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Cowpea Early Adoption Study

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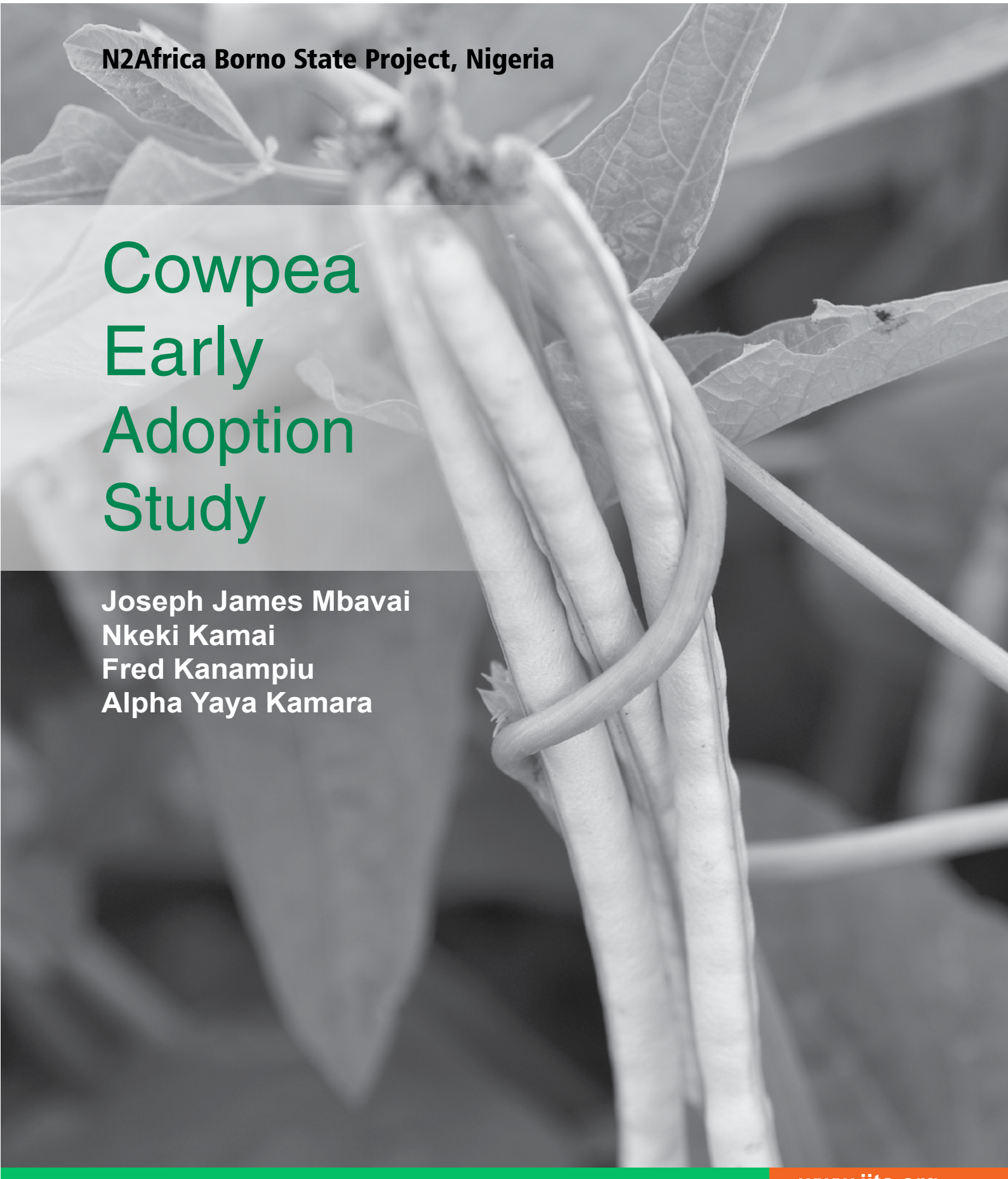

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International Institute of Tropical Agriculture, Ibadan

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Contents

Figures and Tables

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Acronyms/Abbreviations

BMGF	Bill & Melinda Gates Foundation
BNF	biological nitrogen fixation
FGD	Focus Group Discussion
FGT	Foster-Greer-Thorbecke
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
LGAs	Local Government Areas
PROSAB	Promoting Sustainable Agriculture in Borno State

Executive summary

The N2Africa project is ongoing in Borno State. The vision of success of the Borno State project is to reach more than 40 000 farming families and pioneer models for youth engagement in agri-business through which job opportunities in agri-business would be created for at least 2000 youth living in the target area. The intervention areas (geographical coverage) are mainly in southern Borno State and in the following local government areas: Bayo, Biu, Hawul, and Kwaya Kusar. In achieving this, a series of activities were undertaken in the project area, one of which was to promote the dissemination of improved crop varieties. The dissemination process was accompanied by improved agronomic practices to boost the yield potentials of the crops being promoted. A baseline study was conducted prior to project implementation. Since the inception of the N2Africa project, there has been no information on the state of adoption of any of the improved crops being promoted. There was therefore the need to undertake an early adoption study on improved cowpea varieties and its impacts on the livelihoods of rural farming households in the project areas. This will enable the N2Africa project to understand the progress made so far in project implementation in Borno State. The objectives of the study therefore were to: (i) determine the level and rate of adoption of improved cowpea varieties in the project area, (ii) determine the pattern of adoption of improved cowpea varieties among male and female farmers, (iii) examine the factors influencing adoption of improved cowpea varieties, (iv) examine the productivity of cowpea varieties promoted among male and female farmers, (v) examine the reasons for growing improved cowpea varieties, (vi) determine the impact of adoption of improved cowpea varieties on household income of male and female farmers, (vii) determine the impact of adoption of improved cowpea varieties on poverty of male and female farmers and, finally, (viii) determine the impact of adoption of improved cowpea varieties on food security of male and female farmers.

To achieve these objectives, a formal survey was carried out in three local government areas (LGAs) in the study area. A total of 30 communities were selected randomly from three LGAs (Biu, Hawul, and Kwaya Kusar) and 20 households selected randomly per community. A total of 609 farmers were selected to represent 25% of the population of cowpea farming households (2436) for the study. The sample comprised 258 (43%) female and 351 (57%) male farmers. The major instrument for data collection was a structured questionnaire, focus group discussions (FGD), and a digital camera. Data collected were analyzed separately for male and female farmers using both descriptive and inferential statistics.

Socioeconomic characteristics of farm households

The study revealed that the respondents were mostly married in either monogamous (52.4% male and 31.8% female) or polygamous (38.2% male and 36.4% female) relationships. A good number of the women were widowed (26.4%). Altogether, 53.5% of the male respondents had post primary education while 31.8% of the female had post primary education. The majority of the male respondents fell within the ages of 18 and 56 years and the females within the ages of 37 and 76 years. The majority of the male (85.5%) and female (73.3%) farmers had contacts with the extension service. Participation in the project's activities was also very high (85.2% male and 77.9% female). The majority of them participated in training on crop production (75.2% for male and 64.3% for female). Social capital was a great asset in the study area as most of the respondents (77.8% male and 73.6% female) belonged to associations, particularly farmer and religious associations.

Level of adoption of improved cowpea varieties

Results from the study revealed an overall adoption level of 48.1%. which accounts for 47.9% male adoption and 48.4% female adoption of improved cowpea varieties. Different varieties of improved cowpea were introduced in the study area. Results showed that adoption of the improved varieties ranged from 2.6% to 17.4% for male and 1.9–16.3% for female farmers. For both male and female farmers, adoption was highest for the variety IT89KD288 and lowest for UAM09-1046-6-1 probably because the UAM varieties were just recently released in the region. Results showed that the local variety was the most adopted among all the

cowpea varieties. Farmers prefer local varieties because of the seed size and color. Compared with the baseline report, this result showed that there has been a 1.6% improvement in the adoption of improved cowpea varieties.

To enhance adoption of the improved cowpea varieties, breeders should consider some of the preferred traits in these local varieties and try to incorporate them in the new, improved varieties. Results also showed that adoption of improved cowpea is progressing as the implementation activities of the N2Africa project progress. Adoption was 39.6% and 41.5% for male and female adopters in 2013; 43.3% and 44.6% for male and female adopters, respectively, in 2014; and finally 47.9% and 48.4% for male and female farmers, respectively, in 2015. This can be related to the dissemination patterns adopted by the project. For example, the majority of the respondents, both male and female, have been participating in the project's activities. Other activities include: participation in field days, field demonstration activities, workshops, and training. All these activities create awareness on the yield and economic potential of the crop.

Pattern of adoption of improved cowpea varieties

Results on the pattern of adoption revealed that the majority of the male adopters were young adults and in the active farming age bracket of 17 and 56 years. This may be due to the high cash value of cowpeas in the target region. On the other hand, the majority of the female adopters fell within the category of 37 and 76 years with the majority being married (polygamous [35.5%], monogamous [29.8%], and widowed [29.0%]). Cowpea is traditionally grown by women because of its low input requirement and its importance for home consumption as a source of affordable protein. The majority of the male adopters (79.8%) have at least a formal type of education including primary, secondary, and tertiary education. Half of the female adopters have no formal education (49.6%) and half have at least one form of formal education or another (50.4%). This is not surprising as most of the women are given out early into marriage to husbands who do not permit them to go to school after marriage. The only education many have is what they achieved while living with their parents. Furthermore, the majority of the adopters were those who participated in the IITA (N2Africa/PROSAB) project activities (89.9% male and 88.0% female). Farmer 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 of the new technologies. To increase adoption therefore, farmers should be encouraged to participate in activities relating to new farm practices like on-farm trials and demonstrations, and training related to such technologies as in the case of improved cowpea introduced in the study area. Also, most of the adopters were those who had contact with extension services (88.7% male and 80.8% female). The utilization of new technologies is often influenced by farmer 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. Constant meeting/frequency of extension contact between extension personnel and farmers would enlighten the farmers and create better awareness of the potential gains of improved agricultural innovations. Finally, a high percentage of the farmers were members of associations (77.4% male and 79.2% female). Associations such as farmer associations are avenues for information sharing among farmers especially on new agricultural practices. Furthermore, the IITA projects (N2Africa/PROSAB), alongside the introduction of improved cowpea varieties, introduced improved agronomic practices that enhance the yield potential of the improved crop. These practices were adopted extensively by both male and female farmers. The results of the adoption pattern showed the following: legume-specific fertilizer (50.6% male and 38.7 female), cereal/legume rotations (48.0 male and 36.4% female), cereal/legume intercropping (50.6% male and 39.9% female), drilling fertilizer application (42.0% male and 24.9% female), and legume utilization (35.1% male and 26.1% female).

Factors influencing the adoption of improved cowpea varieties in Borno State

To determine the factors influencing adoption, the Probit and Tobit econometric regression models were used to determine the decision of farmers to adopt improved cowpea varieties in the study areas. Using the Probit model to determine factors influencing the adoption of improved cowpea varieties, 14 explanatory variables disaggregated by gender were assumed to influence the probability of adoption. For the female farmers,

participation in project activities ($p < 1\%$), extension contact, high yield, drought resistance, pest resistance ($p < 10\%$), and less fertilizer requirement ($p < 5\%$) significantly influenced the decision to adopt the new cowpea varieties. For the male farmers, participation in project activities and drought resistance, both significant at $p < 1\%$, early maturity, seed color ($p < 5\%$), high yield, and resistance to pests ($p < 10\%$) significantly influenced adoption of the improved varieties. Similarly, using the Tobit model regression analysis, 14 explanatory variables disaggregated by gender were assumed as factors to influence the intensity of adoption of improved cowpea varieties. For the female farmers, extension contact, disease resistance, and drought resistance ($p < 10\%$) influenced the decision of farmers to increase the area under cowpea production. For the male farmers, education and seed size ($p < 10\%$) significantly influenced the extent of adoption of the cowpea varieties.

Cowpea production in the study area

Comparing the yield potentials of both improved and local cowpea varieties, adopters of improved cowpea recorded higher yield than non-adopters. The yields of local cowpea varieties were lower than 1 metric tonne/ha (t/h) for both male and female farmers unlike the yields of the improved varieties. This can have implications for income and food security. The extra income from improved cowpea varieties can be an added value to total household income and can also be used to purchase other food items for household consumption.

Reasons for growing improved cowpea varieties

The major reasons given by male farmers for growing improved cowpea varieties include: high yield (98.8%), early maturity (98.8%), less fertilizer requirement (94.6%), seed color (92.2%), and less labor inputs (91.0%). The major reasons given by the female farmers are high yield (97.6%), early maturity (97.6%), and makes better local foods/utilization (93.5%). Also, improved household income (82.0% male and 81.8% female) and improved food security (70.5% male and 73.2% female) were among the major reasons why farmers grow improved cowpea varieties.

Impact of adoption of improved cowpea varieties on household income by gender and adoption

Results of the impact of improved cowpea varieties on household income showed that cowpea contributes more to farmers' income than all other cash crops (groundnut, maize, millet, rice, sorghum, and soybean). However, adopters of improved cowpea varieties enjoyed higher income than the non-adopters. Comparing the results with the baseline results indicated that cowpea earned farmers more income than all other crops in the study area. Cowpea can be grown alongside cereal crops like maize, millet, and sorghum. This can be related to the fact that improved cowpea varieties produce higher yield than the local varieties. Farmers should therefore be encouraged to increase their areas under improved cowpea production as it has the potential to contribute significantly to their income.

Impact of adoption of improved cowpea varieties on household poverty by gender and adoption

The poverty profile for the respondents across gender was 0.49. This means that 49% of respondents interviewed were poor. The poverty headcount for the male adopters was 0.46 and 0.48 for non-adopters. Similarly, poverty headcount for the female adopters was 0.42 and 0.52 for non-adopters. This means that poverty was more common among non-adopters than the adopters. The reduction in poverty among adopters cannot be attributed to income from cowpea alone because farmers have other sources of income that could fetch them additional income. Since the income from cowpea was significant, one can conclude that cowpea income plays an important role in poverty alleviation among farmers especially those cultivating improved varieties as the yield from improved varieties was higher than that from local varieties. Growing improved cowpea therefore can contribute to a reduction in poverty level among farmers. This implies that there is more poverty in households that are not cultivating improved cowpea varieties when compared to adopters with access to additional income from improved cowpea varieties.

Impact of adoption of improved cowpea varieties on household food security aggregated by gender

Results on the food security status in 2008 revealed that the cost of the minimum basic food requirement, which is the food insecurity line, was N740.9314. Using this to define the food insecurity line, it was found that 41% of all respondents were food insecure. The estimated aggregate expenditure gap of N356.19 (48.03%) indicated is the amount by which food insecure households were below the minimum expenditure level required to meet their basic food needs. The estimated food insecurity headcount for male adopters was 41%. The estimated aggregate expenditure gap of N352.54 (47.58%) indicated the amount by which male-adopter, food-insecure households were below the minimum expenditure level required to meet their basic food needs. The estimated food insecurity headcount for male non-adopters was 43%. The estimated aggregate expenditure gap of N374.466 (50.45%) indicated the amount by which male non-adopter food-insecure households were below the minimum expenditure level required to meet their basic food needs.

The estimated food insecurity headcount for female adopters was 38%. The estimated aggregate expenditure gap of N339.88 (47.58%) indicated the amount by which female-adopter, food-insecure households were below the minimum expenditure level required to meet their basic food needs. The estimated food insecurity headcount for female non-adopters was 43%. The estimated aggregate expenditure gap of N345.96 (46.69%) indicated the amount by which female non-adopter food-insecure households were below the minimum expenditure level required to meet their basic food needs. Cowpea is both a cash and food crop. Its contribution to food security does not mean that farmers consume the crop entirely; rather, the extra income from its sale could be used to purchase other food items that are rich in protein to boost their health and nutrition. Since the results showed that adopters of improved cowpea varieties are more food secure, it can be concluded that the adoption of improved cowpea varieties increases food security among farmers.

Farmers' testimony on the impact of improved cowpea varieties

The testimonies of farmers during the focus group discussions show that poverty reduction in the study area could be related to improved cowpea varieties and IITA. The major benefits derived from improved cowpea production are: access to improved seeds; improved income; improved shelter; improved farming techniques; asset ownership; better education; ownership of livestock; improved health; food security; land ownership, and elevated social status. Some tangible proofs on the benefits derived from cowpea production and IITA are presented in pictograms (See Appendix I).

Conclusion and recommendations

Adoption of improved cowpea varieties revealed an overall adoption of 48.1%, which shows an increase in the level of adoption by 1.6% over the baseline. The adoption of the newly introduced varieties indicates a gradual improvement in the adoption of these varieties because they have certain characteristics present in the local varieties. These characteristics include brown seed color and large seed size. Farmers consider these when deciding to adopt varieties. We recommend that breeders of improved cowpea consider the desired traits in preferred local varieties and try to incorporate them in the new/improved varieties. Adoption of improved cowpea varieties also increased crop yield and household income, and reduced poverty and food insecurity.

1.1 Introduction

N2Africa is a large-scale, science-based “research-in-development” project focused on putting nitrogen fixation to work for smallholder farmers growing legume crops in Africa. The project is funded by the Bill & Melinda Gates Foundation by a grant to Wageningen University & Research, which leads the project together with IITA, the International Livestock Research Institute (ILRI), the University of Zimbabwe, and many partners in all N2Africa countries. N2Africa aims to contribute to increasing biological nitrogen fixation (BNF) and the productivity of grain legumes among African smallholder farmers. This in turn helps to enhance soil fertility, improve household nutrition, and increase the income of smallholder farmers. The project is designed to ensure that the benefits of grain legumes impact positively on rural livelihoods and their production environment. The project is currently being implemented in 11 countries including Nigeria. In Nigeria, it is implemented in four main states of Borno, Kaduna, Kano, and Niger and focuses on cowpea, groundnut, and soybean. The vision of success of the Borno State project is in line with the project’s vision of success, i.e., to reach more than 40 000 farming families and pioneer models for youth engagement in agri-business through which job opportunities in the agri-business would be created for at least 2000 youth living in the target area. The intervention areas (geographical coverage) in Borno State are mainly in the southern part of the State and in the following local government areas: Bayo, Biu, Hawul, and Kwaya Kusar.

A former project “Promoting Sustainable Agriculture in Borno (PROSAB)” was implemented from 2004 to 2009 with an objective of contributing to improving rural household livelihoods in Borno State through the promotion of improved agricultural technologies, management practices, and capacity building of farmers in the use of technologies for sustainable agricultural production. N2Africa and PROSAB projects therefore overlap in terms of objectives and operational areas (except Bayo local government area [LGA] for N2Africa).

1.2 Purpose of the study

The N2Africa project since inception has undertaken a series of activities some of which include promotion of improved cowpea varieties through community seed production, field demonstrations, and field days. There was therefore the need to undertake an early adoption study on improved cowpea varieties and its impacts on the lives of rural farming households in the project area. This study serves as an update on the baseline information earlier collected to enable the N2Africa project to understand the progress since its implementation in Borno State. It will also assess the impact of PROSAB that was implemented between 2004 and 2009. In addition, the study will provide program staff, funders, and other stakeholders with detailed information on the progress the project has made so far in the promotion of improved cowpea varieties in the State. Finally, the study will provide detailed information on the state of cowpea production which would be used by the N2Africa project for modifications in the remaining implementation period.

1.3 Objectives of the study

The study was intended to achieve the following objectives:

1. Determine the level and rate of adoption of improved cowpea varieties in the project area.
2. Determine the pattern of adoption of improved cowpea varieties.
3. Examine the factors influencing adoption of improved cowpea varieties.
4. Examine the productivity of cowpea by adopters of new varieties.
5. Examine the reasons for growing improved cowpea varieties.
6. Determine the impact of adoption of improved cowpea varieties on household income.
7. Determine the impact of adoption of improved cowpea varieties on household poverty.
8. Determine the impact of adoption of improved cowpea varieties on food security.

1.4 Scope of the study

The study collected qualitative and quantitative data on adoption and key impact on farmers' livelihoods. Respondents involved both project beneficiaries, non-beneficiaries, and other stakeholders in the selected value chains and agreed target areas. The study area was limited to 30 communities selected from three LGAs that included Biu, Hawul, and Kwaya Kusar LGs of Borno State, Nigeria. Field data was collected in August 2016. However, information obtained from households relates to the previous (2015) cropping season. The information was also to provide insight into the impact of the N2Africa project.

2. Methodology

A formal survey was carried out for the study. A total of 30 communities were randomly selected from three LGAs for the purpose of the study with the help of extension agents, community leaders, and the project staff.

For the study, 609 farmers were randomly selected from among the cowpea farming household population of 2436 (1687 male and 749 female). The sample included 254 females and 313 males. The LGAs and communities were selected because the N2Africa project mainly promoted improved cowpea varieties in these areas. The male sample was increased to 351 and female to 258 to take care of missing data. This accounts for 43% female and 57% male as the sample and 25% of the total population all put together. The information is presented in Table 1.

Table 1. Summary of sample frame and size.

LGA	No. of communities	Names of communities		Sample
Biu	10	Filin Jirgi	Kigir	217
		Yamarkumi	Mainahari	
		Tum	Tabra	
		Nzukuku	Kabura	
		Miringa	Yawi	
Hawul	10	Sakwa	Ghuma	197
		Marama	Nggabu	
		Hema	Kinping	
		Dusu	Yimirshika	
		Mbulatawiwi	Ngwa	
Kwaya Kusar	10	Kwaya Kusar	Miltha	195
		Gashina	Peta	
		Gadam A	Jalingo	
		Gadam B	Guwal	
		Kurba Gayi	Gusi	
Total	**30**	**30**		**609**

Source: Field Survey 2016.

The major instrument used for data collection from the 609 respondents was a structured questionnaire developed based on the objectives of the study. FGDs were also held to gather further information on the impact of improved cowpea on the livelihoods of the farmers. A digital camera was used to capture some of the tangible proofs of some social benefits derived from the project. Trained enumerators were used to administer the questionnaire for a period of two weeks (15–31 August 2016). Data collected were analyzed separately for male and female farmers using both descriptive and inferential statistics. Descriptive statistics were used to present information on the socioeconomic characteristics of the respondents. Simple frequency tables and graph were used to present information on the level, rate, and pattern of adoption. The Probit and

Tobit regression models were used to examine the factors influencing the probability and intensity of adoption of improved cowpea varieties, respectively. Adoption of improved cowpea in the study area and intensity of adoption of improved cowpea among adopters were the dependent variables.

Specification of the Probit model

The specification of the Probit model follows that in the process of planting improved cowpea varieties, farmers have to decide between two choices. If *Y* is the outcome from the choice, then:
Yi = 1, if the farmer plants the improved cowpea varieties introduced.
Yi = 0, if the farmer does not plant the improved cowpea varieties introduced.
Either choice yields a utility index, Ui, that the individual farmer, I, acts to maximize. If Ui* is the critical or threshold level at which decision to plant occurs, then:
Yi = 1 if Ui > Ui*---------- (1.1)
Yi = 0 if Ui ≤ Ui* ---------- (1.2)
The non-observable underlying utility function which ranks the preference of the *ith* farmer can be expressed thus
∑= 1BnXni ei ---------- (1.3)
Where
Xni = the nth variable of the ith observation
Bn = the nth parameter to be estimated
The probability Pi for the farmer i to adopt the varieties is then:
Pi = P [Y =1] = P [Ui> = Ui*] = P [Ui* < = Ui] ---------- (1.4)
Since Ui* is a discrete random variable, if F [*] is its cumulative distribution function, then,
P [Y = 1] = P [Ui* < = Ui] F [Ui] ---------- (1.5)
P [Y-1] = 1 – F [Ui] ---------- (1.6)
The form of F [*] is determined by the probability density function of the random variable Ui.
Equation [ii] is a form of generalized linear model which can be rewritten as follows:
The linear form of the model is specified as:
Yi = α + β1X1 + β2X2 + β3X3 + β4X4 + β5X5 + β6X6 + β7X7 + β8X8 + μ ----------(1.7)
X1 = Education of Household Head (Formal education = 1, No formal education = 0)
X2 = Household size (Number)
X3 = Participation in N2Africa Project (Participate = 1, Not participate = 0)
X4 = Extension contact (Contact = 1, No contact = 0)
X5 = Membership of association of household (Member = 1, Not member = 0)
X6 = Cowpea high yielding potential (Yield high = 1, Yield not high = 0)
X7 = Cowpea large seed size nature (Large = 1, Not large = 0)
X8 = Cowpea resistant to disease (Resistant = 1, Not resistant = 0)
X9 = Cowpea resistant to drought (Resistant = 1, Not resistant = 0)
X10 = Early maturing nature of cowpea (Early = 1, Not early = 0)
X11 = Cowpea requiring less labor input (Less labor = 1, Not less labor = 0)
X12 = Cowpea resistant to pest (Resistant = 1, Not resistant = 0)
X13 = Fertilizer requirement for cowpea production (Less fertilizer = 1, No less fertilizer = 0)
X14 = Color of cowpea seed (Good color = 1, No good color = 0)
α = constant term
μ = disturbance term or error term
β1, …… β8 are the regression coefficients of the independent variables

Specification of the Tobit model

This study was designed to measure the intensity/extent of adoption of improved cowpea varieties by farmers in the IP sites in Katsina State, and to identify the effect of variables on farmer adoption decision. The Tobit model (Tobin 1958) was used to measure the extent or intensity of use of the improved cowpea varieties after the initial decision to adopt. Using the Tobit regression model, it was based on the land area under cultivation to improved cowpea varieties out of the total land area for cowpea production as a dependent variable against the independent variables in equation 4. Shiyani et al. (2002) used the Tobit model to measure the extent of farmer adoption decision. The functional form of the model following Shiyani et al. (2002) is as follows:

Yi = Xiβ if i* = Xiβ + Ui > T---------- (2.1)

Yi = 0 if i* = Xiβ + Ui >T---------- (2.2)

Where

Yi = the probability of adopting and intensity of use of improved cowpea varieties

I* = a non-observable latent variable

T = a non-observed threshold level

Xi = the vector of independent explanatory variables determining the adoption decision of ith farmer

β are the regression coefficients of the independent.

Ui = an independently normally distributed error term with zero mean and constant variance б2

The equation is a simultaneous and stochastic decision model. If the non-observed latent variable i* is greater than T, the observed qualitative variables Yi that indexes adoption becomes a continuous function of the explanatory variable and zero otherwise the Tobit Model uses a maximum likelihood method to estimate the coefficient of the equation. The regression coefficients are asymptomatically efficient, unbiased, and normally distributed.

To examine the impact of adoption of improved cowpea varieties on the income of farmers, descriptive statistics were used to determine the level of income differences between male and female farmers and between adopters and non-adopters. From these, the percentage contribution of cowpea to farming income is established. To determine the impact of improved cowpea varieties on household poverty, the Foster-Greer-Thorbecke (FGT) measure was used. This study focused only on the poverty headcount index (PO),which measures the proportion of the population that is poor. It is popular because it is easy to understand and measure but it does not indicate. The size of households was adjusted by adult equivalent, which was used to draw the poverty line (two-thirds of mean monthly adult head equivalent).

Headcount index analysis

By far, the most widely used measure is the headcount index, which simply measures the proportion of the population that is counted as poor, often denoted by *P*0. Formally,

$$P_0 = \frac{N_p}{N}$$ ---------- (3.1)

where Np is the number of poor and N is the total population (or sample). It is often helpful to rewrite (4.1) as

$$P_0 = \frac{1}{N}\sum_{i=1}^{N} I(y_i < z)$$ ---------- (3.2)

Here, I(·) is an indicator function that takes on a value of 1 if the bracketed expression is true, and 0 otherwise. So if expenditure (*yi)* is less than the poverty line (*z*), then *I*(·) equals 1 and the household would be counted as poor.

For the food security analysis, the cost of the minimum basic food requirement—the food insecurity line—was used by this study to define the food insecurity line.

Food security analysis

The study used the cost-of-calorie (CoC) method proposed by Foster et al. (1984) to determine the food insecurity line. This method yields a value that is usually close to the minimum calorie requirements for human survival. The process involves defining a minimum level of nutrition necessary to maintain healthy living. This minimum level is referred to as the “food insecurity line” for the study area, below which households are classified as food insecure, subsisting on inadequate nutrition. Calorie adequacy was estimated by dividing the estimated calorie supply for the household by the household size adjusted for adult equivalents using the consumption factor for age–sex categories.

Therefore, using this method, the food insecurity line is given as

$$LnX = a + bC \quad (4.2)$$

Where X is the adult equivalent food expenditure (in Naira) and C is the actual calorie consumption/adult equivalent of a household (in kcal). The calorie content of the recommended minimum daily nutrient level (L) by Gohl (1981) was used to determine the food insecurity line (S) using the equation:

$$S = e^{(a+bL)} \quad (4.2)$$

Where S = the cost of buying the minimum calorie intake (food insecurity line) a & b = parameter estimates from equation 1

L = recommended FAO minimum daily energy (calorie) level (2250 kcal)

Based on the S calculated, households will be classified as food secure or insecure, depending on which side of the line they fall.

3. Results

3.1 Socioeconomic characteristics of respondents

The socioeconomic characteristics of the respondents are presented in Tables 2 and 3. The results show that the respondents were mostly married and were either monogamous (52.4% male and 31.8% female) or polygamous (38.2% male and 36.4% female). A good number of the women are widowed (26.4%). Altogether, 53.5% of the male respondents had post primary education compared to 31.8% of the females. The majority of the male respondents fell within the ages of 17 and 56 years and the female within the ages of 37 and 76 years.

Table 2. Percentage distribution of farmers according to marital status, education level, and age.

Marital Status	Male	Female
Single	5.1	3.9
Monogamous	52.4	31.8
Polygamous married	38.2	36.4
Widowed	3.7	26.4
Divorced	0.6	1.6
Education		
No formal education	25.6	46.1
Primary	14	18.6
JSS	3.1	1.6
SSS	31.3	19
OND/NCE/Diploma	22.2	12.8
HND/University	3.7	1.9
Age		
17–36	32.8	11.2
37–56	48.4	54.7
57–76	17.9	29.1
77 and above	0.9	5

Source: Field Survey 2016

In Table 3, 85.5% of the male and 73.3% of the female respondents had contacts with extension service. Participation in the project's activities revealed male participation as 85.2% and female participation as 77.9%. The majority of the respondents participated in training on crop production (75.2% male and 64.3% female). Also, 77.8% of male and 73.6% of female respondents belong to associations which were mainly farmer/ agricultural and religious associations.

Table 3. Percentage distribution of farmers according to extension contact, participation in project activities, and membership of associations.

Extension Contact	Male	Female
Had no extension contact	14.5	26.7
Had extension contact	85.5	73.3
Participation in project activities		
Did not participate	14.8	22.1
Participated	85.2	77.9
Activity participated in		
Training in crop production	75.2	64.3
Training in crop processing	4	7
Fertilizer application	2.6	0.8
Crop varietal demonstration trials	1.4	4.7
Field days	0.6	
Membership of Association		
Does not belong to association	22.2	26.4
Belongs to association	77.8	73.6
Type of association		
Farmer/agricultural association	48.2	49.8
Village NGO or civic group	15.7	8.8
Finance, credit, or savings group	2.6	1.1
Education/Health group	3.1	1.8
Religious or spiritual group	25.7	30.9

Source: Field Survey 2016

3.2 Level and rate of adoption of improved cowpea varieties

The level of adoption of improved cowpea varieties reveals an overall adoption level of 48.1% which includes 47.9% for male and 48.4% for female (Fig. 1). When disaggregated by variety, results show that IT89KD288 was the most adopted (17.4% for male and 16.3% for female). Other varieties that were adopted include: IT97K-537-1-1 (14.0% for male and 10.1% for female), IT97K-573-2-1 (7.7% for male and 6.6% for female), UAM09 -1055-6 (3.1% for male and 7.4% for female), and UAM09- 1046-6-1 (2.6% for male and 1.9% for female). Results further revealed that the local variety was the most adopted variety. This shows that breeders should consider farmer-preferred traits when developing improved cowpea varieties. Farmers in northeast Nigeria prefer cowpea that has brown seed color, large seed size, and is resistant to the parasitic weed *(Striga)*.

The rate of adoption shows that adoption of improved cowpea is progressing as the N2Africa project's implementation activities progress (Fig. 2). Results revealed that adoption ranges from 39.6% for male and 41.5% for female in 2013 to 47.9% for male and 48.4% for female in 2015. This shows that there has been a significant increase in the adoption of improved cowpea varieties within three years. This can be attributed to the effort made by the project to disseminate improved cowpea production technologies. The high adoption by female farmers is also due to efforts made by the project to mainstream gender in all activities to ensure equal participation by male and female partners. The establishment of field demonstrations through lead farmers, establishment of community seed schemes, organization of field days, and training of farmers in the use of improved production practices may have triggered the adoption of improved varieties at an early stage.

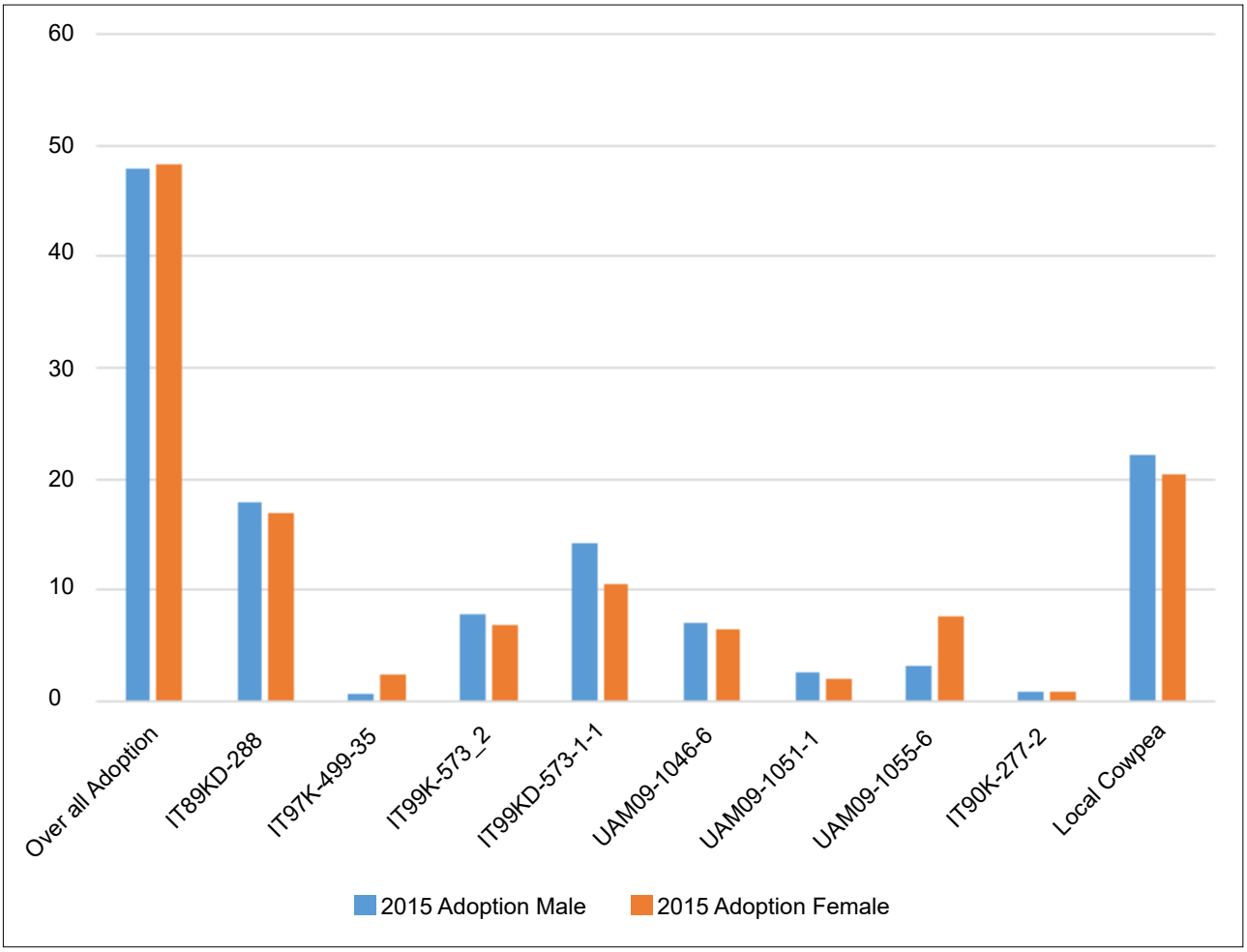


Figure 1. Distribution according to level of adoption of improved cowpea varieties introduced by N2Africa/PROSAB.

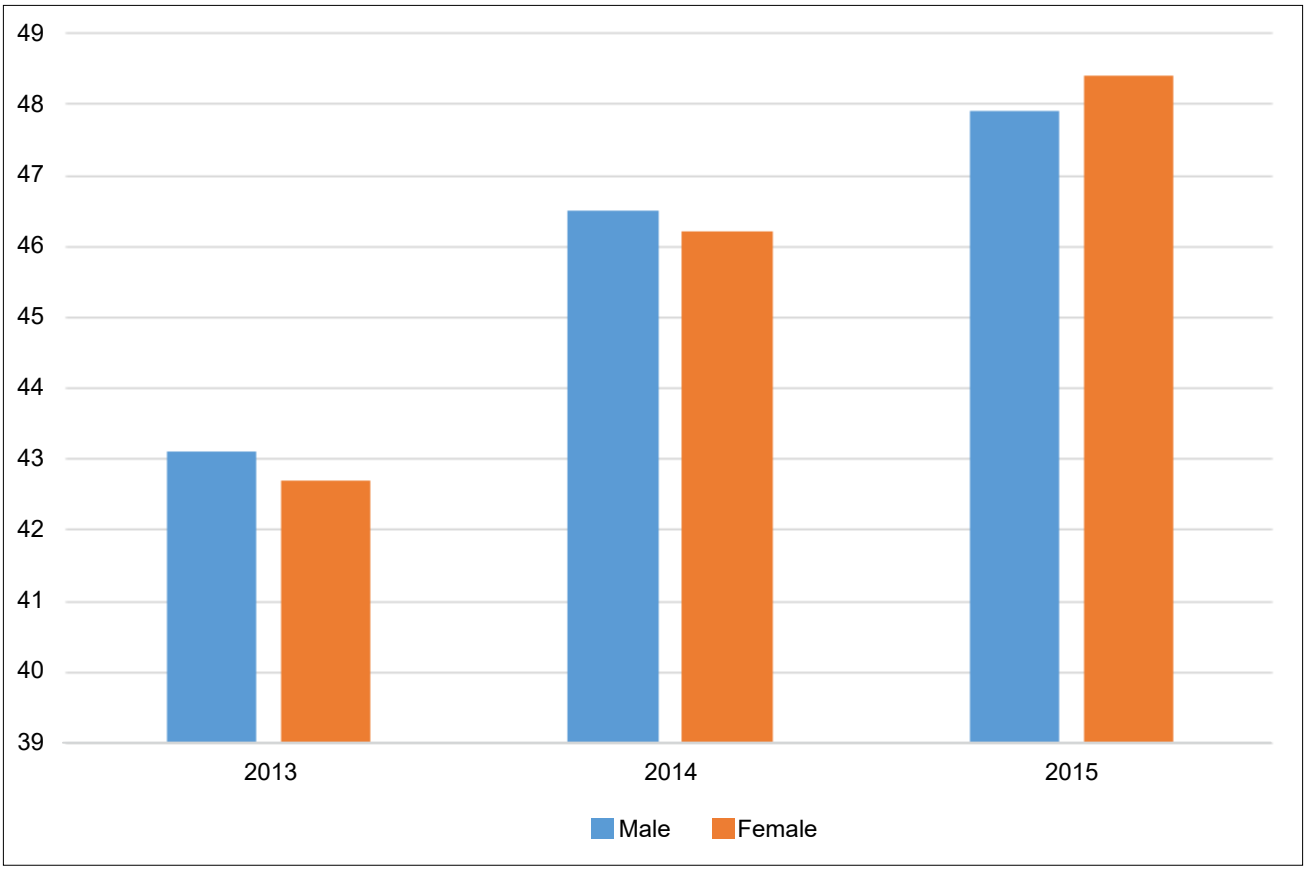


Figure 2. Rate of adoption of improved cowpea varieties in Borno State.

3.3 Pattern of adoption of adoption of improved cowpea varieties

3.3.1 Pattern of adoption according to age category, marrital status, education, participation in project activities, extension contact, and membership of association

The study revealed that the majority of the male adopters fall within the age category of 17 and 56 years, suggesting that they are within their active age periods. The majority are married and in either monogamous (54.8%) or polygamous (37.5%) relationships, which may encourage them to produce crops to ensure food security in their households. On the other hand, the majority of the female adopters fall within the category of 37 and 76 years with the majority being married (polygamous 35.5%, monogamous 29.8%) and widowed (29.0%). The majority of the male adopters (79.8%) have at least a formal type of education including primary, secondary, and tertiary education. Unlike the male adopters, half of the female adopters (49.6%), have no formal education while half have at least one form of formal education (50.4%). This is not surprising as most of the women are given out early in marriage to husbands who do not permit them to go to school. Furthermore, the majority of the adopters had participated in the N2Africa/PROSAB project activities (89.9% male and 88.0% female), had contacts with extension agents (88.7% male and 80.8% female), and were members of associations (77.4% male and 79.2% female) (Table 4). Participation in projects, membership of associations, and contact with extension agents will create awareness among farmers about improved varieties and production technologies as well as encourage farmer-farmer transfer of technologies.

Table 4. Percentage distribution of farmers according to pattern of adoption by age category, marrital status, education, participation in project activities, extension contact, and membership of association.

Variables	Male	Female
Age Category	**Adopter**	**Adopter**
17–36	**33.3**	**14.4**
37–56	**50.6**	**51.2**
57–76	**16.1**	**29.6**
77 and Above	**0.0**	**4.8**
Marriage status		
Single	**4.8**	**2.4**
Monogamous	**54.8**	**29.8**
Polygamous married	**37.5**	**35.5**
Widowed	**2.4**	**29.0**
Divorced	**0.6**	**3.2**
Formal education		
No formal education	**20.2**	**49.6**
Primary	**14.9**	**14.4**
JSS	**4.8**	**1.6**
SSS	**32.1**	**20.0**
OND/NCE/Diploma	**23.2**	**12.8**
HND/University	**4.8**	**1.6**
Participation		
Did not participate	**10.1**	**12.0**
Participated	**89.9**	**88.0**
Extension contact		
No contact	**11.3**	**19.2**
Had contact	**88.7**	**80.8**
Membership of association		
Not a member	**22.6**	**20.8**
Member	**77.4**	**79.2**

3.3.2 Pattern of adoption of improved agronomic practices introduced by N2Africa/PROSAB

The adoption of improved agronomic practices introduced by the N2Africa/PROSAB project shows that the majority of the technologies introduced have been adopted extensively by both male and female farmers. These technologies if well practiced should increase the productivity of improved cowpea varieties. The adoption pattern includes the following: legume-specific fertilizer (50.6% male and 38.7 female), cereal/legume rotations (48.0 male and 36.4% female), cereal/legume intercropping (50.6% male and 39.9% female), drilling fertilizer application (42.0% male and 24.9% female), and legume utilization (35.1% male and 26.1% female). The information is presented in Figure 3.

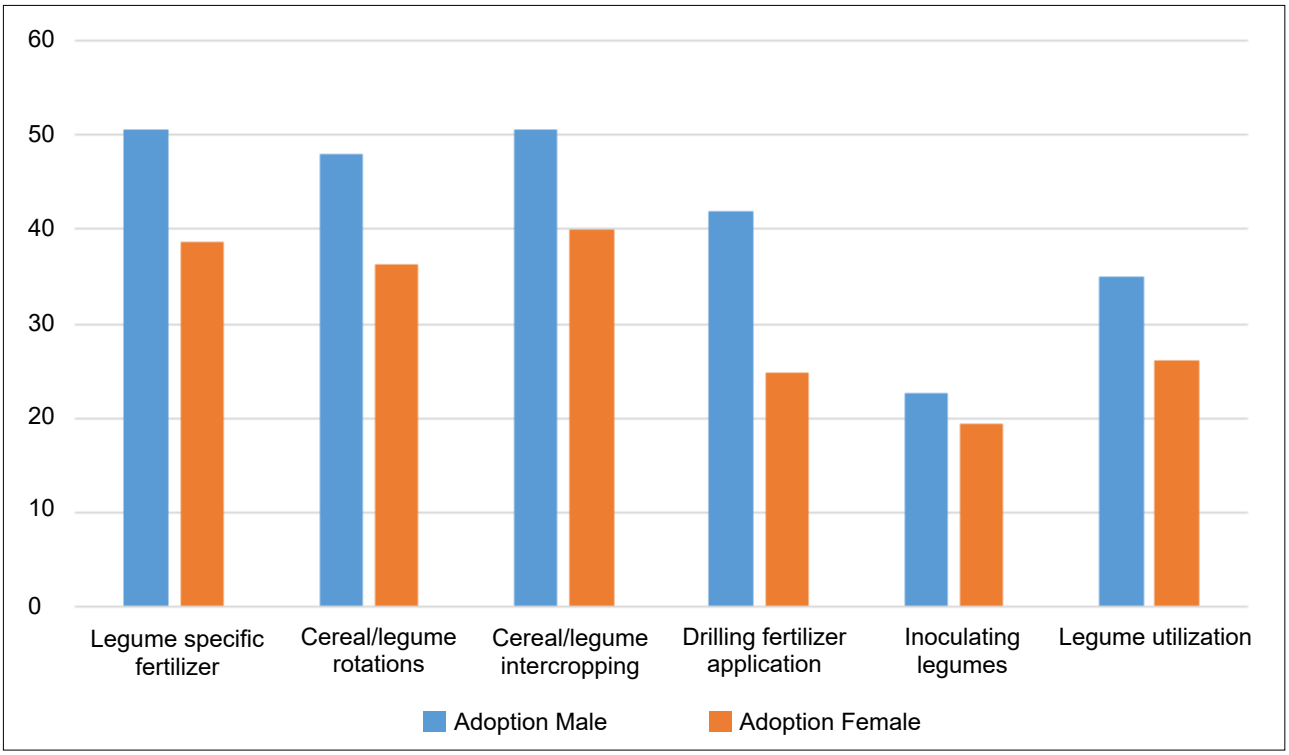


Figure 3. Adoption of improved agronomic practices introduced by N2Africa/PROSAB.

3.4 Factors influencing adoption of improved cowpea varieties in Borno State

Both the Probit and Tobit econometric regression models were used to determine farmer adoption decision of improved cowpea varieties in the study areas. Using the model to determine factors influencing the adoption of improved cowpea varieties, 14 explanatory variables disaggregated by gender were assumed to influence the probability of adoption (Tables 5a and 5b). For the female farmers, participation in the project activities ($p < 1\%$), extension contact, high yield, drought resistance, pest resistance ($p < 10\%$), and less fertilizer requirement ($p < 5\%$) significantly influenced the decision to adopt improved cowpeas. For the male farmers, participation in the project activities, drought resistance ($p < 1\%$), early maturity, seed color ($p < 5\%$), high yield, and resistance to pests ($p < 10\%$) significantly influenced adoption of improved cowpeas.

Using the Tobit regression analysis (Tables 6a and 6b) to determine factors influencing the intensity of adoption of improved cowpeas, 14 explanatory variables disaggregated by gender were also considered. Among the female farmers, extension contact, disease resistance, and drought resistance ($p < 10\%$) significantly influenced the extent of adoption of improved cowpea varieties. For the male farmers, education and seed size ($p < 10\%$) both significantly influenced the extent of adoption of improved cowpeas.

Table 5a. Probit regression results based on female farmers.

Variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
B3_EDU_HHEAD	—0.0047	0.00887	—0.53	0.597	—0.0221	0.0127	1.84581
B5_HHSIZE	0.00046	0.00204	0.22	0.823	—0.0035	0.00445	9.43172
B13a_PARTICIPATE	0.36873	0.05645	6.53	**0.000*** **	0.2581	0.47936	0.80617
B13d_EXT_CONT	0.10222	0.05189	—1.97	**0.049***	—0.2039	-0.0005	0.7533
B14a_MEM_ASSOC	0.05715	0.04195	1.36	0.173	—0.0251	0.13936	0.7489
E9a_HIGH_YIELD	0.30494	0.13507	2.26	**0.024***	0.04021	0.56968	0.92071
E9b_SEED_SIZE	0.06868	0.0772	0.89	0.374	—0.0826	0.21999	0.80617

Variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
B3_EDU_HHEAD	—0.0047	0.00887	—0.53	0.597	—0.0221	0.0127	1.84581
E9c_RESISTACE_DISEASE	0.0448	0.0735	0.61	0.542	—0.0993	0.18886	0.7489
E9f_DROUGHT_RESISTANT	0.1228	0.06642	1.85	**0.064***	—0.0074	0.25298	0.80617
E9g_EARLY_MATURITY	0.08728	0.09257	0.94	0.346	—0.0942	0.26871	0.89868
E9h_LESS_LABOR_INPUT	0.02429	0.06044	0.4	0.688	—0.0942	0.14275	0.72687
E9i_RESISTANCE_PEST	—0.1293	0.06897	—1.87	**0.061***	—0.2645	0.00591	0.77093
E9n_LESS_FERT_REQUI	0.22509	0.07728	2.91	**0.004****	0.07364	0.37655	0.81057
E9o_SEED_COLOR	2.5E-05	0.07848	0	1	—0.1538	0.15384	0.82819

Table 5b. Probit regression results based on male farmers.

Variable|	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
B3_EDU_HHEAD	0.00443	0.00824	0.54	0.591	—0.0117	0.02058	2.82075
B5_HHSIZE	—0.0007	0.00336	—0.19	0.847	—0.0072	0.00593	10.0912
B13a_PARTICIPATE	0.24576	0.0625	3.93	**0.000*****	0.12326	0.36827	0.85535
B13d_EXT_CONT	0.07044	0.06668	1.06	0.291	—0.0603	0.20112	0.86478
B14a_MEM_ASSOC	—0.0335	0.04267	—0.78	0.433	—0.1171	0.05015	0.77359
E9a_HIGH_YIELD	0.2059	0.12478	1.65	**0.099***	—0.0387	0.45046	0.94025
E9b_SEED_SIZE	—0.0487	0.0739	—0.66	0.51	—0.1935	0.09619	0.87736
E9c_RESISTACE_DISEASE	—0.0906	0.05531	—1.64	0.101	—0.199	0.01782	0.77987
E9f_DROUGHT_RESISTANT	0.26106	0.05282	4.94	**0.000*****	0.15753	0.36458	0.81132
E9g_EARLY_MATURITY	0.24357	0.07396	3.29	**0.001****	0.09861	0.38853	0.89308
E9h_LESS_LABOR_INPUT	0.02976	0.06047	0.49	0.623	—0.0888	0.14828	0.83019
E9i_RESISTANCE_PEST	0.13078	0.051	—2.56	**0.010***	—0.2307	—0.0308	0.77359
E9n_LESS_FERT_REQUIRED	—0.1151	0.08514	—1.35	0.176	—0.282	0.05177	0.90566
E9o_SEED_COLOR	0.1985	0.06867	2.89	**0.004****	0.06391	0.33309	0.87736

Table 6a. Tobit regression results based on female farmers.

Variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
B3_EDU_HHEAD	—0.0107	0.0202	—0.53	0.596	—0.0503	0.02888	1.87156
B5_HHSIZE	—0.0014	0.00458	—0.3	0.765	—0.0103	0.0076	9.54587
B13a_PARTICIPATE	0.07082	0.1282	0.55	0.581	—0.1805	0.32209	0.81651
B13d_EXT_CONT	0.27403	0.11663	2.35	**0.019***	0.04543	0.50263	0.76147
B14a_MEM_ASSOC	—0.012	0.09732	—0.12	0.902	—0.2028	0.17873	0.76606
E9a_HIGH_YIELD	—0.0782	0.30976	—0.25	0.801	—0.6853	0.52889	0.94495
E9b_SEED_SIZE	0.16535	0.17369	0.95	0.341	—0.1751	0.50576	0.82569
E9c_RESISTACE_DISEASE	0.35558	0.16447	2.16	**0.031***	0.03322	0.67794	0.76606
E9f_DROUGHT_RESISTANT	—0.3765	0.14998	—2.51	**0.012***	—0.6705	—0.0826	0.82569
E9g_EARLY_MATURITY	—0.2643	0.20921	—1.26	0.207	—0.6743	0.1458	0.92202
E9h_LESS_LABOR_INPUT	0.04503	0.13523	0.33	0.739	—.22	0.31007	0.74312
E9i_RESISTANCE_PEST	0.10365	0.15475	0.67	0.503	—0.1996	0.40695	0.78899
E9n_LESS_FERT_REQUIRED	0.00763	0.17295	0.04	0.965	—0.3314	0.3466	0.83028
E9o_SEED_COLOR	0.23515	0.17581	1.34	0.181	—0.1094	0.57974	0.84862

Table 6b. Tobit regression results based on male farmers.

Variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
B3_EDU_HHEAD	0.05422	0.02429	2.23	**0.026***	0.00662	0.10182	2.81169
B5_HHSIZE	0.01412	0.00986	1.43	0.152	—0.0052	0.03344	10.1688
B13a_PARTICIPATE	0.14924	0.18191	0.82	0.412	—0.2073	0.50577	0.86364
B13d_EXT_CONT	0.15839	0.20144	0.79	0.432	—0.2364	0.5532	0.87338
B14a_MEM_ASSOC	—-0.0069	0.12768	—0.05	0.957	—0.2572	0.24335	0.78247
E9a_HIGH_YIELD	—0.2904	0.37212	—0.78	0.435	—1.0197	0.43892	0.9513
E9b_SEED_SIZE	0.39762	0.22298	1.78	**0.075***	—0.0394	0.83465	0.88961
E9c_RESISTACE_DISEASE	—0.0058	0.16228	—0.04	0.971	—0.3239	0.31225	0.78896
E9f_DROUGHT_RESISTANT	—0.0838	0.1544	—0.54	0.587	—0.3864	0.21884	0.82143
E9g_EARLY_MATURITY	0.09637	0.22167	0.43	0.664	—0.3381	0.53084	0.90584
E9h_LESS_LABOR_INPUT	—0.011	0.17936	—0.06	0.951	—0.3625	0.34054	0.84416
E9i_RESISTANCE_PEST	0.02843	0.15084	0.19	0.85	—0.2672	0.32408	0.78571
E9n_LESS_FERT_REQUIRED	0.3716	0.25105	1.48	0.139	—0.1205	0.86365	0.91883
E9o_SEED_COLOR	0.19827	0.20093	0.99	0.324	—0.1955	0.59208	0.88636

3.5 Cowpea productivity in the study area

Table 7 shows cowpea production by male and female farmers in the study area. Comparing the yield potentials of both improved and local cowpea varieties, it is evident that the yield varies among male and female farmers as well adopters and non-adopters. Adopters of improved cowpea enjoy higher yield than non-adopters. From the results, yields of local cowpea varieties were lower than 1 t/ha for both male and female farmers when compared with the yield of the improved cowpea varieties. This can have implications for income and food security. The extra income from improved cowpea varieties can add value to total household income and can also be used to purchase other food items for household consumption. Higher productivity can also increase home consumption of cowpea which is an affordable source of protein for poor rural farmers.

Table 7. Cowpea productivity of among farmers. (yield kg/ha).

	Local cowpea varieties	Improved cowpea varieties		
	*(*yield kg/ha*)*	*(*yield kg/ha*)*	Yield difference	P-Value
Female	619.794	1013.842	394.0484	0.000***
Male	468.422	1132.316	663.8933	0.000***

3.6 Reasons farmers grow improved cowpea varieties

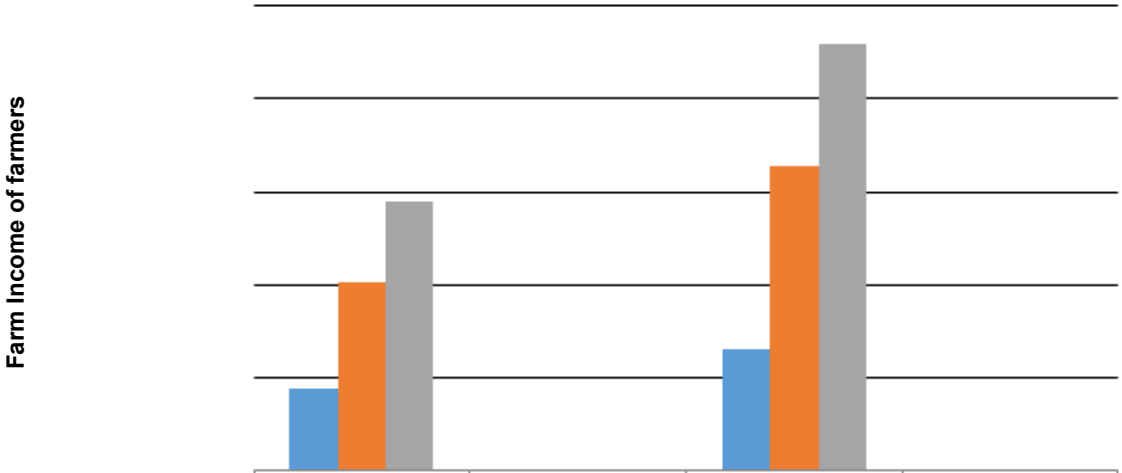
Farmers were asked for the reasons they grow improved cowpea varieties. Results are presented in Table 8. Major reasons given by male farmers include: high yield (98.8%), early maturing (98.8%), less fertilizer requirement (94.6%), seed color (92.2%), and less labor inputs (91.0%). Major reasons given by the female farmers are high yield (97.6%), early maturing (97.6%), and makes better local foods/utilization (93.5%). Also, improved household income (82.0% male and 81.8% female) and improved food security (70.5% male and 73.2% female) were among the major reasons why farmers grow improved cowpea varieties.

Table 8. Percentage distribution of farmers according to reasons for growing improved cowpea varieties.

Reasons	Male	Female
High yield	98.8	97.6
Seed size	88.6	78.9
Resistance to disease (s)	80.8	76.4
High fodder yield	83.2	72.4
Drought resistant	87.4	83.7
Early maturity	98.8	97.6
Less labor inputs	91.0	78.0
Resistance to pest	82.6	79.7
Soil fertility improvement	87.4	83.7
Makes better local foods/utilization	89.2	93.5
Striga control	89.2	89.4
Less fertilizer required to grow	94.6	87.0
Seed color	92.2	86.2
Improved food security	70.5	73.2
Improved household incomes	82.0	81.8

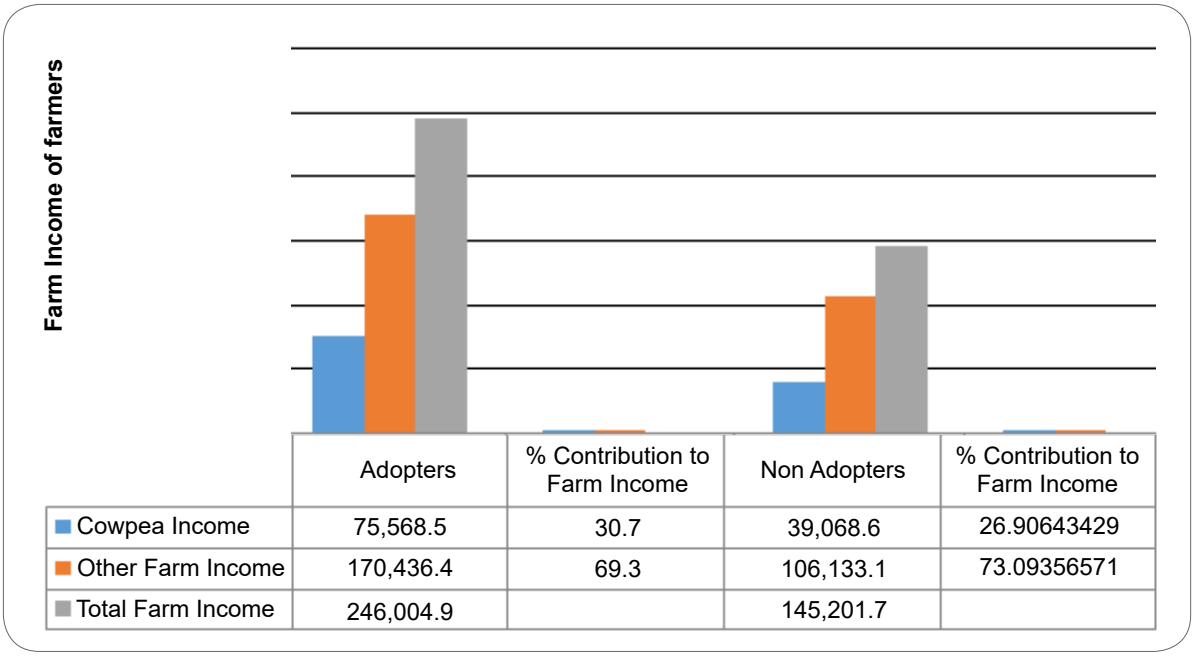
3.7 Impact of adoption of improved cowpea varieties on household income

One of the major objectives of this study was to examine the impact of the adoption of improved cowpea varieties on farmer income. Results in Figures 4a and 4b show that cowpea contributes to a greater extent to farmers' income than all other cash crops (groundnut, maize, millet, rice, sorghum, and soybean) with adopters of improved cowpea varieties enjoying higher income than the non-adopters. These results confirm the baseline results which indicated that cowpea earned farmers more income than all other crops in the study area. Cowpea can be grown alongside other cereal crops like maize, millet, and sorghum. The results can be related to the fact that improved cowpea varieties produce higher yield than the local varieties as shown in Table 7. Farmers should therefore be encouraged to increase their areas under improved cowpea production as it has the potential to contribute significantly to their income.



	Female	% Contribution to Farm Income	Male	% Contribution to Farm Income
Cowpea Income	44,089.5	30.4	65,846.6	28.71506426
Other Farm Income	101,163.4	69.6	163,463.7	71.28493574
Total Farm Income	145,252.9		229,310.3	

Figure 4a. Farm income of male and female farmers in the study area.



	Adopters	% Contribution to Farm Income	Non Adopters	% Contribution to Farm Income
Cowpea Income	75,568.5	30.7	39,068.6	26.90643429
Other Farm Income	170,436.4	69.3	106,133.1	73.09356571
Total Farm Income	246,004.9		145,201.7	

Figure 4b. Distribution of farmers according to impact of adoption of improved cowpea varieties on household income by adoption.

3.8 Impact of adoption of improved cowpea varieties on household poverty

The poverty profile of the households in the study area is presented in Table 9. The poverty headcount for the general population was 0.49. This means that 49% of respondents interviewed were poor. The poverty headcount for the male adopters was 0.46 and that for non-adopters 0.48. Similarly, the poverty headcount for the female adopters was 0.42 and 0.52 for non-adopters. This means that poverty was more common among non-adopters than the adopters. The reduction in poverty among adopters cannot be attributed to income from cowpea alone because farmers have other sources of income that could fetch them more income. Since the income from cowpea was significant, one can conclude that cowpea income plays an important role in helping to alleviate poverty among farmers especially those cultivating improved varieties because of their high productivity. Growing improved cowpea therefore can contribute to a reduction in poverty level among farmers. This shows that households that are not cultivating improved cowpea will have more poverty incidence, than adopting households with access to additional income from improved cowpea varieties.

Table 9. Distribution of farmers according to poverty profiles.

Variable	Poverty line	Poverty headcount
General population	55582.78	0.49
Female adopters	57928.53	0.42
Female non-adopters	43754.80	0.52
MaleAdopters	55190.54	0.46
Male - Non-Adopters	59057.77	0.48

3. 9: Impact of adoption of improved cowpea varieties on household food security

Table 10 shows the food security status among the households in the study area. The food security status revealed that the cost of the minimum basic food requirement which is the food insecurity line, was N740.9314. Using this to define the food insecurity line, it was found that 41% of all respondents were food insecure. Results also show that 41% of male adopters were food secure, while 43% of male non-adopters were food insecure. The estimated food insecurity status among female adopters was 38% while that of non-

adopters was 46.69%. Cowpea is both a cash and food crop. Its contribution to food security does not mean that farmers consume the crop entirely, rather, the extra income from its sale could be used to purchase other food items that are rich in protein to boost their health and nutrition. Since the results showed that adopters of improved cowpea varieties are more food secure, it can be concluded that adoption of improved cowpea varieties increases farmers chances of being food secure.

Table 10. Distribution of farmers according to food security status.

Variables	Food insecurity line (Naira)	Food insecurity headcount	Aggregate expenditure gap	Aggregate income gap
General population	740.9314	0.41	48.03%	—356.192
Male adopters	740.9314	0.41	47.58%	—352.54
Male non-adopters	740.9314	0.43	50.45%	—374.466
Female adopters	740.9314	0.38	45.4%	—339.88
Female non-adopters	740.9314	0.43	46.69%	—345.96

3.10 Farmers' testimony on the impact of the improved cowpea varieties

The testimonies of farmers during the FGD follow:

i. In all, 69.2% said they can attribute poverty reduction in the study area to improved cowpea varieties and IITA.

ii. Benefits derived from improved cowpea production include:

- Access to improved seeds
- Improved income
- Improved shelter
- Improved farming techniques
- Asset ownership
- Payment for better education
- Ownership of livestock
- Improved health
- Food security
- Land ownership
- Elevation of social status

Tangible proof of the benefits derived from cowpea production and IITA are presented in pictograms (See Appendix I).

Conclusion

From the findings of the study, the following conclusions were drawn:

i. Farmers in the study area are mostly married with the level of education of male farmers higher than that of the female farming population. Considering the age brackets of the farming population, the male farming population are younger than the female farming population, showing that most of the female farmers are old and widowed. The level of farmer extension contacts in the study area is high with high farmer participation in the project activities in various ways especially in crop production. The majority of the farmers belong to one association with a high percentage belonging to farmer and religious associations. Extension contact and membership of associations can result in high adoption of improved cowpeas.

ii. Almost half of the farming population is growing the improved cowpea varieties introduced to them by the project with the majority of the adopters being those who participated in the project, those who had extension contacts, younger farmers, and those who are members of associations. The improved agronomic practices adopted extensively by farmers include: legume-specific fertilizer, cereal/legume rotations, cereal/legume intercropping, drilling fertilizer, and legume utilization.

iii. Farmers, despite adopting the improved cowpea varieties, still prefer their local varieties due to certain characteristics that include large seed size and brown seed color.

iv. Factors influencing adoption of improved cowpea varieties are: participation in the project activities, extension contact, high yield, drought resistance, pest resistance, less fertilizer requirement, early maturity, seed color, disease resistance, education, and seed size.

v. Adopters of improved cowpea enjoy higher yield than non-adopters. The yields of local cowpea varieties are lower than those of the improved cowpea varieties.

vi. Reasons given by farmers for growing improved cowpea varieties include: high yield, early maturity, less fertilizer requirement, seed color, and less labor inputs, make better local foods/utilization), improvement of household income, and improved food security.

vii. Cowpea contributes to a greater extent to farmers income more than all other cash crops (soybean, maize, millet, sorghum, groundnut, and rice). Adopters of improved cowpea varieties enjoy higher income than non-adopters.

viii. Almost half (49%) of the respondents interviewed were poor with poverty more common among non-adopters of improved cowpea varieties.

ix. The study revealed that close to half of all respondents were food insecure with food insecurity more common among non-adopter of improved cowpea varieties.

Recommendations

i. The project should encourage older farmers to be involved in their activities as they have a wealth of experience that the younger ones can learn from.

ii. Participation in project activities should be intensified through involving more stakeholders who are the potential users of the technologies introduced to them and improving on the farmer-extension ratio, by involving more extension agents who are directly living with the farmers within their operational areas.

iii. Breeders of improved cowpea varieties should develop varieties that have large seed size and are brown in color. Where available, the project should promote these cowpea varieties.

iv. Since adopters of improved cowpea enjoy higher yield than non-adopters, farmers should be encouraged to grow high yielding improved varieties.

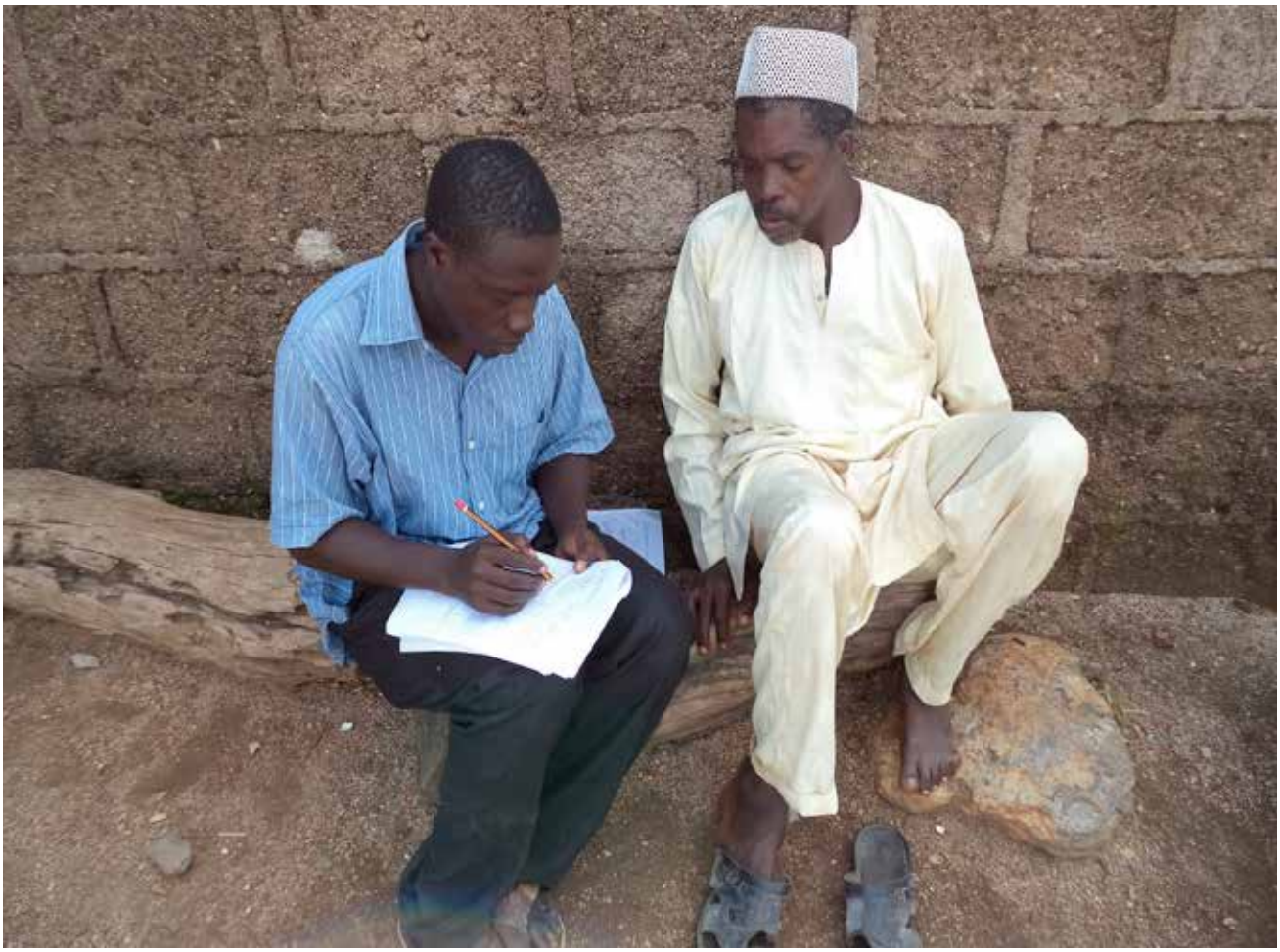
Appendix I

Pictorial presentation of farmers displaying benefits derived from IITA and their readiness for farming activities.

Cowpea farmer built his house (above) and bought a piece of land (bottom) entirely with income from the sale of farm produce one of which is cowpea.

Cross section of male and female farmers in one of the study communities.

Active young farmers displaying their readiness for farming.



Enumerators interviewing male and female farmers, the picture also depicting male and female differences in the study area.

Group discussion with farmers during data collection.






Farmer signalling, they have benefitted greatly from IITA's project.






Farmers displaying what they have benefitted from IITA's project (above) and a contract sprayer (bottom)with his family showcasing their support to cowpea farmers.