani (1985), cowpea grain contains about 25% protein and 64% carbohydrate and according to Inaizumi et al. (1999) the crop has a tremendous potential to contribute to the

*Corresponding author E-mail: jmbavai@yahoo.com. Tel: +2347031653684, +2348025282497.

alleviation of malnutrition among resource-poor farmers and to enhance food security and the productivity and sustainability of the crop-livestock system. In Nigeria, farmers who cut and store cowpea fodder for sale at the peak of the dry season have been found to increase their annual income by 25% and also plays an important role in providing soil nitrogen to cereal crops such as maize, millet, and sorghum, when grown in rotation, especially in areas where poor soil fertility is a problem (Dugje et al., 2009).

Cowpea is a low cost nutritious food that does not require refrigeration. It fits the condition of the urban poor. It is a versatile African crop: it feeds people, their livestock and the next crop, and is referred to as the "hungry-season crop" given that it is the first crop to be harvested before the cereal crops are ready. It is a crop that offers farmers great flexibility (Coulibaly et al., 2010). The dry grain and fodder yield are two most important components of cowpea (Mahalakshmi, 2004). According to Moalafi et al. (2010), cowpea is a staple food in many regions of Africa. Its desirability reflects the fact that the leaves, immature pods, fresh seeds (southern pea or “green pods”), and the dry grain are popularly eaten or marketed. According to Singh et al. (2003), some varieties have a short cycle and mature early and thus are able to provide food during the hungry period, usually at the end of the wet season when food availability can become extremely scarce in semi arid regions of Sub-Saharan Africa.

However, despite the potential for further yield increases, cowpea production faces numerous problems including insect pest attack, *Striga gesneroides* parasitism, disease, drought, low and erratic rainfall, and long dry season (Singh and Tarawali, 1997; Inaizumi et al., 1999; Singh et al., 2002). According to International Institute of Tropical Agriculture (IITA, 2006), every stage in the life cycle of cowpea has at least one major insect pest. Also, since cowpea is grown mainly in the dry savanna areas with no irrigation facilities, irregular rainfall especially early in the season have adverse effects on the growth of the crop. All of these factors, singly or combined, are responsible for the low grain yield, estimated at approximately 350 kg/ha that farmers in Northern Nigeria including Katsina State obtain from their cowpea fields.

Strong agricultural research for development is crucial for improving agricultural productivity and efficiency, which in turn will lead to agricultural development, food security, and poverty reduction. In an attempt to address these issues, several efforts have been made over the decades to strengthen National Agricultural Research Systems (NARS) in numerous developing countries. Many development projects have sought to remove some of these constraints by introducing facilities to provide credit, information, the orderly supply of necessary and complementary inputs, infrastructure investment, marketing networks, etc. The (IITA) has made effort to develop several improved varieties of cereal and legume crops that are high yielding, early maturing, resistance to drought and striga among others in order to enhance farmers’ productivity and income. Despite the development of a large number of improved cowpea varieties, farmers in northern Nigeria including Katsina State have continued to grow predominantly local varieties.

According to Kamara et al. (2009), the limited use of improved varieties in a predominantly cowpea growing region may be due to several factors; lack of information on improved cowpea varieties, unavailability of seed, or the unacceptability of new varieties due to low market values or unsuitability for the farming system.

In 2008, the Sudan Savanna Taskforce project was set up to disseminate improved agricultural technologies in northern Nigeria including Katsina State. Among the technologies promoted by the project in the State are improved cowpea varieties. In achieving its objectives, the Sudan Savanna Taskforce used Innovation Platforms (IPs) comprising a coalition of partners and stakeholders have been setup, one in Musawa Local Government Area and another in Safana Local Government Area all in Katsina State. The project is particularly concerned with agricultural intensification and integrated natural resource management to improve the rural livelihoods in the Sudan Savanna. The collaborating partners include scientists from the Institute for Agricultural Research (IAR), Samaru, IITA, NGOs, private sector actors, policymakers (especially at the local level) and the Katsina State Agricultural and Rural Development Authority (KTARDA) which provides extension services. This group constitutes the nucleus of the innovation platform.

There have been reports by farmers that they have adopted the improved varieties of cowpea introduced by the Sudan Savanna Taskforce project but there is no adequate information provided regarding the category of farmers that have adopted the improved cowpea varieties. There is also no information on the varieties that have been adopted, and the reasons for adoption. Information is also lacking on constraints farmers are facing in the process of adopting the crop. This study focused on; examining the pattern of adoption of improved cowpea varieties, reasons for the adoption of improved cowpea varieties and identifying problems faced by cowpea farmers.

METHODOLOGY

Musawa LGA is one of the two Innovation Platforms in Katsina State established by the Sudan Savanna Taskforce project; the other being Safana LGA. Musawa IP is also known as the maize-legume-livestock innovation platform by the project and covers the entire Musawa Local Government Area. It is located within the Sudan Savanna Agro Ecological Zone (AEZ) and is geographically located across Longitude 7°40´11´´ East of the Greenwich Meridian and Latitude 12°7´48´´ North of the Equator. It is found in the

Table 1. Percentage distribution of adopters of general cowpea and improved cowpea variety by gender

Gender	Grow cowpea	Grow improved cowpea
Male	90.3(271)	30.7(92)
Female	9.7(29)	5.0(15)
Total	100.0(300)	35.7(107)

Source: Field survey (2011), ( ) = Frequency.

Table 2. Percentage distribution of Adopters of improved cowpea varieties by participation and extension contact.

Participation (N = 107)	Frequency	Percentage of respondents
Participants	84	78.5
Non-participant	23	21.5
Extension contact (N = 107)		
Yes	96	89.7
No	11	10.3

southern part of Katsina State. The Local Government Area enjoys tropical wet and dry climate with relatively wind and rapid change in temperature and humidity. The highest amount of rainfall in the area normally falls between June and September. The mean annual rainfall ranges between 450 and 650 mm per annum; with duration of not less than three (3) months and not more than five (5) months, (that is, between May to September). The mean temperature of the area ranges from 14°C as the lowest to 33°C as the highest.

The farming household population for the ten (10) communities (study area) based on census conducted by the project was estimated at 21,800 (Sudan Savanna Taskforce, 2009). Two-stages of sampling techniques were carried out to select the sampled communities and respondents. In the first stage, a purposive sampling technique was used to select villages from the where the project promoted improved cowpea technologies. The second stage was a simple random selection of respondents that included participants and non-participant.

Participants were those farmers who participated in the Sudan Savanna Taskforce project's activities (those given improved seed directly or indirectly, who attended trainings, field days and demonstrations). The pattern of adoption explains which of the cowpea varieties was mostly adopted by farmers, which category of farmers adopted the improved cowpea varieties that includes: Participating and non participating farmers, male and female farmers, farmers who had extension contacts and those who did not and which of the project communities adopted the most.

Among the respondents selected were: one hundred and fifty (150) participant or direct beneficiaries and one hundred and fifty (150) non-participants or indirect beneficiaries, making a total of three hundred (300) farmers as sample. Data were collected with a Focus Group Discussion guide and a structured questionnaire designed to capture information on households in the Sudan Savanna Taskforce project communities in Musawa LGA of Katsina State.

The questionnaire contained information on farm and farmer characteristics, market, credit, extension, and awareness/adoption of crop technologies. The pre-tested questionnaire was administered two months prior to the actual survey by trained enumerators. Data collected were entered using SPSS spreadsheet and analyzed using descriptive statistics by SPSS package. The results of the study were presented based on the percentage of farmers who adopted the improved cowpea varieties.

RESULTS AND DISCUSSION

Table 1 shows that almost all the farmers (99.3%) were growing cowpea. This is represented by 90.3% male and 9.7% female farmers. The results further revealed that from the total population of farmers growing cowpea, 35.7% were growing improved cowpea varieties. When segregated by participation in the Sudan Savanna Taskforce project activities as revealed in Table 2, the result showed that 78.5% of those who adopted were those who participated in the project's activities and 21.5% were those who did not participate. Similarly, 89.7% of those who adopted were those who had extension contacts and 10.3% did not have any extension contact.

Results in Table 3 also revealed that those who adopted improved cowpea varieties were young farmers within the ages of 25 to 54 years (86.0%). Improved cowpea varieties are largely new technologies in the study area. The study revealed that cowpea is one of the major crops grown in the study area as almost all the farmers were growing the crop. Farmers attach greater risk to new varieties than their traditional or local varieties.

Based on the results, women are not actively involved in cowpea production in the study area. They are supposed to be key players especially in cowpea production as most processing is being done by them. Coulibaly et al. (2010) stated that women play key roles in agricultural production, but agriculture is increasingly characterized by growing gender imbalances in access to

Table 3. Percentage distribution of respondents according to adoption by age range.

Age (years)	Frequency	Percentage of respondents
15-24	4	3.7
25-34	26	24.3
35-44	38	35.5
45-54	23	21.5
55-64	11	10.3
65 and above	5	4.7

N = 107.
Source: Field survey (2011)

key productive assets such as land, animal power, and education. The failure of many agricultural research and extension programs in Africa has been argued to be due largely to gender biases in project design and implementation. With the interventions largely inappropriate to them, it is argued that women have been effectively excluded from the development process. The role of women in agriculture is no way insignificant. They should be encouraged to participate actively in farming activities especially cowpea production because of the nutritional value attached to the crop.

Farmers participation in agricultural activities organized by institutions promoting agricultural activities is very crucial especially for the adoption of new technologies, which can be enhanced through farmers who have first-hand experience with the new technologies. To increase the rate of adoption therefore, farmers should be encouraged to participate in activities relating to new farm practices like; on-farm trials, demonstrations and training related to such technologies as in the case of improved cowpea introduced in the study area.

In a recent study, Adedipe (2012) reported that farmers who participated in cowpea related activities benefitted from the activities by using the income they generated from the sales of cowpea to meet certain needs that are associated with improved standard of living such as food, clothing, shelter, education, healthcare and recreation. Unlike the non participants she reported that they were more of subsistent farmers. Farmer's participation has been an important factor in extension programmes.

The implication of the findings is that farmers should be actively involved in the analysis of their situation which forms the basis for identifying their immediate needs and constraints for appropriate interventions. Through participation, farmers are exposed to new farming techniques to improve on their production yields to enhance better standard of living.

This study revealed that farmers who had extension contacts adopted more than those who did not. According to Owens et al. (2001) and Doss et al. (2002), extension contact is clearly the variable that is most highly correlated with the use of improved technologies and that regular contact with extension raises improved cowpea production by an average of 18.5 and 15% but the contact has no significant effect on cowpea production under traditional technology.

The goals of extension according to Chikaire et al. (2011) includes; transferring knowledge from researchers to farmers; advising farmers on their decision making; educating farmers to be able to make similar decision in future and enabling farmers to clarify their own goals and possibilities to enhance desirable agricultural development. This result corroborates findings of Onu (2006) who reported that farmers who had access to extension adopted improved farming technologies. They had 72% more productivity growth rate than those who had no access to extension services.

The utilization of new technologies is often influenced by farmers' contact with extension services, as they provide technical advice for increase in agricultural production. Adoption level increases with the intensity of extension services offered to farmers. This is in line with Odoemenem and Obinne (2010), who pointed out that constant meeting / frequency of extension contact between the extension personnel and farmers would enlighten them and create better awareness for the potential gains of improved agricultural innovations.

Farmers who adopted were between active farming age ranges of 25 to 54 years. The role of a farmer's age in explaining technology adoption has been controversial. Older people are sometimes thought to be less amenable to change and hence reluctant to change their old ways of doing things. In this case, age is expected to have a negative impact on adoption.

On the other hand, Muyanga (2009) reported that older people may have higher accumulated capital, more contacts with extension and preferred by credit institutions predisposing them more to technology adoption than younger ones. Bonabana-Wabbi (2002) classified age as the primary latent characteristic in adoption decision.

Caswell et al. (2001) and Khanna (2001) reported that farmers perceive that technology development and the subsequent benefits require long duration to realize, can reduce their interest in the new technology because of their advanced age and the possibility of not living long enough to enjoy it. According to Bamire et al. (2010), younger

Table 4. Percentage distribution of adoption of improved cowpea varieties, year and source of seeds.

Year of adoption	Varieties			
	IT97K-499-35	**IT98K-205-8**	**IT98K-573-1-1**	**IT89-288**
	% (N)= 47	**% (N)= 25**	**% (N) = 12**	**% (N) = 29**
2009	55.3 (26)	48.0(12)	33.3(6)	51.5(17)
2010	36.2(17)	32.0(8)	27 .8(5)	24.2(8)
2011	6.4(3)	20.0(5)	11.1(2)	12.1(4)
Seed origin	**% (N) = 46**	**% (N) = 24**	**% (N) = 17**	**% (N) = 33**
SSTF/IITA	85.1(40)	95.8(23)	52.9(9)	60.6(20)
KTARDA/ADP	0(0)	0(0)	0(0)	6.1(2)
Market retailer	2.1(1)	0(0)	0(0)	0(0)
EAs	2.1(1)	4.2(1)	17.6(3)	18.2(6)
Friends/relatives	6.4(3)	0(0)	23.5(4)	15.2(5)
Other farmers	2.1(1)	0(0)	5.9(1)	0(0)

Source: Field survey (2011); ( ) = Frequency.

Table 5. Percentage distribution of adopters of improved cowpea variety by location.

Village / community	Frequency	% of respondents
Bakam	15	14.0
Gingin	9	8.4
Tarbbani	6	5.6
Yarkanya	18	16.8
Dan kado	10	9.3
Rugar	9	8.4
Farin Dutse	9	8.4
Garu	13	12.1
Kurkujan	6	5.6
Tuje	12	11.2
Total	**107**	100.0

Source: Field survey (2011).

younger farmers are willing to take risk and adopt new technologies.

Table 4 shows adoption pattern of four different improved cowpea varieties from 2009 to 2011. IT97K-499-35 and IT89-288 were mostly adopted in 2009. In 2010, IT97K-499-35 and IT98K-205-8 were also the most adopted. In 2011, IT98K-205-8 was mainly adopted. From the result, it could be concluded that IT97K-499-35 and IT98K-205-8 were farmers' choices as they have the average adoption level of 32.6 and 33.3% over three years respectively.

The Sudan Savanna Taskforce project should therefore promote more of these varieties in order to enhance farmers' well-being as majority of the improved seeds were from the Sudan Savanna Taskforce project. Also, Table 5 revealed the adoption pattern of improved cowpea varieties by location. Results showed that four out of the ten sampled communities adopted more than the other communities. They include: Yarkanya (17%), Bakam (14%), Garu (12%) and Tuje (11%).

Table 6 shows the desired characteristics of improved cowpea varieties given farmers in the study area. The farmers gave high income (94.7%), high yield (89.7%), resistance to drought (56.3%), early maturing (72.3), household food security (61.7) and diversified food products from cowpea (65.3%) as reasons why they grow improved cowpea. The major constraints to the adoption of improved cowpea varieties were: non-availability of seeds when needed (68.0%), non-availability of fertilizer (54.3%), high cost of fertilizer (59.3%), diseases (70.3%) and pests (79.3%) as presented in Table 7.

Non-availability of improved seed was the third major constraint which singly can lead to low adoption rate in the study area. It is not surprising to see farmers citing

Table 6. Percentage distribution of respondent according to technology related characteristics as reasons why farmers grow improved varieties.

Variable	Frequency	Percentage of (%) n=300
Is it high yield	269	89.7
High income/profit from market sales	284	94.7
Resistance to drought	169	56.3
Early maturity	217	72.3
Household food security	185	61.7
Diversified food products from cowpea	196	65.3

Source: Field survey (2011).

Table 7. Major problems / constraints to cowpea production.

Problems / Constraint	Frequency	Percentage
Non-availability of seeds when needed	204	68.0
Non-availability of fertilizer	163	54.3
High cost of fertilizer	178	59.3
Diseases	211	70.3
Pests	238	79.3

Source: Field survey (2011).

high income and food security as a reason for growing cowpeas. Cowpea is a cash crop in the dry savannas of West Africa. It is consumed in the entire West African region with high demand all year round. Farmers in the dry savannas prefer early maturing and drought-tolerant crops because of high crop failure associated with terminal drought in the region.

According to Coulibaly et al. (2010), the low adoption of improved varieties is argued to be one of the reasons for low yields. Even when a farmer is said to have adopted an improved variety, it is usually the case that the seeds have been recycled for many generations to the extent that their yields advantage have been lost and hence give no more yields than the local varieties. Also, that most improved varieties lack the characteristics valued by farmers. This has in turn been due to the failure of crop improvement programs to involve farmers in the process of designing and developing improved varieties with a view to meeting their priorities and preferences.

It is therefore important that Breeders look for these traits (high yielding, earliness, marketability and drought resistant) while breeding seeds for farmers. According to Kamara et al. (2009), although new varieties have potential roles where they offer advantages over local varieties, they are unlikely to replace local varieties which combine many farmer-preferred characteristics. It is therefore essential that researchers (Breeders) in developing new varieties are aware of the wide range of criteria or local preferences in the production and utilization of cowpea and, if possible, build these traits into new germplasm which fits local farming systems. It was also revealed by the study that improved cowpea varieties can lead to food security by providing food at the peak of hunger period when food is mostly needed and the crop has the quality to be produced twice in the year making it to be known as a dual-season crop.

Across the surveyed communities, it is clear that non-availability of seeds, disease and insect pests attack were among the major constraints facing farmers in cowpea production. These reasons are mostly responsible for abandoning or why farmer are not growing improved cowpea varieties. The study is in agreement with the findings of Singh and Tarawali (1997), Inaizumi et al. (1999), Singh et al. (2002) and IITA (2006). They all reported that despite the potential for further yield increases, cowpea production faces numerous problems including insect pest attack, *Striga gesneroides* parasitism, disease, drought, low and erratic rainfall, and long dry season.

As reported by Oladele (2005), that since prices of seed and fertilizer are the major cost components of production, a rise in input, coupled with other constraints, may render farm activities unprofitable which is in line with disenchantment theory of dis-adoption. According to Coulibaly et al. (2010), the profitability of the cowpea cropping systems depends mainly on the types of varieties used (local or improved), the cropping practices and management (use of chemicals including fertilizers and pesticides), and the access to input and outputmarkets.

Conclusion

Considering the results of this study, it can be concluded that the study has obviously brought to light some facts about the adoption pattern and constraints facing farmers in cowpea production in the study area. Results of this study revealed that the adoption level of improved cowpea varieties increased from zero percent (Ayanwale et al., 2009) to 35.7%. From those who adopted the improved cowpea varieties, 86.0% were male farmers, 78.5% were those who participated in cowpea related activities organized by the Sudan Savanna Taskforce project, 89.7% were those who had extension contacts and 85.0% were farmers within the age bracket of 25 to 54 years. IT98K-205-8 was more adopted in 2011 among the four varieties of improved cowpea varieties that were introduced in the project area by the Sudan Savanna Taskforce project. Yarkanya, Bakam, Garu and Tuje were the communities that recorded the highest adoption rate among the ten communities where the project was implemented. High yielding, early maturing, drought tolerance, high income leading to payment of school fees, payment of medical bills and buying of clothing, household food security and diversified food products were reasons given for the adoption of improved cowpea varieties. Non-availability of seeds and fertilizer when needed, high cost of fertilizer, pests and diseases were revealed as the major constraints facing farmers in the study area.

Based on the findings of this study the following recommendations are suggested in order to improve the adoption level of improved cowpea varieties in the study area. Farmers need to take full advantage of the benefits of cultivating improved cowpea varieties which usually translates into increased income. This will only be possible with an effective network of extension agents who deliver their services to these farmers more frequently.

Farmers' participation in development project activities should be emphasized by States Agricultural Development Projects (ADPs) and development agencies so as to enjoy the full packages of such projects. In addition, policy makers and development agencies should ensure that adequate inputs are being made available to farmers at subsidized rates in order to improve on their crop yields.

Conflict of Interest

The authors have not declared any conflict of interest.

REFERENCES

Adedipe OI (2012). Effect of improved cowpea varieties on farmers income in Sudan Savanna Taskforce's maize – legume platform of Kano-Katsina-Maradi Project site. An (Unpublished) Master's thesis Bayero University Kano.

Ayanwale A, Abdoulaye T, Ayedun B, Akinola A (2009). Baseline Report Of The Sudan Savannah Zone Of The Kano-Katsina-Maradi Pilot Learning Sites of the Sub Saharan Africa-Challenge Program (SSA CP) Baseline Report.

Bamire SA, Abdoulaye T, Amaza P, Tegbaru A , Alene AD, Kamara A Y (2010). Impact of promoting sustainable agriculture in Borno (PROSAB) program on adoption of improved crop varieties in Borno State of Nigeria. J. Food, Agric. Environ. 8(3&4): 391-398.

Bonabana-Wabbi J (2002). Assessing Factors Affecting Adoption of Agricultural Technologies: The case of Integrated Pest Management (IPM) in Kumi District, Eastern Uganda. Unpublished MSc. Thesis, Virginia Polythenic Institute of State University.

Bressani R (1985). Nutritive value of cowpea. Pages 353-360 in Cowpea: Research, Production and Utilization, edited by S.R. Singh and KO. Rachie. John Wiley & Sons, New York, USA.

Caswell M, Fuglie K, Ingram C, Jans, S, Kascak C (2001). Adoption of Agricultural Production practices: Washington DC. US Department of Agriculture. Resource Economics Division, Economic Research service. Agriculture Economic Report No. 792.

Chikaire J, Ejiogu-Okereke FN, Anyoha NO (2011). Agricultural extension: key to implementing the millennium development goals in developing countries. Cont. J. Agric. Sci. 5(2).

Coulibaly O, Alene AD, Abdoulaye T, Chianu C, Manyong V, Aitchedji C, Fatokun D, Kamara A, Ousmane B, Tefera H, Boahen S (2010). Baseline assessment of cowpea breeding and seed delivery efforts to enhance poverty impacts in Sub-Saharan Africa (Report).

Doss C, Mwangi W, Verkuijl H, De Groote H (2002). *Adoption of maize and wheat technologies in East Africa: Synthesis of East African adoption studies.* CIMMYT Economics Working Paper 02-04. Mexico, D.F.: CIMMYT.

Dugje IY, Omoigui LO, Ekeleme F, Kamara AY, Ajeigbe H (2009). Farmer's Guide to Cowpea production in West Africa. IITA Ibadan, Nigeria.

Inaizumi H, Singh BB, Sanginga PC, Manyong VM, Adesina AA, Tarawali S (1999). Adoption and impact of dry-season dual-purpose cowpea in the semiarid zone of Nigeria. Ibadan, Nigeria: IMPACT, IITA. P 14.

International Institute of Tropical Agriculture (IITA) (2006). Research for development. Cereals and Legumes Systems. Cowpea.

Kamara AY, Ellis-Jones J, Ekeleme F, Omoigui LO, Amaza P, Chikoye D, Dugje IY (2009). A participatory evaluation of improved cowpea cultivars in the Guinea and Sudan Savanna zones of north east Nigeria. Taylor and Francis (Pub.) London W1T3JH, UK.

Khanna M (2001). Sequential Adoption of Site-Specific Technologies and its implications for Nitrogen Productivity: A Double Selection Model. Ame. J. Agric. Econ. 83(1):35-51.

Mahalakshmi V (2004). Marker development and marker assisted selection for striga resistance in cowpea. IITA, Ibidan, Nigeria.

Moalafi AI, Asiwe JAN, Funnah SM (2010). Germplasm evaluation and enhancement for the development of cowpea (*Vigna unguiculata* (L.) Walp. dual-purpose F2 genotypes.

Muyanga M (2009). Smallholder adoption and economic impacts of tissue culture banana in Kenya Department of Agricultural, Food and Resource Economics, Michigan State University, 012 Cook Hall, East Lansing MI 48824 USA.

Odoemenem UI, Obinne CPO, (2010). Assessing the factors influencing the utilization of improved cereal crop production technologies by small-scale farmers in Nigeria. India J. Sci. Technol. 3(1):180-183.

Oladele OI (2005). A Tobit analysis of propensity to discontinue adoption of agricultural technology among farmers in southwestern Nigeria. J. Central Eur. Agric. 6(3):249-254.

Onu DO (2006). Socio-economic factors influencing farmers' adoption of alley farming technology under intensified agriculture in Imo state, Nigeria. Philipp. Agric. Sci. 89(2):45-52.

Owens T, Hoddinott J, Kinsey B (2001). The impact of agricultural extension on farm production in resettlement areas of Zimbabwe. Working Paper, Center for the Study of African Economies, University of Oxford, UK.

Singh BB, Ajeigbe H A, Tarawali SA, Fernandez-Rivera S, Abubakar M (2003). Improving the production and utilization of cowpea as food and fodder. Field Crop Res. 84:169-177.

Singh BB, Tarawali SA (1997). Cowpea and its improvement: Key to sustainable mixed crop/livestock farming systems in West Africa. In:

Renard C (ed.), Crop Residues in Sustainable Mixed Crop/Livestock Systems. CAB International in association with ICRISAT and ILRI, Wallingford, UK. pp. 79-100.

Singh BB, Ehlers JD, Sharma B, Freire-Filho FR (2002). Recent progress in cowpea breeding. In: Fatokun CA, Tarawali SA, Singh BB, , Tamo PM (eds.), Challenges and opportunities for enhancing sustainable cowpea production. Ibadan, Nigeria: IITA. pp. 22-40.

Sudan Savanna Taskforce (2009). Community Mobilization List 2009 http://world-food.net/tag/sudan-savanna-task-force/