N2Africa Baseline Report
Borno State

Paul Amaza

Submission date: 24 February 2016

N2Africa

Putting nitrogen fixation to work for smallholder farmers in Africa

N2Africa is a project funded by The Bill & Melinda Gates Foundation by a grant to Plant Production Systems, Wageningen University who lead the project together with CIAT-TSBF, IITA and many partners in Ethiopia, Tanzania and Uganda.

Email: n2africa.office@wur.nl
Internet: www.N2Africa.org

Authors of this report and contact details

Name: P.A. Amaza Partner acronym: IITA

Table of contents

Table of tables

Table of figures

Acronyms and abbreviations

CBO	Community-Based Organization
CIDA	Canadian International Development Agency
CoC	Cost of Calorie
FAO	Food and Agriculture Organization
FOS	Federal Office of Statistics
FGN	Federal Government of Nigeria
FGT	Foster, Greer, and Thorbecke weighted poverty index
GM	Gross margin
IAR	Institute of Agricultural Research
IITA	International Institute of Tropical Agriculture
Kg	Kilogramme
Kcal	Kilo calorie
LGA	Local Government Area
MAHE	Mean per adult equivalent household expenditure
Mt	Metric tonne
NBS	National Bureau of Statistics
NGO	Nongovernmental Organization
NGS	Northern Guinea Savannah
PROSAB	Promoting Sustainable Agriculture in Borno State

Executive summary

N2Africa 'Putting nitrogen fixation to work for smallholder farmers in Africa' is a project funded by The Bill & Melinda Gates Foundation (BMGF) by a grant to Plant Production Systems, Wageningen University who lead the project together with the International Institute of Tropical Agriculture (IITA), the International Livestock Research Institute (ILRI), University of Zimbabwe and many partners in Ghana, Nigeria, Tanzania, Uganda, Ethiopia, the Democratic Republic of Congo, Rwanda, Kenya, Malawi, Mozambique and Zimbabwe. Shortly after inception, N2Africa obtained an additional grant expanding project implementation to Borno State, Nigeria, which is the target area for the baseline study report at hand.

N2Africa will build sustainable, long-term partnerships to enable smallholder farmers to benefit from symbiotic N_2-fixation by grain legumes through effective production technologies, including inoculants and fertilizers. The goal of the project is to contribute to improved rural household livelihoods of smallholder farmers in the project areas of Borno State in Nigeria, by enhancing the yield of grain legumes and expanding the farm area cropped with legumes to improve incomes, and food and nutrition security.

The purpose of this study is to provide program staff, funders and other stakeholders with detailed baseline information on key project milestones and related indicators. N2Africa has clearly defined its milestones and indicators in its results framework, but baseline data for Borno State are currently unavailable. Therefore, in order to create the benchmarks for future impact assessment and to improve targeting of project interventions, a baseline survey was commissioned to generate the required information and possible targets for the selected milestones and indicators in the results framework.

A sample of 800 households comprising 400 households in N2Africa participating communities i.e. includes overlap communities with the former (ended 2009) Promoting Sustainable Agriculture in Borno (PROSAB) project and 400 non-participating communities were selected for this study. The four local government areas (Bayo, Biu, Hawul and Kwaya Kusar) were purposively selected as N2Africa project operational areas[1]. In each of the four local government areas, two areas were purposively selected (i); N2Africa beneficiary communities and (ii) N2Africa non-beneficiaries for counter-factual. The criteria for the selection of the communities included: PROSAB implementation, i.e. operational communities for N2Africa, non-operational communities for N2Africa and overlap communities for N2Africa and PROSAB.

The sampled farmers were mostly (78%) between 26 and 55 years of age, and over 90% of them were married. About 70% of the farmers had some form of formal education at varied levels with 62% of children aged 5 to 14 years old in school. The mean household size in the study area was approximately 8 persons.

The study results reveal significant difference exist in terms of total farm size (4.2 ha), number of plots owned by spouse (3) and number of plots owned by spouse currently under cultivation (3) in PROSAB area compared to only 1-plot in non-N2Africa area (counterfactual). The significantly higher figures under PROSAB reflect the impact of PROSAB on crop production. Significantly higher yields of crops under PROSAB have encouraged farmers to acquire and/or rent more land for crop production. In addition, under PROSAB, gender mainstreaming strategy, women farmers were empowered to have access to more productive resources, especially land. This had increased average farm plots (2.9) owned by women in PROSAB/N2Africa area, which double that of women (1.4) in the non- intervention areas.

The levels of awareness of most of the crop technologies are generally high at over 70% among sampled farmers in N2Africa and PROSAB areas (with the exception of improved sorghum - 38%,

[1] Three LGAS (Biu, Hawul and Kwaya Kusar) overlap PROSAB and N2Africa communities

legume specific fertiliser - 63%, inoculating legumes - 43% and legume utilization - 61%). These high levels of awareness of the crop technologies and management practices are partly attributed to the 2014 disseminations activities by N2Africa. On the contrary, in the non-intervention N2Africa survey areas, the proportion of farmers that were aware of the crop technologies and management practices were considerably much lower, generally ranging at varied proportion of sampled farmers from 36% to 59%. The level of awareness of these farmers in the non-intervention project areas could have been created through farmer-to-farmer information sharing between farmers in the N2Africa, especially farmers in PROSAB intervention communities with farmers in non-intervention communities.

The mean income from crops earned by farmers in N2Africa and PROSAB, which reflects similarity in terms of yields achieved by farmers are significantly higher than non-intervention project areas[2]. Households in PROSAB/N2Africa areas earned significant increases in the value of cowpea, groundnut, soyabean and rice over non-N2Africa project area, ranging from 50% to 100% increases. This significant increases in income earned are directly related to the obtained yields in kg/ha and linkages to output market in the case of soyabean. The mean income earned from crops, which are further disaggregated by gender revealed that male farmers earned relatively more income than female from the sales of all the crops (10% to 50%). Youth farmers who are mostly singles earned relatively more income (₦105,783) than both male (₦93,485) and female (₦58,620) farmers from growing soyabeans, as they are motivated more by growing crops mainly for commercial purposes rather than food security considerations.

The study results suggest that PROSAB has made significant contribution towards improving food security of households. In PROSAB project communities, food insecurity has been reduced from 58% in 2004 to 30% in 2014, an 18% improvement in food security over the 10-year period. In addition, a comparison of PROSAB and non-PROSAB communities in 2014 showed that food insecurity is higher (62%) in communities where PROSAB had no intervention compared with 30% in PROSAB communities. Logit regression technique was used to determine factors that influence household food security. The regression results suggested that adoption of improved varieties, trainings received, access to inputs and output markets, credit, level of education, farm size and number of plots had a positive and statistically significant effect ($P = 0.05$) on household food security status.

The poverty measures in N2Africa, PROSAB and non-intervention communities in 2014 were 52%, 54% and 66% respectively. Thus, the incidence of poverty in PROSAB communities had decreased from 67% in 2004 to 54% in 2014, indicating a 13% reduction in the poverty level among households in the project area. A comparison of household poverty between PROSAB communities and non-participating communities in the State indicates that the incidence of poverty is lower in PROSAB communities by 12%[3]. Even though less robust than the food security case, poverty status regression results suggest that participation in PROSAB activities had a negative and significant effect on household poverty status. Therefore, participating in PROSAB activities contributed to reducing household poverty.

From this study and based on the success of the PROSAB project, the following recommendations are suggested for the implementation in the new N2Africa project in Borno State.

- The capacity building of gender with regards to household processing and utilization of legumes should be strengthened and scaled-up, especially in the new areas (e.g. Bayo LGA). This has the potential to facilitate increased adoption of legume technologies, improving household nutrition and enhance household incomes.
- Farmer-to-Farmer extension was found to have strong influence on awareness creation and the rate of adoption of improved crop technologies. It is therefore recommended that increased number of farmers be informed on the efficacy of the respective legume technologies.
- The adoption of improved soyabean technologies and related technologies such as soyabean-maize crop rotation and linkages to output market have been strong success drivers for the

[2] 50% of the N2Africa Communities overlap with PROSAB communities
[3] Incidence of poverty in non-PROSAB communities is 66% (i.e., 66 – 54 = 12%)

PROSAB project. The N2Africa project should build on this success by exploring more and new market opportunities that can be accessed by farmers, especially youth and women.

- The existence of a local seed company (JIRKUR SEED) amongst many other factors had contributed to the adoption of improved varieties. It is recommended that N2Africa should strengthen the capacity of seed producers, especially women and youth
- Given the pivotal role that credit plays in enhancing farmers' access to new crop technologies, inputs such as fertilisers, N2Africa should enhance farmers, especially women and youth's access to credit by building their capacity on how to access credit and linking them to formal credit institutions.
- In other N2Africa project communities, efforts should target women and youth entrepreneurship development in the areas of seed production, inputs and output marketing, legume value addition (processing), especially soyabean. These activities have the potential to promote increased adoption of legume technologies and management practices.
- The probit regression result revealed that farmers' participation in the PROSAB project had positive impact in poverty reduction. This is a learnt lesson for N2Africa. Therefore, it is recommended that the N2Africa project should intensify scaling-up of legume technologies and management practices to farmers, especially those in Bayo LGA in order to speed up the rates of adoption in the project area.

1 Introduction

1.1 Background of the Study

N2Africa is putting nitrogen fixation to work for smallholder farmers in Africa through enhancing the yield of grain legumes and expanding the farm area cropped with legumes to improve incomes, food and nutrition security. It is a large scale, science-based "research-in-development" project funded by the Bill and Melinda Gates Foundation with a vision of building sustainable, long-term partnerships to enable smallholder farmers to benefit from symbiotic N_2-fixation by grain legumes through effective production technologies, including inoculants and fertilizers.

The project is currently being implemented in 11 countries including Nigeria. In Nigeria it is implemented in four main states of Niger, Kaduna, Kano and Borno States and focuses on cowpea, groundnut and soyabean.

The vision of success of the Borno State project is in line with the project 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 agri-business would be created for at least 2,000 youths living in the target area.

The intervention areas (geographical coverage) in Borno State are mainly in southern Borno 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 (apart from Bayo LGA for N2Africa).

This study therefore will enable N2Africa project understand the situation at the beginning of the project in Borno State regarding key milestones and indicators as agreed with the project funders and to design appropriate strategies and interventions to achieve the agreed results. The information will also be used to benchmark the results achieved by the project during its impact assessment stage. It will also be used in assessing the impact of PROSAB project.

1.2 Purpose of the study

The purpose of the baseline study is to provide programme staff, funders and other stakeholders with detailed baseline information on key project milestones and related indicators. N2Africa has clearly defined its milestones and indicators in its results framework but baseline of these milestones and indicators for Borno State are currently unavailable. Therefore, in order to create the benchmarks for future impact assessment and for targeting of project interventions, a baseline survey is necessary to come up with baseline information and possible targets for the selected milestones and indicators in the results framework.

It is also crucial to use the results of the study to assess the impact of PROSAB interventions after its initial impact assessment in 2009 as it has similar objectives and operational areas as N2Africa. Analysed data can generate inferences to assess such impacts.

1.3 Objectives of the study

The main objective of the baseline study was to provide information of the target beneficiaries as per the project results framework and project document. It also provides insight into the impacts created by the PROSAB project after 2009. The specific objectives of the baseline study are as follows:

a) To collect and analyze verifiable milestones/indicators from the project results framework.
b) To collect and analyse relevant information of existing situation of project's targeted beneficiaries (including gender; youth, men and females), service providers, and related stakeholders. These included collection and analysis of relevant information in terms of household characteristics (composition, assets, sources and level of income, food security situation, etc.), awareness and adoption of legume technologies, access to extension, credit, improved seeds, household consumption and expenditures, access to markets, access and control to available productive resources, etc.
c) The information gathered were used to determine the starting point of the project in Borno State and also served as benchmark for impact assessment at the end of the project to ascertain the contributions of the project interventions. The baseline will provide data upon which the projects' progress on generation of outputs, contribution to outcomes and impacts is assessed.
d) The analysed data will be used to design appropriate and focused interventions to achieve the needed changes in legume productivity and other related improvements as indicated in the vision of success and results framework.
e) The study provides information on the impact assessment of the PROSAB project implemented in Borno State between 2004 and 2009 using the data collected.

1.4 Scope of the study

The scope of the study included collecting qualitative and quantitative data on key milestones of the Borno Results framework. It also comprised collecting information on the impact indicators of the project as indicated in the project results framework. The field data collection was carried out in June, 2015. However, information obtained from households relates to the previous 2014 cropping season. The data also provided insight into the impacts created by the PROSAB. Respondents involved both project beneficiaries' non-beneficiaries, proposed implementers and other stakeholders in the selected value chains and agreed target areas. These beneficiaries and implementers overlapped for both projects in the operational areas. The study area comprised: Bayo, Biu, Hawul and Kwaya Kusar LGAs of Borno State, Nigeria. The main reference points of the study were the project document (project proposal) and the Borno results framework.

2 The study area and N2Africa project

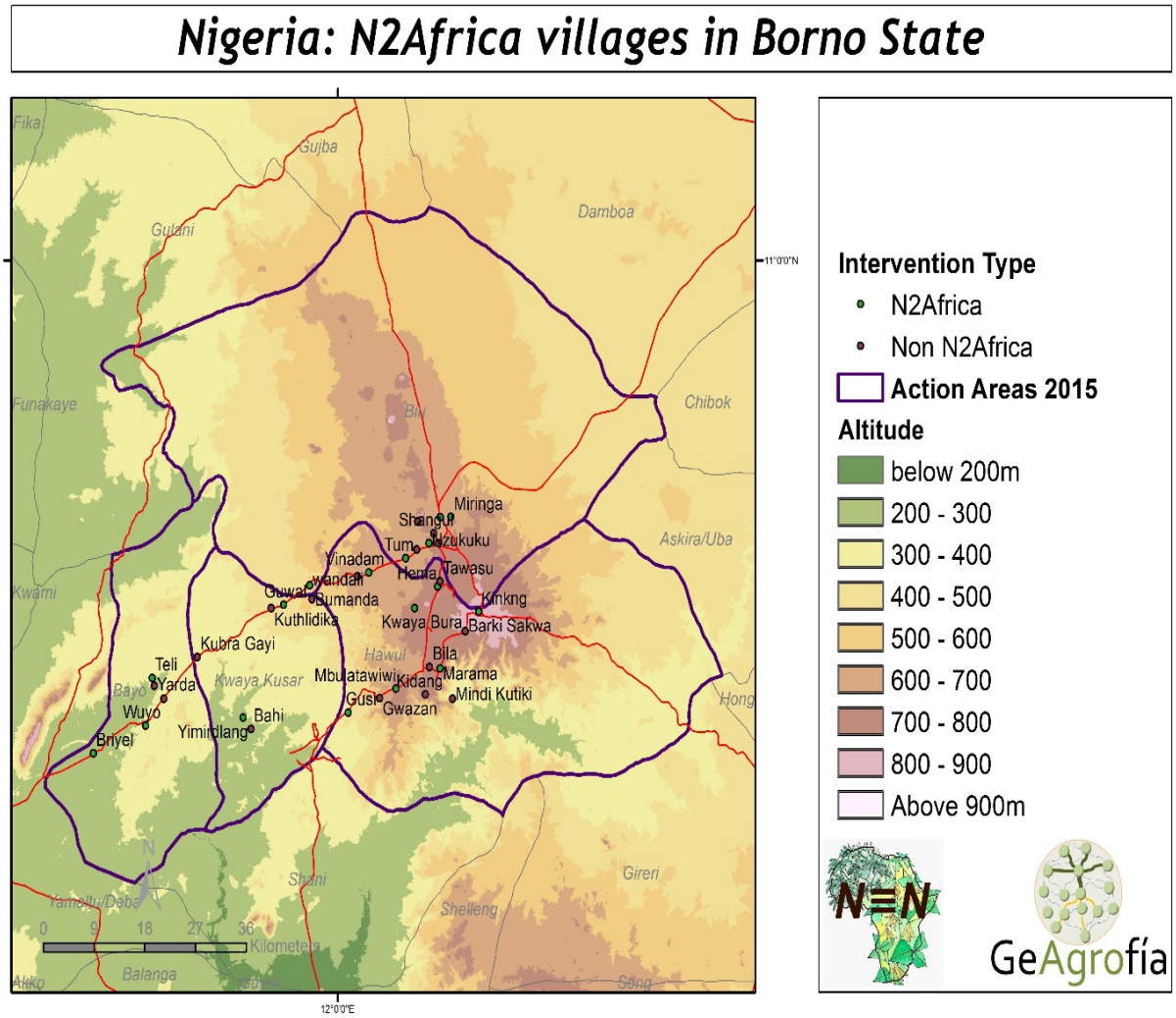
Description of the Survey Area

The baseline field survey was carried out in the communities covered by the N2Africa project in Borno State. Borno State, located in northeast Nigeria, covers an area of 69,435 square kilometers. The state is demarcated into four agro-ecological zones, viz southern and northern guinea savanna in the south, Sudan savanna in the southern and central parts and the Sahel in the north.

The project area covers two agro-ecological zones comprising southern and northern Guinea savanna, located between Latitude 10^{o} and 12^{o} north of the Equator and Longitude 11^{o} 30 and 14^{o} east. It consists of *Bayo*, *Biu, Hawul and Kwaya Kusar* local government areas of Borno State. Numerous ethnic groups and cultures characterize the area, with approximately 80 percent of the population being small-scale farmers. Agriculture and trading constitute the major economic activities of the area (BOSADP, 1998).

The baseline study area is characterized by a relatively wet and humid weather as compared with the drier northern part of the state. The annual rainfall ranges from 600 mm in the north to 1200 mm in the south and extends over a growing season of between 100 and 180 days. Annual rainfall varies from year to year, with decreasing trends during the past two decades. According to the 2006 census, Borno State has a population of 4.2 million people who depend mainly on agriculture (Amaza et. al., 2007). In the north, major crops grown are millet, sorghum, and cowpea. In the savannahs of the southern part of the State, major crops are maize, sorghum, cowpea, groundnut, rice, and recently soyabean. Crops may be grown as sole, multiple, mixed or relay. Crops may also be grown in rotations, depending on preference

The vegetation of the study area is of the northern guinea and southern guinea savanna types, consisting of shrubs interspersed with trees and woodland. Most parts of the area are mountainous with abundant rivers, which are, however, seasonal in nature. The agricultural activities in the project area can be categorized into cropping activities and animal husbandry. The cropping pattern is almost uniform throughout the area, probably due to similarities in vegetation.



Map: Surveyed communities in Borno State

In Borno State, as most places in northern Nigeria, food security depends on weather and soil fertility. With erratic rainfall and marginal soil fertility, the region's food production is no longer sufficient to feed the growing population. Other major threats to rural livelihoods in Borno State are desertification and poverty, which have been worsening in recent years. Desertification results in low yields from crops, resulting in food insecurity and misery, which is common across the dry savannahs of West and Central Africa.

Poor soil management practices, increasing soil erosion, and deforestation are decreasing the productive capacity of land that is already over cultivated. Often this has led to permanent degradation in some areas. There are many factors that trigger desertification, including the unpredictable effects of drought, unsustainable land use (over-cultivation, overgrazing, and deforestation), fragile soils and erosion, nutrient mining, a growing population and neglect by policy makers. This hampers food security, limits efforts to reduce poverty, and constrains human development. This environmental degradation results in low crop yields and poverty among agricultural communities where the average household income is less than US$1/ day (Amaza *et al*., 2007).

The challenge of increasing food production is developing technologies that not only enhance food production but also maintain ecological stability and preserve the natural resource base, i.e., technologies that are both economically viable and sustainable.

3 Methodology

3.1 Sampling technique and data collection procedure

The baseline study followed an accepted statistical sampling procedures and collected adequate samples that reflected important characteristics of the population under study. Random sampling and non-random sampling methods were used to select samples. For the random sampling technique, the following sampling formula was used to determine the sample size for the baseline study.

$$n = \frac{(1.96)^2 \times N}{(1.96)^2 + I^2 \times (N-1)} . \quad (1)$$

Where;

n = sample size
N = study population
I = confidence interval

For the N2Africa communities a 95% confidence interval was applied. For 40,000 households, questionnaires were administered to 381 randomly selected households based on the formula. However, the sample size was increased by 5% to 400 samples for N2Africa communities when allowance was introduced to account for non-response rate during data collection. An equal sample of 400 households was also sampled for non-N2Africa communities (counterfactual), giving us a total sample of 800 households for the survey

Household surveys were undertaken in N2Africa participating communities (i.e. includes overlap communities with PROSAB) and non-participating communities. The four LGAs were purposively selected as N2Africa project operational areas[4]. In each of the 4 LGAs, communities were purposively selected; N2Africa beneficiary communities and their corresponding N2Africa non-beneficiaries for counter-factual. The criteria for the selection of the communities included: operational communities for N2Africa, non-operational communities for N2Africa and overlap communities for N2Africa and PROSAB.

The households interviewed in the N2Africa communities were selected through purposive sampling based on the fact that some households have already been engaged with the project in 2014 and others are yet to. Again, some would have had the opportunity and participated in PROSAB that was also an additional criteria for selection. Simple random sampling was used in the non-N2Africa communities. Table 1 presents the selected communities and number of sampled households in each community (in bracket).

[4] Three LGAS (Biu, Hawul and Kwaya Kusar) overlap PROSAB and N2Africa communities

Table 1: Selected communities in the Study Area, Borno State, Nigeria

N2Africa LGAs	N2Africa Communities & Number of Sampled Households	Non-N2Africa Communities & Number of Sampled Households
Bayo	Wuyo (35)	Tashan Tsamiya ((35)
	Briyel (40)	Kurba Gayi (40)
	Teli (35)	Yarda (35)
Biu*	Tum* (20)	BCG (20)
	Miringa* (25)	Hizi Gwaram (25)
	Yamarkumi (10)	Shagul (10)
	Nzukuku (15)	Tabra Tsahuyam (15)
Hawul*	Vinadam* (25)	Tasha Gauta (25)
	Marama* (35)	Kidang (35)
	Mbulatawiwi* (25)	Gwadzang (25)
	Kinging (25)	Barki Sakwa (25)
	Kaya Bura (25)	Billa (25)
	Hema (15)	Tawasu (15)
Kwaya Kusar*	Guwal* (15)	Kuthlidika (15)
	Wandali* (30)	Bumanda (30)
	Gusi (15)	Mindi Kutiki (15)
	Yimirdlang (10)	Bahi (10)
Total Sampled Households	**400**	**400**

* PROSAB LGAs and Communities

Focus Group Discussion was held with 10-15 representatives of local level actors in selected project areas and non-project areas. These representatives were purposively selected and they provided information on the village-level questionnaire.

3.2 Analytical techniques

Data

The data for the N2Africa Borno Situational survey were obtained through a survey of 800 households in Borno State conducted in June, 2015. The main instruments for data collection were well-structured questionnaires administered on households by trained enumerators under the supervision of the Consultant from the Department of Agricultural Economics, University of Jos, Nigeria.

Data were collected from 34 communities and settlements spread across the four LGAs in the project area (Table 1.). Seventeen of the communities were selected from the N2Africa communities where N2Africa project has chosen to be directly promoting improved crop technologies and better crop management practices since 2014[5]. The remaining seventeen communities, although they are within the four LGAs areas, are not among the N2Africa selected communities that were earlier identified and selected in preparation for project implementation activities. These non-intervention communities (counterfactuals) were selected for comparative analysis to assess the impact of PROSAB intervention in promoting improved crop technologies and management practices among resource-poor farmers.

Methods

A combination of analytical tools was employed in this study. These included descriptive statistics, (means, frequencies, etc.) and test of significances were carried out using t-test, and chi-square test; Gross margin analysis; Foster, Greer, and Thorbecke (FGT) weighted poverty index, cost of calorie (CoC) food security status estimation, Logit and probit regression techniques.

[5] Includes both N2Africa and PROSAB communities

Descriptive statistics

Descriptive statistics were used to examine the socioeconomic characteristics of the respondents' households and basic features of the existing crop production system in the study area. The need for such analysis is based on the fact that households' food security and poverty are largely functions of farmers' social and economic characteristics.

Gross margin analysis

The budgetary technique was used to determine the profitability of crop enterprises grown by the sampled households. It provided actual information on farm-input use and costs, output and prices and farmers' gross margins.

The gross margin was estimated as

$$GM = \sum piqi - \sum rjxj \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where:

GM = Farm gross margin
pi = Unit price of output i
qi = quantity of output i
rj = unit cost of the variable input j
xj = quantity of the variable input j

Estimation of food security line and status

In assessing food security at the household level, we first asked the household heads to make their own assessment of food security. We then proceeded and calculated food security for all the households and then classified them as food-secure or food-insecure households accordingly. The food security measures were carried out for the year (2014) and compared with the 2004 baseline food security data to assess impact of crop technologies, management practices, and market linkages delivered by PROSAB project on households' food security. The second component of food security analysis was to compare the food security status for PROSAB communities where N2Africa is also directly working in terms of promoting the use of improved crop varieties and management practices with the situation in non-intervention communities where N2Africa is not directly working.

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 households 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

$$LnX = a+bC \quad (3)$$

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:

$$S=e^{(a+bL)} \quad (4)$$

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 food insecure, depending on which side of the line they fall.

Estimation of the poverty line and poverty status

Similarly, as with the food security measures, current (2014) poverty measures were carried out and compared with the 2004 poverty measures for PROSAB intervention areas. The comparison provided information on the level of poverty reduction in the communities as a result of PROSAB intervention through the introduction of improved crop technologies and management practices among farmers in the project areas. Secondly, poverty measures within the PROSAB project communities were compared with those communities (counterfactuals) outside the project area. The estimation of poverty status involves the measurement of the standard of living of the households, estimation of the poverty line, and the computation of the poverty profile.

Table 2: Nutritional (calorie-based) equivalent scales

Years of age	Male	Female
0–1	0.27	0.27
2–3	0.45	0.45
4–6	0.61	0.61
7–9	0.73	0.73
10–12	0.86	0.78
13–15	0.96	0.83
16–19	1.02	0.77
20 and above	1.00	0.73

Source: Adapted from FOS (2004).

Measuring the standard of living

The standard of living of households in the area was measured based on the expenditure of the households. The household expenditure was converted into per capita expenditure by dividing it by the number of members of the household. This was further converted into adult equivalents based on the nutritional requirement, sex, and age of household members, using the nutrition-based adult equivalent scales provided by FOS (2004) shown in Table 2. By multiplying the nutrition equivalent scales by the number of household members that fall in any of the age-by-sex categories, the monthly mean/adult equivalent household expenditure (MAHE) for the sampled households was calculated.

Estimating the poverty line

The poverty line was calculated from the MAHE of the sampled households. Two-thirds of the MAHE of the sampled households was used as the poverty line for the study. This approach was used by several researchers (World Bank 1996, FOS 1999, Omonona 2001; FOS 2004; Bandabla 2005, Kwaghe 2006, Amaza et al. 2007, and Amaza et al. 2009. This was done by ranking the MAHE of the households and then dividing the population into equal increments. For this study, the division was based on deciles or 10% increments, such that the first decile represents the bottom 10% of the sampled households in terms of expenditure (or presumably, the poorest) and the highest or the 10^{th} decile was that increment which represents the highest 10% of the sample in terms of consumption (or presumably, the richest). The MAHE of the deciles were added and divided by 10 to get their mean. Two-thirds of the mean was then computed to arrive at the MAHE that served as the poverty line for the study area.

For the determinants of household poverty status, a probit regression model was conceptualized. The full model is expressed in equation 4, following McDonald and Moffit (1980) and as adapted by Omonona (2001).

$V_i^* = \beta T X_i + e_i$
$Vi = 0 \text{ if } V_i^* \leq 0$
$Vi = V_i^* \text{ if } V_i^* > 0$
$i = 1, 2 \ldots n$ (5)

Where,
V_i^* = Limited dependent variable depicting the depth of household poverty.
X_i =Vector of explanatory variables
βT = Vector of unknown parameters
e_i = Independently distributed error term.

The limited dependent variable V^* is defined as:

$(Z - Y_I)/Z$ (6)

Where,
Z = Poverty line,
and Y_i = Mean household food expenditure per adult equivalent

The vector of explanatory variables is as defined earlier for equations (4-5).

The empirical model in equation 4 was used to draw inferences on the causal factors for household poverty. The probabilities of being poor and the depth or intensity of poverty in the context of household characteristics (as captured by the X_is) were obtained from the probit regression estimates.

Factors affecting food security and poverty

In analysing factors that affect household food security and poverty status, the logit and probit regression models were respectively used. Households were classified as food secure or insecure based on estimations of the food security line. This dummy variable (1 = food secure, 0 = food insecure) was then used as dependent variable for the regression analysis to estimate the coefficient of factors that affect household food security. The same technique was used for the poverty status. However, this time the poverty status determined was used as the dependent variable (1 = poor, 0 = non-poor). Thus, the model is estimating the factors that determine the household poverty status.

3.3 Limitations and issues encountered during survey

Three major limitations were faced during field data collection. First, initially some respondents were sceptical and were hesitant to divulge information, especially on issues relating to income and revenues. However, with much persuasion they cooperated. Second, the field data collection took place at time when farmers have started farming activities. This has posed some limitations in terms of getting the attention of the farmers, which required several visits in some cases. Third, farmers did not keep records and the information generated depended on memory recall. This has its limitations where in some cases, the information obtained may not be exact but proxies. However, despite the limitations, the quality of data generated is reasonably good, adequate and acceptable for the purpose of the study.

4 Results and discussion

4.1 Descriptive analysis of household characteristics

The major socioeconomic characteristics of households covered in the survey are presented. These characteristics relate to the relative frequency distribution of heads of households by gender, age, marital status, level of education and household sizes. Also included are household asset ownership structures, size distribution of household farms, sources of farm credit, types of crops grown, household farm income distribution, household non-farming employment and income distribution, gross margin from crop production, household food and non-food consumption patterns.

4.1.1 Distribution of household heads by gender

The pattern of gender distribution of household heads was similar in both the N2Africa and non-project areas (Table 3). Generally, the male gender predominates. However, in relative terms, the percentage of male-headed households was marginally higher in the non-project area.

Table 3: Distribution of household heads by sex

Sex	**N2Africa Project Area (n=400)**		**Non-N2Africa Project Area (n=400)**		**All Areas**	
	Frequency	*Percent*	*Frequency*	*Percent*	*Frequency*	*Percent*
Male	345	86.5	351	87.5	696	87.0
Female	54	13.5	50	12.5	104	13.0
Total	**399**	**100.0**	**401**	**100.0**	**800**	**100.0**

4.1.2 Distribution of household heads by age

The age of the head of household has been found to determine how active and productive the head of the household would be. Age has also been found to affect the rate of household adoption of new innovations, which in turn, affects household productivity and livelihood improvement strategies (Dercon and Krishman, 1996).

Table 4 shows the distribution of household heads by age ranges. The distribution of the age of household heads was fairly similar across the surveyed areas. But on average, approximately 78% of the household heads were between 26 and 55 years of age. The mean age of household heads was 46 years. The proportion of youth[6] in the sample is approximately 28% across the sample areas, suggesting predominance of an aging farming population.

The predominance of active and productive heads of households in the project area has a direct bearing on (1) increased availability of able-bodied labour for primary production; (2) ease of adoption of innovations; and (3) reduction in the degree of risk aversion. All these have great potential for increasing agricultural productivity and production and, hence, for improving household livelihoods and reducing poverty.

Table 4: Distribution of household heads by age

Age	**N2Africa Project Area**		**Non-N2Africa Project Area**		**All Areas**	
	Frequency	*Percent*	*Frequency*	*Percent*	*Total*	*Percent*
Less than 15 years	1	.3	6	1.5	7	.9
15-25 years	6	1.5	25	6.2	31	3.9
26-35 years	108	27.1	91	22.7	199	24.9
36-45 years	128	32.1	124	30.9	252	31.5
46-55 years	84	21.1	89	22.2	173	21.6
Over 55 years	72	18.0	66	16.5	138	17.3
Youth (18- 35 yrs)	110	27.6	114	28.4	224	28.0
Non-Youth	289	72.4	287	71.6	576	72.0

[6] 18 to 35 years old

4.1.3 Marital status of household heads

Table 5 shows the distribution of the marital status of household heads in the study area. There was a high level of homogeneity in the distribution of household heads' marital status in the project area because of similarities in cultural and religious practices. The significance of marital status on agricultural production can be explained in terms of the supply of agricultural family labour. It is expected that family labour would be more available where the household heads are married.

The majority of household heads in the study area were married. On average, about 94% of all household heads in all the project areas were married. Only 3.0% were single.

Table 5: Marital status of household heads

Marital status	**N2Africa Project Area**		**Non-N2Africa Project Area**		**All Areas**	
	Frequency	*Percent*	*Frequency*	*Percent*	*Total*	*Percent*
Single	8	2.0	14	3.5	22	2.8
Married	382	95.7	366	91.3	748	93.5
Widowed	8	2.0	18	4.5	26	3.3
Divorced	1	0.3	3	0.7	4	0.5
Total	**399**	**100.0**	**401**	**100.0**	**800**	**100.0**

4.1.4 Level of education

The level of farmers' education is believed to influence the use of improved technology in agriculture and, hence, farm productivity. The level of education determines the level of opportunities available to improve livelihood strategies, enhance food security, and reduce the level of poverty. It affects the level of exposure to new ideas and managerial capacity in production and the perception of the household members on how to adopt and integrate innovations into the household's survival strategies. Table 6 shows the distribution of the levels of formal education among household heads.

The pattern of distribution of the levels of formal education of household heads differs among households in N2Africa compared to the counterfactual area. Household heads in N2Africa relatively have higher levels of formal education. This had some positive influences on the awareness of crop technologies, management practices and their levels of adoption (see Table 20). The highest illiteracy level was in the non-project areas where 37% of respondents had no formal education. In relative terms, female are less educated and majority of children aged 5 to 14 years (65%) are in school.

Table 6: Level of Education

Level of education	N2Africa Project Area		Non-N2Africa Project Area		All Areas	
	Frequency	*Percent*	*Frequency*	*Percent*	*Total*	*Percent*
No formal education	95	23.8	149	37.2	244	30.5
1-6 years – Primary	72	18.0	96	23.9	168	21.0
7-9 years – Junior Secondary	13	3.3	28	7.0	41	5.1
10-12 years –Senior Secondary	102	25.6	72	18.0	174	21.8
13-16 years – OND/NCE	91	22.8	52	13.0	143	17.9
17 years or more- HND/University	26	6.5	4	1.0	30	3.8
Highest level of Education obtained by Females						
None or incomplete Primary	*98*	*25.8*	*119*	*29.8*	217	27.1
Primary	*126*	*33.2*	*108*	*27.1*	234	29.3
Secondary or higher	*126*	*33.2*	*102*	*25.6*	228	28.5
% of children aged 5-14 that are in school						
	262	*65.7*	*232*	*57.9*	494	61.8

4.1.5 Household sizes

The significance of household size in agriculture hinges on the fact that the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption, and the marketable surplus are all determined by the household size. The pattern of household sizes was similar across the areas surveyed. Approximately, 49% of the surveyed households had 8 or more persons per household. This has significance on the availability of labour for farm production, the total area cultivated to different crop enterprises, the amount of farm produce retained for domestic consumption and marketable surplus, which are all determined by the household size. The mean household size in the area of study is approximately 8 persons (Table 7).

Table 7: Household sizes and structure

Household Size	N2Africa Project Area		Non-N2Africa Project Area		All Areas	
	Frequency	Percent	Frequency	Percent	Total	Percent
8 or More	192	48.9	186	46.4	378	47.3
6-7	81	20.6	83	20.7	164	20.5
5	42	10.7	39	9.7	81	10.1
4	43	10.9	40	10.0	83	10.4
3	16	4.1	30	7.5	46	5.8
2	14	3.6	17	4.2	31	3.9
1	5	1.3	6	1.5	11	1.4

4.1.6 Access and Control of Productive Resources

The respondents' access and control of productive resources is presented in Table 8. On the average, respondent household heads had an average of 21 years farming experience, owned average of 4 farm plots with total farm size of 4 hectares. The number of farm plots owned by their spouses was relatively less at approximately 3 plots, which are presently all under cultivation.

Table 8: Access and Control of Productive Resources

Variables	N2Africa Baseline (n=395)	PROSAB Project Area (n=292)	Non-N2Africa Project Area (n=398)	Mean Difference (PROSAB/N2Africa and Non-N2Africa)
No of Farm Plots (mean)	4.0	3.9	3.9	0.07
Mean No of farm plots under cultivation	3.5	3.5	4.9	-1.32
Total farm Size (ha)	4.3	4.3	4.2	0.09***
No. of farm plots owned spouse(s)	2.6	2.5	1.4	1.07***
No of farm plots owned by spouse presently under cultivation	2.6	2.5	1.3	1.15***
Mean no of Farming Experience (years)	20.6	21.7	23.2	-1.55

*** Significant at 0.01 level

However, significant difference exist in terms of total farm size, number of plots owned by spouse and number of plots owned by spouse currently under cultivation in PROSAB and N2Africa areas compared to the non-N2Africa area (counterfactual). There is also an equally significant difference between N2Africa area (which does not overlap PROSAB) and the counterfactual areas. The significantly higher figures under PROSAB reflects the impact of PROSAB on crop production. Increased yields of crops under PROSAB, as will be examined later seem to have encouraged farmers to acquire and/or rent more land for crop production. In addition, under PROSAB's Gender Mainstreaming Strategy, women farmers were empowered to have access to more productive resources, especially land. This had increased average farm plots owned by women in PROSAB area, which doubles that of women in the non- intervention areas.

4.1.7 Access and Control of Productive Resources disaggregated by gender

The distribution of respondents' access and control of productive resources in N2Africa and non-project areas disaggregated by gender are presented in Table 9. The mean number of farming experience of youths in N2Africa project area at 9 years is significantly less compared to the non-project area (12 years). The mean number of farm plots and total farm size owned by female farmers are relatively less among female farmers compared to male farmers in both N2Africa and the non-project areas. However, the number of farm plots owned by spouses and the effective farm plots under cultivation are higher among females in N2Africa project area (4) compared with non-project areas (1).

Table 9: Access and control of productive resources disaggregated by gender in the survey area

Variables	**N2Africa Area**			**Non-N2Africa Area**		
	Male	Female	Youth	Male	Female	Youth
No. of Farm Plots (mean)	4.1	3.3	3.4	3.9	4.0	4.1
Total farm Size (ha)	4.3	2.4	5.0	4.2	4.1	4.2
Mean No of farm plots under cultivation	3.6	2.8	3.5	5.0	3.8	3.1
No. of farm plots owned spouse(s)	2.9	4.3	4.5	1.4	1.0	1.2
No of farm plots owned by spouse presently under cultivation	2.9	4.3	2.4	1.3	1.0	1.2
Mean no of Farming Experience (years)	17.6	16.6	9.0	23.4	21.9	12.0

4.1.8 Type of crops grown

The type of crops grown by farmers and their averages yields in kilogram per hectare in the surveyed areas are presented in Figure 1. Among the cereals, maize is the most popular crop grown by farmers in N2Africa project area (95%), PROSAB area (96%) and non-project areas (88%). Among legumes, cowpea is the most favoured crop grown by 91%, 94% and 87% in N2Africa, PROSAB and non-project areas respectively.

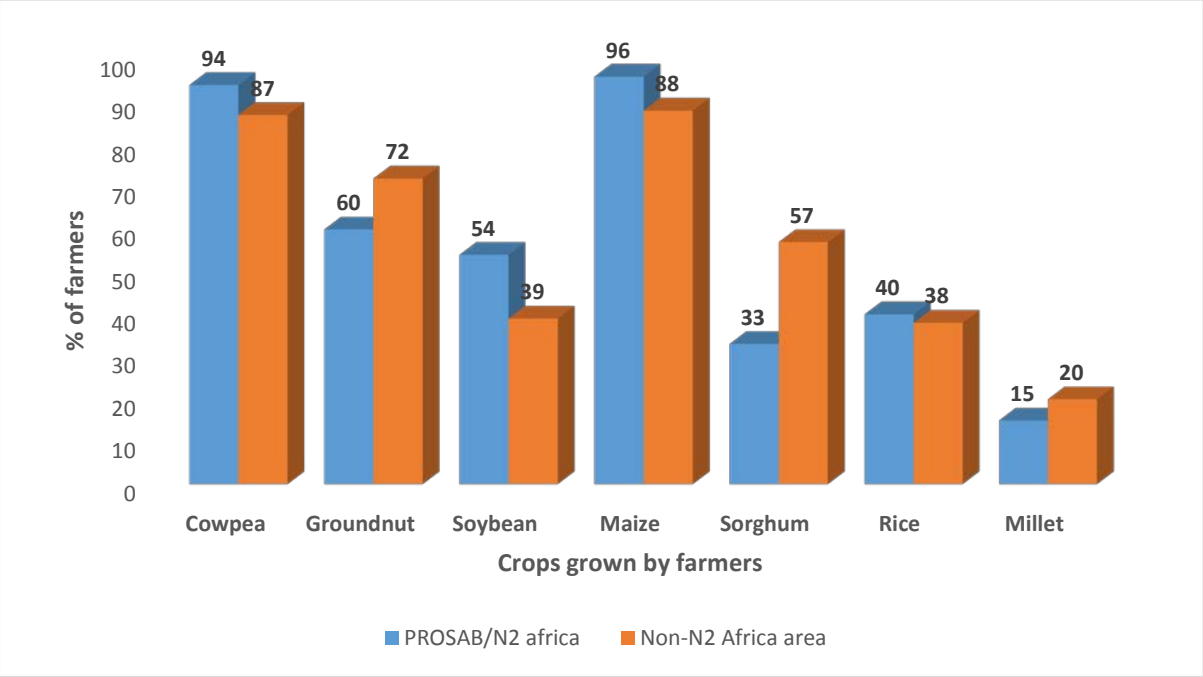


Figure 1: Type of crops grown

The popularity of maize stem from the fact that this cereal is a basic staple in the surveyed areas. Hence, farmers grew it largely for household food security requirements. Cowpea is also a food crop that has a lot of commercial value, thus is grown both for subsistence consumption but largely for the market. Groundnuts and soyabean, the third and fourth important crops in N2Africa and PROSAB areas are industrial crops mainly grown for commercial sales. The major driver for improved livelihoods of farmers in the PROSAB project area is related to the developments in the soyabean market. Soyabean has emerged as an important legume, which was largely influenced by the previous PROSAB project[7]. Prior to 2004, its production was non-existent on a commercial scale. The project however introduced the crop for improved soil fertility, control of *striga* parasitic weed, improved nutrition and increased incomes through sales to industrial processors.

The increased popularity of cowpea, groundnuts and soyabean might be attributed to the dissemination of improved varieties by the previous PROSAB and the current N2Africa project. In addition to sales; most women add value to the groundnuts and soyabean they grow by processing them into oil and cake in the case of groundnuts and a range of other food products, such as soy milk, soy cake, etc. from soyabean. These are further sold and/or consumed by the households.

4.1.9 Crop production in Surveyed areas

There are differences in total area cropped by gender. Youth farmers in N2Africa cultivated the highest number of hectares (5ha) compared to male and female farmers in all the surveyed areas (Table 10). There are also major differences in crop yields disaggregated by gender in N2Africa, PROSAB and the counterfactual areas. Female farmers in N2Africa realized significant groundnut yields at 1317 kg/ha (p= 0.05) compared to male and youth farmers in all N2Africa, PROSAB and the counterfactual area. Male farmers achieved higher yields in kilogram per hectare for cowpea (896 kg/ha), soyabean (1,080 kg/ha), maize (1,350 kg/ha) and rice (1,160 kg/ha) in PROSAB areas compared yields obtained by female and youth farmers in the other areas. The significantly higher

[7] In 2003, soyabean was grown by only 0.1% of sampled farmers in the project area (see Amaza et al. 2007).

yields are plausibly associated with the introduction and adoption of improved crop varieties and agronomic practices by farmers in N2Africa and the PROSAB project areas. Since the end of PROSAB in 2009, farmers in the area had continued to use improved crop varieties and crop management practices and these are reflected in the observed higher yields[8].

Table 10: Yield of crops in kg/ha

Crop	N2Africa Baseline			PROSAB Area			Non-N2Africa Area		
	Male	Female	Youth	Male	Female	Youth	Male	Female	Youth
Total area cropped (ha)	4.3	2.4	5.0	3.3	3.2	3.7	4.2	4.1	4.2
Crop yield in kg/ha									
Cowpea	648	651	606	896	757	888	709	669	725
Groundnut	764	1,317	855	886	1,007	944	602	613	633
Soyabean	723	575	771	1,080	793	1043	950	887	887
Maize	1,084	909	1,111	1,350	1,175	1330	1,059	1,119	1,070
Sorghum	795	500	725	1,060	1,213	1140	1,025	1,021	1,043
Rice	1,025	1,083	1,174	1,160	805	1115	760	776	719
Millet	1,000	651	1,000	959	757	1005	917	1080	895

4.1.10 Household income

The Frequency distribution of farmers' major income crop is presented in Figure 2. The crop that yielded most income to the sampled farmers is cowpea, accounting for 33%, 37% and 51% of farmers in N2Africa and PROSAB and non-project areas respectively. This is followed by soyabean and groundnuts. The limited source of income from maize is derived from the fact that most farmers utilise their production output mainly for subsistence household consumption rather than market sales.

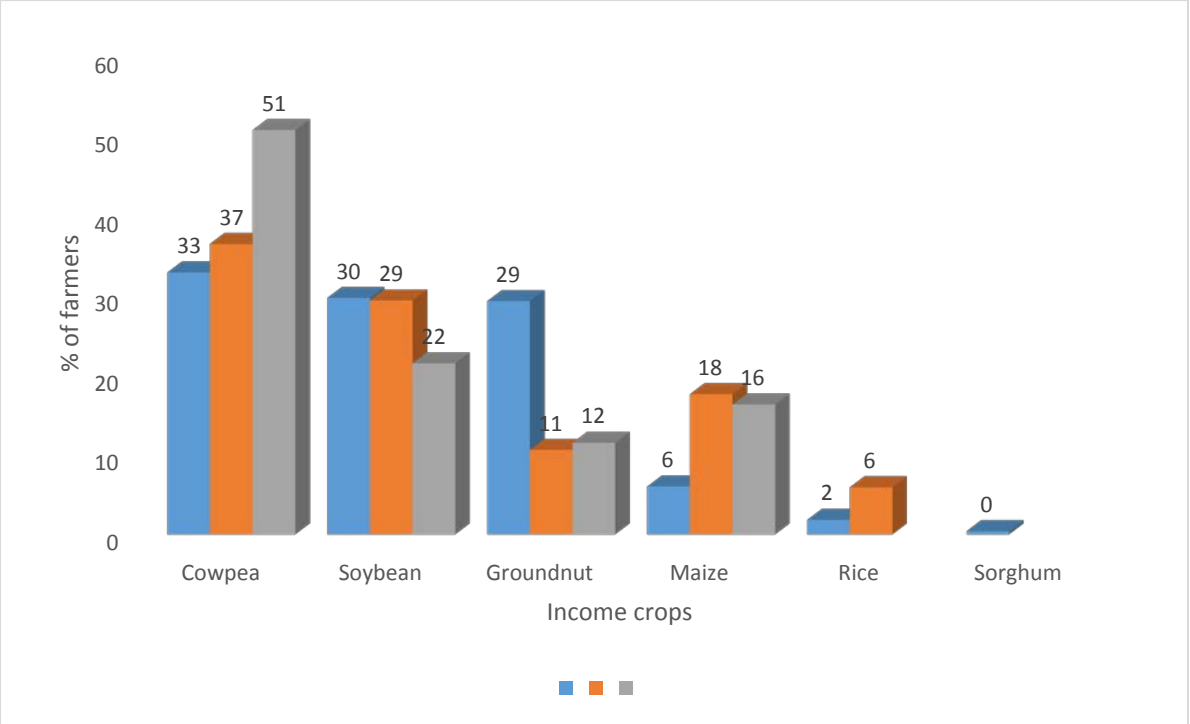


Figure 2: Distribution of farmers' major income crop

[8] Average yields realized by farmers in the survey

The frequency distribution of crops that yield major sources of income to farmers disaggregated by gender is presented in Figure 3. Cowpea is the most favoured crop grown for the market by all categories of farmers; male, female and youth. Following cowpea, cereals, especially maize is the second most preferred crop grown for the market. In addition to being staples, cereals have high market demand due to increasing population pressure for food but also has industrial uses such as in livestock feeds, food industries and so on. The third crop is soyabean, a relatively new crop compared with others in the survey areas. Across gender, soyabean contributed to income of female farmers more than others. The female farmers in addition to income from sales of soyabeans, derived additional income by selling soyabeans in processed form as soy milk, soy cake, and so on. But, increasing demand by industries has stimulated increased production by farmers in the survey areas.

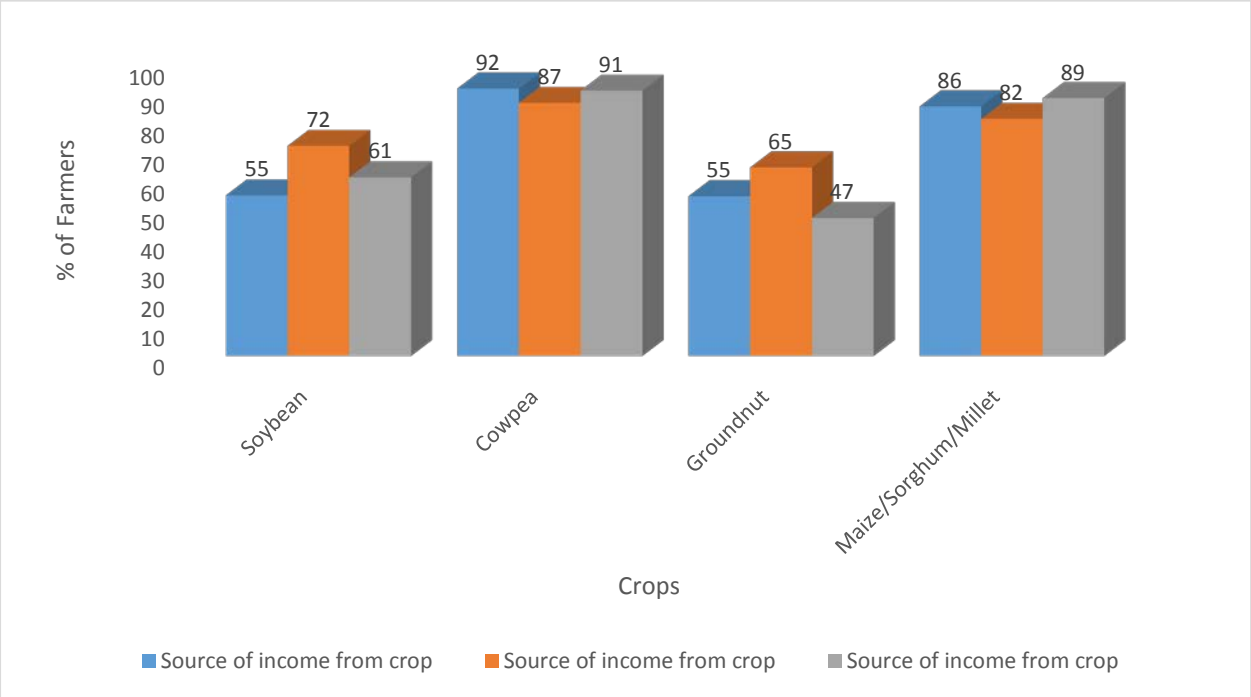


Figure 3: Distribution of major sources of Income in N2Africa project area disaggregated by gender

The mean value of key agricultural crops produced in 2014 was calculated using 2014 prices (Table 11). There is similarity in the mean revenue from crops earned by farmers in N2Africa and PROSAB, which reflects the similarity in terms of yields achieved by farmers[9]. To assess the impact of PROSAB on farmers' income, we examine the differences in income earned from crops by farmers' in PROSAB area compared with farmers in non-N2Africa project areas as presented in Table 11. Households in PROSAB earned significant increases in the value of cowpea, groundnut, soyabean and rice over non-N2Africa project area (50-100 percent increases). This significant increases in revenue earned are directly related to the earlier obtained yields in kg/ha and linkages to output market in the case of soyabean.

Table 11: Mean income earned from sales of crops in 2014 (in Naira)

Crops	N2Africa Baseline	PROSAB Area	Non-N2Africa Project Area	% Difference (PROSAB and Non-PROSAB)
Cowpea	78,209	84,989***	40,783	52.0
Groundnut	11,716	11,456***	9,263	80.6
Soyabean	102,332	99,898***	62,898	37.0
Maize	68,124	65,801	57,657	12.4
Sorghum	20,937	20,494	16,271	20.6
Rice	45,112	44,940***	15,593	65.3
Millet	34,915	18,035	16,250	9.9

[9] 50% of the N2Africa Communities overlap with PROSAB communities

The mean income earned from crops are further disaggregated by gender as presented in Table 12. On the average male farmers in N2Africa and PROSAB areas earned relatively more income than female and youth from the sales of cowpea and maize than female and youth farmers. Similarly, youth farmers from N2Africa area earn relatively more from soyabeans and millet compared to adults or non-youth and female farmers. The majority of the youth are single who are likely to be motivated more by growing crops mainly for commercial purposes rather food security considerations, hence their involvement in the increased production of soyabeans.

Table 12: Mean income earned from sales of crops disaggregated by Gender in 2014 (in Naira)

Crop	N2Africa Baseline			PROSAB Area			Non-N2Africa Area		
	Male	Female	Youth	Male	Female	Youth	Male	Female	Youth
Cowpea	54,650	44,693	45,512	90,345	47,328	83,784	7,150	37,287	43,597
Groundnut	13,906	121	7935	11,649	10,453	10,651	53,048	7,830	8,661
Soyabean	114,396	47,650	212,004	107,447	66,063	90,429	64,313	46,538	66,455
Maize	78,298	62,600	49,094	68,253	43,441	54,538	16,989	65,763	44,962
Sorghum	23,694	0	36,625	20,675	10,500	14,666	6,156	9,150	18,248
Rice	46,835	29,500	38,682	48,540	20,100	45,621	7,347	16,083	16,464
Millet	164,333	0	219,000	18,035	0	0	7,150	16,250	19,875

The significantly higher income derived from soyabean sales by all categories of farmers (male, female and youth) is associated with market linkage activities that PROSAB implemented over the period 2004-2009 as shall be discussed later.

4.1.11 Household asset ownership structure

The level of asset ownership in a household is an indication of its endowment and provides a good measure of household resilience in times of food crisis, resulting from crop failures, famine or natural disasters (Hassan and Babu, 1991). This is because a household can easily fall back on its assets in times of need by selling or leasing them. The assets owned by the surveyed households is presented in Table 13.

Motorbike is the most common asset owned by households, owned by 50% and 34% of households in the N2Africa and Non-areas respectively. This is followed by television/fridge owned by 43% and 30% of households in project area and non-project areas respectively. This is indicative of improved economic welfare among the households. Only one household in N2Africa project area owned oxcart, which suggests that there is limited practice of mechanized or semi-mechanized farming in the surveyed areas.

Table 13: Percentage distribution of asset ownership in surveyed area

Type of Household Asset	N2Africa Baseline		Non-N2Africa area		All areas	
	Frequency	Percent	Frequency	Percent	Total	Percent
bicycle	71	18.3	67	16.7	113	14.1
oxcart	1	.3	0	0	4	.5
motorbike	195	50.3	137	34.2	394	49.3
car or truck	18	4.6	6	1.5	57	7.1
Television/Fridge (one)	163	42.6	118	29.6	347	43.4
Television/Fridge (> 1)	23	6.0	11	2.8	74	9.3

4.1.12 Gross margin from selected crop production

A summary of the benefit–cost computations of crops grown by farmers in N2Africa project area is presented in presented in Table 14.

Table 14: Gross margin for crops in N2Africa, PROSAB and Non-N2Africa Project areas

	N2Africa Baseline				PROSAB Area				Non-N2Africa Area			
	Cowpea	Groundnut	Soyabean	Maize	Cowpea	Groundnut	Soyabean	Maize	Cowpea	Groundnut	Soyabean	Maize
Yield(kg/ha)	822	888	927	1,260	877 (20)	906 (33)	1022 (8)	1324 (19)	704	603	942	1066
Price (Naira/kg)	150	140	160	45	150	140	160	45	150	140	160	45
Revenue(Naira/Ha)	123,300	124,320	148,320	56,700	131,550	126,800	163,516	59,567	105,600	84,420	150,799	47,970
Total Variable Cost (Naira/Ha)	34,200	26,752	25,743	53,121	43,117	31,215	35,442	51,137	37,808	30,851	34,456	46,639
Gross Margin (Naira/Ha)	89,100	97,568	122,577	3,579	88,433 (23)	95,586 (44)	128,074 (9)	8,430 (84)	67,792	53,569	116,344	1331
Benefit: Cost	3.61	4.65	5.76	1.07	3.05	4.06	4.61	1.16	2.79	2.74	4.38	1.03

Note: Numbers in parenthesis are percentage differences between PROSAB and non-PROSAB areas

The revenue from crops was obtained by multiplying the output of various crops by their average market prices. Usually, factors such as crop output, varieties of crops grown, prices of crops, farm sizes, technologies used, cropping patterns, and general socioeconomic factors affect gross farm revenue. The relatively higher revenues from soyabean, groundnut and cowpea is directly related to the earlier observed higher yields from these crops and the associated farm gate prices.

The total variable cost comprises costs that change with the level of production. The farmer can control their level because they are incurred only during production. The variable costs of production comprise seeds, fertilizers, herbicides, pesticides, land preparation, planting, weeding, harvesting, transportation, storage, and so on. Expectedly, the variable cost is generally highest in maize followed by cowpea as their production are associated with the increased use of inputs, especially fertilizers and agrochemical. The use of these inputs tends to increase the level of total variable costs (TVC). However, the gains from revenue far outweighs the increase in TVC as revealed by their respective gross margins.

Soyabean farmers attained the highest level of profitability with a gross margin ratio of 4.76, followed by groundnut with gross margin ration of 4.65, and cowpea with a gross margin ratio of 3.61 and maize farmers barely breakeven with benefit: cost ratio of 1.07.

To assess the impact of PROSAB on crop performance and profitability, gross margins for farmers in PROSAB area were computed and compared with farmers in non-project areas (counterfactual) as presented in Table 14.

Three significant inferences can be drawn from the gross margin comparison. First, the mean crop yields were significantly higher, ranging from 8% (soyabeans) to 33% (groundnut) for all crops in PROSAB area compared to the mean yields obtained by farmers in the counterfactual area. Farmers in PROSAB areas benefited from the promotion and use of improved crop varieties, which was sustained by most farmers even after the end of PROSAB in 2009. Secondly, the positive influences of the improved crop varieties and crop management practices promoted by PROSAB are also reflected in obtained gross margins, whereby PROSAB farmers earned significantly higher gross margins ranging from 9% (soyabean) to 84% (maize) over farmers in non-intervention areas. Thirdly, for cowpea and groundnuts, the attained benefit–cost ratio (profitability) of PROSAB farmers were relatively much higher than farmers in non-intervention areas. The differences in gross margin are attributed to a number of factors. First, farmers in PROSAB and N2Africa areas have access to improved crop varieties. In addition, they have improved output market access, access to market information and better prices that play a role in the gross margin differences.

4.2 Adoption of Crop Technologies and Access to Markets

This section presents awareness and adoption of crop technologies and management practices, farmers' access to extension and information services in the survey areas. Also, presented and discussed are farmers' access to credit, access to improved seeds, other agricultural inputs, access to output markets and legume utilization.

4.2.1 Awareness of crop technologies and management practices

In the adoption process of a new technology, farmers must first of all be aware of the new technology, including its advantages before they accept and adopt the technology. The frequency distribution of farmers' awareness of crop technologies and management practices are presented in Table 15. The levels of awareness of most of the crop technologies are generally high with over 70% among sampled farmers in N2Africa and PROSAB areas (with the exception of improved sorghum-38%, legume specific fertiliser-63%, inoculating legumes-43% and legume utilization 61%). These high levels of awareness of the crop technologies and management practices are partly attributed to the 2014 disseminations activities by N2Africa.

Table 15: Frequency distribution of farmers' awareness of crop technologies and management practices (Percent of farmers)

Crop technologies and practices	N2Africa Baseline (n=400)	PROSAB Area (n=294)	Non-N2Africa Area (n=400)
Improved Cowpea varieties	88.3	87.4	58.8
Improved groundnut varieties	76.4	73.1	52.3
Improved soyabean varieties	89.1	87.8	58.3
Improved maize varieties	93.3	92.5	52.3
Improved sorghum varieties	38.3	0	0
Legume specific fertilizer	62.9	0	0
Cereal/legume rotations	80.1	81.0	38.8
Cereal/legume intercropping	81.1	81.0	35.5
Drilling fertilizer application	60.7	90.5	0
Inoculating legumes	43.3	0	0
Legume utilization	60.7	0	0

On the contrary, in the non-intervention N2Africa survey areas, the proportion of farmers that were aware of the crop technologies and management practices were considerably much lower generally ranging at varied proportion of sampled farmers from 36% to 59%. The level of awareness of these farmers in the non-intervention project areas could have been created through farmer-to-farmer information sharing between farmers in the N2Africa and especially farmers in PROSAB intervention communities with farmers in non-intervention communities. Farmers in N2Africa project areas very often through interactions with farmers in counterfactual areas exchange or share improved seeds varieties. The other form through which farmers in counterfactual areas access improved varieties is through direct purchase from the local seed company or purchases in the local markets in their communities.[10] Farmer-to-farmer extension is an informal system in which an individual farmer in a community assists other farmers by sharing information on improved technologies with other farmers (Gwary 2008). Such information sharing is critical to adoption and facilitates the use and therefore the adoption of technologies. This factor plausibly influenced the awareness of the crop technologies and management practices in the non-intervention project areas.

4.2.2 Access to seeds and other inputs

Farmers in N2Africa project area source their seeds from a variety of sources with significant differences by crop (Table 16). In most cases, farmers purchase these inputs, especially fertilizer and agrochemicals as individuals by physically visiting the local markets that are accessible and buy them. Major limitations to access to these inputs are irregular availability of the inputs and poor road infrastructures, which is associated with high transportation costs. The main source of fertiliser and agrochemicals for farmers in the project area was from urban dealers. Rural agro-dealers are the second most important source for fertiliser and agrochemicals. Farmers largely source manure from their own farms (66%) and limited proportion of farmers sourcing from local (16%) and rural markets (6%).

[10] The local seed company have their market agents who sell improved seeds on weekly market days in the counterfactual areas

Table 16: Frequency of sources of improved seeds and other inputs (% of farmers)

Inputs	Own farm	Local market	Rural market	Urban market	Seed company	Extension worker	NGO	Farmers' Group	Others
Chemical fertiliser	0.0	2.1	35.4	56.3	0.0	0.0	2.1	2.1	2.1
Agrochemicals	0.0	3.1	26.5	65.3	1.0	0.0	2.0	2.0	
Manure-livestock	64.5	16.1	6.5	0.0	3.2	6.5	0.0	3.2	
Improved soyabean	9.7	50.0	*12.9*	0.0	1.6	3.2	3.2	14.5	3.2
Improved groundnut	2.2	50.0	*10.9*	*8.7*	0.0	0.0	8.7	17.4	2.2
Improved cowpea	3.8	41.5	*18.9*	*7.5*	0.0	0.0	5.7	18.9	1.9
Improved maize seed	9.0	52.6	*10.3*	*14.1*	0.0	0.0	5.1	7.7	1.3
Improved sorghum	0.0	46.2	*15.4*	*15.4*	0.0	0.0	0.0	23.1	

Local markets[11] in the survey areas is the most important source for improved seeds of soyabean, groundnut, cowpea, maize and sorghum varieties. This is followed by farmers' group as the second most important source of seeds for improved soyabean, groundnut, cowpea and sorghum varieties. The third most important source for purchase of these seeds is from rural markets within the survey communities. Other main sources seeds are purchased from urban markets often from agro dealers, NGOs, saved seed (own harvest) and other farmers.

4.2.3 Adoption of crop technologies and management practices

The proportion of farmers that adopted the respective crop technologies and management practices in N2Africa project area is presented in table 17.

Table 17: Adoption of improved crop technologies and management practices disaggregated by gender in N2Africa and Non-N2Africa project areas

Crop technologies	N2Africa Area			Non-N2Africa Area		
	Female	Male	Youth	Female	Male	Youth
Biological Technologies						
Improved Cowpea varieties	25.0	63.4	51.4	18.0	17.9	14.0
Improved groundnut varieties	25.0	44.1	54.3	6.0	7.7	7.0
Improved soyabean varieties	66.7	67.7	74.3	14.0	19.9	14.0
Improved maize varieties	50.0	72.0	74.3	10.0	12.5	7.9
Improved Rice varieties	33.3	46.2	45.7	6.0	7.1	6.1
Improved sorghum varieties	16.7	11.8	8.6	0	3.1	1.8
Chemical Technologies						
Legume specific fertilizer	25.0	17.2	22.9	2.0	5.1	4.4
Inoculating legumes	0	9.7	17.1	0	0	0
Management Practices						
Cereal/legume rotations	41.7	34.4	45.7	2.0	5.7	4.4
Cereal/legume intercropping	41.7	44.1	45.7	6.0	7.7	4.4
Drilling fertilizer application	25.0	14.0	17.1	4.0	2.6	0
Legume utilization	33.3	15.1	22.9	2.0	2.3	2.6

[11] A local seed company, JIRKUR SEED has retailer outlets in local and rural markets in the project area that sell improved seeds

The pattern of adoption rates of the various crop technologies reveals a close correlation with the level of awareness of these technologies (see Table 15) among the sampled farmers as awareness of new or improved technology necessarily precedes its adoption. Several factors are also responsible for the adoption rates of the crop technologies. They include the simplicity of the technologies, compatibility with smallholder farmers' lifestyle, relative advantages of these technologies amongst other factors.

Improved maize varieties is the most adopted crop technology amongst the farmers with 83% adoption rates by male and youth farmers and 82% adoption rate by female farmers. This is followed by the adoption of improved cowpea (61%) and improved soyabean as the second most adopted technologies among male farmers and female (80%) and youth farmers (63%). The relatively higher adoption rates of soyabean by female farmers is largely influenced by its importance in processing into a range of food products for domestic consumption and/or for market, in addition to commercial sales in unprocessed form.

During the PROSAB era, the project had introduced legume utilization technologies and built the capacity of women with respect to household processing and utilization of soyabean into a range of food products, such as soyamilk, soyabean cake, soyabean cheese, etc. which is critical for nutrition, especially infants and children. This gender mainstreaming activity had spurred women in the project area to grow soyabeans for both domestic utilization and the market. At least 25% of the processed legumes, especially cowpea and groundnuts are consumed by the households in form of cowpea cake and groundnut oil & cake respectively. The processed soyabean mostly in the form of soymilk and soy cheese are generally sold and utilised for feeding infants and children by the households.

The youth are largely motivated by the commercial sales of soyabeans. Cereal/legume intercropping and cereal/legume rotation often as soyabean/maize intercrop or rotation have been adopted by 70% of female farmers with adoption rates ranging from 50% to 58% by male and youth farmers. Inoculants, a relatively new technology compared to the others is the least adopted technology among the various technologies[12]. The inoculants were provided by the N2Africa project for demonstrations to lead farmers and for soyabean only. It was not yet available in the market.

Farmers' use and their access to improved seeds and other inputs

A major aim of improving the productivity of farmers is improve their access to improved seeds and other agricultural inputs (fertilizers, agrochemicals, etc.). The inputs that are commonly needed by farmers are: - chemical fertilizers, agrochemicals, improved seeds of maize, groundnuts, cowpea, soyabean and sorghum. Table 18 presents frequency distribution of farmers' use of improved crop technologies and crop management practices disaggregated by gender.

Table 18: Frequency distribution of farmers' use of agricultural inputs in N2Africa project area disaggregated by gender

Inputs	Male (n=346		Female (n=54)		Youth (n=114)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Chemical fertilizers	313	90.5	52	96.3	109	95.6
Agro-chemicals	321	92.8	54	100.0	107	93.9
Manure - livestock	155	44.8	28	51.9	49	43.0
Improved seed of soyabean	181	52.3	41	75.9	71	62.3
Improved seed of cowpea	220	63.6	36	66.7	65	57.0
Improved seed of groundnuts	169	48.8	31	57.4	47	41.2
Improved seed of maize	285	82.4	45	83.3	94	82.5
Improved seed of sorghum	68	19.7	15	27.8	14	12.3
Other	31	9.0	4	7.4	6	5.3

[12] Inoculating legumes was newly introduced by the N2Africa project, whilst the other crop technologies were introduced in 50% of the survey communities by the previous PROSAB project.

Agrochemicals is the most important input used by both male (93%) and female farmers (100%); whilst chemical fertilizer is the second most important input used by male farmers (91%) and female farmers (96%). Amongst youth, chemical fertilizer (96%) is the most popular input used, followed by agrochemicals (94%). The importance of fertilizer as a critical input in the cropping system is not unexpected, especially maize. In a study of 'resource-use efficiency in food crop production in Gombe State, Nigeria, Amaza (2000) reported that the technical efficiency of maize-based enterprises is highly dependent on fertilizer application, as they are well known to be responsive to fertilizer application.[13] This factor plausibly accounts for farmers' use of chemical fertilizer.

Amongst seeds, improved maize seed is the most widely used by male (82%), female (83%) and youth (83%) farmers. This is followed by improved cowpea seeds as the second most important used by male (65%) and female farmers (68%); whilst improved soyabean seed (83%) is the second among the youths. The use of these crop technologies are influenced by several factors, including crop productivity, food security considerations, prices and so on

To assess the impact of technologies and management practices promoted by PROSAB, farmers that adopted the respective crop technologies and management practices in the PROSAB project intervention and non-intervention areas were compared as presented in Table 19.

Table 19: Comparison of adoption rates of improved crop technologies and management practices among PROSAB and non-N2Africa farmers disaggregated by gender (Percent of Farmers)

Crop technologies	PROSAB Area			Non-N2Africa Area		
	Male	Female	Youth	Male	Female	Youth
Improved cowpea varieties	59.7	73.8	60.8	13.7	16.0	9.5
Improved groundnut varieties	45.1	76.2	43.2	5.7	6.0	5.2
Improved soyabean varieties	53.4	83.3	59.5	19.7	14.0	14.7
Improved maize varieties	87.4	90.5	90.5	12.3	10.0	8.6
Improved Rice varieties	48.2	76.2	44.6	7.1	6.0	6.0
Improved sorghum varieties	28.9	42.9	25.7	3.1	0.0	2.6
Legume specific fertiliser	39.5	71.4	29.7	4.9	2.0	4.3
Cereal/legume rotations	61.3	78.6	55.4	5.4	2.0	4.3
Cereal/legume intercropping	62.5	78.6	60.8	7.4	6.0	4.3
Drilling fertilizer application	24.9	54.8	21.6	2.3	4.0	0.0
Inoculants	14.6	35.7	13.5	0.0	0.0	0.0
Legume utilization	26.5	61.9	18.9	2.3	2.0	2.6

In the PROSAB project area, the rates of adoption are significantly higher as expected for all the crop technologies and management practices adopted by male, female and youth. There are no significant differences in the adoption rates for crop technologies in PROSAB Area and the other N2Arica areas. Generally, there are high adoption rates for improved maize by 87% male and 91% female and youth farmers each. Improved cowpea varieties were adopted by 60%, 74% and 61% by male, female and youth farmers respectively. Also, improved soyabeans were adopted by 53%, 83% and 60% of male, female and youth farmers respectively. These high adoption rates for example, improved maize, is in conformity with an adoption rate of 84% in 2008 reported by Ellis-Jones (2009) in the PROSAB area.

In most cases the adoption rates for the other improved crop varieties in the current 2015 survey exceeds adoption rates for improved soyabeans (63%), improved rice (50%), improved cowpea (28%), improved groundnuts (25%) and improved sorghum (8%) reported by Ellis-Jones (2009). This suggests that since the end of PROSAB project in 2009, farmers in PROSAB areas have increasingly adopted and have been sustainably planting improved crop varieties. The sustainable use of the

[13] About 95 per cent of the sample farmers grew maize in 2014

improved varieties hinges on the fact these improved varieties were accessed by the farmers largely through JIRKUR Seed Producers Cooperative domiciled in the project area[14].

The relatively high rates of adoption legume specific fertiliser, cereal/legume rotation and cereal/legume intercropping, especially by women is associated with the female farmers' preference for growing legumes for processing into a range of products both for households domestic utilization and market sales. Legumes such as groundnuts are commonly processed by women into oil and cake, cowpea processed into cowpea cake which is a common fast food sold by women, soyabean processed into range of products such as soymilk, soy cheese for both household utilisation and sales.

In the non-intervention areas, the adoption rates were generally considerably lower ranging from zero to 20%. The significantly low rate of adoption of crop technologies in non- intervention areas are not unexpected given the relatively lower levels of awareness of the crop technologies and management practices among farmers in the non-project areas. It is highly plausible that the adoption rates of the respective crop technologies and management practices in the non-intervention areas, without any promotional efforts, might have been influenced by PROSAB farmer-to-farmer technology transfer to farmers outside the project area or non-intervention communities.

4.2.4 Access to extension and information service

The type of training or information delivered to farmers is presented in Table 20. Generally, more farmers in the N2Africa areas were exposed to various types of trainings and /or information service. Farmers had been trained more in handling legume technologies compared with other crops and crop management practices. The limited proportion of farmers in non-project areas might have heard of the trainings/information through farmer-to-farmer information sharing delivered in intervention areas; and on their own decide to participate.

Table 20: Frequency distribution of the type of training/information received by farmers

Type of training/information service	N2Africa Baseline (N=400)	Non-N2Africa Area (N=400)
Improved Cowpea varieties	72.9 (291)	2.0 (8)
Improved groundnut varieties	64.2 (256)	2.0 (8)
Improved soyabean varieties	72.2 (288)	2.0 (8)
Improved maize varieties	63.4 (253)	2.0 (8)
Improved Rice varieties	42.6 (170)	0.7 (3)
New varieties of other crops	23.1 (92)	0.2 (1)
Soil and Water Management	25.1 (100)	0
Crop rotations	53.0 (215	0.7 (3)
Output markets and prices	39.8 (159)	0.2 (1)
Inputs markets and prices	38.1 (152	0.2 (1)
Livestock production	67.4 (269)	0.5 (2)
Legume utilization	37.3 (149)	0.2 (1)

*Number in parenthesis represent number of farmers

Sources of information service in N2Africa project area

Farmers obtain information on the various crop technologies and management practices from diverse sources including: government extension service, farmers' group, other farmers (friends and relatives), N2Africa/NGOs, private company, Research centres (e.g. IITA, IAR), farmers' field or demonstrations, town hall meeting, farmers' training centre and traders/agro dealers as revealed in Table 21. The baseline survey revealed that N2Africa was the most important source of knowledge for improved production (36%), new cowpea (36%), new groundnuts (41%), new soyabean (37%) and output markets (44%), inputs market (44%), livestock production (54%) and food processing (56) and second most important source for new rice (24%) and crop rotations (31%). Extension service of government agencies were a leading source of knowledge on new maize and new rice varieties, and

[14] The seed cooperative emerged from a group of seed farmers that were trained by PROSAB

second leading source of information on improved crop production, new cowpea, new groundnuts, new soyabean, food processing and soil and water management.

The role of N2Africa lead farmers as community extension agents is highlighted by the survey. Other farmers are the most important source of knowledge in soil and water management (64%), crop rotation (42%), and second most important source for new maize (21%), output market (22%), input markets (23%) and livestock production.

Table 21: Frequency distribution of farmers' sources of information service in N2Africa Project Area

Source of Information	Good Agricultural Practices	New Cowpea	New G/nuts	New Soyabean	New Maize	New Rice	New Others	Soil & water mgt	Crop rotation	Output markets	Input markets	Livestock production	Food processing
	Percentage of farmers												
Government Extension service	30	31	28	29	**39**	30	27	16.0	15	13	13	17	19
Farmer Groups	2	1	2	1	2	1	2	6.0		2	3	2	1
Other farmers[15]	9	8	8	8	21	22	23	64.0	42	22	23	19	11
NGOs	36	36	41	37	17	24	29	9.0	31	44	44	54	56
Private Company		2		1	3	3	3	1.0	6	2	3	2	2
Research centre	17	14	13	15	12	15	11	4.0	1	1	1	2	1
Farmer field	1	1		1	1	2	1	0	1	1	1	2	3
Town hall meeting	1	3	5	4	1	1	4	0	2	1	1	2	7
Farmers' training centre	2	2	2	2	2	2	0	0	0	1	1	1	0
Traders/Agro dealer	1	0	0	0	0	0	0	0	0	2	12	0	0
Other	0	1	1	1	0	0	0	0	0	12	0	0	0

[15] Farmers as community extension agents

4.2.5 Access to credit and support services

Access to farm credit plays a significant role in agricultural production. It enables farmers to finance the purchase of inputs such as fertilizers, agro-chemicals, and so on. A study by Adesimi (1996) on the relative efficiency of farms reveals that access to credit is among the factors which significantly increases farm incomes. The frequency distribution of farmers disaggregated by gender who needed credit by reasons credit required is presented in Table 22.

Table 22: Frequency distribution of household credit need by purpose in N2Africa project area in 2014

Purpose for Credit	**Male (n=346)**		**Female (n=54)**		**Youth (n=114) (18-35yrs)**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Buy improved seed	126	36.4	29	53.7	126	36.4
Buy fertilizer	158	45.7	32	59.3	158	45.7
Buy chemicals	135	39.0	29	53.7	135	39.0
Buy farm implements	88	25.4	19	35.2	88	25.4
Buy livestock	98	28.3	18	33.3	98	28.3
Invest in irrigation system	65	18.8	15	27.8	65	18.8
Non-farm business or trade	95	27.5	19	35.2	95	27.5
Buy food	49	14.2	16	29.6	49	14.2
Medical expenses	59	17.1	20	37.0	17.05	20.0
School fees	62	17.9	21	38.9	62	17.9

Majority of the farmers required credit to purchase inputs, especially fertiliser and agrochemicals. Female farmers (59%) relatively expressed the need for credit more compared to male (46%) and youth (46%). The third impotence for credit need was to purchase improved seeds, which is relatively highest among female farmers (54%) compared to male and youth farmers (36%). Generally, the table reveals that female farmers have higher demand for credit compared to male and youth farmers.

In the study area, the supply of farm credit is highly inadequate as revealed by Table 23. Generally, less than 5% of the farmers got the credit they desired. The majority of the farmers

that got credit utilized it to purchase fertilizer, followed by agrochemicals and thirdly the purchase of improved seeds. Relatively fewer farmers obtained credit to purchase food, suggesting that these farmers face food insecurity problems. The mean amounts that were obtained for food more than double the mean for purchase of inputs. The mean amount of credit obtained is relatively higher among male famers compared to female and youth farmers.

Table 23: Frequency and mean amount of credit farmers got by purpose and disaggregated by Gender in N2Africa project area

Purpose for Credit	Male (n=346)		Female (n=54)		Youth (n=114) (18-35yrs)	
	Frequency	Mean (₦)	Frequency	Mean (₦)	Frequency	Mean (₦)
Buy improved seed	18	26,602	3	25,667	8	6,268
Buy fertilizer	60	27,183	5	11,760	27	17,222
Buy chemicals	35	23,557	5	15,200	15	19,633
Buy farm implements	8	28,438	1	5,000	4	37,625
Buy livestock	0	0	0	0	0	
Non-farm business or trade	0	0	0	0	3	51,667
Buy food	11	67,273	2	35,000	8	67,500
Medical expenses	1	15,000	1	20,000		
School fees	12	21,792	1	3,000	5	7,300

4.2.6 Access to output markets

The outlets through which farmers sold their marketed outputs in 2014 disaggregated by gender is presented in Figure 4. The table reveals that for both the N2Africa and PROSAB farmers, formal or structured markets are the main market outlets accessed by male farmers. These formal or structured markets are large markets where industries patronize and/or have market intermediaries who buy commodities in large quantities often on their behalf. The formal/structured markets are located mostly in Kano and Jos (over 500 km) from N2Africa project areas, however agents or middlemen purchase produce on the behalf of industrial processors. Rural markets are the major outlet for both female farmers in N2Africa areas and non-project areas; and also a major outlet for male farmers in non-N2Africa area. On the contrary, female farmers had limited access to the formal or structured markets but marketed their crop outputs mainly through rural markets (58%, 52% and 62%) in N2Africa, PROSAB and Non-N2Africa areas respectively.

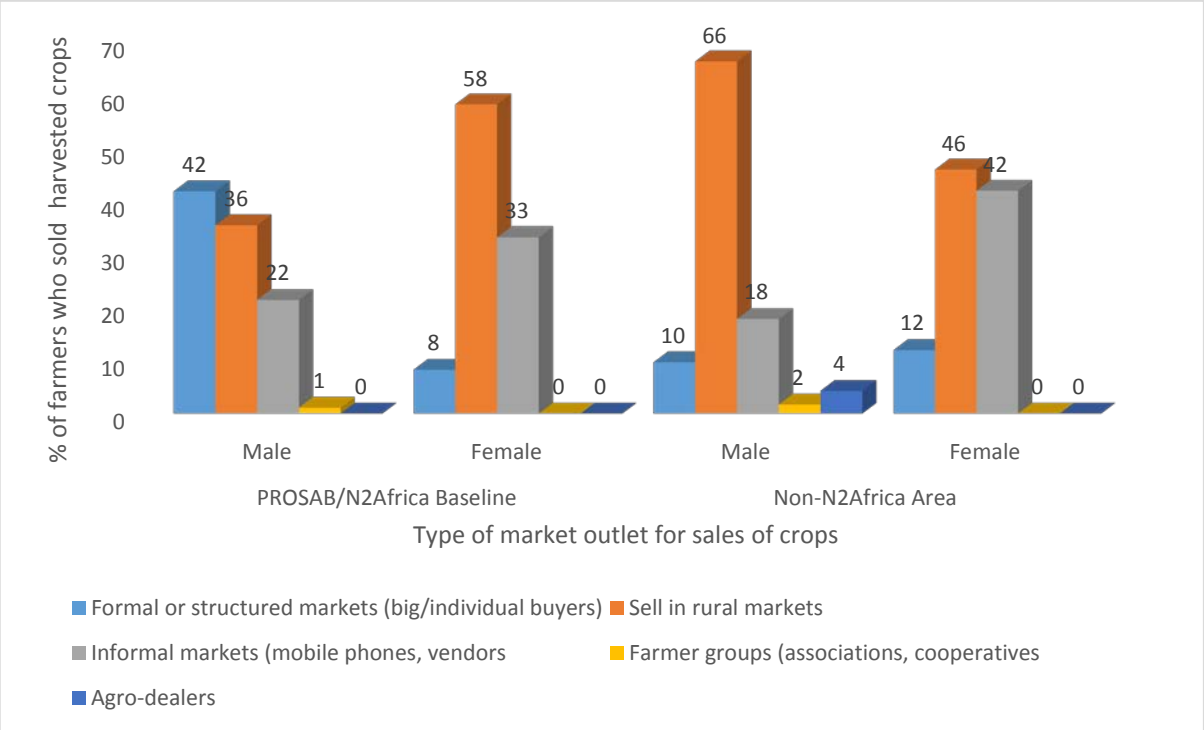


Figure 4: Distribution of how farmers sold crops disaggregated by gender in N2Africa and Non-N2Africa project areas in 2014

During PROSAB intervention, the project had facilitated farmers' access to such output markets by linking them to industries, especially for soyabean. The project had embarked on chain of market activities such as

dissemination of price information to farmers, farmers' trainings on marketing techniques and market linkage activities all cumulatively contributed to the development of the soyabean market. The soyabean market development, especially the market linkages and awareness created among market agents has been sustained up-to-date since exit of PROSAB in 2009.

The market linkages led to the development of soyabean market; this led to a quantum leap in the sales of soyabeans by farmers in PROSAB project area over the period 2005-2009 (Table 24). The number of farmers that were linked to markets increased by at least 135% from 201 soyabean farmers in 2005 to 472 farmers in 2009. The quantity of soyabean sold over the period rose from 20.7 MT in 2005 to 1,098.2 Mt in 2009, a percentage growth of 5205%. The aggregate revenue realised from the sales equally increased drastically from 0.93 million Naira to 89.8 million Naira, representing over 9000% increase in accrued revenue to farmers. It is equally of interest to note that average market price had consistently been increasing; and rose from ₦45,000 per tonne in 2005 to ₦81,000 per tonne in 2009, representing 80% increase over the period (PROSAB, 2009).

Table 24: Soyabean market linkage statistics: 2005–2009

	2005	2006	2007	2008
Farmers linked to market (no.) (male/female)	201 (127/74)	301 (190/111)	391 (231/160)	485 (344/141)
Quantity sold through market linkage (t) (male/female)	20.7 (13.1/7.6)	57.2 (36.0/21.2)	218.5 (129.1/89.4)	811.0 (754.0/57.0)
Revenue (million Naira) (male/female)	0.93 (0.59/0.34)	2.8 (2.3/0.5)	14.2 (11.4/2.8)	46.8 (43.7/3.1)
Average price/kg (Naira)	45	49	54	58

Source: PROSAB 2008–2009 Annual Report

The trend in the soyabean market suggests that farmers had increasingly adopted the production of soyabeans, with more farmers planting the crop and existing producers increasing land area under cultivation. Increased demand for soyabean by industrial processors coupled with attractive market prices among other reasons were major factors that motivated farmers to grow the crop. The fact that the unit price of soyabeans had increased by nearly 80% as at 2009; and currently (2014) the average unit price for soyabeans is ₦85 per/kg, which suggests that there is a great market potential in Nigeria.

The impact of this market development is visible in both N2Africa and PROSAB project areas. It can be noted that the 10% and 12% of male and female farmers from the non-intervention areas who sold crop outputs in structured or formal markets plausibly sold them in the markets that were developed during the PROSAB era (Figure 4). This further suggest that the benefits of market development has no boundaries but benefit farmers and other stakeholders both within intervention and non-intervention

4.3 Household Food Security

This section presents the results of the household food security carried out in the study, based on the model developed in chapter three. It begins by presenting the households' own perception of their food security status, followed by food security statistics and impact of crop technologies, management practices and market linkages delivered by PROSAB on households' food security in the study areas.

4.3.1 Household own perception of food security status

Food security is a key indicator of household wellbeing and includes food sources from own production and cash purchases. Generally, households interviewed reported improvements in their food security situation in all areas (Figure 5) in 2014.

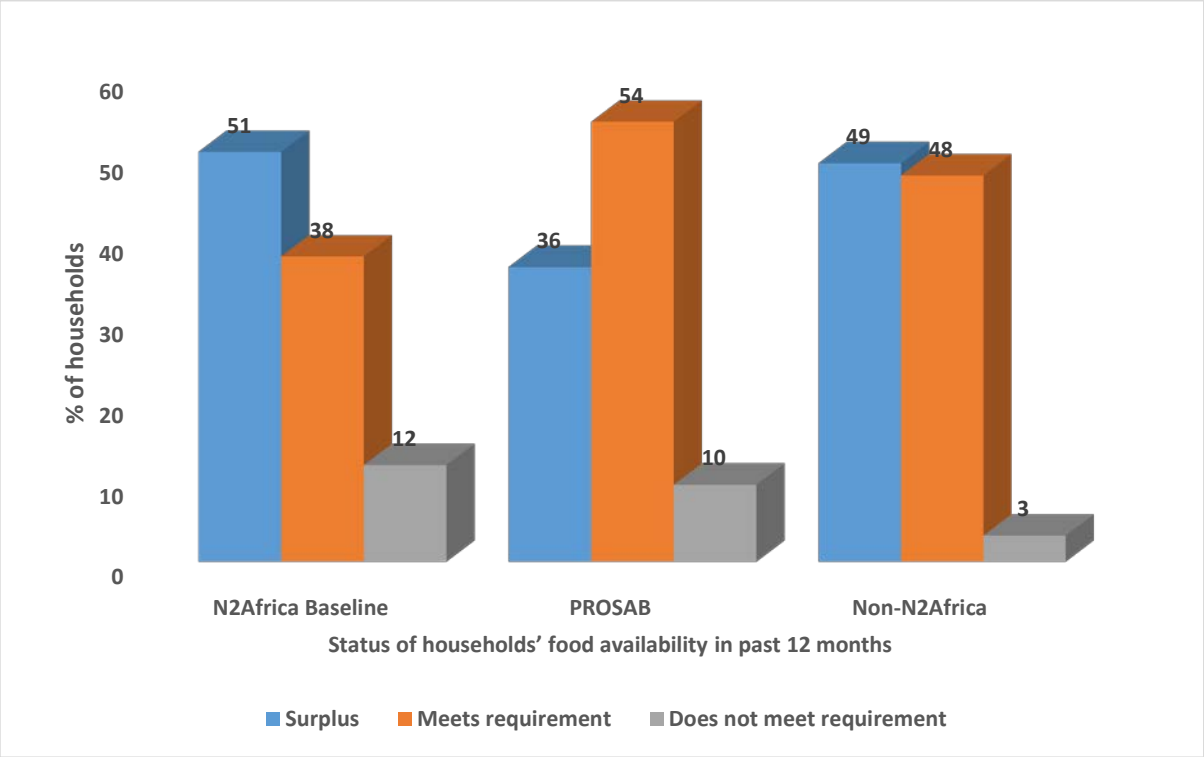


Figure 5: Frequency percentage of households' own food security perception in 2014

4.3.2 Household Food Insecurity Statistics

The summary statistics on the food insecurity status of households are presented in Table 25. Based on the FAO recommended daily energy level (L) of 2250 kilocalories, the food insecurity threshold or line (S) for the households in the N2 project area, PROSAB area and non-intervention area were found to be ₦2543, ₦2814 and ₦1996 respectively per month per adult equivalent. Using the defined food insecurity line, it was found that 32%, 30% and 62% of all households sampled in the N2Africa, PROSAB and non-intervention areas were food insecure by headcount (H). Furthermore, the estimated aggregate income gap (G) of –426, -400 and -586 indicated the amounts of ₦426, ₦400 and ₦586 by which food insecure households in N2Africa, PROSAB and non-intervention areas respectively were below the minimum expenditure level required to meet their basic food needs.

Table 25: Summary Statistics on Food Insecurity among Households in the N2 Project Area and Non-N2 Project Area

Measures	N2Africa Baseline	PROSAB Area	non-N2Africa
FAO recommended daily energy level (L)	**2250 Kcal**		
Food insecurity line Z (cost of the minimum energy requirement/adult equivalent)/month	₦2543	₦ 2,814	₦1,996
Head count (H) food insecurity index:	0.321	0.301	0.616
Food Insecure households (%)	32	30	62
Food Secure households (%)	68	70	38
Aggregate income gap (G)	-426.21	-399.78	-585.52

4.3.3 Impact of PROSAB project on household food security

In this section, the impact of improved crop technologies, management practices and linkages to inputs and output markets promoted by the PROSAB project are examined with regards to food security. This was done by first comparing households' food security status before the start of the PROSAB project (2004) and after the end of the project (2014). The ten (10) years' time lag is sufficiently long enough to assess this impact factor. The second component of the food security impact analysis was to compare the food security status of households in PROSAB area (i.e. 'with' PROSAB project) with households in non-intervention area (i.e. 'without' PROSAB project[1])

Food security before and after PROSAB in project communities

Table 26 shows the food security status among the households in the PROSAB project area over the period 2004 to 2014. The table revealed some positive changes in the increase in level of food security. The food security status revealed that the cost of the minimum basic food requirement- the food insecurity line which was ₦ 1,975/month per adult equivalent in 2004 had risen to N2,161/month in 2008 and a further risen to N2,814/month in 2014. Using the defined food insecurity line, it was found that 58% of all sampled households that were food insecure by head count in 2004 had decline to 49% in 2008 and a further decline to 30% in 2014. This suggest that the proportion of households in PROSAB project area that were food secure had increased by 28% over the period between 2004 and 2008. These positive changes in food security status of the households are attributed to the gains derived from PROSAB project, especially increases from the achieved levels of crop productivity and household incomes.

Table 26: Food insecurity status before and after the PROSAB project

Measures	Before PROSAB (2004)	PROSAB (2008)	After PROSAB (2014)	% change (2004-2014)
FAO recommended daily energy level (L)	**2250 Kcal**			
Food insecurity line Z (cost of the minimum energy requirement/adult equivalent)/month	₦1975	₦ 2161	₦ 2,814	+30.9
Head count (H) food insecurity index:	0.58	0.49	0.30	-18.0
Food Insecure households (%)	58	49	30	-28.0
Food Secure households (%)	42	51	70	+28.0
Aggregate income gap (G)	–375.74	–1108.35	-399.78	+6.0

Sources: Amaza et. al. (2009)
Survey results computation (2015)

Current food security level in PROSAB communities and non-PROSAB communities

A comparison of the results of the food security measures for PROSAB and non-PROSAB communities is presented in Figure 6. Food insecurity lines of ₦2, 814 were estimated from households in PROSAB communities and of ₦1, 996 from households in the non-PROSAB participating communities (see Table 26). These food insecurity lines were expected to meet the minimum recommended daily energy level (2250 kilocalories) of an adult/month in the participating communities and 62% in the non-participating communities. Based on these food insecurity lines, 30% of households were classified as food insecure in the participating communities and 62% of households in the non-participating communities (Figure 6). The 62% food insecurity status of households in the non-PROSAB project area is marginally higher than the estimated 61% food insecurity status reported in the early impact of PROSAB study by Amaza et.al (2009). This suggests that over the past six years, households in non-intervention project area have experienced only slight changes in their food security status. This is plausible as households in non-intervention areas

[1] The counterfactual area does not include N2Africa communities

have largely been using local crop technologies and traditional crop management practices which have limited impact or contribution to their improved food security.'

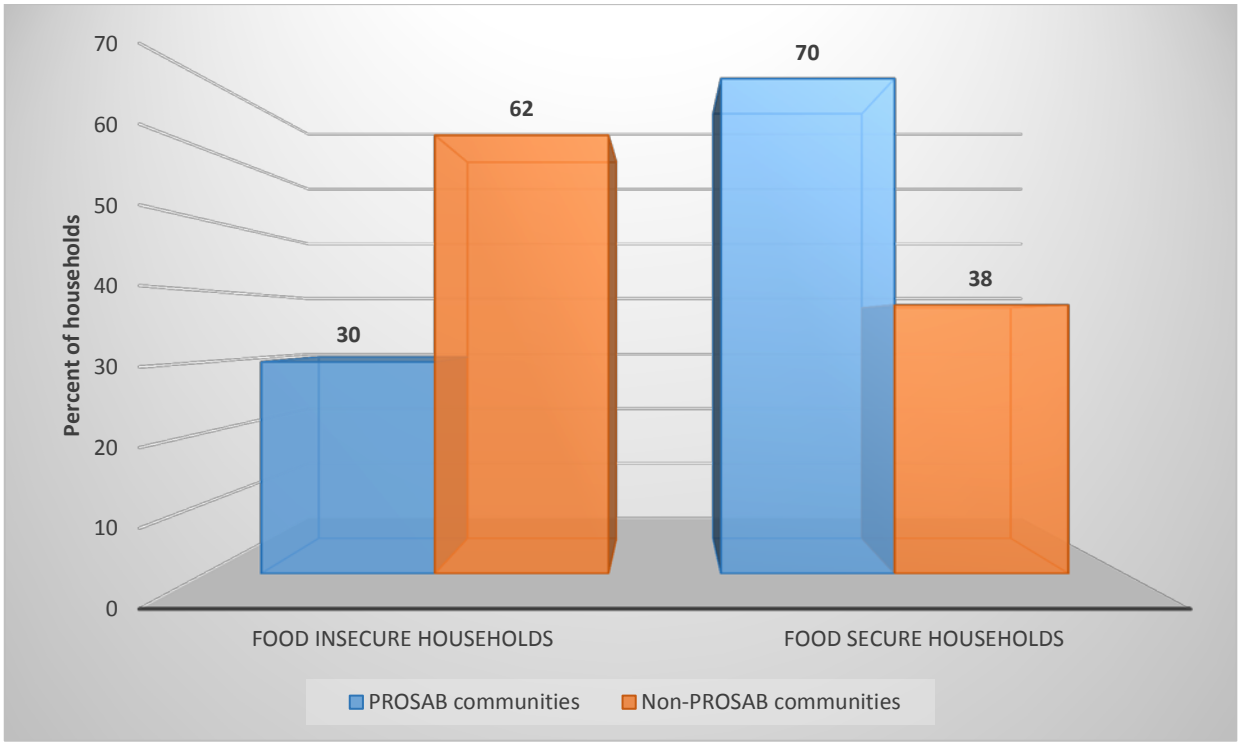


Figure 6: Food insecurity status in PROSAB and non-PROSAB communities

Household food dietary diversity

Household dietary diversity was used as a measure of food intake quality of households. Dietary diversity indexes have been shown to be good proxies for calorie intake and nutritional outcomes (Ruel, 2006). Ten (10) food groups included in the household's dietary diversity were: - *grains, roots and tubers; legumes, pulses and nuts; organ meat, poultry and offal; fish and sea foods; dairy products; green leafy vegetables; other vitamin A rich vegetables.* Other food groups considered included fruits, eggs and oil/fats. These food groups were used to identify food intake quality of households in the study area. The frequency distribution of households' dietary diversity index in PROSAB/N2Africa project and non-intervention project areas are presented in Figure 7. The figure shows that 23% and 57% of households in PROSAB/N2Africa and non-intervention areas respectively of the sampled households had 0-5 food groups in their diet per day, which implies a low food intake diversity per day. A comparison of the food dietary diversity scores reveals that more households in N2Africa/PROSAB (78%) relatively have higher food dietary diversity than households in the non-intervention areas (43%). This suggests that households in N2Africa and PROSAB areas relatively significantly have higher food intake diversity per day. This observed higher food diversity in PROSAB/N2Africa project areas is directly linked to the impact of PROSAB project in improving food security, including dietary diversity in terms of increased availability of food and higher incomes.

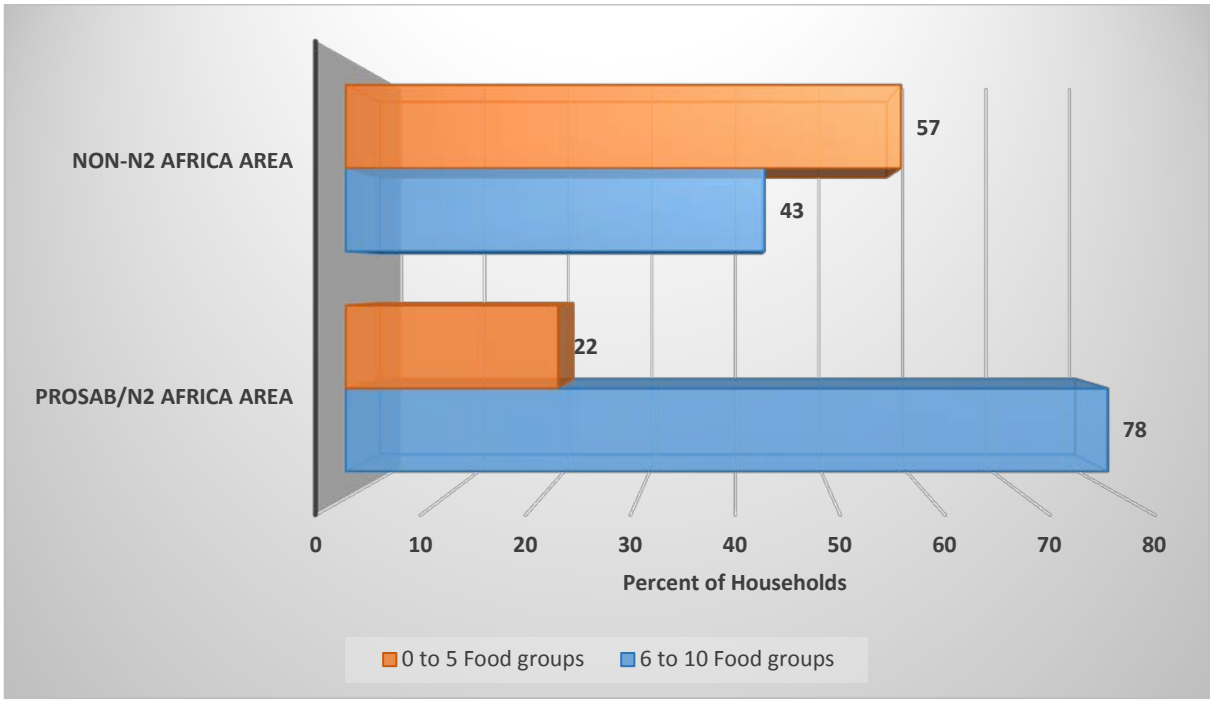


Figure 7: Frequency distribution of number of food groups consumed per household in the last 24 hours

4.3.4 Determinants of Household Food Insecurity

The various variables included as the determinants of household food insecurity in the logit regression model used were as defined earlier under section 3.2 of this report. The results of the logit regression analysis are presented in Table 27.

From the logit analysis, 13 regression coefficients were found to be statistically significant at $p \leq 0.05$ (i.e. at 5% level or below). However, some variables which were earlier included in the model were dropped from the analysis because of the problem of multicollinearity.

The result shows that the significant determinants of household food insecurity in the N2Africa project area were gender of household head, age of the household head, marital status, level of education of household head, household size, child dependency ratio, annual income, number of farm plots owned, household farm size, years of farming experience of household head, household's adoption of new crop technologies, received training on new technologies by the household, distance to source of inputs, distance to market and household's access to credit. The pattern of the behaviour of these variables is explained as follows.

Table 27: Result of the Logit Regression Analysis of Household food security Status

Variable	Effects on food security status	Marginal effects on food security status
	Estimated Coefficients	Estimated Coefficients
Constant	12.191**	NA
Gender	-0.352 (-1.65)	-0.447
Age	0.485** (2.56)	0.0320
Marital status	0.641 (1.59)	0.123
Education	0.496** (2.61)	0.095
Household size	-0.482** (-2.18)	-0.076
Child dependency ratio	0.670** (2.86)	0.151
Annual income	0.833*** (5.09)	0.092
Adoption of new crop technologies	0.814** (1.96)	0.156
Received training on new technologies	0.864** (2.23)	0.131
Farming experience	0.677** (1.96)	0.032
Farm size in hectares	0.785** (2.84)	0.075
Number of plots owned	2.016*** (6.25)	0.386
Distance to source of inputs	0.830*** (5.06)	0.159
Distance to market	1.012*** (4.01)	0.065
Access to credit	0.785** (2.84)	0.042
Number of Observations	800	
LR Chi2 (14)	149.43	
Log likelihood	-174.24	
Pseudo R-square	0.2054	

Source: Regressions Results, 2015
Notes: Numbers in parenthesis are Z values for each coefficient.
*** Statistical significance at 1%; ** at 5%; NA = Not available.

The regression result indicates that age of the household head, level of education, household size, child dependency ratio and adoption of new crop technologies have significant effects on the food security status of the household. Age of the household head has a positive effect, indicating that older household's head tend to be more food secure. Such households tend to have larger household sizes that contribute to household production and incomes that tend to have positive influence on the level of food security.

Education: The coefficient of education variable is statistically significant at 5% level and carries a positive sign, thus suggesting that the higher the educational level of the head of a household, the more food secure (or less food insecure) the household tended to be, and vice versa. This is expected, since level of education should positively affect income-earning capacity and the level of efficiency in managing household food resources.

Household size had a negative effect on food security, indicating that large households are more likely to be food insecure. This shows that households with large sizes had higher probabilities of being food insecure than those with smaller sizes, and vice versa. That is, household size is a negative factor determining the food security status of a household in the project area.

Child dependency ratio: Similarly, the child dependency ratio was found to have positively affected the food security status of the households in the area. The coefficient of this variable was positive (0.790) and significant at ($P<0.05$). The positive coefficient implies that one unit increase in the child dependency ratio would improve the probability of food security by approximately 0.790 in an average household in the area. This is unexpected *a priori*. However, it suggest that children contributes to household food security by contributing their labour in farming activities such as planting, weeding, harvesting of crops and so on. This is plausible as the survey was carried out at a time when public schools at both primary and secondary levels in Borno State were closed down due to the insecurity

problem caused by Boko haram insurgency[1]. This situation implies that that children who hitherto were in schools became available to work on farms, thus contributing to the household food security.

Household annual income also has a positive impact on the food security of the household. The coefficient of this variable was positive (0.833) and significant at (P<0.01). The positive coefficient implies that 1-% increase in household income would improve the probability of food security by approximately 0.833 in an average household in the area. This variable is a proxy for the household's ability to purchase inputs, such as fertilizers and improved seeds, which are critical to increased agricultural production.

Adoption of new crop technologies by the household also had a positive effect on household food security. This variable measured household adoption of improved crop varieties. The survey results revealed that over 60% and 15% of households in the N2Africa and non-intervention areas respectively have adopted especially improved maize and cowpea, which are commonly consumed by households in the survey areas. The adoption of new crop varieties tend to increase crop yield per hectare, thus improving household food security. Similarly, households that received training on the new technologies are likely to be food secure. This suggests that the project activities, such as farmers' training on crop management practices, marketing, adoption of improved crop varieties by farmers and their links to inputs and output markets and so on, positively contributed to enhancing food security.

Farming experience: the coefficient of this variable is statistically significant at the 5% level and carries a positive sign, thus suggesting that the more the farming experience of the household head, the more food secure the household tended to be, and vice versa. This is as expected; since the level of experience of the household head is expected to position the household's farming activities in forecasting the future in the face of changing climate/weather variability. Also, farmers that have more years of farming experience have accumulated knowledge through learning-by-doing and this tend to have positive effect of farm productivity leading to increased output and improved food security.

The total farm size of a household is another significant determinant of food security status. The coefficient of the variable is positive and statistically significant at 5% level, meaning that farm size exhibits a positive relationship with the food security status of a household. That is, households with larger farm sizes tend to be more food secure than those with smaller sizes, and vice versa. As household farm size increases, the probability of household food security tends to rise.

Distance to source of inputs: The coefficient of distance to inputs market is positive and highly significant at 1% level. This underscores the importance inputs play in improving household food security. The distance to source of inputs, such as fertiliser has implications for expenditure on food production. The positive coefficient suggest that farmers who have shorter travel distance to source for inputs tend to be more food secure and vice-versa.

Distance to output market: The distance to output market has shown strong positive significance with food security at 1% level. The shorter the distance to output markets, the more food secure is the household. This is plausible as households that are closer to output markets earn higher net incomes from sales of crops with greater potential to purchase more and/or produce diversified food for household consumption.

Household head's access to credit: The coefficient is positive and significant at 5% level. Households whose heads had access to credit facilities had a higher level of food security than those whose heads did not have access to credit facilities. This might be due to the fact that those households with access to credit were able to acquire more productive resources for their household enterprises. This would subsequently enhance household income-generating ability and household welfare. This variable has an intercept dummy of 0.785, meaning that the autonomous food security status of households whose heads had access to credit facilities was, on the average, higher by 0.785 than that of households without access to credit.

[1] Public schools at primary and secondary levels have been closed for 2 years in the State

4.4 Households' Poverty Status

4.4.1 Households' expenditure in N2Africa and non-N2Africa communities

To evaluate the welfare of the households in both the project and non-project areas, the study tabulated the welfare indicator (expenditure pattern) by consumption level as monthly mean per capita adult equivalent household expenditure (MAHE) by deciles (Table 28). The result shows that the sampled households in the project areas that fell in the first decile or the bottom 10% survived on an average of ₦6,523.37 per month while those in the non-project areas survived on an average of ₦1,529.30 and their share of the total monthly MAHE was 1.40% and 0.8% respectively. Those in the last decile in the project areas spent on an average, ₦178, 395.60 per month against the ₦112, 891.00 spent by their counterparts in the non-project areas; and their share of the total monthly MAHE was 38.36% and 59.04% respectively. The first decile represented the poorest thirty households from the sampled three hundred and ten households of the samples. The poverty line of ₦30,999.73 which was the $^2/_3$ of the mean of the MAHE was located within the thirtieth households of the sixth decile for the project areas, while for the non-project areas, it was found to be ₦12,747.63 The MAHE of the remaining deciles and their corresponding percentages are as presented in Table 28.

Table 28: Distribution of the Monthly MAHE by Deciles

	N2Africa Baseline Area		Non Project Area	
Deciles	MAHE	Expenditure distribution (%)	MAHE	Expenditure distribution (%)
1st	6523.37	1.4	1529.3	0.8
2nd	12810.63	2.75	2493.38	1.3
3rd	17160.97	3.69	3782.15	1.98
4th	21340.23	4.59	5138.47	2.69
5th	25576.41	5.5	6331.04	3.31
6th	32696.71	7.03	8107.78	4.24
7th	41153.16	8.85	11144.9	5.83
8th	53998.46	11.61	15688.72	8.2
9th	75340.36	16.2	24107.76	12.61
10th	178395.6	38.36	112891	59.04
Total	464995.9	100	191214.5	100
Mean	46499.59		19121.45	
2/3 MAHE	30999.73		12747.63	

The poverty line

The poverty line used for this study was calculated from the monthly MAHE of the sampled households as shown in Table 28. Two third (₦30, 999.73 and ₦12, 747.63) of the monthly MAHE of the sampled households in both project and non-project areas were used as the poverty line. This was also used by similar studies in Nigeria (World Bank, 1996; FOS, 1999a; 1999b; Omonoma, 2001; FOS, 2004; and Bandabla, 2005). This poverty line was expected to meet the minimum basic requirements (food and non-food – food) of an adult per month in the study area.

The result from this study showed that any household in both the N2Africa project and non-project areas with per capita monthly expenditure greater than or equal to ₦30,999.73 and ₦12,747.63 was considered to be non – poor or rich whereas any household with per capita monthly expenditure below ₦30,999.73 and ₦12,747.63 respectively is considered poor.

Current poverty profile of households in N2Africa and non-N2Africa communities

The poverty profile of the households which include poverty headcount or incidence (P_0), poverty gap or depth (P_1) and squared poverty gap or severity (P_2) were calculated. The P_0 for the entire respondents in the N2Africa project areas was 0.52 (52%) while for the non-project area was 0.66 (66%). This means that 52% and 66% respectively of the respondents in the project and non-project areas were poor (Table 29). These people could not attain the minimum standard of living; this leaves 48% of the total households in the

N2Africa project areas to be non-poor, while 34% of respondents in the non-project areas were non-poor. These were the households with per capita monthly expenditure equal or higher than ₦30, 999.73 and ₦12, 747.63 respectively. Although the poor are conventionally defined as the population that fall below a certain poverty line, it is assumed that even individuals above the poverty line may suffer from "investment poverty" (Reardon and Vosti 1995).

When compared with national and regional figures, Poverty both in N2Africa and non-intervention communities were considerable less that the national figures. In 2004, Nigeria's relative poverty measurement stood at **54%,** but increased to **69%** in 2010. The North-West and North-East geo-political zones recorded the highest poverty rates in the country with **78%** and **76%** respectively in 2010 (NBS, 2010).

Table 29: Poverty Profile of Households

Index	N2Africa Baseline Area	Non-Project Area
	₦/Percentage	₦/Percentage
MPAEHE	46499.59	19121.45
2/3 MPAEHE	30999.73	12747.63
1/3 MPAEHE	15499.86	6373.82
Head Count Index (P0)	0.52	0.66
Poverty Gap Index (P1)	0.029	0.083
Poverty Severity Index (P2)	0.0008	0.007

The poverty gap index (P_1), usually referred to as the depth of an average poor person from the poverty line for both areas was 2.9% and 8.3% respectively. This implies that 2.9% of the poverty line was required to bring an average poor person in the N2Africa project area to the poverty line, 8.3% was required for the non-project areas. The poverty severity index (P_2) which measures the distance of each poor person to one another was found to be 0.0008 and 0.007 respectively for project and non-project areas. This means that among the poor households in the N2Africa project areas, 0.08% were severely poor, while 0.7% were severely poor in the non-project areas. This shows that the poor households were not equally poor but they vary in their degree of poverty.

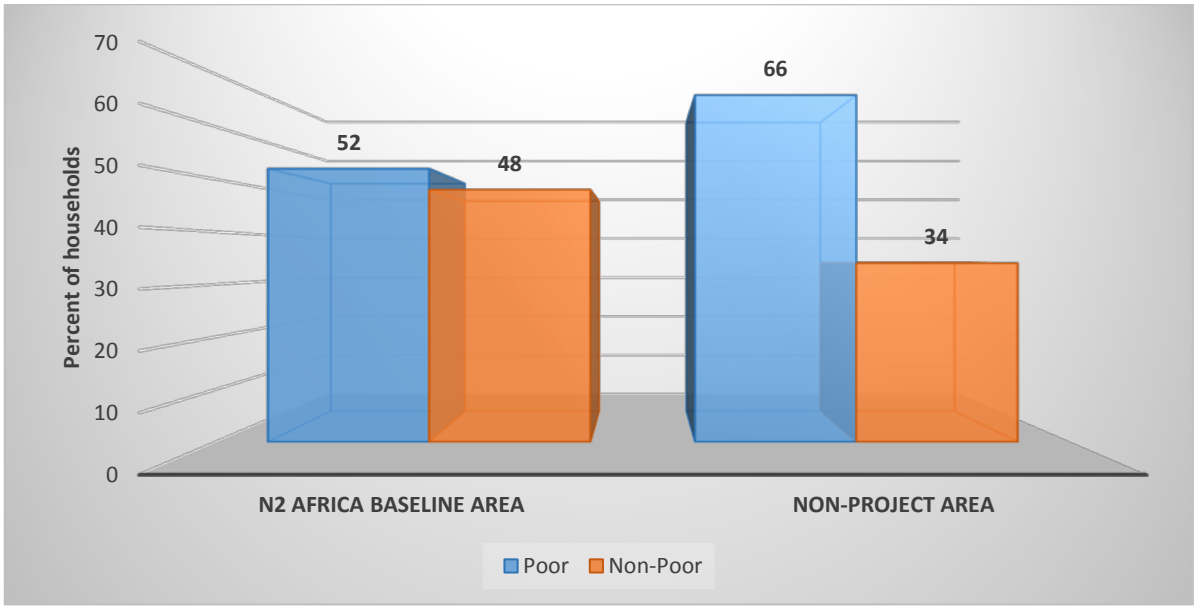


Figure 8: Households' poverty measures in N2Africa and non-N2Africa project area

4.4.2 Impact of PROSAB project on household poverty levels

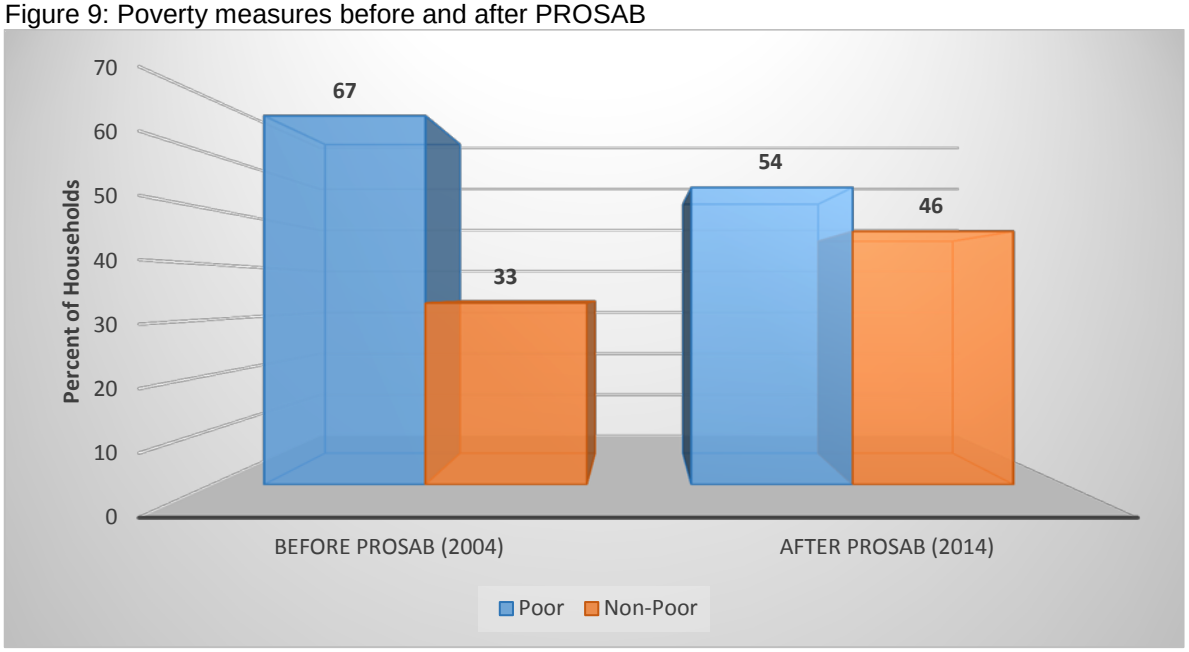
This section examines the impact that the PROSAB project has played in reducing poverty among households in the project area. First, the analysis examined and compared the poverty level of households before the PROSAB project as reported by Amaza et al (2004) with poverty measures after the project in

2014. Second, poverty measures of households in PROSAB communities were examined and compared with poverty measures of households in non-PROSAB communities. Thirdly, the results of these comparisons were further strengthened by households' perception and attribution of the changes in their wellbeing to the PROSAB project.

Poverty level in PROSAB communities before and after the project

A poverty line of ₦37, 815.64 based on 2014 prices, is two-thirds of the MAHE, and was expected to meet the monthly minimum basic requirements (food and non-food) of an adult in the study area. Households with a MAHE below this poverty line were classified as poor, while those with a higher MAHE were classified as being non-poor. Based on this poverty line, 52% of the households were classified as poor while 48% were classified as non-poor (Fig. 9)

Figure 9: Poverty measures before and after PROSAB



In a baseline study by Amaza et al. (2007) prior to the implementation of the PROSAB project, a poverty line of ₦2446.67 was estimated and used to classify households into poor and non-poor. Based on this poverty line, 67% of households were classified as poor whereas the non-poor accounted for 33% of the sample households.

Analysis of the two studies revealed that PROSAB project has reduced poverty in the project area by 13% (67% – 54%). This shows that, due to improved livelihoods as a result of the PROSAB intervention, poverty was alleviated in 13% of the poor households.

Poverty level in PROSAB communities and non-PROSAB communities

Two kinds of analyses were simultaneously carried out to examine the impact of PROSAB on the poverty level of the households in the project area. To ascertain the impact of the project on the participating communities, a similar study was also conducted in non-participating communities in the survey. Table 36 shows results of the studies.

Table 30: Poverty status in PROSAB and non-PROSAB communities

Poverty index	PROSAB communities	Non-PROSAB communities	Percentage difference
Poverty head count (P_0)	54.00	66.00	12.00
Poverty gap (P_1)	0.0176.	0.083	6.5
Severity (P_2)	0.00031	0.007	0.7

Source: Survey data, 2015.

The poverty lines used for these studies were calculated from the monthly MAHE of the sampled households. A poverty line of ₦37, 815.64 was estimated for the PROSAB communities and ₦12, 747.63 for non-participating communities, which was two-thirds of the MAHE of PROSAB-participating households. These poverty lines, based on 2014 prices, were expected to meet the monthly minimum basic requirements (food and non-food) of an adult in both participating and non-participating communities. Households with a MAHE below these poverty lines were classified as poor, while those with a higher MAHE were classified as being non-poor. Based on these poverty lines, 54% of the households were classified as poor in the participating communities and 66% in non-participating communities (Fig.6). Based on this computations, it can be inferred that the PROSAB project has alleviated poverty by 12%.

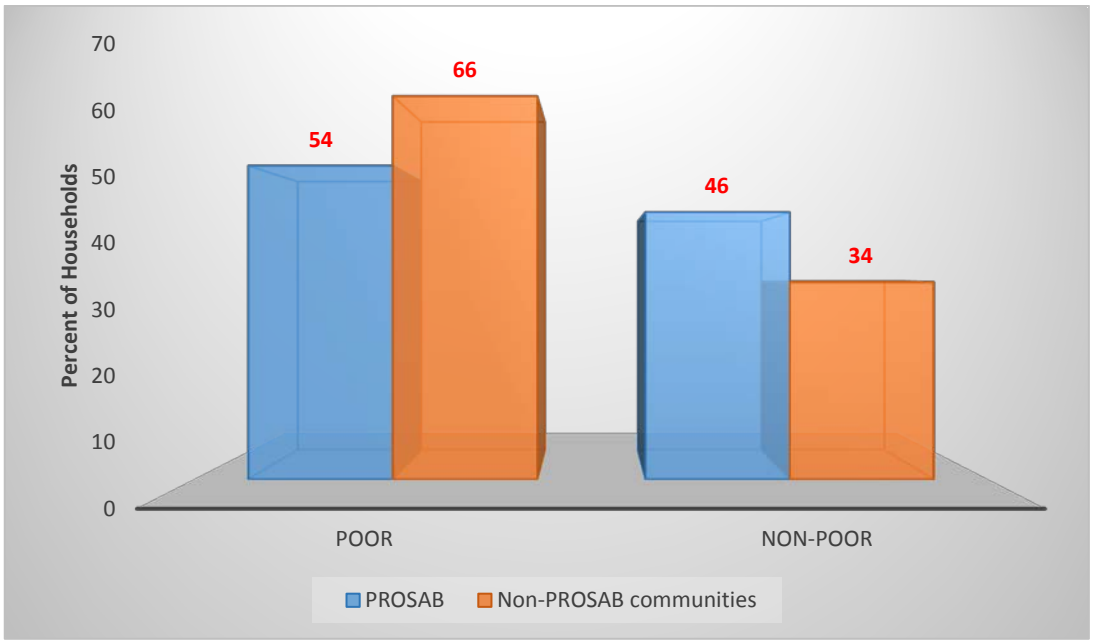


Figure 10: Poverty status in PROSAB and Non-PROSAB communities

4.4.3 Perception of sampled households' attribution in poverty reduction to PROSAB project

An integral component of the survey was to sample the households' perception on benefits derived from PROSAB project and whether they attribute the changes in their welfare to the PROSAB project. Table 31 presents the frequency distribution of the household's perceived benefits from PROSAB.

Table 31: Frequency distribution of Farmers' perceived benefits from PROSAB PROJECT

Benefits from PROSAB	N2Africa Baseline		PROSAB Area		Non-N2Africa	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Good agronomic practices	238	63.5	168	44.8	18	28.6
Improved food security	182	48.5	133	35.5	22	34.9
Improved household incomes	205	54.7	155	41.3	11	17.5
Improved access to improved seeds	222	59.2	167	44.5	9	14.3
Improved household welfare (i.e. reduced poverty	154	41.1	108	28.8	2	3.2
Improved interaction among farmers	111	29.6	79	21.1	1	1.6

***Multiple responses**

The farmers' perception of benefits derived from PROSAB is presented in 36. The significant benefits derived from PROSAB project are good agronomic practices, improved access to improved seeds, improved household incomes, improved food security and improved household welfare. Generally, more farmers in N2Africa and PROSAB relatively derived more benefits compared with non-intervention areas. This is not unexpected given that households in the non-intervention areas did not have direct contact the PROSAB project. However, the fact that households in these non-intervention areas indicated they benefited from PROSAB intervention, demonstrates the empirical evidence of the impact of PROSAB has affected considerable number of farmers beyond the immediate project area. Most of the technologies, crop management practices and market linkages were promoted through farmer-to-farmer technology and extension transfer.

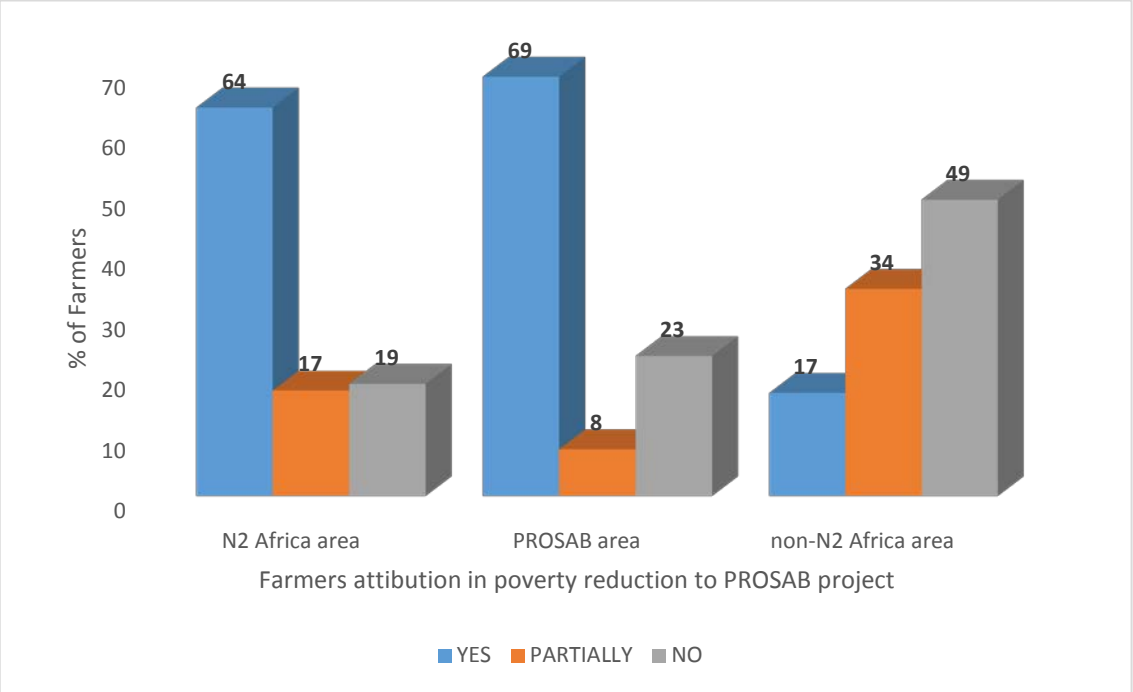


Figure 11: Frequency distribution of farmers' attribution in Poverty reduction to PROSAB project

A significant proportion of the farmers, 62% and 69% in N2Africa and PROSAB areas respectively attributed the reduction in their poverty levels to the PROSAB project (Figure 11). While, 17%, 8% and 34% of farmers in N2Africa, PROSAB and non-intervention areas partially attributed reduction in poverty to PROSAB project. This further shows that the PROSAB project has made significant impact in households' wellbeing. This suggests the technologies promoted by PROSAB, crop management practices, capacity building activities, market linkages all together have cumulatively made impact that was felt at household level.

4.4.4 Determinants of poverty status

In this section, we examined the factors that determine the poverty status of respondents in Borno State, North East Nigeria. In analysing factors that affect the poverty status of the households, a probit regression model was estimated using dummy variable (1, 0) for poverty status as the dependent variable. Household characteristics, participation in PROSAB activities and incomes of households were the explanatory variables. The estimated function is as follows:

PS = Poverty status (dummy, where 1 = below poverty line, 0 = above poverty line)
Gen = Gender (dummy where 1 = male, 0 = female)
Age = Age (years)
Yrs. = Years spent schooling
Yrf = Years spent farming
Exv = Extension visit (dummy, where 1 = visit, 0 = no visit)
Ppp = Participation in PROSAB project (dummy, where 1 = participate, 0 = not participate)
Ads = Adoption of soyabean (dummy, where 1 = adopted, 0 = not adopted)
Fml = Family size (No of people)
Dtm = Distance to input market (Km)

Nop = Number of plots owned
Crr = Credit received (₦)
Nai = Non-agricultural income (₦)
Agi = Agricultural income received (₦)
Fms = Farm size (Ha)

The regression parameters and diagnostic statistics were estimated using the Maximum Likelihood Estimation (MLE) technique (Table 32). From the MLE of the probit regression, the results reveal that the LR chi^2 is 61.12 while the Log likelihood has a value of -376.59013 and are significant at 1-% level. This implies that the model has a good fit to the data and the model as specified, explained significant non-zero variation in factors determining poverty status.

Table 32: Estimated coefficients of different factors affecting household poverty status

	Effects on poverty status	Marginal effects on poverty status
Variable	Estimated coefficients	Estimated coefficients
Gender	-0.5087*** (-2.95)	-0.1734
Age	-0.0043 (-0.88)	-0.0014
Years spent schooling	-0.0814** (-2.29)	-0.0277
Years spent farming	-0.0145 (-1.62)	-0.0049
Extension visit	0.3778** (2.17)	0.1288
Participation in PROSAB	-0.4544** (-1.91)	-0.1549
Adoption of soyabean	0.1303 (1.05)	0.0444
Family size	0.0072 (0.65)	0.0024
Distance to input market	0.0099 (0.24)	0.0033
Number of plots	-0.00892** (2.42)	-0.0304
Credit received	-0.0099(-0.09)	0.0067
Non-agricultural income	-0.0019** (2.12)	-0.0017
Income from agriculture	-0.0010 (0.42)	-0.0003
Farm size	-0.0505** (-2.12)	-0.0172
Constant	-0.0054 (-0.01)	NA
Number of obs = 629		
LR chi2 (14) = 61.12		
Log likelihood = -376.59013		
Pseudo R2 = 0.0751		

Source: Regression results 2014
Notes: Numbers in parenthesis are Z values for each coefficient
*** indicates statistical significance at 1% and ** at 5%
NA: Not available

The result showed that seven out of the fourteen listed regressors had significant influence on the poverty status of the households. The variables that had significant co-efficients are gender of household heads, years spent schooling, number of times extension agents visited the farmers and participation in PROSAB project. Others are number of plots cultivated, income from non-agricultural sources (i.e. not the direct sales of agricultural products) and farm size. It should be noted that a positive sign on a parameter indicated that higher values of the variables tend to increase the likelihood of poverty depth. Similarly, a negative value of a co-efficient implied that higher values of the variables would reduce the probability of the depth of poverty. All the above mentioned variables, with the exception of extension visit have negative coefficients.

The coefficient of gender is negatively significant (P<0.01) with a marginal effect of 17%. This implies that when households are headed by females, there is a probability that poverty in those households could be decreased by 17%. The significance of this variable could be attributed to the PROSAB's gender mainstreaming strategy. The PROSAB project had made some positive contribution in training women and men's groups in improved farm management practices, effective land utilization, improved livestock management practices, improved post-harvest practices, knowledge of land rights, and effective engagement with markets that have produced enormous benefits to the communities (PROSAB, 2009).Thus, the positive influence of the gender mainstreaming is reflected by this coefficient.

The coefficient of years spent schooling is significant (P<0.05) and has a marginal effect of 2.8%. This implies that probability of poverty depth among the households will decrease by 2.8% as a result of a year increase in school.

The result further shows that the coefficient of participation in PROSAB project is significant (P<0.05) with a marginal effect of 15%, implying that as household heads that participated in PROSAB project, there is a probability that their poverty will decrease by 15%. Households that participated in PROSAB activities are less likely to be poor compared to those that have not participated. These results are associated with the improved education that farmers acquired through various training, such as crop management practices, seed production techniques, marketing, and so on. In addition, the use of improved crop varieties had increased farmers' yields considerably, leading to an increased marketable surplus, which in turn contributed to increased incomes.

The coefficient of the number of plots owned by household heads is also significant (P<0.05) with a marginal effect of 3.04%. This implies that as the household heads increased the number of plots cultivated, there is a probability that poverty depth will be decreased by 3.04%.

Income from non-agricultural sources had negative influence on poverty, meaning that a one naira increase in non-agricultural income earned by the household heads, will probably decrease poverty by 1.76%. Farm size is also significant (P<0.05) and has a marginal effect of 1.7%. This implies that the probability of poverty among the households will decrease by 1.7% as a result of an increase in farm size. They should therefore be encouraged to increase their farm holdings.

The coefficient of extension visit is significant (P<0.05) and has a marginal effect of 12.9%. This implies that the probability of poverty depth is increased by 12.9% for every visit by extension staff. This could imply that the extension agents don't really pass the right knowledge to the household heads or the visits are too frequent such that the household heads hardly get enough time on their farms. It could also be that the timing of the visits is not right at all.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The N2Africa project has made some significant contributions on some its major project indicators. Some of these indicators includes: awareness of crop technologies and management practices, including their adoption levels; incomes derives from crops, food and food security. The PROSAB project also has made significant impact on a number of outcomes among households in the project communities. These includes: crop productivity, incomes, food security and poverty reduction. PROSAB used a participatory approach to promote improved varieties of cereals and legumes along with agronomic practices that had made positive impact on crop yields and incomes. The survey results indicated that PROSAB has been successful in significantly increasing crop yields and farmers' incomes in the communities where it worked. The trainings and linking farmers to markets were also important components of the project that had significantly improved farmers' access to markets, especially soyabeans.

The levels of awareness of most of the crop technologies are generally high with over 70% among sampled farmers in N2Africa and PROSAB areas (with the exception of improved sorghum-38%, legume specific fertiliser-63%, inoculating legumes-43% and legume utilization 61%). These high levels of awareness of the crop technologies and management practices are partly attributed to the 2014 dissemination activities by N2Africa.

On the contrary, in the non-intervention N2Africa survey areas, the proportion of farmers that were aware of the crop technologies and management practices were considerably much lower generally ranging at varied proportion of sampled farmers from 36% to 59%. The level of awareness of these farmers in the non-intervention project areas could have been created through farmer-to-farmer information sharing between farmers in the N2Africa and especially farmers in PROSAB intervention communities with farmers in non-intervention communities.

Improved maize varieties is the most adopted crop technology amongst the farmers with 83% adoption rates by male and youth farmers and 82% adoption rate by female farmers. This is followed by the adoption of improved cowpea (61%) and improved soyabean as the second most adopted technologies among male farmers and female (80%) and youth farmers (63%). The relatively higher adoption rates of soyabean by female farmers is largely influenced by its importance in processing into a range of food products for domestic consumption and/or for market, in addition to commercial sales in unprocessed form.

Cereal/legume intercropping and cereal/legume rotation often as soyabean/maize intercrop or rotation have been adopted by 70% of female farmers with adoption rates ranging from 50% to 58% by male and youth farmers. Inoculants, a relatively new technology compared to the others is the least adopted technology among the various technologies. The inoculants were provided by the N2Africa project for demonstrations to lead farmers and for soyabean only. It was not yet available in the market.

Cowpea, groundnut and soyabean farmers in N2Africa project area attained the highest profitability from growing these crops compared to other areas with a gross margin of 3.61, 4.65 and 5.76 respectively. This suggests that the crop technologies disseminated by the N2Africa project are highly profitable.

The mean income from crops earned by farmers in N2Africa and PROSAB, reflects similarity in terms of yields achieved by farmers are significantly higher than non-intervention project areas. Households in PROSAB and N2Africa areas earned significant increases in the value of cowpea, groundnut, soyabean and rice over non-N2Africa project area, ranging from 50% to 100% increases. This significant increases in income earned are directly related to the obtained yields in kg/ha and linkages to output market in the case of soyabean. The mean income earned from crops, which are further disaggregated by gender revealed that male farmers earned relatively more income than female from the sales of all the crops (10% to 50%).

Also, on the average male farmers in N2Africa and PROSAB areas earned relatively more income than female and youth from the sales of cowpea and maize than female and youth farmers. Similarly, youth farmers from N2Africa area earn relatively more from soyabeans and millet compared to adults or non-youth and female farmers.

The food security status revealed that 32%, 30% and 62% of all households sampled in the N2Africa, PROSAB and non-intervention areas were food insecure by headcount in 2014. This study suggests that PROSAB has also made a significant impact to improving food security in its project areas. In project communities, food insecurity has been reduced by 28% from 58% in 2004 to 30% in 2014. In addition, the

comparison of PROSAB and non-PROSAB communities in 2014 showed that food insecurity is higher (62%) in communities where PROSAB had no interventions compared with 30% in PROSAB communities. Also, regression analysis suggested that participation in PROSAB activities had a positive and statistically significant effect on household food security status. Households that participate in PROSAB activities had a 28% increase in the probability of being food secure, according to our results.

The poverty measures in N2Africa, PROSAB and non-intervention communities in 2014 were 52%, 54% and 66% respectively. The evidence from this study also suggests that the PROSAB has contributed to poverty reduction in the area it operated by 13% as shown by poverty incidence before (67%) and after PROSAB (54%). Similarly, poverty incidence has also been found to be lower in PROSAB communities (54%) compared with non-PROSAB communities (66%). Furthermore, regression results indicate that participation in PROSAB activities significantly reduced the probability of a household being poor. According to these regression results, participation in PROSAB activities reduces the probability of being poor by 15%.

Several factors played a significant role in the success of PROSAB, including the technologies promoted, the trainings delivered to farmers, linking farmers to markets, especially output markets for sales of crops, the project approach (including partnership), collaborators and stakeholders, and support from the local people. This analysis has not tried to single out the effect of any of these components. Instead, it endeavoured to measure the impact that have happened since the project started in these communities ten years ago and then compared them with outcomes in non-participating communities.

5.2 Recommendations

Based on the findings of this study, a number of recommendations are suggested for the implementation in the new N2Africa project in Borno State. The overlap of PROSAB and N2Africa in terms of both objectives and operational areas suggests that the recommendations are imperative. Broadly, the recommendations are grouped into nine, recommendations relating to (i) adoption of crop technologies and management practices, ii) gender mainstreaming, (iii) farmers' education, (iv) linkages to output market, (v) strengthen the capacity of seed producers, (vi) linkages to credit market, (vii) agribusiness for youth, viii) PROSAB areas, and ix) scaling out of project technologies and management practices:

1. **Adoption of crop technologies and management practices**
   The study reveals that the adoption of improved crop technologies such as groundnuts, maize, soyabean have generally been high in the N2Africa and PROSAB communities. It is recommended that emphasis on crop technologies promotion be shifted to the counterfactual communities within the project area and greater focus in Bayo LGA. This will facilitate adoption in the counterfactual communities. There should be more focus on the promotion of crop management technologies as these adoption rates were generally less than the crop varieties.

2. **Gender mainstreaming**
   The PROSAB gender mainstreaming activities had some good-learnt lessons that can be replicated in N2Africa project, especially for women and the youth in agriculture (Agripreneurs). The capacity building of gender with regards to household processing and utilization of legumes should be strengthened and scaled-out especially in the new areas (e.g. Bayo LGA).. This has the potential to facilitate increased adoption of legume technologies, improving household nutrition and enhance household incomes.

   The food security and poverty regressions results revealed that female-headed households are relatively more food secure and less poor than male-headed households. This finding suggest the need to strengthen gender mainstreaming in N2Africa with regards to strengthening gender, especially women and youth's capacity in entrepreneurship to enhance their income-earning capabilities through technical and managerial skill acquisition, access to credit, resource supply support, and social capital formation.

3. **Farmers' education**
   Farmer-to-Farmer extension was found to have strong influence on awareness creation and the rate of adoption of improved crop technologies. This underscores the importance to strengthen farmer education and popularize awareness among increased number of farmers. Thus, measures to promote farmer-to-farmer extension are likely to speed up the take-up of improved varieties, especially amongst youth and women.

4. **Linkages to Output Market**
   The adoption of soyabean technologies and related technologies such as soyabean-maize crop rotation and linkages to output market have been strong success driver for the PROSAB project. This linkages to output market played a key role for the increased and sustained production of soyabean even after the exit of PROSAB in 2009. The N2Africa project can build on this success by exploring more and new market opportunities that can be accessed to by farmers, especially youth and women. Farmer can also be encouraged to cooperate through bulking their crop outputs, as they stand to benefit from economies of scale when marketing rather than selling individually.

5. **Strengthen the capacity of seed producers**
   The sustainable use of the crop technologies and management practices promoted by PROSAB, was possible because currently there exist in the project area a local seed company (JIRKUR SEED) that have been marketing improved seeds that were accessed by farmers. JIRKUR seed emerged from a group of seed producers that were trained by the PROSAB project. It is recommended for N2Africa to strengthen the capacity of seed producers, especially women and youth. This can plausibly lead to the emergence of more seed cooperatives or seed companies in the project area, increasing income earning opportunities, creating employment opportunities and enhancing competition in the seed industry in southern Borno State.

   In addition, the N2Africa project through the agripreneurers can encourage the youth engagement in marketing of inputs (seeds, fertilisers, agrochemicals, etc.) in the project area to be accessed by farmers. One way to encourage youth engagement in inputs marketing is to demonstrate the profitability of being an inputs dealer or supplier and also to link them up with credit institutions.

6. **Linkages to Credit market**
   Farmers' access to credit was found to have significant positive effect on household food security. Generally, farmers in the project area, especially youth and women had limited access to such credit. Given the pivotal role that credit plays in enhancing farmers to improved access to new crop technologies, inputs such as fertilisers. N2Africa should enhance farmers, especially women and youth's access to credit through building their capacity and linking them to formal credit institutions.

7. **Agribusiness for Youth**
   The results of this study suggests a number of agribusinesses that the youth can be engaged in the project area. They include: i) improved seed production, ii) inputs marketing iii) outputs marketing, iv) operational technologies service providers such as *harvest threshers, ploughing*, *planter,* etc. for fee, and v) value addition (processing) of legumes into products, and vi) livestock feed production and marketing.

8. **Bayo LGA**
   In Bayo LGA, there was no single community that was covered by the previous PROSAB project. As a result, farmers from this LGA had limited awareness of the crop technologies and management practices promoted by PROSAB. It is therefore recommended that N2Africa extensively focus in promoting;
   a) Biological technologies
   b) Chemical technologies
   c) Management technologies
   d) Value addition technologies, especially among women

9. **PROSAB Area**
   The impact created by PROSAB suggest that there is limited need for N2Africa in areas where PROSAB had operated. It is therefore suggested that N2Africa intervene by giving attention in disseminating the following technologies in the PROSAB areas:
   a) Operational technologies such as threshers, planters, etc.
   b) Value addition technologies
   c) Linkages to credit market
   d) Promotion of legume Inoculants
   e) Youth involvement in agribusiness

10. Other N2Africa areas

These are communities though located in the LGAs covered by the previous PROSA project was not directly targeted by PROSAB in 2004-2009. However, their proximity to PROSAB communities, had contributed to the dissemination and adoption of some of the crop technologies promoted by PROSAB, largely through farmer-to-farmer technology sharing. Now that N2Africa is directly targeting these other N2Africa communities, the kind of intervention should focus on: -

a) Biological technologies
b) Chemical technologies
c) Value addition technologies
d) Management technologies
e) Youth involvement in agribusiness

11. Scaling out of N2Africa technologies and management practices

The probit regression result revealed that farmers' participation in the PROSAB project had positive impact in poverty reduction. This is a learnt lesson for N2Africa. Therefore, it is recommended that the N2Africa project intensify scaling-out the legume technologies and management practices to greater number of farmers, especially in Bayo LGA. This will plausibly speed up the rates of adoption in the project area. The lead farmer approach and Farmers' field days involving the participation of local leadership (village heads, district heads, Emir and the LGA officials) were found to be an effective means for dissemination of improved technologies and management practices. These approaches are very much recommended for the N2Africa project.

REFERENCES

Adesimi, A.A. 1991. "Farm Enterprise Combination and Resource-use Among Small holder Farmers in Ijebu, Nigeria", **In** Doss, C and Olson (eds.), Issues in African Rural Development, African Rural Social Sciences Research Network, Winrock International, pp110-129.

Amaza, P.S., J.K. Olayemi, A.O. Adejobi, Y. Bila, and A. Iheanacho. 2007. Baseline socioeconomic survey report: agriculture in Borno State, Nigeria. IITA, Ibadan, Nigeria. 84 pp.

Amaza, P., T. Abdoulaye, P. Kwaghe, and A. Tegbaru. 2009. Changes in household food security and poverty status in PROSAB area of Southern Borno State, Nigeria. IITA, Ibadan, Nigeria. 51 pp

Amaza, P.S., J.K. Olayemi, A.O. Adejobi, Y. Bila, and A. Iheanacho. 2007. Baseline socioeconomic survey report: agriculture in Borno State, Nigeria. IITA, Ibadan, Nigeria. 84 pp

Amaza, P.S. 2000. Resource-use efficiency in food crop production in Gombe State, Nigeria. PhD thesis, University of Ibadan, Nigeria

Bandabla, T. 2005. Comparative study of statistical distribution and efficiency of some poverty estimators in Ibadan northeast Local Government Area, Oyo State, Nigeria. M.Sc. Thesis, Department of Mathematical Sciences, College of Natural Sciences, University of Agriculture, Abeokuta. 91 pp.

Beer, C.F. 1975. The politics of peasant groups in western Nigeria. Ibadan University Press, Ibadan, Nigeria, 276 pp.

Dercon, S. and P. Krishnan.1996. Income portfolios in rural Ethiopia and Tanzania: choices and constraints. Journal of Development Studies 32 (6): 850–875.

Ellis-Jones, J., Paul Amaza and Tahirou Abdoulaye, 2009. An early assessment of adoption and impact of PROSAB's activities. In Proceedings of a Stakeholder Conference, Sharing Experiences, PROSAB, Maiduguri, Borno State, Nigeria, 1-2 September 2009

FOS. 1999. Poverty Profile for Nigeria 1980–1996. Pages 12–15. Federal Office of Statistics, Abuja, Nigeria.

FOS. 1999b. Poverty and Agricultural Sector in Nigeria. Federal Office of Statistics. Abuja, Nigeria. Pp 17-21.

FOS. 2004. Nigeria: Living Standard Survey 2003/2004. Pages 9–24 *in* Report prepared by FOS in collaboration with EU, World Bank, Department for International Studies, Federal Office of Statistics, Abuja, Nigeria

Fagernäs, S. and L. Wallace. 2007. Determinants of poverty in Sierra Leone, Working Economic and Statistics Analysis Unit (ESAU) Paper No. 19, Overseas Development Institute (ODI). 56 pp.

Foster, J., J. Greer, and E. Thorbecke. 1984. A class of decomposable poverty measure, Econometrica 52: 761–766.

Gohl, B. 1981. Tropical feeds: feed information summaries and nutritive values. Pages 485–489 *in* FAO Animal Production and Health Series, No.12. FAO, Rome, Italy.

Gwary, M. 2008. Evaluation of the effectiveness of Participatory research and extension approach in promoting sustainable agriculture in Borno State, Nigeria. PhD thesis, Department of Agricultural Economics & Extension, University of Maiduguri. 197 pp

Goni, M. 2005. Analysis of household food security in the Lake Chad area of Borno State, Nigeria. MSc dissertation, Department of Agricultural Economics and Extension Services, University of Maiduguri, Nigeria. 67 pp.

Hassan, R.M. and S.C. Babu. 1991. Measurement and determinants of rural poverty: household consumption patterns and food poverty in rural Sudan. Food Policy 16 (6): 451–460.

Kwaghe, P.V. 2006. Poverty profile and its determinants among farming households in Borno State, Nigeria. PhD thesis, Department of Agricultural Economics and Extension, University of Maiduguri, Nigeria.

Minot, N. 2006. Market access and rural poverty in Tanzania, Paper presented at the 26th International Association of Agricultural Economists Conference held at Brisbane, Gold Coast, Australia, 12–18 August 2006.

NBS (2010) Nigeria Poverty Profile Report. National Bureau of Statistics, Abuja. Nigeria

Okurat, F.N., J.A. Odwee, and A. Adebua. 2002. Determinants of regional poverty in Uganda, African Economics Research Consortium (AERC) Paper No. 122. 53 pp.

Omonona, B.T. 2001. Poverty and its correlates among rural farming households in Kogi State, Nigeria. Pages 61 –237, PhD thesis. Department of Agricultural Economics, University of Ibadan.

Phillips, J.M. 1994. Farmer education and farmer efficiency: a meta-analysis. Economic Development and Cultural Change 43: 1439–1465.

PROSAB. 2009. Promoting Sustainable Agriculture in Borno State, 2008–2009 Annual Report, IITA, Ibadan, Nigeria.

Reardon. T. and Vosti, S. A. 1995. Links between Rural Poverty and the Environment in Developing Countries: Asset Categories and Investment Poverty. *World Development,* 23 (9):1495-1506.

Ruel, M. T. 2006. Operationalizing Dietary Diversity: A Review of Measurement Issues and Research Priorities. *Journal of Nutrition*. Pp 1-11

Wang, J., E.J. Wailes, and G.L. Cramer. 1996. A shadow-price frontier measurement of profit efficiency in Chinese agriculture. American Journal of Agricultural Economics 78: 146–156.

World Bank, 1996. Nigeria: Poverty in the Midst of Plenty, the Challenge of Growth with Inclusion. A World Bank Poverty Assessment. World Bank, Washington D.C

Yang, D.T. 1997. Education in production: measuring labor quality and management. American Journal of Agricultural Economics 79(3): 764–772.

ANNEXES
Annex I. Terms of Reference (Tor) for the Baseline Study

1. Project Details

Project Name	N2Africa-Putting Nitrogen Fixation to work for Smallholder Farmers
Project Location (as per the study)	Borno State, Nigeria
Project Start	June, 2014
Project End	May, 2018
Implementing Agency	IITA
Study Type	Situational Analysis
Study Timeframe	April-June 2015
Report deadline	30th June, 2015

2. Background

N2Africa is Putting nitrogen fixation to work for smallholder farmers in Africa through enhancing the yield of grain legumes and expanding the farm area cropped with legumes to improve incomes and food and nutrition security. It is a large scale, science-based "research-in-development" project funded by the Bill and Melinda Gates Foundation with a vision of building sustainable, long-term partnerships to enable African smallholder farmers to benefit from symbiotic N_2-fixation by grain legumes through effective production technologies, including inoculants and fertilizers.

The project is currently being implemented in 11 countries including Nigeria. In Nigeria it is implemented in four main states Niger, Kaduna, Kano and Borno States and focuses on cowpea, groundnut and soyabean.

The vision of success of the Borno State project is in line with the project vision of success and but will specifically reach more than 40,000 farming families and pioneer models for youth engagement in agri-business through which job opportunities in agri-business for at least 2,000 youths living in the target area will be created.

The intervention areas (geographical coverage) in Borno State are mainly in southern Borno State and in the following local government areas (LGAs): Bayo, Biu, Hawul and Kwaya Kusar on cowpea, groundnut, and soyabean.

On the other hand, 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. The local government areas were Biu, Damboa, Hawul and Kwaya Kusar. N2Africa and PROSAB projects therefore overlap in terms of objectives and operational areas (apart from Bayo LGA for N2Africa).

This study therefore will enable N2Africa project understand the situation at the beginning of the project in Borno State regarding key milestones and indicators as agreed with the project funders and to design appropriate strategies and interventions to achieve the agreed results. The information will also be used to benchmark the results achieved by the project during its impact assessment stage. It will also provide a means to assess the impact of PROSAB project in its operational areas.

3. Purpose of the Baseline study

The purpose of the baseline study is to provide programme staff, funders and other stakeholders with detailed baseline information on key project milestones and related indicators. N2Africa has clearly defined its milestones and indicators in its results framework but baseline of these milestones and indicators for Borno State are currently unavailable. Therefore, in order to create the benchmarks for future impact assessment and for targeting of project interventions, a baseline survey is necessary to come up with baseline information and possible targets for the selected milestones and indicators in the results framework. The project has designed a monitoring & evaluation (M&E) plan and this study will provide relevant information to support the plan's implementation. This study relates to the following aspects of the project results framework as well as the Borno State results framework:

- Project objective 5: Enable learning and assess impacts at scale through strategic M&E
- Activity 5.3: Conduct situation analysis, including the overall bio-physical, socio-cultural, and political environment and farming system and yield gap analysis for targeting legume interventions
- Output 5.3.1: By Q4 of year 1, information from the situation analysis available for the proper targeting of legume interventions

It is also imperative to use the results of the study to assess the impact of PROSAB interventions after its early impact assessment in 2009 as it has similar objectives and operational areas as N2Africa. Analyzed data can generate inferences to assess such impacts.

4. Objectives of the Baseline Study

The main objective of the baseline study is to provide information of the target beneficiaries as per the project results framework and project document and to provide insight into the impacts created by the PROSAB project after 2009. The specific objectives of the baseline study are the following:

a) To collect and analyze verifiable milestones/indicators from the project results framework.

b) To collect and analyze relevant information of existing situation of project's targeted beneficiaries (including gender; youth, men and females), service providers, and related stakeholders. These will include to collect and analyze relevant information in terms of household characteristics (composition, assets, sources and level of income, food security situation, etc), awareness and adoption of legume technologies, access to extension, credit, improved seeds, household consumption and expenditures, access to markets, access and control to available productive resources, etc.

c) The information gathered will be used to determine the starting point of the project in Borno State and also serve as benchmark for impact assessment at the end of the project to ascertain the contributions of the project interventions. The baseline will provide data upon which the projects' progress on generation of outputs, contribution to outcomes and impacts is assessed.

d) The analyzed data will be used to design appropriate and focused interventions to achieve the needed changes in legume productivity and other related improvements as indicated in the vision of success and results framework.

e) The study will provide information on the impact assessment of the PROSAB project implemented in Borno State between 2004 and 2009 by IITA using the data collected.

5. Scope of the Baseline study

The scope of the study will include collecting both qualitative and quantitative data on key milestones of the Borno Results Framework and also including information gathered on the impact indicators of the project as indicated in the project results framework. It will also provide insight into the impacts created by the PROSAB project in Borno State. Respondents will include both project beneficiaries' non beneficiaries, proposed implementers and other stakeholders in the selected value chains and agreed target areas. These beneficiaries and implementers overlap for both projects in the operational areas. The study area will include: Bayo, Biu, Hawul and Kwaya Kusar LGAs of Borno State, Nigeria. The main reference points of the study will be the project document (project proposal) and the Borno results framework. Various actors in the selected value chains will be interviewed. The primary users of the study are N2Africa project, including

Borno project team specifically, the project beneficiaries, donors, other stakeholders and IITA as an organisation.

Table I.33 Proposed Study Areas in Borno State

N2Africa LGAs	N2Africa Communities in LGAs	Non N2Africa Communities in LGAs
Bayo	Maina-Baba, Jauro-Garga, Briyel, Geidam, Teli, Wuyo	To be determined
Biu*	Tum*, Yamarkumi, Maina-Hari*, Nzukuku*, Miringa*	To be determined
Hawul*	Vinadam, Grim, Dusu, Kwaya-Bura, Tilla*, Hema, Kayamda, Marama*, Mbulatawiw*i, Sakwa*, Azare, Shaffa*, Tashan-Alade*, Shindiffu, Manjakwa, Ngwa, Yimirshika*, Kinging, Ghuma*, Kirbutu, Kwajaffa	To be determined
Kwaya Kusar*	Wandali*, Guwal, Gusi*, Mithla, Peta, Gashina, Kurba-Gaye, Yimirhlalang	To be determined

*indicates PROSAB LGAs and communities (13 out of 40 N2Africa communities are also PROSAB communities)

6. Methodology

6.1 Sample Frame and Sample Size

N2Africa has already completed a baseline study of three countries (Ethiopia, Uganda and Tanzania) and expects the consultant to adopt similar methodology used in that study to complete this assignment. The essence is to have a valid basis for comparing this study's results with the outcome of the baseline study.

This study will provide information on both target beneficiaries and non-target beneficiaries in Borno State (N2Africa communities and in non-N2Africa communities). The number of communities to be involved in the study will be determined together with the consultant at the inception stage. However, data will be collected from all four LGAs.

The sample frame will be based on an initial classification of the project action sites based on agro-ecological (AEZ) potential and market access zones. Consultant can refer to initial characterization of AEZ used in previous N2Africa baseline surveys (to be provided as part of initial project documents). However this will be done in accordance with Borno State agro-ecological potential and market access by households. The four LGAs will then be selected purposively as N2Africa project operational areas followed by communities also selected using purposive which will include participating and non- participating N2Africa communities to enable establishing some level of counterfactuals at the end. The criteria for the selection of the communities must also include PROSAB implementation, i.e. operational communities for N2Africa, non-operational communities for N2Africa and overlap communities for N2Africa and PROSAB.

The sample frame for the study at community/village level will therefore be the total number of participating and non participating households of the classified action sites of the project in Borno State. The project proposes a sample size of 800 farmers (400 each in both targeted and non targeted communities).

A sample size of 400 households with equal representation of the different classifications is proposed by the project though not all action sites/communities will have equal representation sample for varied reasons. This means, total number of households will depend on the households present.

The households to be interviewed in the N2Africa communities will be selected through purposive sampling based on the fact that some have already been engaged with the project in 2014 and others are yet to. Again, some would have had the opportunity to also participate in PROSAB and can also be additional criteria for selection. Simple random sampling will be used in the non N2Africa communities to select households. However, the total number of farmers to be interviewed per community will depend on the community's sample frame.

6.2 Data Collection

The study will be based on data and information gathered from both primary and secondary sources. Secondary sources would comprise a review of relevant project documents and other national and international related documents. The consultant will be in contact with N2Africa staff who will share key documents and required literature (if any).

Primary data will have both qualitative and quantitative aspects. The quantitative data will be collected from sampled beneficiaries (households), market actors and other stakeholders in each of the study area. A village/community questionnaire will be administered in each village/community to cover village level information. Information at institutional/stakeholder level will also be gathered using interview guides. At individual level, randomly drawn household from the sample frame will be interviewed using a designed questionnaire. Though the project proposes to use existing questionnaire, the final one should address at least household characteristics (composition, assets etc), awareness and adoption of legume technologies (including PROSAB technologies), access to extension, credit, improved seeds, household consumption and expenditures, access to markets, etc.

Qualitative data will allow verifying the perceptions, and experiences of different gender and stakeholders. The consultant will use qualitative approaches, such as focus group discussions and key informant interviews, as well as participatory approaches to gather such information. The consultant will be required to organize separate focus groups for different gender groups. List of major gender groups and key informants within the legume sector in Borno state will be provided by the project and updated by the consultant as the study progresses.

All data, qualitative and quantitative, collected through the survey must be disaggregated based on agreed classification, LGAs, location/communities, gender, etc.

The consultant will further develop and finalize the methodology in the inception phase of the study, in collaboration with the N2Africa team.

7. Key Activities and Deliverables

The overall work plan for the baseline study is presented as follows, to be updated, adapted and revised at the inception phase by the consultant and the N2Africa team.

Table I.34 Tasks with related deliverables and deadlines

Activity/Task	Deliverable	Number of Days	Deadline
A. Inception Phase			
1. Inception meeting to discuss the study design, methodological issues and briefing with N2Africa team including agreeing on types of questionnaire and interview guides	Agreed survey design, methodology, etc	1	
2. Prepare and submit an inception report	Inception report will represent a more detailed study design, methodology and work plan including interview guides, survey questionnaire etc.	4	
3. Review, share feedback and finalize inception report	Final inception report including interview guides, agreed questionnaire and processes	2	
B. Field Work			
4. Recruit and train Enumerators	Enumerators selected and trained	3	
5. Test and revise survey instruments	Survey instruments tested and revised	2	
6. Field work: Data collection	Data collected	15	
7. Data cleaning and entry	Data cleaned and entered	10	
8. Post fieldwork debrief meeting with N2Africa staff	Post field work debriefing exercise completed	1	
C. Reporting			
9. Data analysis	Analyzed data	15	
10. Present draft report (in a meeting) with initial results to N2Africa including discussion of comments with consultant	Draft study report including results of analysis and raw data collected	1	
11. Finalize report and submit to N2Africa team	Final study report	2	
Total approximate Consultant days:		**56**	

8. Management of Consultancy

The Consultant will report to the N2Africa Borno Coordinator regarding general coordination, logistics and all contractual obligations. He/She will also work closely with a team of IITA and N2Africa staff including the M&E Specialist of the project, the Senior Business Development Officer, IITA Impact Economist (Dr Tahirou), the Borno Coordinator and other project/IITA staff in Nigeria and ultimately to the Project Coordinator for N2Africa. The team shall be responsible for approving the quality of the work (including the tools and methodology to use during the survey) and the extent to which the report fulfils the requirements stated in the TOR before payment is done.

The Consultant will also be responsible for managing the field team of enumerators with the support from the N2Africa staff in Borno State. The Consultant will keep regular communication with the N2Africa Borno Coordinator on progress of work at various stages including scheduling meetings.

9. Reporting

At the conclusion of the inception phase of the evaluation, the Consultant is expected to produce an inception report, which should include the following;

a. Inception Report Structure (suggested)
- Overview of project as understood by the consultant
- Baseline study methodology and approach for data collection and analysis
- Study workplan and updated timeframe for activities and deliverables (prepared in collaboration with N2Africa staff, Borno), including timelines for briefing and debriefing on progress of the assignment

b. Baseline Report Structure (suggested)
The final baseline report should contain the following sections, to be agreed upon and finalized with the consultant. N2Africa will have the opportunity to input on drafts of the report before it is finalized.
- *Title page*
- *Executive summary (maximum two pages)*
- *Introduction*
- *Purpose*
- *Background,*
- *Methods: survey methodology(ies) and sampling frame(s) and sampling method,*
- *Limitations and issues encountered during the survey*
- *Results: presentation of data,*
- *Discussion: interpretation of data,*
- *Conclusions*

c. Annexes to the report
- *Terms of Reference (TOR) for the evaluation*
- *Study work plan with timetable*
- *Data collection tools, including survey tool, interview guides and other tools as appropriate*
- *List of individuals interviewed and of stakeholder groups and/or communities consulted*
- *List of supporting documentation reviewed*
- *Clean data sets (no personally identifiable information),*
- *Codebook for data sets*
- *Data tables for all variables*

10. Qualifications and Experience of the consultant (s)

A PhD or MSc in agricultural economics or a related field from a recognized university and at least 10 years' experience developing or working with agricultural value chains and projects in Africa especially Nigeria. The following minimum qualifications are expected;

- Strong experience in conducting Situational Analysis of complex, agricultural change programmes in the Nigerian context
- Expertise with a range of data collection and analysis methods, with particular emphasis on both quantitative and qualitative methods
- Strong knowledge and experience with African farming systems and input/output value chains;
- Highly developed project management, implementation and monitoring skills;

- Experience in developing survey tools and Experience with and knowledge of survey data quality assurance.
- Report writing experience
- Excellent spoken and written English;

11. Consultancy time lines

The consultancy shall be implemented within a period of no more than [eight] weeks from the signing of the contract. The consultancy will commence not later than April, 2015 to be finalized before July, 2015.

12. Budget and Submission of Proposals

Proposals should include: a cover letter showing expression of interest, a short proposal of not more than five pages outlining the anticipated study design, methodology and approach, including a proposed schedule and the consultant(s) daily rate and suggested number of days. The following information should also be provided as appendices:

- CV outlining previous related experiences and accomplishments
- Estimated budget of the study
- Two professional references.

Annex II. Data Collection Tools

INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE
N2AFRICA-BORNO STATE SITUATIONAL ANALYSIS

Household Questionnaire

Household Identification Number.....

Beginning time: [ ] End time: [ ]

Interviewer's Name: _____Signature_____ Date _____

Supervisor's Name: _____Signature_____Date _____

RESPONDENT'S INFORMED CONSENT

My name is…….

I am here on International Institute of Tropical Agriculture (IITA) carrying out baseline study for N2Africa and also assess the impact of PROSAB project on households' livelihoods over the life of the project. Your honest responses will only be used to inform the project of the current situation and will be treated with utmost confidentiality. Your participation is very important. You are free to ask me anything about this survey. Do you accept that I go ahead with the interview?

Respondent accepts the interview…… 1 (Conduct the interview)

Respondent does not wish to be interviewed…….. ….2 (Terminate interview)

Thank you for accepting to take part in this study.

Respondent's Identification Information

Village: _____

Local Government Area: _____

GPS Reading of Homestead: WAYPOINT ID_____LONGITUDE_____

LATITUDE_____ ALT_____ Mobile N0:_____

Name of Household Head _____

Name of Respondent _____

Relationship of Respondents to HH Head: (Tick)

(a) Owner ◯ (b) Spouse ◯ (c) Other (specify)_____

1.0 SOCIO ECONOMIC CHARACTERISTICS:

N2AFRICA Beneficiary ---------- Non-Beneficiary ---------- **(Tick or code)**

No	Questions	Options	Household Head Response
1.1	Gender	1= Male 2= Female	
1.2	Age	Less than 15 years	
		15-25 years	
		26-35 years	
		36-45 years	
		46-55 years	
		Over 55 years	
1.3	Marital Status	Single	
		Married	
		Widowed	
		Divorced	
		Polygamy	
1.4	Formal Education *(Tick highest level)*	0- No formal education	
		1-6 years – Primary	
		7-9 years – Junior Secondary	
		10-12 years –Senior Secondary	
		13-16 years – OND/NCE	
		17 years or more- HND/University	
1.5	**Household members**	**Male (number)**	**Female (num.)**
	Children under 5		
	Children 5-15		
	Adults 16-35		
	Adults 36-59		
	Adults 60+		
	TOTAL:		

2: household Asset Status – Poverty Index

Read the following question as an introduction to the questioning. In table, go row by row.

Asset Poverty Index - Indicators:

Indicator	Code	Write Code	
		2014	2009
a) How many members does the household have? *(Please fill based on information obtained in table A2)*	1. Eight or More 2. Six or Seven 3. Five 4. Four 5. Three 6. Two 7. One	[____]	[____]
b) Are all children aged 5 to 14 in school?	1. No 2. No member aged 5 to 14 3. Yes	[____]	[____]

Asset Poverty Index - Indicators:			
Indicator	**Code**	**Write Code**	
		2014	**2009**
	4. Not applicable		
c) What is the highest grade completed by female head /spouse?	1. No female head /spouse 2. None or incomplete primary 3. Primary 4. Secondary or higher	[____]	[____]
d) What is the highest grade completed by second wife?	1. No second spouse 2. None or incomplete primary 3. Primary 4. Secondary or higher	[____]	[____]
d) What is the main flooring material of the house?	1. Earth /mud/straw 2. Wood /tile/cement or other	[____]	[____]
e) What is the main construction material used for the roof?	1. Palm leaves /thatch 2. Corrugated iron sheets, asbestos/slate, roofing tiles	[____]	[____]
f) What is the main source of lighting for the dwelling?	1. Electricity (mains) 2. Generator 3. Solar lamps/battery torches 4. Paraffin/Kerosene lamps 5. Firewood/straw etc.	[____]	[____]
g) What is the main source of drinking water for the household?	1. Unprotected well /rain water, River/stream dugout/pond/lake/dam 2. Borehole/ protected well 3. Communal standpipe/tap outside (public or private), pipe in neighbours 4. Indoor plumbing, inside standpipe, treated pipe water 5. Sachet/bottled water	[____]	[____]
h. Does the household own television /fridge?	1. No 2. Yes (one) 3. Yes. (More than 1)	[____]	[____]
i. What type of toilet is used by the household?	1. No toilet, 2. Pail bucket, covered or uncovered pit latrine, 3. Ventilated/Improved pit latrines (VIP), 4. Toilet on water or flush to sewer or septic tank	[____]	[____]
j. Does the household own any means of transport? (give highest form of transport)	1. No 2. Bicycle 3. Oxcart 4. Motorbike 5. Car or truck	[____]	[____]

3. Households major sources of income

3.1 What are your priority sources of income and what is the income estimate from these sources in 2014?

S/N	Income source	Do you get income from this	Hoe regular do you get income from this source	Estimated amount from this	What is the importance of this

		source? YES= 1 NO=2	(see Code) **	source in 2014 (NAIRA)	source to total household income (see code) ***
1	Sale of soyabean				
2	Sale of cowpea				
3	Sale of groundnuts				
4	Sale of maize/sorghum/millet				
5	Sale of other products e.g. firewood, fruits, etc.				
6	Sale of livestock				
7	Regular employment (salary)				
8	Casual labour (agriculture related)				
9	Casual employment (non-agricultural)				
10	Trading				
11	Remittances				
12	Other (specify)				
	TOTAL INCOME IN 2014 (NAIRA)				

**** Regularity of Income source:** 1= Do not get at all; 2=occasionally; 3=regularly; 4= all the time
***** Importance of source**: 1= Not important; 2= Moderate importance; 3= High importance; 4= Very high importance

3.2 What are your priority sources of income and what is the income estimate from these sources 5 years ago (2009)?

S/N	Income source	Do you get income from this source? YES= 1 NO=2	Hoe regular do you get income from this source (see Code) **	Estimated amount from this source in 2014 (NAIRA)	What is the importance of this source to total household income (see code) ***
1	Sale of soyabean				
2	Sale of cowpea				
3	Sale of groundnuts				
4	Sale of maize/sorghum/millet				
5	Sale of other products e.g. firewood, fruits, etc.				
6	Sale of livestock				
7	Regular employment (salary)				
8	Casual labour (agriculture related)				
9	Casual employment				

	(non-agricultural)				
10	Trading				
11	Salaried employment				
12	Remittances				
13	Other (specify)				
	TOTAL INCOME IN 2009 (NAIRA)				

**** Regularity of Income source:** 1= Do not get at all; 2=occasionally; 3=regularly; 4= all the time
***** Importance of source**: 1= Not important; 2= Moderate importance; 3= High importance; 4= Very high importance

4.0 ACCESS AND CONTROL OF PRODUCTIVE RESOURCES

1.	Have you or any members of your household engaged in cultivating farmland in the last 12 months?	Yes No
2.	What does your household use to cultivate most of this farmland?	**(Tick as applicable)** (a) Hand tool (hoe/spade) (b) Animal-drawn plough (c) Tractor drawn plough (d) Power tiller (e) Don't know (f) Other (specify)
3	How many farm plots do you have?	(Number)
4.	What is your total farm(s) size?	(HA)
5.	How long have you been farming?	(years)
6.	How many of your farm plots are presently under cultivation?	(Number)
	How many farm plots owned by your spouse	(Number)
7.	How many farm plots owned by your spouse are presently under cultivation?	(Number)
8.	Which of the following crops did you grow last year?	**(Tick as applicable)** a) Cowpea b) Groundnuts C) Soyabean d) Maize e) Sorghum f) Rice g) Millet h) Other (specify)

9. Provide the following information on the crops grown in 2014?

Crops	**Land Area (ha)**	**Quantity (yield) PRODUCED**		**Quantity consumed/given out**		**Quantity SOLD**		**Revenue (NAIRA)**
		Quantity	Unit* **(see code)**	Quantity	Unit* **(see code)**	Quantity	Unit* **(see code)**	
a) Cowpea								
b) Groundnuts								
c) Soyabean								
d) Maize								
e) Sorghum								
f) Rice								
h) Millet								
i) Others (specify)								

***Unit Code: 1= kg; 2= 50kg bag; 3= 100kg bag 4= other (specify)**

10.	10. Provide the following information on livestock owned and sold in 2014			
Livestock type	**Quantity owned (number)**	**Total number consumed/given out**	**number sold (₦)**	**Total Amount (₦)**
a) Cattle				
b) Goat				
c) Sheep				
d) Donkey				
e) Local Chicken				
f) Exotic Poultry				
g) Other (specify)				

10.	Provide information of the inputs used in production and associated costs in 2014												
	Crops		Crop Activity				Inputs used and Cost						
		Land Area (Ha)	Cost of land clearing	Cost of Weeding	Cost of Harvesting	Cost of other labor	Quantity of fertilizer	Cost of fertilizer (₦)	Quantity of seed	Cost of seed (₦)	Quantity of Agro chemicals	Cost of Agro chemicals(₦)
a.	Cowpea											
b.	Groundnuts											
c.	Soyabean											
d.	Maize											
e.	Sorghum											
f.	Rice											
g.	Millet											
h.	Others (specify)											

5.0 AWARENESS AND ADOPTION OF CROP TECHNOLOGIES

5.1 Are you aware of the following crops and management practices?

S/N	Crop varieties and Management Practices used	Awareness of crop varieties and management practices (TICK)	
		YES = 1	***NO=2***
1.	Improved Cowpea varieties		
2.	Improved groundnut varieties		
3.	Improved soyabean varieties		
4.	Improved maize varieties		
5.	Improved Rice varieties		
6.	Improved sorghum varieties		
7.	Legume specific fertilizer		
8.	Cereal/legume rotations		
9.	Cereal/legume intercropping		
10	Drilling fertilizer application		
11.	Inoculating legumes		
12.	Legume utilization		

5.2 Adoption of improved seeds and crop management practices in 2014

1	2	3	4	6
Improved seeds/crop management practices	Year of awareness of the variety and/or management practices	Source of information **(See source code below)**	How many years ago did you first use this variety?	What is the area cropped (Ha)
Improved Cowpea varieties				
Improved groundnut varieties				
Improved soyabean varieties				
Improved maize varieties				
Improved Rice varieties				
Improved sorghum varieties				
Legume specific fertilizer				
Cereal/legume rotations				
Cereal/legume intercropping				
Drilling fertilizer application				
Inoculating legumes				
Legume utilization				

Source of Information: 1= ADP; 2= N2Africa, 3= PROSAB, 4= EA, 5= other farmer, 6= Seed company 7= other (specify)

6.0 ACCESS TO EXTENSION/INFORMATION SERVICE

Type of service (Tick as applicable)	Did you receive training or information on [……] during the last cropping season? (No = 0, Yes = 1)	If Yes in column 2, main source of information/training, **(Codes A)**	If Yes in column 2, number of contacts during the season **(days/year)**
1	**2**	**3**	**4**
1. Improved production practices			
2. New varieties of cowpea			
3.New varieties of groundnuts			
4. New varieties of soyabean			
5. New varieties of maize			
6. New varieties of rice			
7.New varieties of other crops			
8. Soil and water management			
9. Crop rotation			
10. Output markets and prices			
11. Input markets and prices			
12. Livestock production			
13. Food processing			

Codes A

1. Government extension service 4. NGOs 5. Private 7. Farmer field school 10. Mobile phone 11. Town hall 13.Traders/Agro-dealers

2. Farmer Coop or groups 3. Neighbour/relative farmers	Company 6. Research centre	8. Radio/TV 9. Newspaper	meetings 12. Farmer's training centres	14. Other, specify.....

7.0 ACCESS TO CREDIT AND SUPPORT SERVICES

7.1 Household credit need and sources during last cropping season. If the credit is in non-cash form, indicate the cash equivalent or value.

Activity	Needed credit? **Codes A**	If **No** in column 2, then Why? **Codes B**	If **Yes** in column 2, then did you get it? **Codes A**	If **NO in column 4**, then what was the main reason? **(codes C)**	If **Yes in column 4**		
					Source of Credit, **Codes D**	How much did you get? **(Naira)**	Have you repaid the loan? **Codes A**
1	**2**	**3**	**4**	**5**	**8**	**9**	**10**
1. Buying improved seed							
2. Buying fertilizer							
3. Buy herbicide/pesticides							
4. Buy farm implements							
5. Buy livestock							
6. Invest in irrigation system							
7. Non-farm business or trade							
8. Buy food							
9. Medical expenses							
10. School fees							

Codes A	**Codes B**	**Codes C**			**Codes D**	
0. No 1. Yes	1. Not cash constrained 2. Activity is not profitable 3. Never thought of this investment 4. Other, specify.....	0. No reason 1. Borrowing is risky 2. high Interest 3. Too much paper work/ procedures	4. Expected to be rejected, so did not try it 5. I have no asset for collateral 6. No money lenders in this area for this purpose	7. Lenders don't provide the amount needed 8. No credit association available 9. Not available on time 10. Other, specify…….	1. Money lender 2. Farmer group/coop 3. Microfinance 4. Bank	5. Savings and Credit 6. Relative/friend /neighbor 7. Other, specify……..

8.0. ACCESS TO AGRICULTURAL INPUTS (Seeds, Fertilizers and agrochemicals)

8.1 Do you use any of the following inputs, for how long and what are the sources?

Inputs	*1= Yes 2 = No*	*Sources of input (see codes below)*	*Year started using input(see codes)*	Last 12 months (2014)		5 years ago (2009)	
				Quantity used (Kg)	Amount spent	Quantity used (Kg)	Amount spent (Naira)

Chemical fertilizers							
Agro-chemicals							
Manure - livestock							
Improved seed of soyabean							
Improved seed of cowpea							
Improved seed of groundnuts							
Improved seed of cowpeas							
Improved seed of maize							
Improved seed of sorghum							
Other _____							

Codes Source: 1= Own farm; 2= other farmers; 3= Local market; 4= Rural agro-dealer; 5= Urban agro-dealer; 6= Seed company; 7= Extension worker (government), 8= NGO; 9=Farmer group; 10= Cooperative; 99=other (specify)

Codes Years: 0= Less than 1 year; 1= 1 year, 2= 2 years; 3= 3 years; 4= Four years; 5= Five Years 6=more than 5 years

8.2 How far do you have to travel to find an agro-dealer selling agro-inputs?

	Less than one km	**1-5 km**	**6-10 km**	**11=15 km**	**16-25 km**	**Over 25 km**
Improved Seed						
Fertilizer						
Agro-chemicals						

8.3 If there are agro-dealers in the area, how has the distance changed over the 5 years? (Tick)

Improved_____Worsened_____ No change_____ Don't know _____

8.4 How do you rate the quality of fertilizer/inputs available with your nearest agro-dealer?

	Good quality	***Average quality***	***Poor quality***
Seed			
Fertilizer			
Agro-chemicals			

8.5 Does your agro-dealer provide you with reliable advice on inputs?

Inputs	***Always***	***Sometimes***	**Never**
Seed			
Fertilizer			
Agro-chemicals			

8.6 Does your agro-dealer stock all the inputs at the time that you require them?

Inputs	***Always***	***Sometimes***	**Never**
Seed			
Fertilizer			
Agro-chemicals			

8.7 If you do not buy seed and fertilizer from agro-dealers, what are the reasons? (TICK)

a) Expensive ……
b) Not always available ……
c) Distance too far/difficult accessibility ……

d) Insufficient inputs from agro dealers……
e) Other (specify)……..

9.0 ACCESS TO OUTPUT MARKETS

9.1 How did you sell your crops over the last year (2014)? _____
1= Informal markets (mobile phones, vendors); 2 = Farmer groups (associations, cooperatives), 3 = Agro-dealers, 4= Formal or structured markets (big/individual buyers with defined quality and volume –standards) 5 = Sell in rural markets; 6= Don't sell

9.2 How did you sell your crops 5 years ago (2009)? _____
1= Informal markets (mobile, vendors); 2 = Farmer groups (associations, cooperatives), 3 = Agro-dealers, 4= Formal or structured markets (big/individual buyers with defined quality and volume –standards)
5. Sell in rural markets; 6= Don't sell

9.3 Of the crops you grow, which one is key source of your cash? (TICK)
1= Soyabean; 2= Cowpea; 3=Groundnut; 4= Maize; 5= Rice; 6= Sorghum
7= Millet 8=Bambara nuts; 9= Cassava; 10= Sweet potato; 11= Others (specify)

9.4 Over the past 5 years, how has the quantity sold of the key crop changed?
1= Increased; 2=Decreased; 0= No change

9.6 What do you think needs to be done to improve income from crops?
1= improve access to markets; 2= access to market information; 3= improve market price; 4= Other (specify)

9.7 Have you observed changes in markets 2014 compared to 5 years ago (2009) in:

Parameters	**Improved 1 = yes 2 = no**	**If yes, Reason (TICK)** 1= good price 2= available market 3= increased yield 4=Other (specify)	**Worse 1 = yes 2 = no**	**If yes, Reason (TICK)** 1= poor price 2= lack of market 3= poor yield 4=Other (specify)	**Same 1 = yes 2 = no**
Cash income from sales of crops					
Household purchases of food crops					
Home processing of crops Value addition?					
Marketing of crop output					
Access to credit/finance					
Storage facilities					
Other changes_____					

10.0 HOUSEHOLD CONSUMPTION AND EXPENDITURE

10.1 Please, provide information on the following crops (only those you have purchased or produced)

	Item purchased last week for household	Amount produced last cropping	Amount consumed from	Value of prepared foods purchased

	consumption		season (quantity/ units)	last season's production (quantity/ units)	outside household last week (N)
	Quantity and units[1]	Price paid/ unit			
Maize					
Grain					
Flour					
Sorghum					
Grain					
Flour					
Millet					
Grain					
Flour					
Rice					
Imported					
Local					
Cassava					
Tubers					
Gari					
Cassava chips					
Yam					
Tubers					
Yam flour					
Cocoyam					
Corms					
Groundnut					
Shelled					
Unshelled					
Soyabean					
Grain					
Flour					
Cowpea					
Meat, poultry and Fish					
Food additives and condiments					
Grocery food (bread, milk, eggs, oils, nuts)					
Fruits and					

[1]Units refers to local measures (e.g., *Mudu, Shakade, Tiya*, baskets, etc.) and kilograms (kg)

Vegetables					
Beverages (tea, coffee, juices)					
Other (specify)					
1.					
2.					
3.					
TOTAL FOOD EXPENDITURE					

10.2 NON-FOOD EXPENDITURE

Please, provide information of the following NON-FOOD Expenditure for your household in the last 12 months

No.	Expense Item	Unit (e.g. kg, litre, packet, bundle, number)	Frequency of purchase (e.g., one time per year, two times per year, etc.)	Average quantity each time	Total quantity per year	Average price per unit **(Naira)**	Total cost of purchase **(Naira)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8=6x7**
1	Clothing						
2	Shoes						
3	Blankets						
4	Bed sheets						
5	Soap/washing products						
6	Electricity						
7	Fuel wood						
8	Charcoal						
9	Kerosene						
10	Batteries						
11	School fees						
12	School books and supplies						
13	Health care						
14	Grain milling						
15	Land tax						
16	Church contributions						
17	Dowry						
18	Membership fees						
19	House building/construction						
20	Guard/security						
21	Newspapers, magazines etc.						
22	Travel expenses						
23	Mobile phone air time (voucher)						
24	Radio/TV service charge						
25	Kitchen utensils						

26	Personal care (toothpaste, nail etc.)						
27	Furniture (tables, chairs, beds etc.)						
28	Home repairs						
29	Purchase of bicycle, motorcycles						
30	Repairs for vehicles, bicycles etc.						
31	Petrol and engine oils for cars						
32	House rent						
33	Utility bills (water, telephone etc.)						
34	Cigarettes, tobacco etc.						
35	Remittances paid						
36	Match boxes						
37	Debt payments						
38	Payment for land rent in cash						
39	Other, specify.....						
TOTAL NON-FOOD EXPENDITURE (NAIRA)							

10.3 HOUSEHOLD DIETARY DIVERSITY

1. Did you or any member of your household consumed foods from a set of 12 different food groups yesterday (24-hour recall period)?

No. (a)	**Food Group/Items** (b)	**Frequency of Consumption** (c)		
		No. of days per week	**In the last 24hrs**	
FOOD GROUP		**0 – 7**	**Yes (1)**	**No (0)**
1	**Grains, Roots and Tubers**			
	Maize			
	Wheat			
	Sorghum			
	Millet			
	Cassava			
	Yam			
	Cocoyam			
	Sweet potato			
	Irish potato			
	Others (specify)			
2	**Legumes, Pulses and Nuts:**			
	Groundnut			
	Cowpea			
	Soyabean			
	Melon			
	Others (specify)			
3	**Organ Meat, Poultry, Offal:**			
	Heart, liver, kidney, intestine,			
	Exotic poultry, local poultry			
	Others (specify)			
4	**Fish and Sea Foods**			
	Fish, shrimps, cray fish			
	Others (specify)			
5	**Diary and products:**			
	Milk, yogurt			
	Cheese			
	Others(specify)			
6	**Green Leafy Vegetables:**			
	Water leaf, bitter leaf, spinach			
	Amaranths *(Aliahu)*			
	Roselle (*Yakuwa*)			
	Others (specify)			
7	**Other Vitamin A Rich Vegetables and Fruits:**			
	Tomatoes, Pepper			
	Okra			
	Carrots, cabbage			
	Garden Egg			
	Pumpkin			

	Others (specify)			
8	**Fruits**			
	Orange, banana, Mango, guava			
	Pineapple			
	Plantain			
	Others (specify)			
9	**Poultry products:**			
	Guinea fowl, chicken			
	Eggs			
	Others (specify)			
10	**Oil/fats**			
	Palm oil, g/nut oil, soya oil			
	Butter, Margarine			
	Others (specify)			
11	**Sugar/honey**			
	Sugar, honey			
12	**Miscellaneous (e.g. tea, coffee, condiments, etc.)**			
	Beverages			

11.0 HOUSEHOLD FOOD SECURITY AND POVERTY

11.1 Household food security: Did you have sufficient food to meet household needs over last 12 months and 5 years ago – from own production and other sources?

Year	**Household Food availability:** 1= Surplus; 2= Meets requirement; 3= Does not meet requirement	**If deficit, number of months in the year**
Past 12 months (2014)		
In 2009		

11.2 Coping Strategy for Food Shortages

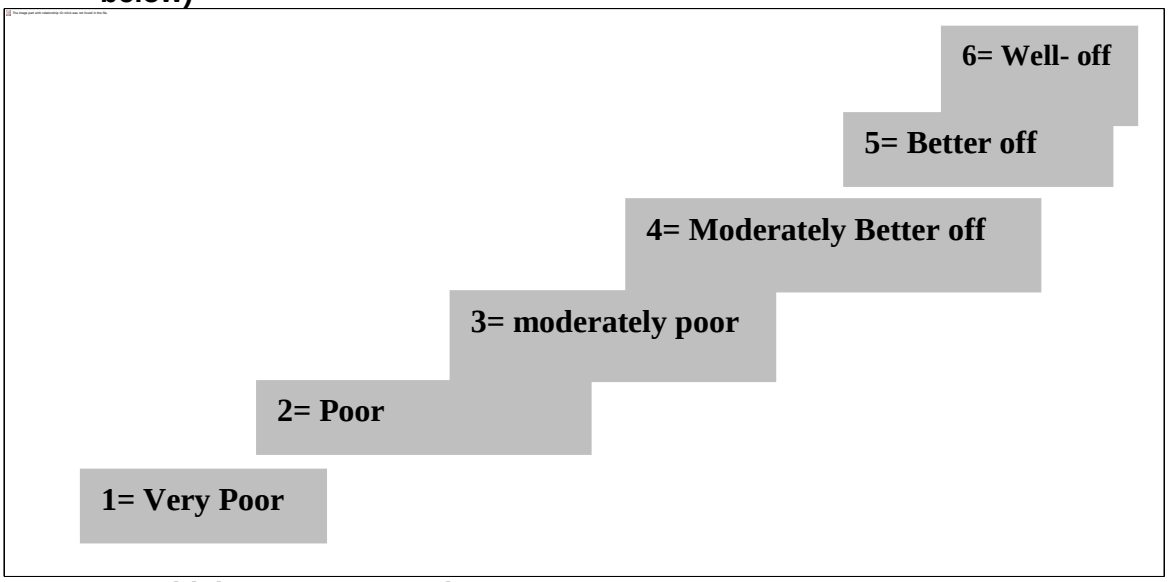
1. If you faced any food shortage in the past 12 months, what coping strategies did you use?

Coping mechanism	Did it happen? 1=Yes, 0=No	If you used coping strategy, how often did you use it? 1= Regularly; 2=Occasionally
1.Borrowed money to buy food or got food on credit		
2.Reduced the number of meals		
3.Mother ate less		
4.Father ate less		
5.Children ate less		
6.Substituted commonly bought foods with cheaper kind		
7.Modified cooking method		
8.Mortgaged/sold assets		
9.Borrowed from neighbours		

11.3 Have you observed the following changes in your household over the past year (2014) compared to 5 years ago (2009) in:

Parameters	Improving? 1 = yes 2 = no	If yes, Reason (TICK) 1=improved incomes 2= good yield 3= training got 4= other (specify)	Worsening 1 = yes 2 = no	If yes, Reason (TICK) 1=Poor incomes 2= Poor yields 3= lack of knowledge 4= other (specify)	Same as before 1 = yes 2 = no
Home processing of crops /Value addition					
Hiring of labour for crop production					
Purchase of household items					
Improvements to house					
Children's health					
Children going to school					

11.4 Imagine six steps, where on the bottom step (1) stand the poorest people, and on the highest step stand the richest IN THIS COMMUNITY (Show the picture below)



11.4a On which step were you in 2009 _____?
11.4b What is your current position 2014 _____?
11.4c Would you attribute your current position to PROSAB project: 1= Yes; 0= No; 3= partially
11.5 Have you experienced any benefits from PROSAB project? (TICK)
a) Learnt good agronomic practices
b) Improve food security
c) Improved household incomes
d) Improved access to improved seeds
e) Improved household welfare (i.e. reduced poverty)
f) Other (specify)
11.6 Have you experienced any challenges with PROSAB project (TICK?)
a) Lack of access to markets
b) Poor access to credit
c) Poor access to agricultural inputs
d) Poor access to credit
e) Other (specify)

End of the questionnaire

Thank you for your collaboration

Village-level Questionnaire

A. Geographical Information

1. Name of Village:……
2. Name of LGA:…….
3. Name of Supervisor……..
4. Was PROSAB working in this village? 1 = Yes ( ), 0 = No.( )
5. GPS coordinates of central Point: a. longitude:…… b. Latitudes
   c. ALT……

6. What are the Socio-economic characteristics of this village?

Population	(i) Total Population …… (ii) Number of households ……
Main farming systems that are practiced? (Tick as applicable)	(i) Mono-cropping ( ) (ii) Mixed Cropping ( ) (iii) Livestock production ( ) (iv) Shifting cultivation ( ) (v) Mixed farming ( ) (vii) Other……

B. Average Rainfall	**2014**	**2013**	**2012**
Amount (mm)			
Number of Months			

C. Organizations working in the village

1. Types of external organizations working in the village and their activities

S/No.	(a) Name of Organization (in full)	(b) Type of Organization (see code)	© Types of activities they are involved in (see code)
1			
2			
3			
4			
5			

Code for type of organization: 1=Research, 2=Extension department, 3=Marketing organization, 4=Non Governmental Organization, 5=Input suppliers, 6=other……

Codes for type of activities: 1=Community Mobilization, 2=on farm demonstration of technologies, 3=Farmer training, 4=Output marketing, 5=Input supplies, 6=Natural resource management, 7=other

2. Types of internal organizations which exist in the village (e.g. CBOs, Farmer Organizations etc)

S/No.	(a) Name of Organization (in full)	(b) Types of Organization (see code)	© Types of activities they are involved in collectively as a group (see code)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Code for type of organization: 1=Women only groups, 2=Men only groups, 3=Youth only groups, 4=Social welfare groups, 5=Community NGO, 6=other **Code for type of activity:** 1=Crop production, 2=Natural resource management, 4=Savings and loan

5=Produce marketing, 6=Social activities, 7=other (Specify)

D. Input and output market Access

1. What is the availability of markets in the village?

S/No.	Attributes	(a) Respond	(b) Estimated time to reach the place	© Estimated cost to reach the place (Naira)
I	Number of markets within the village			
Ii	Number of markets within a 10-15 km radius			
Iii	If no market within the village, where is the nearest market (name and distance (km))			
iV	Number of agro-dealer shops within the village			
V	Number of agro-dealer shops within a 10-15 km radius of the village			

Vi	If no agro-dealer shop within the village, where is the nearest (name and distance (km))			

2. What is the cost of transportation to and fro of the following produce and input from village to the nearest market?

S/No.	Commodity	Cost of transportation(Naira)
1	100kg of grains	
2	Live goat/sheep	
3	Live cattle	
4	Fertilizer (50kg)	
5	Others (specify)	

E. Village resources

1. Does the village have any of the following social and physical amenities, if so, how many?

S/No.	Physical amenities	(a) Does the village have 1=Yes, 0=No	(b) If yes, how many?	(c) If no, what is the distance to the nearest one in km?	(d) How long (mins.) does it take to get there using the most common means of transportation	(e) What is the estimated cost for getting there (Naira)?
I	Schools					
2ii	Hospitals/ clinics / health centers					
Iii	Churches / Mosques/ other places of worship					
Iv	Social hall / centres					
V	Boreholes / wells					
vi	Cattle dips / veterinary centers					
vii	Village wood lots					
viii	Telephones					
Ix	Does the village have radio reception /channels					
1x	Circulation of newspapers					

xi	Number of all weather roads passing through village					
xii	Is the village covered by mobile phone network					
xiii	Water bodies (stream, ponds, rivers)					
xiv	Livestock watering points					
xv	Public transport stop					
xvi	Rural Micro-finance bank					
xvii	Government extension / agriculture / livestock office					
xviii	Agriculture research site					

F. PRICES

1. Output prices (per 100 kg bag)

Crops	**At Harvest**			**At Planting**		
	2014	**2013**	**2012**	**2014**	**2013**	**2012**
Cowpea						
Groundnuts						
Soyabean						
Maize						
Rice						
Sorghum						
Millet						

2. Input prices

	2014	**2013**	**2012**
Fertilizers:			
NPK (50 kg bag)			
SSP (50 kg bag))			

Urea (50 kg bag)			
FYM (100 kg bag)			
Herbicides (per litre)			
Fungicides (per litre)			
Pesticides (per litre)			

3. Daily wage rate for the following farm operations

Operation	**2014**	**2013**	**2012**
Land Clearing			
Planting			
Weeding			
Fertilizer application			
Spraying			
Harvesting			
Threshing			
a. 100kg bag			
b. Man-day			
Transportation			

List of project reports

1. N2Africa Steering Committee Terms of Reference
2. Policy on advanced training grants
3. Rhizobia Strain Isolation and Characterisation Protocol
4. Detailed country-by-country access plan for P and other agro-minerals
5. Workshop Report: Training of Master Trainers on Legume and Inoculant Technologies (Kisumu Hotel, Kisumu, Kenya-24-28 May 2010)
6. Plans for interaction with the Tropical Legumes II project (TLII) and for seed increase on a country-by-country basis
7. Implementation Plan for collaboration between N2Africa and the Soil Health and Market Access Programs of the Alliance for a Green Revolution in Africa (AGRA) plan
8. General approaches and country specific dissemination plans
9. Selected soyabeans, common beans, cowpeas and groundnuts varieties with proven high BNF potential and sufficient seed availability in target impact zones of N2Africa Project
10. Project launch and workshop report
11. Advancing technical skills in rhizobiology: training report
12. Characterisation of the impact zones and mandate areas in the N2Africa project
13. Production and use of rhizobial inoculants in Africa
18. Adaptive research in N2Africa impact zones: Principles, guidelines and implemented research campaigns
19. Quality assurance (QA) protocols based on African capacities and international existing standards developed
20. Collection and maintenance of elite rhizobial strains
21. MSc and PhD status report
22. Production of seed for local distribution by farming communities engaged in the project
23. A report documenting the involvement of women in at least 50% of all farmer-related activities
24. Participatory development of indicators for monitoring and evaluating progress with project activities and their impact
25. Suitable multi-purpose forage and tree legumes for intensive smallholder meat and dairy industries in East and Central Africa N2Africa mandate areas
26. A revised manual for rhizobium methods and standard protocols available on the project website
27. Update on Inoculant production by cooperating laboratories
28. Legume Seed Acquired for Dissemination in the Project Impact Zones
29. Advanced technical skills in rhizobiology: East and Central African, West African and South African Hub
30. Memoranda of Understanding are formalized with key partners along the legume value chains in the impact zones
31. Existing rhizobiology laboratories upgraded
32. N2Africa Baseline report
33. N2Africa Annual country reports 2011

34. Facilitating large-scale dissemination of Biological Nitrogen Fixation
35. Dissemination tools produced
36. Linking legume farmers to markets
37. The role of AGRA and other partners in the project defined and co-funding/financing options for scale-up of inoculum (banks, AGRA, industry) identified
38. Progress Towards Achieving the Vision of Success of N2Africa
39. Quantifying the impact of the N2Africa project on Biological Nitrogen Fixation
40. Training agro-dealers in accessing, managing and distributing information on inoculant use
41. Opportunities for N2Africa in Ethiopia
42. N2Africa Project Progress Report Month 30
43. Review & Planning meeting Zimbabwe
44. Howard G. Buffett Foundation – N2Africa June 2012 Interim Report
45. Number of Extension Events Organized per Season per Country
46. N2Africa narrative reports Month 30
47. Background information on agronomy, farming systems and ongoing projects on grain legumes in Uganda
48. Opportunities for N2Africa in Tanzania
49. Background information on agronomy, farming systems and ongoing projects on grain legumes in Ethiopia
50. Special Events on the Role of Legumes in Household Nutrition and Value-Added Processing
51. Value chain analyses of grain legumes in N2Africa: Kenya, Rwanda, eastern DRC, Ghana, Nigeria, Mozambique, Malawi and Zimbabwe
52. Background information on agronomy, farming systems and ongoing projects on grain legumes in Tanzania
53. Nutritional benefits of legume consumption at household level in rural sub-Saharan Africa: Literature study
54. N2Africa Project Progress Report Month 42
55. Market Analysis of Inoculant Production and Use
56. Identified soyabean, common bean, cowpea and groundnut varieties with high Biological Nitrogen Fixation potential identified in N2Africa impact zones
57. A N2Africa universal logo representing inoculant quality assurance
58. M&E Workstream report
59. Improving legume inoculants and developing strategic alliances for their advancement
60. Rhizobium collection, testing and the identification of candidate elite strains
61. Evaluation of the progress made towards achieving the Vision of Success in N2Africa
62. Policy recommendation related to inoculant regulation and cross border trade
63. Satellite sites and activities in the impact zones of the N2Africa project
64. Linking communities to legume processing initiatives
65. Special events on the role of legumes in household nutrition and value-added processing
66. Media Events in the N2Africa project

67. Launch N2Africa Phase II – Report Uganda
68. Review of conditioning factors and constraints to legume adoption and their management in Phase II of N2Africa
69. Report on the milestones in the Supplementary N2Africa grant
70. N2Africa Phase II Launch in Tanzania
71. N2Africa Phase II 6 months report
72. Involvement of women in at least 50% of all farmer related activities
73. N2Africa Final Report of the First Phase: 2009-2013
74. Managing factors that affect the adoption of grain legumes in Uganda in the N2Africa project
75. Managing factors that affect the adoption of grain legumes in Ethiopia in the N2Africa project
76. Managing factors that affect the adoption of grain legumes in Tanzania in the N2Africa project
77. N2Africa Action Areas in Ethiopia, Ghana, Nigeria, Tanzania and Uganda in 2014
78. N2Africa Annual report Phase II Year 1
79. N2Africa: Taking Stock and Moving Forward. Workshop report
80. N2Africa Kenya Country report 2015
81. N2Africa Annual Report 2015
82. Value Chain Analysis of Grain Legumes in Borno State, Nigeria
83. Baseline report Borno State

Partners involved in the N2Africa project

A2N

Bayero University Kano (BUK)

Caritas Rwanda

Diobass

Eglise Presbyterienne Rwanda

Ethiopian Institute of Agricultural Research

Kwame Nkrumah University of science and Technology

MIRCEN
University of Nairobi MIRCEN

Resource Projects-Kenya

Sasakawa Global; 2000

Université Catholique de Bukavu

University of Zimbabwe

Urbanet