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Baseline Report of the Sudan Savanna Zone of the Kano–Katsina–Maradi (KKM) Project Learning Site (PLS) of the sub-Saharan Africa–Challenge Program (SSA–CP)

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Executive summary

The major outcome of the extensive consultations with numerous agricultural stakeholders in sub-Saharan Africa established that the main impediment to the contribution of African agriculture to development lies in the way agricultural research is organized and conducted. The outcome led to the proposal of an alternative approach that aims to appropriately embed agricultural research within a larger system of innovation whereby knowledge from numerous sources is integrated and effectively put into use. This approach to agricultural research is termed the Integrated Agricultural Research for Development (IAR4D) and has been adopted by the Sub-Saharan African Challenge Program (SSA–CP).

One of the project aims is to evaluate the effectiveness of the IAR4D concept in its respective agroecological zone (AEZ) by establishing Innovation Platforms (IPs) and conducting action research aimed at intensifying crop and livestock systems, improving access to markets, and promoting sustainable management of the natural resource base. In pursuance of the goals of the project, a baseline survey was carried out in the Sudan Savanna zone in 2008 to provide baseline data on socioeconomics, resource-use patterns, market opportunities, agricultural productivity, and incidence of poverty in targeted project communities. The baseline data were obtained through a household survey conducted in the year 2008.

The main instruments for data collection were well-structured questionnaires administered on households by trained enumerators under the supervision of the IITA and the project task force.

Altogether eight local government areas (LGAs) were covered for the purpose of data collection; each IP covered five villages within a local government. Ten counterfactual villages (five with no R&D and five with some R&D) were also chosen for comparison purposes. For each IP and its counterfactuals, innovation development, knowledge increase, and information sharing among IP members were monitored and assessed. Furthermore, for each IP, information sharing and technology uptake within the communities were assessed using a random sample of 10 farmers per village. Data were analyzed with the aid of descriptive statistics, budgetary techniques, and regression analysis involving Logit and Tobit. The total sample size was therefore 600 households.

Results showed that the average ages of the households in all the locations were between 40 and 55; indicating that the farmers were in their highly productive age. They were yet to enter into dependent ages. The values may also imply that there was little or no difference in age across IPs and states.

The implication of the above results is that the basic household socioeconomic characteristics of farmers in both the maize–legume–livestock (MLL) IP and sorghum–legume–livestock (SLL) IP are very similar with little statistically significant difference.

With the age range between 47 and 51 years, farming experience 27 to 31 years, and household size ranging between 12 and 17, thepercentage of those who had primary school education ranging for the different IPs was as follows: Kano MLL (24 to 36%); Kano SLL (32 to 50%); Katsina MLL (26 to 36%), and Katsina SLL (20 to 40%). The incidence of polygamy, percentage of male-headed households, and housing properties was also similar among the IPs. This may be because the sample was chosen within the same agroecological zone or sociocultural background.

The small proportion of households that owned draft cattle, draft donkeys, and tractors in all the sites in the project area was indicative of the fact most farming households did not practice mechanized or semimechanized farming. Instead, they relied on hand implements in their farming activities. All the sites of both MLL IP and SLL IP in Kano and Katsina states had similar asset ownership distribution.

The results showed that more farmers in the MLL IP in Katsina State had access to credit, but farmers in the SLL IP in Kano State obtained higher amounts of credit.

Most (79%) of the farmers preferred to make a request for training from their neighbors in the SLLIP, while 54% made requests from the Agricultural Development Program (ADP). In essence, more farmers in the SLL IP requested for training than in the MLL IP.

Access to and use of the extension service was generally low in all the IPs irrespective of the sites. In the MLL IPs and SLL IPs, access to credit was only noticeable in the use of fertilizer, improved varieties, and pest and disease management with 24%, 24%, and 16%, respectively, in IAR4D, R&D, and little or no intervention sites having contact with extension service. The same pattern was recorded in SLL IP in the IAR4D sites with 30%, 30%, and 24% access as regards the use of fertilizer, improved varieties, and pest and disease management, respectively.

Farmers in MLL IP in IAR4D sites of Kano State and all the sites in Katsina State perceived the interaction had on all these factors to be moderate. However, farmers in R&D sites of Kano State perceived interactions on business transaction and material exchange to be very strong. In the SLL IP, farmers in IAR4D sites perceived that interactions on information exchange and business transactions were strong while for other factors interactions were moderate in Kano State. In the two IPs, membership of farmer organizations was generally low; the few who joined farmer organizations were principally men in the IAR4D and R&D sites in Kano and Katsina and they joined for production purposes.

The analysis indicated that farmers had not been carried along in the research and development of new technology in all the IPs and sites. Research, technology transfer, and technology use have been treated as independent activities whereby research-derived knowledge consisting of large prescriptive technology packages flows inwardly from researchers to farmers through extension agents.

The analysis showed that in Kano State MLL IPs, farmers have been having some degree of interaction with other farmers and farmer groups but the occurrence had been average or below. However, in Katsina State, with the exception of IAR4D sites, the interaction had been very low. A similar result was recorded in the SLL IP in both Kano and Katsina states. The result of the analysis showed that in both IPs farmers used hired labor. However the proportion that used hired labor in Kano State (> 62 percent) were more than those that used them in Katsina State (< 60) in all the sites. All the farmers in the two IPs had a sizeable proportion of their households aged 16 years and above. This suggests the availability of members of the household as a source of labor on the farm.

Household priority crops in the two IPs included maize, sorghum, millet, cowpea, and groundnut. In SLL IP little or no intervention sites produced the highest yields in maize and groundnut while IAR4D produce the average yields in sorghum, and R&D sites produced the highest yields in cowpea in Kano State. But in Katsina State, the highest yields in all the crops were produced in IAR4D sites. The results obtained for priority cereals crops in all the sites show a lot of similarity in the enterprise gross margin for all the sites. However, Kano State villages and especially the MLL IP had better results than Katsina State sites. For priority legume crops, the results show that gross margin values obtained in Katsina State were lower, and therefore it could be deduced that the profitability of crop farming was highest in Kano State especially in the MLL IP sites.

Nearly all farmers in the IAR4D, R&D, and little or no intervention sites in Kano State practiced monocropping, mixed cropping, livestock production, and shifting cultivation because not less than 80% of the households were involved. In Katsina State monocropping, livestock production, and mixed livestock practice were only common in IAR4D sites. All the farmers in the R&D and little or no intervention sites practiced mixed cropping.

In all IPs farmers had access to fertilizer, herbicide, and insecticide, but the main source of farm input was the local market. Households that use feed supplement in all the sites ranged between 25 and 41% in SLL IP while not less than 30% used feed supplement in the MLL IPs. The major crops traded by farmers in Kano in IAR4D sites were maize, sorghum and groundnut where more than 50% of the households were involved. Maize was the only commodity traded in large amounts in both the R&D and little or no intervention sites.

Results obtained for livestock output marketing shows that local goats and local sheep were the major livestock traded by farmers in both Kano and Katsina states with annual sales in the little or no intervention sites being highest for the MLL IP. In all the sites of the SLL IP Katsina State, farmers earned the lowest annual average sales from livestock with sales of less than N15,000.00. In terms of household income sources, the two enterprises (sales of crops and livestock) constitute the highest proportion of household income in all the IP sites except in little or no intervention sites where casual employment in agricultural activities made about 53% of the total income in Katsina State. In the MLL IP of Kano and Katsina states no household spent more than 20 % of their income on food, while in SLL IP, especially in Kano State, households spent about 28%, 41%, and 97% of their income on food in IAR4D, R&D, and little or no intervention sites, respectively.

The analysis indicated that farmers in IAR4D sites of Kano State were food secure only in the months of July, August, and September.. In IAR4D sites food insecurity was highest in the month of April and May while in little or no intervention sites, it was highest in the month of January. The level of food insecurity was less than 50% in R&D sites of Kano State. In Katsina State the level of food insecurity was high from March till November in IAR4Ds site of the maize–legume–livestock IP.

The analysis indicated that very few farmers engaged some coping strategies. In the IAR4D site of maize–legume–livestock IP, predominant coping strategies included borrowing money to buy and or buying food on credit, buying cheaper food type (83% of 18 households). In R&D and little or no intervention sites no noticeable coping strategies were identified. The main crops grown in all the sites of the two IPs are maize and sorghum. Cultivation of other crops varies amongst the various sites with cowpea and groundnut featuring most in IAR4D sites and cotton and millet in other sites.

However, the estimated poverty line showed that the poverty line for the little or no intervention sites was highest followed by those of IAR4D and finally the R&D thus indicating that poverty is higher in the little or no intervention villages than the other sites. The incidence of poverty in the study area is higher than that obtained in the North Central Zone of Nigeria, i.e., Kano and Katsina states.

The estimates from the table showed that the headcount index of the population ranged from 25% for the IAR4D population to about 30%for the little or no intervention sites. The implication of this result is that the income in the IAR4D population is more equally distributed than in the other two kinds of sites. Hence, inequality in the other two populations (R&D and little or no intervention) was higher than for those in the IAR4D population. The results further suggest that farmers in Kano State are generally poorer than those in Katsina State in all the IPs.

Under general crop analysis, farmers in non-intervention sites favored the adoption of improved crop varieties more than those in intervention sites. But, as household size and awareness increased, the probability of adopting new varieties increased. The result revealed that distance to input and output markets did not affect the probability of adoption negatively. However, frequency of extension visit, non-farm income, and amount of credit secured tended to affect improved crop adoption in a positive way. Farmers in intervention sites were more favorably disposed to adopting new maize varieties compared to non-intervention sites and as farmers grew older, the tendency to adopt new maize varieties decreased; but increases in other costs of production, did not affect adoption negatively. For the adoption of improved cowpea, farmers in non-intervention

sites favored the adoption of improved cowpea more than those in intervention sites. Long years of farming experience did not affect adoption decisions but visits by extension agents encouraged adoption of the crop. As expected, costs of insecticide affected the probability of cowpea adoption negatively. In the adoption of livestock technologies, the results indicated that farmers in non-intervention sites favored the adoption more than those in intervention sites. Household size, awareness, and availability of land for grazing and non-farm income encouraged farmers' adoption decisions while labor costs did not discourage adoption of improved-livestock technologies.

Results of the Tobit analysis explaining the factors determining the intensity of household poverty shows that eight explanatory variables affect household poverty intensity, viz: Household Head Education(–0.109); Child Dependency Ratio (0.109); Household Size (0.323); Farm Income (–0.394); Household Production Enterprise Portfolio (–0.6650); Non-Farm Income (–0.101); Household Farm Size (–0.229), and Extension Contact (–0.814). According to the results obtained from the elasticity coefficients the important factors that reduce household poverty intensity in the study area were farm income, farm size, and non-farm income in order of importance. Factors that significantly increase poverty intensity were household size (3.96%) and child dependency ratio (23%).

Acronyms

ADP	Agricultural Development Program
AEZ	agroecological zone
AFAN	All Farmers' Association of Nigeria
ARD	agricultural research and development
CBO	community-based organization
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CORAF /WECARD	West and Central African Council for Agricultural Research and Development
CP	Challenge Program
CRST	Cross-Site Research Support Team
DFID	Department for International Development
EU	European Union
FARA	Forum for Agricultural Research in Africa
FEPSAN	Fertilizer Producers and Suppliers Association of Nigeria
GIS	geographical information systems
IAR	Institute for Agricultural Research (Nigeria)
IAR4D	Integrated Agricultural Research for Development
ICRAF	International Center for Research on Agro‐Forestry
ICRISAT	International Crop Research Institute for Semi Arid Tropics
IFDC	International Fertilizer Development Center
IFPRI	International Food Policy Research Institute
SSA CP	sub-Saharan Africa–Challenge Program
MTP	Medium Term Plan 2009–10
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INRAN	Institut National de Recherche Agronomique de Niger
IP	Innovation Platform
IPG	International Public Good
KKM	Kano–Katsina–Maradi
LCRI	Lake Chad Research Institute (Nigeria)
LK	Lake Kivu
MOU	memorandum of understanding
MTP	medium-term plan
MLL	Maize Legume Livestock IP
NAERLS	National Agricultural Extension Research Liaison Service (Nigeria)
NAPRI	National Animal Production Research Institute (Nigeria)
NARS	national agricultural research system
NGO	nongovernmental organization
NGS	Northern Guinea Savanna
NIHORT	National Institute for Horticultural Research and Training (Nigeria)
NRM	natural resources management
NSS	National Seed Service
PCU	Program Coordination Unit
PLAR	Participatory Learning and Action Research
PLS	Pilot Learning Site
PM&E	planning, monitoring, and evaluation
RPG	regional public goods
R&D	research and development
SLL	Sorghum Legume Livestock IP
SRO	subregional organization
SS	Sudan Savanna
SSA	sub-Saharan Africa
TF	task force

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1. Introduction

Background

Evolution of the Sub-Saharan Challenge Program (SSA–CP)

The Sub-Saharan Africa Challenge Program (SSA–CP) was initiated in 2004 following extensive consultations with numerous agricultural stakeholders (researchers, extension and development agents, policy makers, farmers, and the private sector) to diagnose the reasons behind the underperformance of agricultural research in Africa. The consultations established that besides inadequate funding, the main impediment to the contribution of African agricultural research to development lies in the way the research is organized and conducted. Research technology transfer and technology use have been treated as independent activities whereby research derived knowledge consisting of large prescriptive technology packages flows linearly from researchers to farmers through extension agents.

The consultations proposed an alternative approach that aims to appropriately embed agricultural research within a larger system of innovation whereby knowledge from numerous sources (comprising all various actors and stakeholders) is integrated and effectively put into use. This approach to agricultural research is termed Integrated Agricultural Research for Development (IAR4D) and has been adopted by the SSA–CP.

The SSA CP's research has been organized around four projects: One Meta-Analysis project and three Pilot learning site (PLS) projects in three different regions of sub-Saharan Africa (i.e., Lake Kivu (LK) in Eastern and Southern Africa, Kano–Katsina–Maradi (KKM) in West Africa, and Zimbabwe–Malawi–Mozambique (ZMM) in Southern Africa. Each PLS project comprises three sub-projects.

Local leaders admiring cowpea seeds.

The three sub-projects that constitute the KKM project are distinguished by the agroecological zones (AEZs) where their research is based and focused. The relevant AEZs are the Sahel, the Sudan Savanna, and the Northern Guinea Savanna. Each of the three sub-projects aims to evaluate the effectiveness of the IAR4D concept in its respective AEZ by establishing Innovation Platforms (IPs) and conducting action research aimed at intensifying crop and livestock systems, improving access to markets, and promoting sustainable management of the natural resource base.

The Sudan Savanna sub-project is particularly concerned with agricultural intensification and integrated natural resource management to improve the rural livelihoods in the Sudan Savanna. The taskforce implementing the sub-project is led by the International Institute for Tropical Agriculture (IITA).

Each of the three sub-projects that constitute the KKM PLS project has the same type of outputs but activities differ based on the entry points and the specific context of each AEZ. The specificity of each sub-project comes from the actual content of the field research work planned based on the identified entry points. The taskforce responsible for implementing each sub-project comprises scientists, extension services, NGOs, private sector actors, and policymakers (especially at the local level). This group constitutes the nucleus of the innovation platform. Each sub-project will establish four innovation platforms that will deal with issues related to value chains that are most important for the given AEZ.

The baseline study

As noted above the essence of the sub-project is to ascertain the effectiveness of the IAR4D concept, hence the key questions raised were:

- Does the IAR4D concept work and can it generate International Public Goods (IPGs) and Regional Public Goods (RPGs) to end-users?
- Does the IAR4D framework deliver more benefits to end-users than the conventional approaches?

In pursuance of the goals of the project, a baseline survey was carried out in the Sudan Savanna zone in 2008 to provide baseline data on socioeconomics, resource-use patterns, market opportunities, agricultural productivity, and incidence of poverty in targeted project communities.

The remaining aspect of this study is organized as follows. Chapter two explains the scope of the study, the study area and socioeconomic characterizations at the household and village levels, while chapter three considers socioeconomic characteristics of the households and production systems in relation to crops and livestock. Chapter four examines gross margin analysis, awareness, and adoption of major crops, cropping systems, and crop output marketing. Income sources, expenditure patterns, household perception of food security as well as coping strategies and wealth ranking are examined in chapter five. Chapter six analyzes the poverty status of the households in the study area while summary and recommendations are in chapter seven.

2. Methodology

Scope of the study

The report covers household demographic characteristics and land and asset ownership patterns. It examines households' access to credit, and extension services, participation in research activities as well as membership of farmers' organizations. The study also investigates households' labor availability and priority crops, awareness and adoption of technologies and examines access to farm inputs, output and livestock marketing, and use of livestock feed implementation. Moreover, it analyzes costs and returns to farming households, their coping strategies, and poverty level in the study area.

Study area

The Kano–Katsina–Maradi Pilot Learning Site (KKM PLS)

The KKM pilot learning site is located on the border between south central Niger and North central Nigeria, and encompasses three different agroecological zones (AEZs) that cross all of West and Central Africa at this latitude: (1) The Sahelian zone (Sahel), (2) The Sudan Savanna (SS), and (3) The Northern Guinea Savanna (NGS). As one moves from the northern to the southern parts of this PLS, average temperatures decline, and annual rainfall and the length of the growing period increase. Principal crops in the PLS include: (i) cereals (pearl millet, sorghum, maize, upland rice, and wheat); (ii) legumes (groundnut, cowpea, soybeans); (iii) roots and tubers (cassava, sweetpotato); and (iv) cotton. Other emerging crops include tiger nuts (*Cyperus esculentus*) and sesame (*Sesamum indicum*). Vegetable crops (pepper, onion, tomatoes, cabbage or water melon) are mainly grown under irrigation. In all three agroecological zones, livestock is an essential part of the production systems.

Team on a monitoring visit to Katsina.

The Sudan Savanna subproject

The main constraints to agricultural production in the Sudan Savanna include limited adoption of improved technologies, land degradation, diseases, insect pests, *Striga* infestation, and lack of labor saving technologies for field operations and processing. These constraints are compounded by market-related and policy-related constraints such as limited access to credit; low farm-gate prices; inadequate supply, high costs, and low quality of inputs; poor access to output markets; and weak linkages between producers, agro-industry and markets on the market side and, on the policy side, by conflicts arising from access to community resources and utilization especially between farmers and pastoralists. Ineffective extension systems and lack of policy incentives also constrain agricultural intensification.

The Sudan Savanna sub-project is led by IITA (International Institute for Tropical Agriculture). Its areas of intervention include the Sudan Savanna zones of Katsina and Kano states in Nigeria.

This subproject works on cereal-legume-livestock issues in the two states with special focus on the production to consumption value chains. The actual choice of cereal and legume depends on the comparative advantages of each of the regions due to rainfall in the north-south gradient.

Data collection

The baseline data were obtained through a household survey conducted in the year 2008.

The main instruments for data collection were well-structured questionnaires administered on households by trained enumerators under the supervision of the IITA and the project task force.

Altogether eight local government areas (LGAs) were covered for the purpose of data collection. Each IP covered five villages within a local government. Ten counterfactual villages (five with no R&D and five with some R&D) were also chosen for comparison purposes. For each IP and its counterfactuals, innovation development, knowledge increase, and information sharing among IP members were monitored and assessed. Furthermore, for each IP, information sharing and technology uptake within the communities were assessed using a random sample of 10 farmers per village. The total sample size was therefore 600 households.

This study in line with the SSA–CP research method employed multistage stratified random sampling within the selected local government areas (IAR4D and counterfactual) to select the villages where IAR4D were introduced, study village communities where conventional approaches are in operation, and study villages where no agricultural interventions have been carried out over the last 2–5 years. The list of villages and their status is presented in Table 1.

Table 1. Villages and their status.

State	LGA	No. of villages	IP	Status
Kano	Bunkure	5	Maize/Legume/Livestock	Intervention
	Karaye	10	Maize/Legume/Livestock	5 clean+ 5 conventional
	Shanono	5	Sorghum/Legume/Livestock	Intervention
	Dawakin Tofa	10	Sorghum/Legume/Livestock	5 clean+ 5 conventional
Katsina	Musawa	5	Maize/Legume/Livestock	Intervention
	Dan Musa	10	Maize/Legume/Livestock	5 clean+ 5 conventional
	Safana	5	Sorghum/Legume/Livestock	Intervention
	Ingawa	10	Sorghum/Legume/Livestock	5 clean+ 5 conventional

Source: Field Survey Data, 2008.

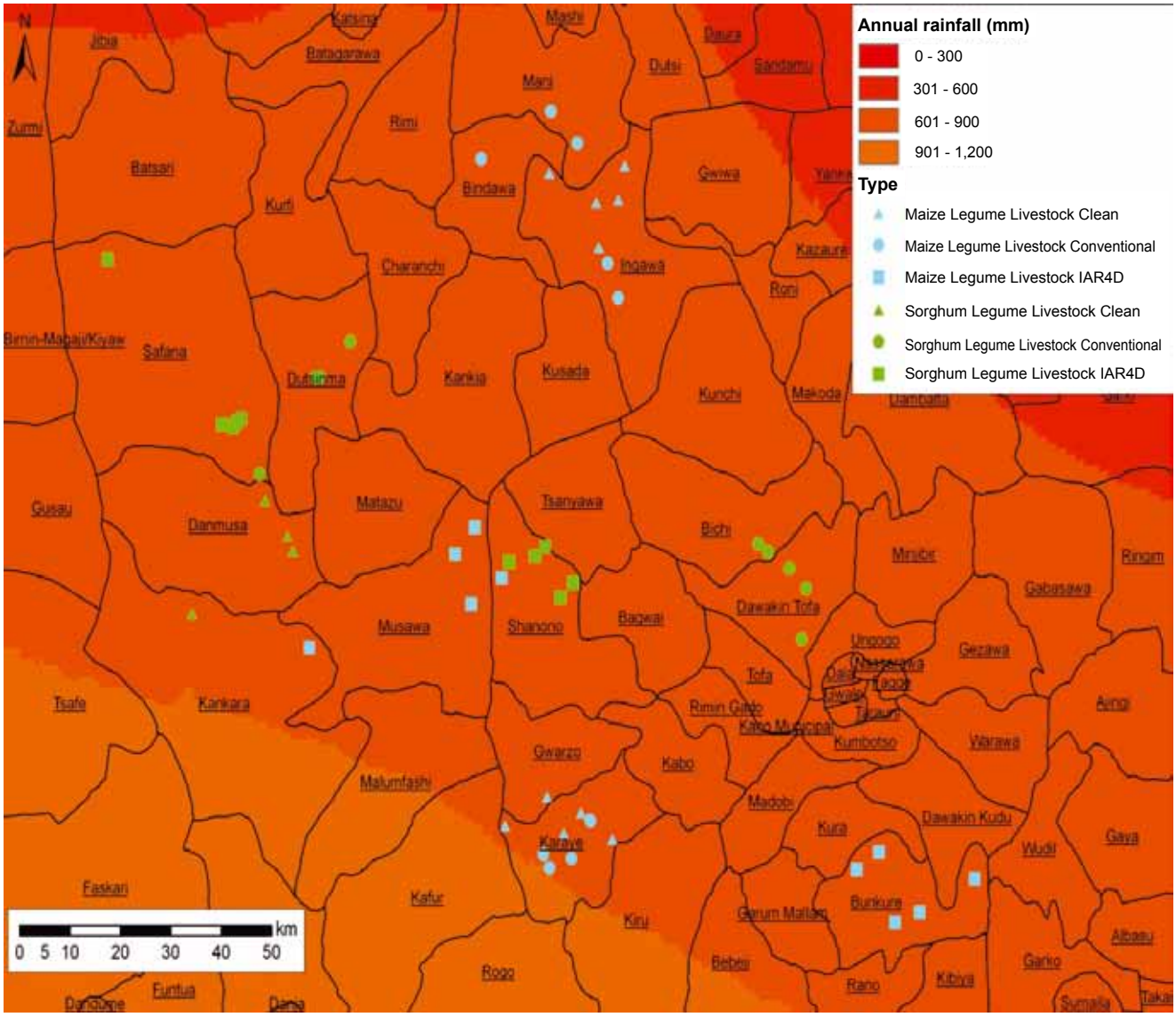

Figure 1. Map of study area.

Village characterization

The main output of the SSA–CP is the implementation of Integrated Agricultural Research for Development (IAR4D) and assessing whether it works or not. The challenge of the SSA–CP is to conduct research to identify the effects of the IAR4D approach and its different components in designing and implementing research targeted at the interface of processes driving productivity gains, efficient use of resources, the care of the environment, policies, and markets that would increase demonstrably the delivery of the benefits to end users and have an impact and do so in a scientific, statistically based manner. IAR4D is an action research approach for investigating and facilitating the organization of groups of stakeholders (including researchers) to innovate more effectively in response to changing complex agricultural and natural resource management contexts, in order to achieve developmental outcomes. At the core of this organization is the establishment of innovation platforms.

In accomplishing the research objective it is necessary to characterize the study area. This is accomplished via the Village Characterization Tool. This tool specifies some of the information to be collected and some examples of methods to do this. The tool is meant to be implemented in both the intervention and the counterfactual villages.

The tool has the following objectives:

- Characterize the various villages in order to be able to compare them with each other.
- Baseline study at village level on those aspects that we think might change under the influence of the IAR4D activities in order to be able to compare the situation before and after the project.

Outputs of the tools:

- A framework and indicators for comparison of villages across taskforces (TFs), PLS, and the SSA–CP.
- Maps of all research villages and counterfactual villages based on various characteristics.

The village characterization has two major parts; part A which is general information based on key informant interviews, secondary information, and village transect walks and part B which is focus group discussions with farmers in the village.

Information collected in the Part A of the instrument includes geographical information such as rainfall pattern, average temperature, number of cropping seasons, population density, main farming system practiced, main cash and food crops, main land tenure systems, poverty levels, input and output markets, and social organizations in the village.

Others include total land area and land use pattern in the last cropping season, organizations working in the village, access to input and output markets, cost items (of transportation), resources available within the village (in terms of social and physical amenities), and perception of the state of natural resources in the village in terms of soil fertility, crop productivity, level of erosion, condition of pastures, water quality, and livestock productivity.

Maize-soybean rotation field.

3. Demographic and socioeconomic characterization

Household socioeconomic characteristics

For household socioeconomic analysis, descriptive statistics, such as mean, standard deviation, frequency distributions, and so on were computed and used. In this section, the major socioeconomic characteristics of households covered in the survey are described. The main characteristics considered relate to the age, farming experience, household size, and level of education among others. Discussion is made along the IPs.

Kano MLL IP

Household socioeconomic characteristics of the MLL IP are shown in Table 2 and Figure 2a. Age has been found to determine how active and productive the household head would be. Age has also been found to affect the rate of household adoption of innovations that in turn affect household productivity and livelihood improvement strategies (Akinola et al. 2008). Table 2 and Figure 2a show the distribution of household heads by their age ranges. The ages of household heads were fairly similar in Kano State. The mean ages of the household head in 1AR4D sites in Bunkure was 48, 46 in R&D sites in Karaye, and 45 in little or no intervention sites in Karaye LGAs.. Since the average ages of the households in all the locations were between 40 and 55, the farmers were in their highly productive age. They were yet to enter into dependent ages.

Table 2. Household socioeconomic characteristics in % (MLL IP).

Treatment	LGA	Polygamy	Male-headed household	Education of household head
Kano State				
IAR4D sites	Bunkure	44(22)	94(47)	24 (12)
Some R &D sites	Karaye	62(31)	82(41)	36(18)
No (little) intervention	Karaye	50(25)	90(45)	28(14)
Katsina State				
IAR4D sites	Musawa	52(26)	84(42)	26(13)
Some R&D sites	Dan Musa	48(24)	60(30)	36(18)
Little or no intervention	Dan Musa	46(23)	54(27)	28(14)

Figures in brackets are N values for frequency. **Source**: Field Survey 2008.

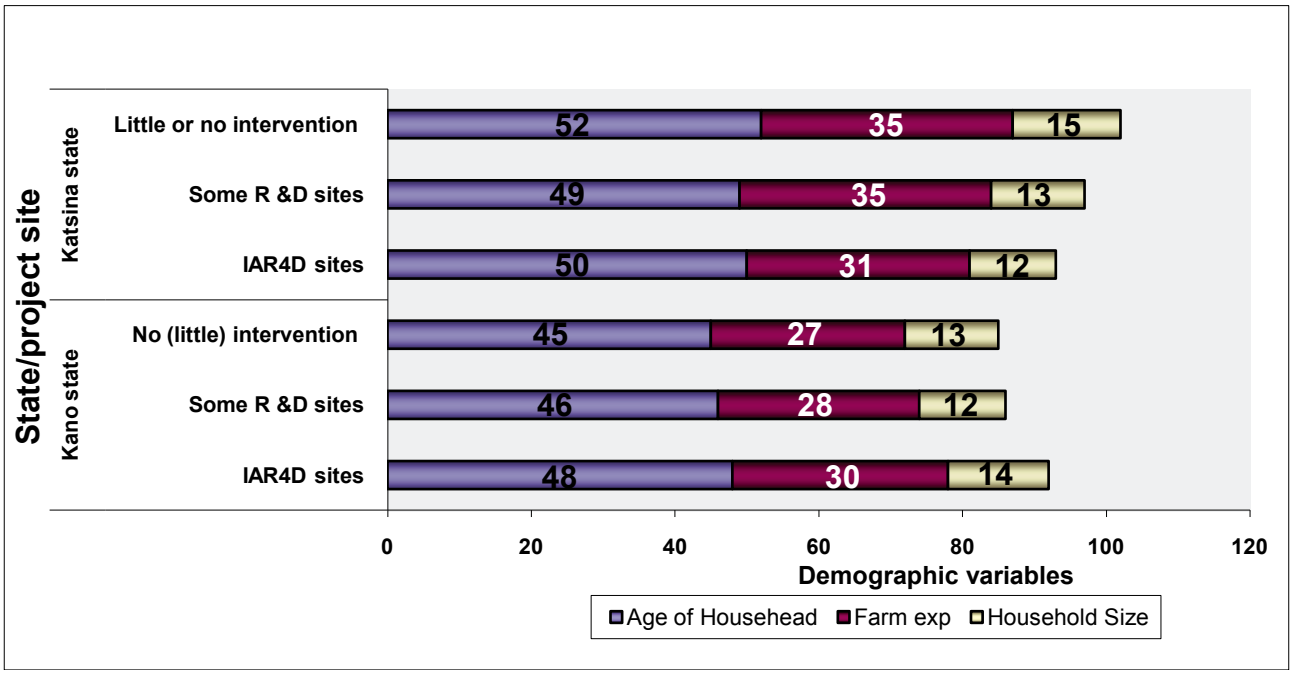

Figure 2a. Socioeconomics features in averages.

Farming experience is an important factor determining adoption of an innovation, and productivity in farming. Though the effect on productivity and production could be positive or negative, the effect on adoption is always expected to be positive. The results showed no significant difference between the farming experience of farmers in the IAR4D and the counterfactual sites. However, the farming experience of an average household head in all the sites in Kano was over 27 years implying that they all have a reasonable number of years of experience in farming. The household size that depicts the availability of family labor for farming activity ranged from 12 to 14 in all the sites in the state. However, the literacy level was generally low as the proportion of household heads that attended primary schools only ranged between 24% and 36% in the population. From Table 2, the proportion of farmers practicing polygamy in all the LGAs of the maize–legume–livestock IP was high as expected, the highest being 62% possibly because most farmers in the study area were Muslims. Most of the households were male headed (82–94%).

As regards their housing properties (Appendix, Table 15), farmers practicing IAR4D in Bunkure in Kano State had 28%of their houses floored with cement, 26% were roofed with iron sheets, and 6% had cement walls. Those practicing R&D had not less than 64% of their houses with cement floors, 38% roofed with iron sheets, and 18% with cement walls.This might indicate that, at present, farmers in the IAR4D sites are poorer than those in the other categories.

Katsina MLL IP

Looking at Table 2 and Figure 2a, the ages of farmers were also fairly similar in Katsina State, where the average ages in IAR4D site in Musawa was 50, in Dan Musa [R&D sites] 49, and in Dan Musa [little or no intervention sites] 52. This also implies that the farmers were still in their productive age. The values may indicate that there was little or no difference in age across IPs and states. The farming experience (> 30 years) in Katsina State was indicative of the fact that the farmers in the state were not new in the farming enterprise. The household size of an average household in the state was also similar to what obtained in Kano State (12–15). In all, there was no significant difference in the household size in all the sites. This suggests labor availability from the farming household in all the sites. Literacy level was as low as 36%% and even fewer in IAR4D, R&D and little or no intervention sites had primary school education. Barely half of the households practiced polygamy and a significant proportion was male headed (54–84%). Households practicing IAR4D in Katsina State had 64%of their houses floored with cement, 18% roofed with iron sheets, and 14% with cement walls while there were similar results in R&D and little or no intervention sites; not less than 70% had houses with cement floors, about 18% roofed with iron sheets, and 6% with cement walls (Appendix-Table 15).

Kano SLL IP

Household socioeconomic characteristics of the farmers in the SLL IP are as shown in Table 3 and Figure 2b. This indicated that in Kano State, the average age of household heads in the little or no intervention site was about 50, as well as in IAR4D, and 51 in R&D sites. In Kano, most of the household heads had farming experience of not less than 31 years in all the three sites with the household size ranging between 15 and 17. The literacy level in this IP was higher with the percentage that attended primary school being 32% of the household in little or no intervention sites, 44% in R&D sites, and 50% in IAR4D sites. Polygamy was also not too rampant in the two states in all the sites (44% highest). Male-headed households ranged between 78 and 98% . With respect to the quality of their houses in (Appendix Table 16), not less than 62% of the houses in all the sites in Kano State had their floor cemented while those in IAR4D sites in Katsina State in Safana LGA had only 20% of their houses floored with cement. In terms of the quality of the roofs, 48% of the houses in IAR4D, 60% in R&D sites, and 28% in little or no intervention sites in Kano State had their houses roofed with iron sheets.

Katsina SLL IP

In Katsina State, the average age of the household head was 47 in each of the IAR4D and R&D sites, while it was 51 in little or no intervention sites. While 44% of the households in R&D and little or no intervention sites had primary school education, only 20% in IAR4D sites went to primary school. Polygamy ranged between 42% in R&D sites and 50% in little or no intervention sites (Table 3 and Figure 2b).

However in Katsina State in all sites, not less than 68% of the houses in region were roofed with iron sheets roofed. In all the sites in both states, only households in R&D sites had about 38% of their houses with cement walls, others had less than 20% or less of the house walls cemented as shown in the Appendix (Table 16).

The implication of the above results is that the basic household socioeconomic characteristics of farmers in both the MLL IP and SLL IP are very similar with little statistically significant difference.

With the age range between 47 and 51 years, farming experience 27 to 31 years, household size ranging between 12 and 17, the percentages of those who had primary school education ranging for the different IPs was as follows: Kano MLL (24–36%); Kano SLL (32–50%); Katsina MLL (26–36%), and Katsina SLL (20–40%). The incidence of polygamy, percentage of male-headed households, and housing properties were also similar among the IPs.

This may be because the sample was chosen the same agroecological zone or sociocultural background.

Table 3. Household socioeconomic characteristics in % (SLL IP).

Treatment	LGA	Polygamy	Male-headed household	Education of household head
Kano State				
IAR4D sites	Shanono	32(16)	94(47)	50(25)
Some R&D sites	Dawakin Tofa	38(19)	92(46)	44(22)
No (little) intervention	Dawakin Tofa	44(22)	82(41)	32(16)
Katsina State				
IAR4D sites	Safana	44(22)	98(49)	20(10)
Some R&D sites	Ingawa	42(21)	78(39)	40(20)
Little or no intervention	Ingawa	50(25)	80(40)	40(20)

Figures in brackets are N values for frequency. **Source**: Field Survey 2008.

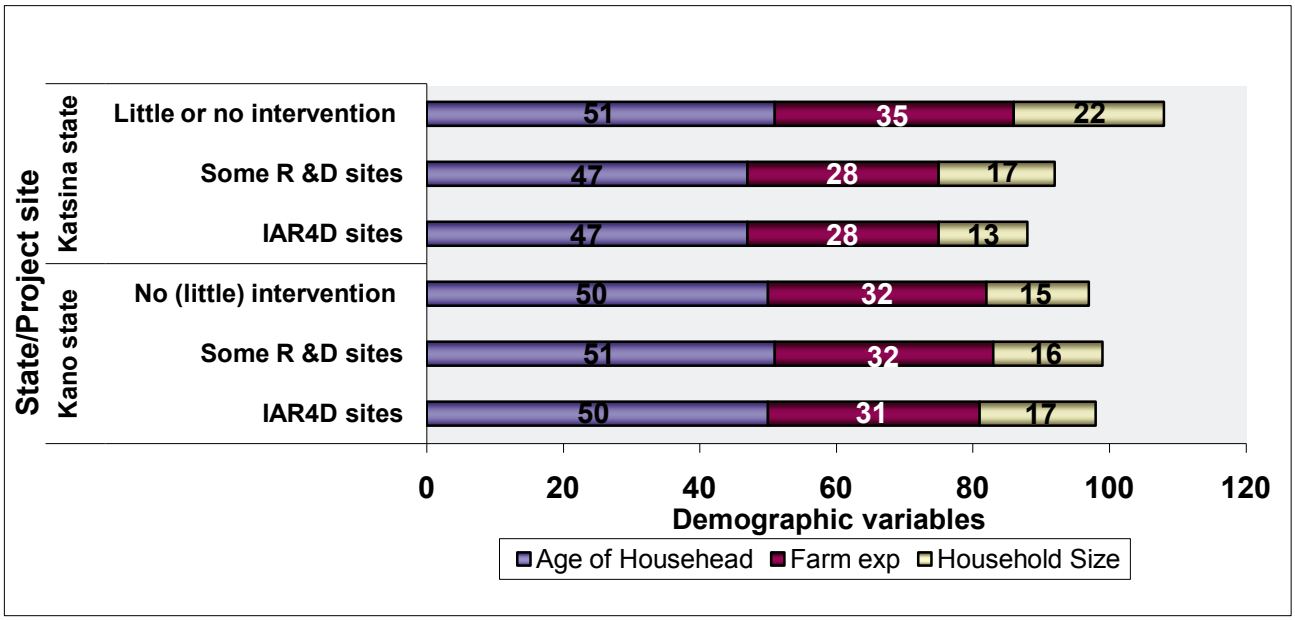

Figure 2b. Socioeconomics features in averages.

Household's asset ownership structure

Kano StateMLL IP

Studies have found that the level of asset ownership in a household is an indication of its endowment and can influence adoption of innovations. This is because assets can easily be converted and serve as an alternative source of credit that can be used in the adoption of new technology. Household land ownership in hectares is as shown in Table 4 and corresponding figures. The table showed that average total area of land possessed by the households were 8 ha, 12 ha and 7 ha, respectively, in the IAR4D, R&D, and little or no intervention sites of Kano State.

Katsina State MLL IP

In Katsina State, the average total land holdings of farmers was 3 ha for IAR4D, 6 ha for R&D, and 19 ha for little or no intervention sites. Thus, the average total land holding of farmers in Kano State is more than that of farmers in Katsina State except the little or no intervention sites. Also, the landholdings of the IAR4D farmers in both states is smaller than those of the counterfactuals.

Table 4. Average household land ownership in hectares (MLL IP).

Treatment	LGA	Total area	Area cropped upland	Area cropped lowland	Homestead
Kano State					
IAR4D sites	Bunkure	3.8(252)	5(97)	2(78)	4(77)
Some R&D sites	Karaye	8.3(130)	9(53)	7(15)	8(62)
No (little) intervention	Karaye	4.4(116)	5(66)	1(6)	4(44)
Katsina State					
IAR4D sites	Musawa	5.6(108)	14(32)	2(16)	2(60)
Some R&D sites	Dan Musa	3.5(136)	4(51)	1(24)	4(61)
No (little) intervention	Dan Musa	6.1(134)	7(47)	4(19)	6(68)

Figures in brackets are number of observations (farms). **Source**: Field Survey 2008.

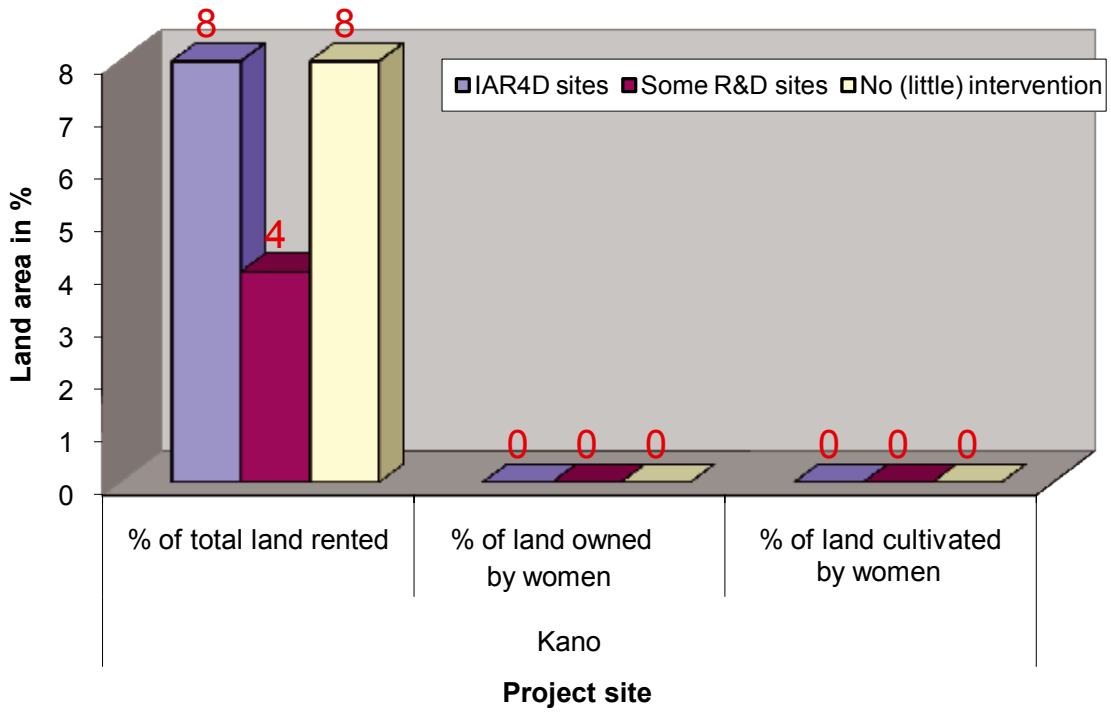

Figure 2c. Land distribution in MLL IP.

Kano State SLL IP

In the SLL IP, all other sites had land holdings of about 7 ha and less. Farmers in IAR4D sites of Kano State had an average total land holding of 6 ha, R&D sites 6 ha, and little or no intervention site7 ha . There was no noticeable difference in the total area of land owned in all the sites.

Katsina State SLL IP

The total land owned by an average household in the state only ranged between 4 and 5 ha in all the sites of the IP. The percentage of total land rented in all the IPs is less than 10% , while only two% of respondents in two sites in Katsina State (R&D and no intervention) have land owned by women and only one in Kano State had three% land owned by women.

The small proportion of households that owned draft cattle, draft donkeys, and tractors in all the sites in the project area was indicative of the fact most farming households did not practice mechanized or semi-mechanized farming. Instead, they relied on hand implements in their farming activities. All the sites of both MLL IP and SLL IP in Kano and Katsina states had similar asset ownership distribution. (Tables 1 and 2 in the Appendix)

Only few of the households owned cattle, goats, and sheep. In both the MLL IP and SLL IPs these livestock were mainly local species in all the three sites that were sourced from was local market.

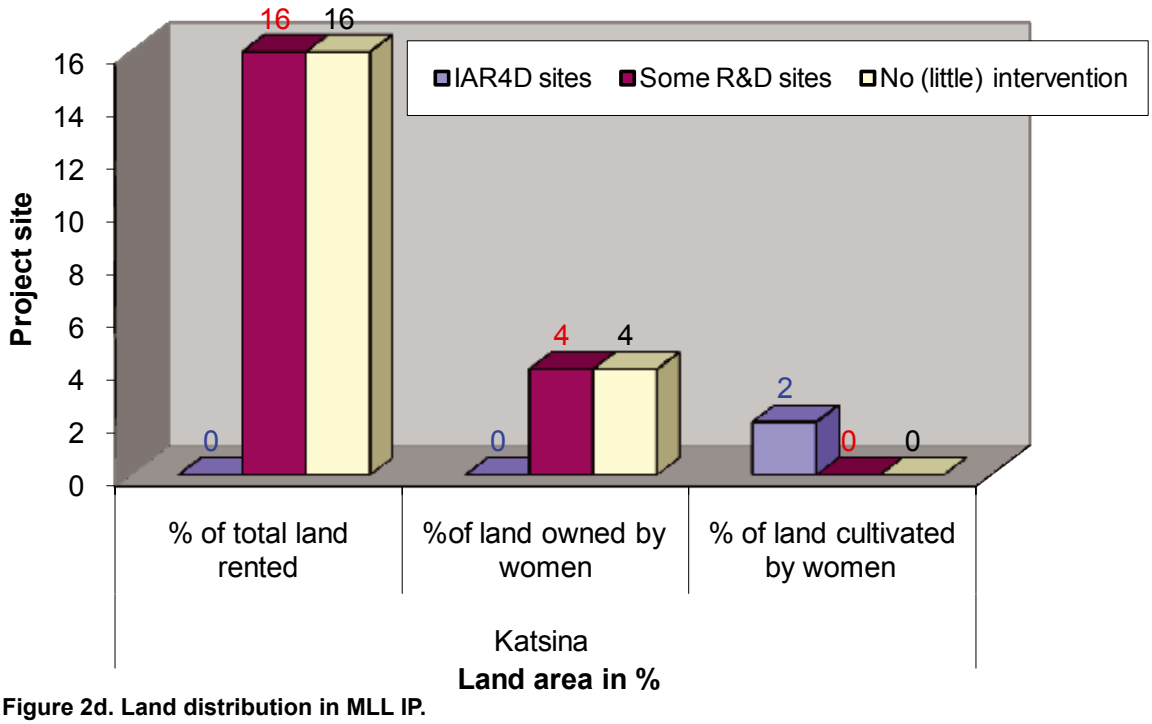

Figure 2d. Land distribution in MLL IP.

Table 5. Average household land ownership hectares (SLL IP).

Treatment	LGA	Total area	Area cropped upland	Area cropped lowland	Homestead
Kano State					
IAR4D sites	Shanono	3.0(190)	3(94)	1(48)	3(92)
Some R&D sites	Dawakin Tofa	3.5(145)	4(119)	2(11)	1(15)
No (little) intervention	Dawakin Tofa	4.2(141)	5(113)	1(9)	1(19)
Katsina State					
IAR4D sites	Safana	2.5(153)	3(77)	2(16)	2(60)
Some R&D sites	Ingawa	3.5(117)	4(98)	1(12)	1(7)
No (little) intervention	Ingawa	3.7(113)	4(97)	2(13)	1(3)

Figures in brackets are number of observations (farms). **Source**: Field Survey 2008.

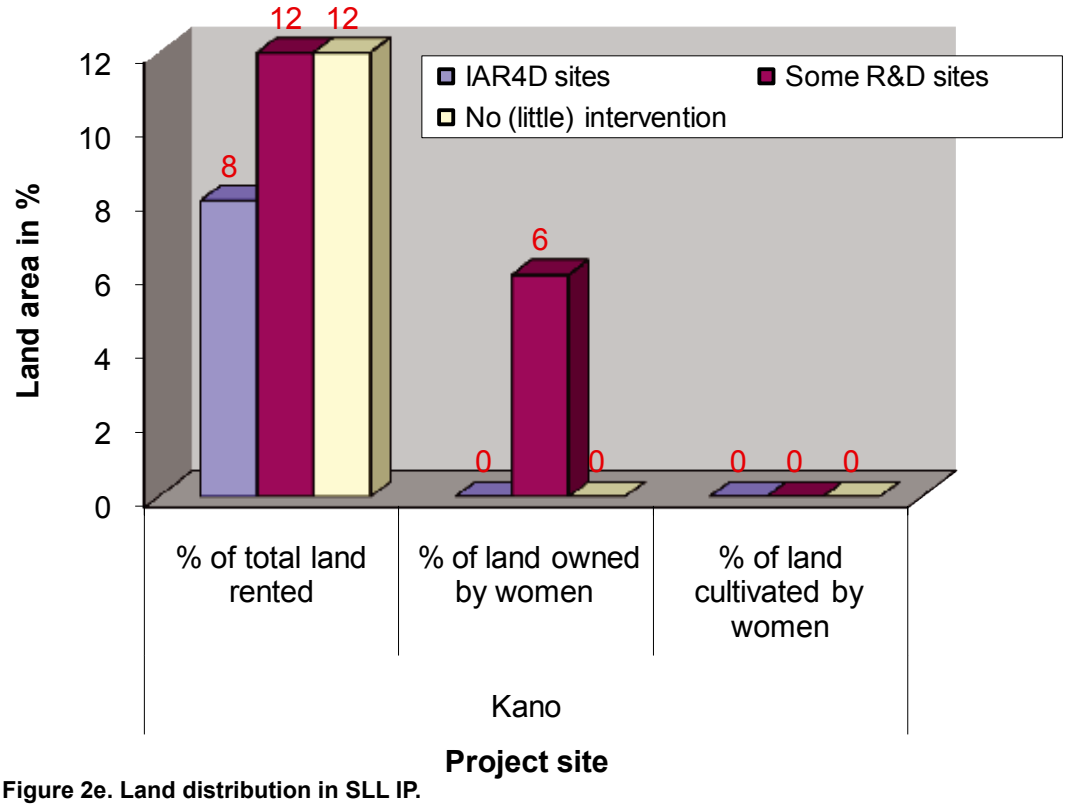

Figure 2e. Land distribution in SLL IP.

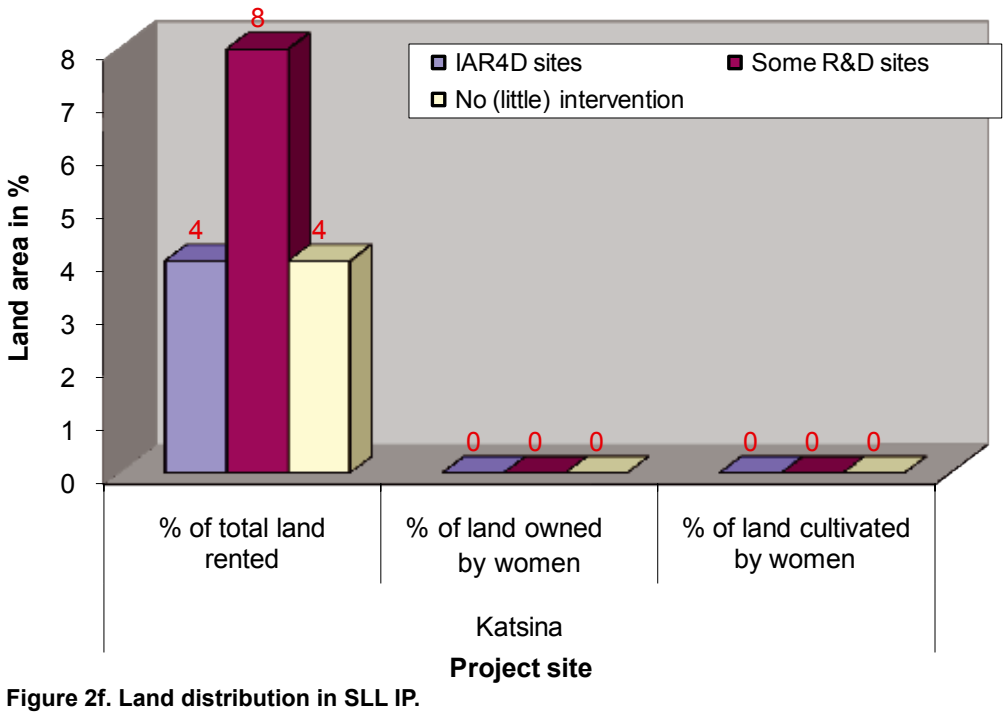

Figure 2f. Land distribution in SLL IP.

Distribution of farmers according to sources and smount of credit obtained for farming

Kano State MLL IP

The availability of credit to farm households is vital to agricultural production and it is an important factor in the adoption process. The distribution of households that obtained credit, the sources, and amount obtained were analyzed. The analysis showed that in all the IPs the farmers who borrowed did so mostly for agricultural purposes and obtained the money mainly from informal sources, relatives, and friends. The analysis showed that only 68% of the 34 respondents who had access to credit in the IAR4D maize–legume—livestock IP borrowed an average amount of ₦25 000, whereas in R&D, only 20% of households had access to credit and received about ₦16 000 and 12% of the farmers who had access to credit received ₦8500 on average in the IP.

Katsina State MLL IP

In Katsina State MLL IP, 64% of the farmers who had access to credit received about ₦30-000 on average, 46% received about ₦28-000 in R&D, and 40% in little or no intervention site received about ₦48-000 on average (Table 6).

Kano State SLL IP

In the same way, in the SLL IP of Kano State not all the households had access to credit (Table 7). Of all that had access to credit, the amount received on the average varied. Generally, those who had access to credit in Kano State under the SLL IP were more in number compared with their counterpart in the MLL IP. The amount received by an average household varied from about ₦31 000 in IAR4D; ₦61 000 in R&D to ₦103 000 in little or no intervention sites.

Katsina State SLL IP

In Katsina State, a smaller proportion of the households had access to credit compared with their counterparts in the MLL IP. Only 12% of the households that had access were able to receive an average of ₦8500. In the R&D and little or no intervention sites in Katsina State, 36% and 38% of the household that had access received about ₦46 000 and ₦48 000, respectively.

In all, the results showed that more farmers in the MLL IP in Katsina State had access to credit, but farmers in the SLL IP in Kano State obtained higher amounts of credit.

Table 6. Access to credit facilities (MLL IP).

Village	LGA	Percent that received credit	Average amount borrowed	Credit sources (major)	Purpose of borrowing (major)
Kano State					
IAR4D sites	Bunkure	68(34)	25 000(34)	Relatives & friends	Agric
Some R&D sites	Karaye	20(10)	16050(10)	Relatives & friends	Agric
No (little) intervention	Karaye	12(6)	85 000(6)	Bank/relatives & friends	Agric
Katsina State					
IAR4D sites	Musawa	64(32)	30 188(50)	Relatives & friends	Agric
Some R&D sites	Dan Musa	46(23)	28 874(23)	Relatives & friends	Agric
Little or no intervention	Dan Musa	40(20)	48 275(20)	Relatives & friends	Agric

Figures in brackets are number of respondents. **Source**: Field Survey 2008.

Table 7. Access to credit facilities (SLL IP).

Village	LGA	Percent that received credit	Average amount borrowed	Credit sources	Purpose of borrowing
Kano State					
IAR4D sites	Shanono	86(43)	31 279(43)	Relatives & friends	Agric
Some R &D sites	Dawakin Tofa	48(24)	60 958(24)	Relatives & friends	Agric
No (little) intervention	Dawakin Tofa	52(26)	102 538(26)	Relatives & friends	Agric
Katsina State					
IAR4D sites	Safana	12(6)	8500(6)	Money lender (local one)	Food/Agric
Some R &D sites	Ingawa	36(18)	45 722.22(18)	Relatives & friends	Agric
Little or no intervention	Ingawa	38(19)	48 315.79(19)	Relatives & friends	Agric

Figures in brackets are number of respondents,

Access to agricultural training and interaction by farmers

Agricultural training is a medium through which scientists, extension agents, and government educate farmers about innovation in order to encourage adoption of new technology, thereby increasing their productivity. Only very few farmers in both IPs had received agricultural training on crop management and pest and disease control from mainly ADPs, LGAs, and neighbors. Of those who received the training, some found the method good and somewhat useful, while some complained about the timeliness of the program. Most (79%) of the farmers preferred to make a request for training from their neighbors in the SLL IP, while 54% of requests were from the ADP. In essence, more farmers in the SLL IP requested for training than in the MLL IP. This is understandable since more farmers perceived the training as very useful and timely in the SLL IP. Access to and use of extension service was generally low in all the IPs irrespective of the sites. In the MLL IPs and SLL IPs, access to credit was only noticeable in the use of fertilizer, improved varieties, and pest and disease management with 24%, 24%, and 16%, respectively in IAR4D, R&D, and little or no intervention sites having contact with extension services.

The same pattern was recorded in SLL IP in the IAR4D sites with 30%, access as regards the use of fertilizer, 30% for improved varieties, and 24% for pest and disease management (Tables 3 and 4 in the Appendix).

In addition Tables 8 and 9 show the most recent interaction by farmers in the MLL IP. The tables reveal that information exchange, business transactions, material, and money exchange were the type of interactions respondents engaged in, with highest frequency of interaction for all sites in Kano State being information exchange. However, for sites in Katsina State, they varied among the aforementioned types of interactions; this was the same for all sites in the SLL IP.

Table 8. Most recent interaction by respondents in MLL IP.

Kano State	Type of interaction	Distance to interactor	Frequency of interaction	Main perception on interaction	Role of interactor
IAR4D sites	Information exchange	1.8	Weekly (45)	Moderate (51)	Farmer
(Bunkure)	Business transaction	3.7	Daily (16)	Moderate (15)	Community leader (13)
	Material exchange	4.7	Daily (6)	Moderate (5)	Group leader (6)
	Money exchange	2.9	Monthly (4)	Moderate (6)	Group leader
Some R&D sites	Information exchange	1.5	Daily (20)	Moderate (24)	Farmer (30)
(Karaye)	Business transaction	1.1	Daily (5)	Very strong (5)	Farmer (7)
	Material exchange	1	Daily (1)	Very strong (5)	Group leader (1)
	Money exchange	1	Daily (1)	Moderate (30)	Farmer (8)
No (little)	Information exchange	0.8	Daily (43)	Moderate	Farmer (1)
intervention	Business transaction	13.7	Annually (3)	Strong (3)	Other s(1)
(Karaye)	Material exchange	0.0	Monthly (3)	Moderate (3)	Farmer (37)
	Money exchange	0.5	Weekly (1)	Strong (1)	others
Katsina State					
IAR4D sites	Information exchange	0.8	Daily (22)	Moderate (28)	Farmer (40)
(Musawa)	Business transaction	3.6	Weekly (25)	Moderate (32)	Farmer/trader (40)
	Material exchange	2.4	Monthly (6)	Moderate (13)	Farmer/trader (13)
	Money exchange	1.5	Monthly (2)	Moderate (2)	Farmer/group leader
Some R&D sites	Information exchange	1.7	Monthly (23)	Moderate (22)	Farmer (45)
(Ingawa)	Business transaction	2.0	Weekly (15)	Moderate (18)	Farmer (20)
	Material exchange	0.7	Monthly (4)	Moderate (2)	Farmer/trader (4)
No/little intervention (Ingawa)	Information exchange	1.2	Monthly (21)	Moderate (42)	Farmer/extension (43.5)

Figures in brackets are number of respondents.

Figure 3a and 3b show the kind of interaction that the farmer had been having in the maize–legume–livestock IP and sorghum–legume–livestock IP of Kano and Katsina states. The result indicated that except in Safana LGA, an IAR4D site of Katsina State where about 80% of the households have interaction in money exchange, the major kind of interaction in the two IPs was on information exchange which involved not less than 62% of the households.

Table 9. Most recent interaction by respondents in the SLL IP.

Kano State	Type of interaction	Distance to interactor	Frequency of interaction	Main perception on interaction	Role of interactor
IAR4D sites	Information exchange	8.2	Daily (27)	Strong (21)	Farmers (37)
	Business transaction	4.3	Daily (19)	Strong (13)	Others
(Shanono)	Material exchange	1	Weekly (1)	Moderate (3)	Farmer (1)
	Money exchange	1.5	Daily (23)	Moderate (3)	Farmers (39)
Some R&D sites	Information exchange	1.1	Daily (6)	Strong (80)	Farmers (17)
(Dawakin)	Material exchange	1	Monthly (4)	Very strong (6)	Traders (4)
	Money exchange	0.82	Daily (32)	Moderate(31)	Farmers (30)
No (little) intervention	Information exchange	13.7	Daily (12)	Strong(12)	Farmers (3)
(Dawakin)	Business transaction	0.0	Monthly (1)	Very strong	Extension (6)
	Material exchange	0.5	Monthly (6)	Very strong	Traders (6)
Katsina State					
IAR4D sites (Safana)	Information exchange	0.0	Annually (1)	Weak (1)	Farmer (1)
	Business transaction	1.5	Daily (37)	Strong (3)	Traders (4)
Some R&D sites	Information exchange	0.3	Daily (1)	Moderate (29)	NA
(Dan Musa)	Money exchange	1.0	Daily (1)	Moderate (1)	NA
No/little intervention	Information exchange	0.5	Weekly (42)	Moderate (32)	NA
(Dan Musa)	Business transaction	2.0	Weekly (1)	Moderate (1)	NA
	Material exchange				NA
	Money exchange	0.8	Monthly (2)	Strong (2)	NA

Figures in brackets are number of respondents.

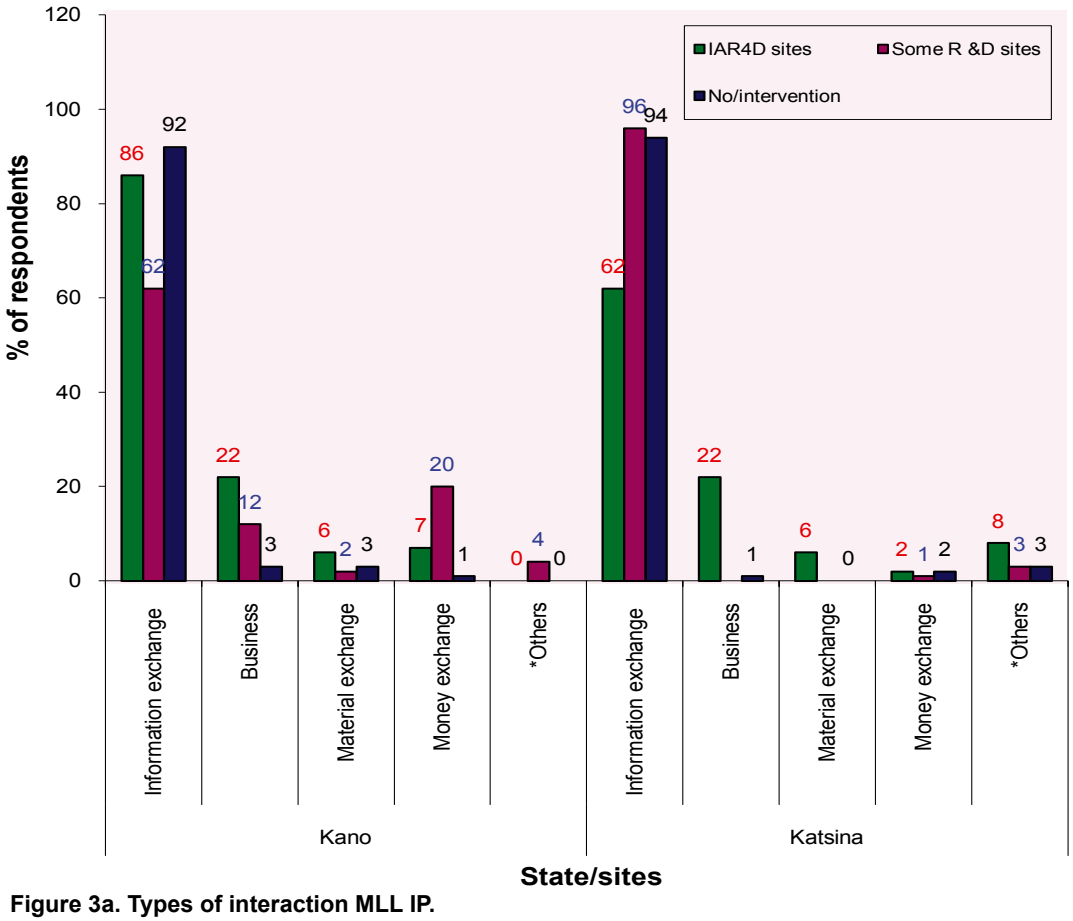

Figure 3a. Types of interaction MLL IP.

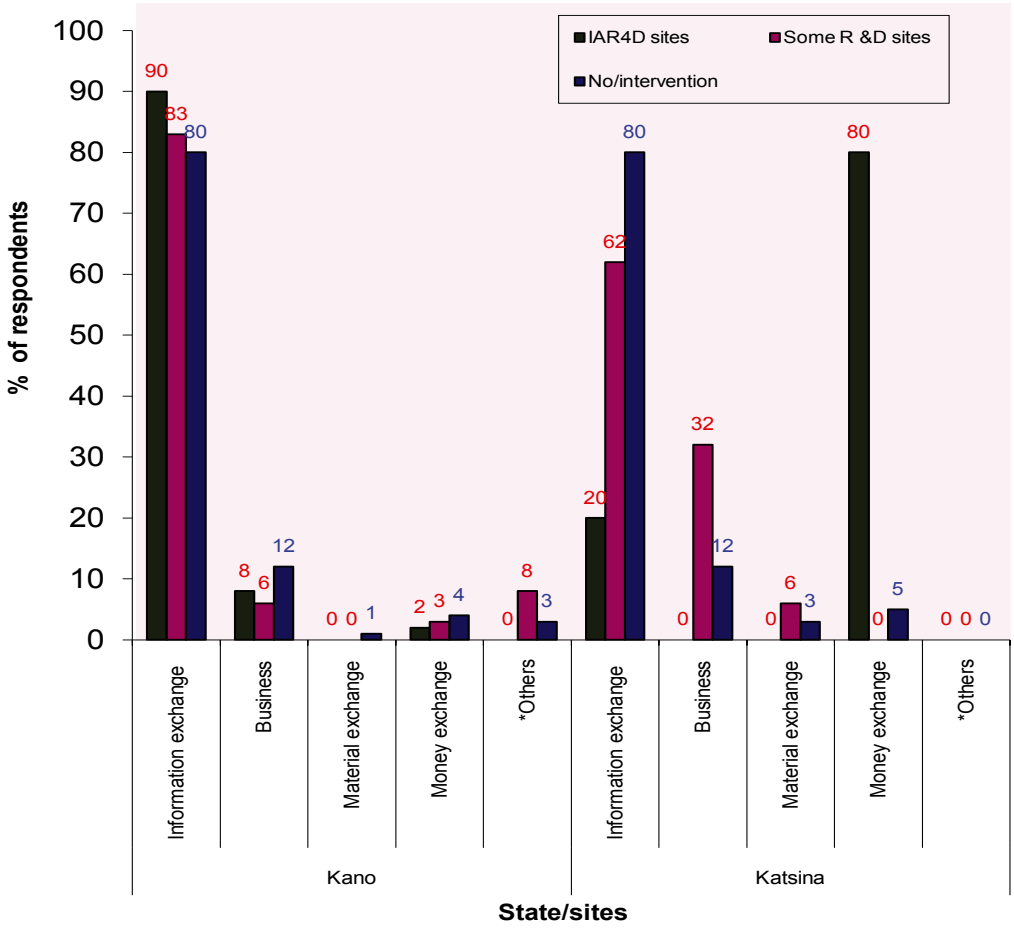

Figure 3b. Types of interaction.

Access to and use of extension services

Access to and use of extension services is vital to the adoption of agricultural innovations. In this study the distribution of farmers that visited extension agency for help and the frequency of visits were obtained and analyzed.

MLL IP in Kano and Katsina states

Most recent interactions made by respondents were in the area of information exchange and business transactions (Table 8). Farmers in the MLL IP in IAR4D sites of Kano State and all the sites in Katsina State perceived the interaction they had on all these factors to be moderate. However, farmers in R&D sites of Kano State perceived interactions on business transaction and material exchange to be very strong.

SLL IP in Kano and Katsina states

In the SLL IP, farmers in IAR4D sites perceived that interactions on information exchange and business transactions were strong while in other factors they were moderate in Kano State (Table 9). In R&D sites of this IP, interaction on information and material exchange was strong whereas all interactions in little or no intervention sites on all the factors were strong in Kano State. With the exception of interaction on information exchange that was weak in IAR4D sites in Katsina State of the SLL IP, all other interactions with respect to other factors were perceived by the farmers to be moderate. On a general note, IAR4D villages have more interaction with extension agents, traders, and policymakers than others.

Distribution of farmers according to membership of farmers' association

Membership of the farmers' association provides a forum for dissemination of information and cross-fertilization of ideas on agricultural innovation. It could also facilitate the procurement of agricultural inputs and marketing of agricultural outputs. In the two IPs, membership of the farmer organization was generally low; the few who joined the farmer organization were principally men in the IAR4D and R&D sites in Kano and Katsina and they joined for production purposes. Some mentioned the benefits derivable from this activity as being beneficial to their economic well-being (Tables 10 and 11).

Farmer participation in research activities

In order to ascertain the level of farmers' participation in research activities, farmers involvement in the development of new technology research activities, usefulness of the research, and roles played were analyzed.

The analysis showed that farmers had not been carried along in the research and development of new technology in all the IPs and sites. Research, technology transfer, and technology used have been treated as independent activities whereby research-derived knowledge consisting of large prescriptive technology packages flows inwardly from researcher to farmer through extension agents (Table 12).

Table 10. Membership of farmer association (MLL IP).

	Kano State				Katsina State			
	Women group	Men group	Mixed group	Cooperative	Women group	Men group	Mixed group	Cooperative
IAR4D sites								
Membership (%)	NA	8	4	NA	4	4	NA	NA
Years of membership (average)	NA	11	8	NA	3	4	NA	NA
R&D sites								
Membership (%)	NA	28	12	NA	NA	28	4	NA
Years of membership (average)	NA	NA	NA	NA	4	6	3	NA
Little or no intervention sites								
Membership (%)	4	40	NA	NA	NA	16	4	NA
Years of membership (average)	5	7	NA	NA	NA	10	6	NA

NA = No response**. Source**: Field Survey 2008.

Table 11. Membership of farmer association (SLL IP).

	Kano State				Katsina State			
	Women group	Men group	Mixed group	Cooperative	Women group	Men group	Mixed group	Cooperative
IAR4D sites								
Membership (%)	4	76	12	4	4	12	4	NA
Years of membership (average)	4	6	5	30	6	5	11	NA
R&D sites								
Membership (%)	NA	28	4	8	NA	8	NA	NA
Years of membership (average)	4	8	6	3	NA	2.5	NA	NA
Little or no intervention sites								
Membership (%)	NA	40	NA	10	NA	16	4	NA
Years of membership (average)	NA	4	10	3	NA	7	13	NA

NA = No respons. **Source**: Field Survey 2008.

Table 12. Distribution of farmers by participation in research activities (%).

	MLL IP	SLL IP
Kano State		
IAR4D	8	32
R&D	NA	32
Little or no intervention	NA	40
Katsina State		
IAR4D %	4	NA
R&D %	NA	NA
Little or no Intervention	NA	16

NA = No response. **Source**: Field Survey 2008.

Table 13. Distribution of farmers by household labor availability (MLL IP).

Village	LGA	Number of HH members ≥16	Average family labor (man hour) available per day	Percent of HH that hired labor (N = 50)
Kano State				
IAR4D sites	Bunkure	7	10	64
Some R&D sites	Karaye	8	11	62
No (little) intervention	Karaye	7	11	64
Katsina State				
IAR4D sites	Musawa	7	10	52
Some R&D sites	Dan musa	7	11	32
Little or no intervention	Dan musa	7	10	46

Figures in brackets are total number of respondents; HH = household. **Source**: Field Survey 2008.

Table 14. Distribution of farmers by household labor availability (SLL IP).

Village	LGA	No. HH members ≥16	Average family labor (person-hour) available per day	Percent of HH that hired labor (N = 50)
Kano State				
IAR4D sites	Shanono	9	13	72
Some R&D sites	D/Tofa	8	13	76
No (little) intervention	D/Tofa	7	14	96
Katsina State				
IAR4D sites	Safana	7	9	48
Some R&D sites	Ingawa	6	9	60
No (little) intervention	Ingawa	6	9	48

Figures in brackets are total number of respondents; HH = household,. **Source**: Field Survey 2008.

As a way of determining the intensity of flow of information among the farmers, levels of interaction among farmers were analyzed. The specific areas considered included whether farmers participated in community development activities, made financial contributions to community activities or collective problems, visited other farms within the community to learn about agriculture, and visited research stations or extension agents to learn about agriculture. The analysis showed that in Kano State MLL IP farmers have been having some degree of interaction with other farmers and farmer groups but the occurrence had been average or below. However, in Katsina State with the exception of IAR4D sites, the interaction had been very low; a similar result was recorded in the SLL IP in both Kano and Katsina states (Table 5 and 6 in the Appendix).

Household labor availability

Since agricultural production in the project area had not been mechanized, farmers still depended on either family or hired labor for farming activities; based on this, household labor availability in the study area was analyzed. The result of the analysis showed that in both IPs farmers used hired labor. However the proportion that used hired labor in Kano State (> 62%) was more than those who used them in Katsina State (< 60) in all the sites. All the farmers in the two IPs had a sizeable proportion of their households aged 16 years and above. This suggests the availability of members of their households as a source of labor on the farm (Tables 13 and 14).

Table 15. Average area and yield of major crops of the respondents (MLL IP).

Kano State/LGA	Cereals						Legumes			
	Maize		Sorghum		Millet		Cowpea		G/nut	
	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)
IAR4D sites	1.4	1070	2.1	908	1.6	797	1.3	394	1.1	698
Some R&D sites	1.1	1108	4.5	847	2.5	631	3.9	561	1.4	752
No (little) intervention	1.8	915	2.4	896	1.4	648	3	397	1.7	670
Katsina State										
IAR4D sites	1.4	1310	1.3	916	1.4	878	1.6	384	1.4	730
Some R&D sites	0.8	1558	2.3	908	2.1	757	0.8	394	1.2	678
No (little) intervention	3.6	1134	2.2	872	2.2	683	3.9	325	1.2	663

Figures in brackets are number of respondents. **Source**: Field Survey 2008.

Table 16. Average area and yield of major crops of the respondents (SLL IP).

Kano State/LGA	Cereals						Legumes			
	Maize		Sorghum		Millet		Cowpea		G/nut	
	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)	Area (Ha)	Yield (kg/ha)
IAR4D sites	1.8	948	2.3	852	1.7	822	1.6	422	1.4	760
Some R&D sites	1.8	1156	1.6	796	1.1	725	1.4	356	1.1	698
No (little) intervention	2.1	1216	2.0	780	1.2	646	1.5	368	0.9	691
Katsina State										
IAR4D sites	0.6	957	0.9	1607	0.7	882	0.3	423	1.2	731
Some R&D sites	1.5	926	1.9	791	2.0	604	2.0	363	1.0	689
No (little) intervention	1.5	838	1.9	794	2.7	460	1.7	310	1.0	673

Figures in brackets are number of respondents. **Source**: Field Survey 2008.

Household priority crops

The type of crops that farm households grow predominantly may be an indication of the perception of the value or importance of various crops to household livelihood strategies. It may even suggest the kinds of crops best suited to a particular farming soil and climatic condition. Hence, in this study, households were asked to indicate their priority crops. An analysis of the data provided showed the following: household priority crops in the two states included maize, sorghum, millet, cowpea, and groundnut. The average yield of these crops in IAR4D site were about 1070 kg/ha, 908 kg/ha, 797 kg/ha, 394 kg/ha, and 698 kg/ha, respectively in the maize-legume-livestock IP of Kano State while that of Katsina State were about 1310 kg/ha, 916 kg/ha, 878 kg/ha, 384 kg/ha, and 730 kg/ha, respectively. On the other hand, in the R&D site of Kano State, the yields were 1108 kg/ha, 847 kg/ha, 631 kg/ha, 561 kg/ha and 752 kg/ha respectively while they were 1558 kg/ha, 908 kg/ha, 757 kg/ha, 394 kg/ha and 678 kg/ha respectively in Katsina State. However, in little or no intervention site the yields were about 915 kg/ha, 896 kg/ha, 648 kg/ha, 397 kg/ha, and 670 kg/ha, respectively in Kano State and 1134 kg/ha, 872 kg/ha, 683 kg/ha, 325 kg/ha, and 663 kg/ha, respectively in Katsina State. This indicates that in Kano State, R&D sites produced the highest yield in maize and IAR4D sites produced the highest yield in sorghum. In Katsina State, R&D sites produced the highest yield in maize and IAR4D sites produced the highest yield in sorghum and millet. However, in legumes, R&D produced the highest yields in cowpea and groundnut (Table 15). In the sorghum–legume–livestock IP, little or no intervention site produced the highest yields in maize while IAR4D sites produced the highest yields in millet and groundnut in Kano State. In Katsina State, highest yields in all the crops were produced in IAR4D sites (Table 16).

4. Crop and livestock production systems

This section examines awareness and adoption of major crops, access to farm inputs, crop output marketing, and gross margin analysis of priority crops.

Awareness and adoption of technology

Farmers' level of awareness and state of adoption of available technology in the study areas were investigated. The technology considered include those of soil and water management, crop protection, crop management practices, pos harvest technology, and improved breeds of livestock as shown in the Appendix (Tables 11 and 12), and improved crop varieties as in Table 17. Soil and water management technology were mulching, water harvesting, trenches, irrigation, and conservation. The technologies involved in the crop protection were fungicide use, herbicide use, insecticide use in the fields, insecticide use for storage, botanical pesticide, and other disease and pest control. Practices considered under crop management included row planting, planting density, thinning, inorganic fertilizer usage (NPK, N [urea], DAP, SSP), animal manure use, composting storage resolve use, legume–cereal rotation, and method of fertilizer application.

The analysis in the Appendix (Tables 11 and 12) indicated that 100%, 69%, and 4% of the farmers in IAR4D, R&D, and little or no intervention sites, respectively, had an awareness of soil and water management technologies in Kano State, however, 92%, 22%, and 1% had adopted them in IAR4D, R&D, and little or no intervention sites. In Katsina State, the levels of awareness were 75%, 98%, and 95% while the levels of adoption were 22%, 69%, and 93%, respectively.

As regards crop protection innovations in Kano State, 65%, 52%, and 14% were aware while 54%, 32%, and 14% adopted in IAR4D, R&D, and little or no intervention sites, respectively. This indicated that only a few farmers had adopted the technologies in little or no intervention sites in Kano State, but, in Katsina State, 28%, 63%, and 98% had adopted the technologies, respectively. With the exception of IAR4D sites in Katsina State, not less than 60% of the households had adopted crop management technologies.

Livestock feeding demonstration in a project village.

Table 17. Awareness and adoption of improved crop varieties (%).

	IAR4D sites			Some R&D sites			Little or no intervention sites		
Improve crop variety	Awareness	Adoption before 2007/08	Adopted 2007/08	Awareness	Adoption before 2007/08	Adopted 2007/08	Awareness	Adoption before 2007/08	Adopted 2007/08
Kano MLL IP									
N	50	50	50	50	50	50	50	50	50
Cowpea	46	46	46	0	0	0	46	38	2
Groundnut	32	32	32	0	0	0	52	44	0
Maize	38	38	38	30	30	30	76	70	24
Millet	24	24	24	2	0	0	2	0	0
Rice	16	16	16	0	0	0	0	0	0
Sorghum	36	36	34	2	0	0	54	46	0
Soybean	2	2	2	6	4	6	2	2	2
Katsina MLL IP									
Cowpea	26	0	0	16	12	10	8	2	2
Groundnut	10	8	8	10	4	4	12	6	6
Maize	82	30	24	8	8	8	22	20	20
Millet	52	20	14	28	20	18	24	14	12
Rice	6	0	0	4	8	4	0	0	0
Sorghum	26	2	2	20	12	12	20	10	10
Soybean	18	10	10	4	2	4	0	0	0
Kano SLL IP									
Cowpea	42	42	40	40	36	32	46	42	42
Groundnut	30	30	32	18	16	16	4	4	4
Maize	52	52	48	60	54	54	58	54	50
Millet	36	36	38	28	24	24	32	28	26
Rice	8	8	8	2	2	2	4	4	4
Sorghum	42	42	44	10	8	6	4	2	2
Soybean	6	6	6	0	0	0	0	0	0
Katsina SLL IP									
Cowpea	18	18	18	22	22	2	34	30	12
Groundnut	0	0	0	14	10	0	26	18	4
Maize	36	36	36	6	4	4	10	6	6
Millet	2	2	2	30	20	12	40	28	14
Rice	0	0	0	0	0	0	0	0	0
Sorghum	0	0	0	20	20	0	32	28	6
Soybean	0	0	0	0	0	0	0	0	0

The level of adoption of postharvest technologies was more than 50% in all the sites in Kano and Katsina State in MLL IP except IAR4D sites in Katsina State where the level of adoption was 44%. The same trend was recorded in improved breed of livestock adoption. Generally, a sizeable proportion of farmers had awareness of all the technologies in the MLL IP.

Awareness and adoption of improved crop varieties of cereals and legumes were investigated and the result is shown in Table 17. In Kano and Katsina state MLL IPs, cowpea had the highest adoption rate in the IAR4D site; in Kano State SLL IP, maize had the highest awareness and adoption rates in R&D sites both before 2007/08 and at the 2007/08 seasons. The result was similar for adoption in Katsina State except that it was in the IAR4D site, while awareness was highest for millet in little/no intervention site.

Determinants of adoption

Factors that influenced the adoption of improved agricultural technologies such as improved crop varieties, improved maize and cowpea, and improved livestock technologies were determined using logistic regression model. The model with dependent variable (Y) and the vector of independent variables and the outcome of the analysis are described and explained here.

The Logistic Regression Model is shown as

$\ln[p/(1-p)] = a + bX + e$ ----------1

- p is the probability that the event Y occurs, or where P = the probability of an ith household being adopter of improved agricultural technologies, X is the vector of explanatory variables in equations (1–3) and is
- p(Y = 1)
- p/(1–p) is the “odds ratio”
- ln[p/(1–p)] is the log odds ratio, or “logit”

Since:

$\ln[p/(1–p)] = a + bX + e$

The slope coefficient (b) is interpreted as the rate of change in the "log odds" as X changes, though not very useful.

Table 18a. Variables on determinants of adoption of improved agricultural technology.

Variable	Description	A priori signs	Variable	Description	A priori signs
Y	Adoption of improved technology: 1=adopted; 0=otherwise				
LGA	1=Intervention local government; 0=non-intervention local government	±	TOTALREV	total income of the farmers	+
GENDER	1=male; 0=female	±	COWAREA	area of cowpea planted	+
HEADAGE	age of household head inyears	±	INSECTIC	Cost insecticide used on cowpea	–
HEADEDU	education of househead: 1=formal education; 0=? 0=no formal education	+	TPREPCOS	other variable cost	–
HHSIZE	household size	±	TLABCOST	total labour cost	–
DURATION	farm experience in years	+	CREDIT	amount of credit in Naira	+
AWARENES	awareness of improved agricultural technologies(crop)	+	TOTALAND	total land area	+
INPUTMKT	distance to input market	–	AWARENE0	awareness of improved agricultural technologies(livestock)	+
OUTPUTMKT	distance to output market	–	NON_FMIN	non-farm income in Naira	+
BORROWED	access to credit: 1=yes; 0=no	+	FERTILIZ	quantity of fertilizer used in kg	+
AGRIEXT	visited by agric extension agent: 1=yes; 0=no	+	ANIMALMA	animal manure in kg	+
FEXTENSION	frequency of extension visits	+			

Since:

p = 1/[1 + exp(–a –b X)] ----------2

The marginal effect of a change in X on the probability is: Mp/MX = f(b X) b

- An interpretation of the logit coefficient which is usually more intuitive is the “odds ratio”
- Since:

  [p/(1–p)] = exp(a + b*X*)----------3

exp (b) is the effect of the independent variable on the "odds ratio"

Our X –vector of independent variables in this model is stated below:

Table 18b shows the result of logistic regression analysis on determinants of adoption of improved agricultural technologies. Improved crop varieties were maize and cowpea, and livestock. Except for maize the overall results were significant as revealed by the respective Chi-square.

Under general crop analysis, factors that influence adoption were LGA, HHSIZE, INPUTMKT, OUTPUTMKT, FEXTENSION, NON FMIH, and CREDIT. As indicated by the coefficient of LGA, farmers in non-intervention sites favored the adoption of improved crop varieties more than those in intervention sites. But, as household size and awareness increased, the tendency to adopt new varieties increased. The result revealed that distance to input and output markets did not affect probability of adoption negatively, as the signs to them came

Table 18b. Logistic regression on determinants of adoption of improved crop

Crop (General)		Maize		Cowpea		Live-Stock	
Variable	Coefficient	Variable	Coefficient	Variable	Coefficient	Variable	Coefficient
CONSTANT	–2.59*	Constant	–1.18*	CONSTANT	–2.03*	CONSTANT	0.10
LGA	–1.79**	LGA	0.07***	LGA	–2.23**	LGA	–0.10**
GENDER	–0.40	GENDER	0.43	GENDER	0.18	GENDER	0.03
HEADAGE	0.001	HEADAGE	–0.004***	HEADAGE	0.22	HEADAGE	0.002
HEADEDU	0.12	HEADEDU	–0.287	HEADEDU	–0.12	HEADEDU	0.001
HHSIZE	0.00*	HHSIZE	0.000	HHSIZE	0.30	HHSIZE	0.001**
DURATION	0.001	DURATION	0.001	DURATION	–0.13**	TOTALAND	0.001**
TOTALAND	0.001	TOTALAND	0.0001	AWARENES	0.90***	AWARENE0	0.80*
AWARENES	4.50*	AWARENES	0.002	INPUTMKT	–0.90	INPUTMKT	0.001
INPUTMKT	0.001***	INPUTMKT	0.001	OUTPUTMKT	–0.68	BORROWED	0.02
OUTPUTMKT	0.0024***	OUTPUTMKT	0.002	BORROWED	0.78	AGRIEXT	-0.07
BORROWED	0.24	BORROWED	0.15	AGRIEXT	0.80***	FEXTENSION	0.003
AGRIEXT	–0.67	AGRIEXT	0.30	FEXTENSION	–0.21	NON_FMIN	0.001***
FEXTENSION	0.47***	FEXTENSION	0.03	TOTALREV	–0.45	TLABCOST	0.00***
NON_FMIN	0.002*	NON_FMIN	0.0001	COWAREA	0.47	CREDIT	0.002
FERTILIZ	0.001	TOTALREV	0.0001	INSECTIC	–0.35***		
ANIMALMA	0.003	FERTILIZ	0.0002	TPREPCOS	0.51		
TPREPCOS	0.002	TPREPCOS	0.0001***	TLABCOST	–0.67		
TLABCOST	0.001	TLABCOST	0.0003	CREDIT	–0.97		
CREDIT	0.001***	CREDIT	0.0002				
Test statistics		**Test statistics**		**Test statistics**		**Test statistics**	
Log likelihood function	–66.7	Log likelihood function	–332	Log likelihood function	–77.91	Log likelihood function	–42.5
Restricted log likelihood	–145	Restricted log likelihood	–342	Restricted log likelihood	–93.17	Restricted log likelihood	–131
Chi-squared	156.9	Chi-squared	18.45	Chi-squared	30.52	Chi-squared	178
Degrees of freedom	19	Degrees of freedom	20	Degrees of freedom	18.00	Degrees of freedom	14
Significance level	0.001	Significance level	0.558	Significance level	0.03	Significance level	0.001

variety/livestock technology.

Note: *= significant @ 1% level; **= significant @ 5% level; ***= significant @ 10% level.

out positively; this may be because the farmer knew both markets were far away and they normally covered the distances frequently in the course of providing for their livelihoods. However, frequency of extension visit, non-farm income, and amount of credit secured tended to affect crop adoption positively.

In considering determinants of adoption of improved maize varieties, only LGA, HEADAGE, and TPREPCOS were significant variables. Farmers in intervention sites were more favorably disposed to adopting new maize varieties compared to those in non-intervention sites. Also, in line with a *priori* expectation, as farmers grew older, the tendency to adopt new maize varieties decreased; but increases in other costs of production did not affect adoption negatively as farmers considered maize production a necessity to the sustenance of their livelihoods.

For the adoption of improved cowpea, LGA, DURATION, AWARENES AGRIEXT, and INSECTIC were the significant variables affecting farmers' adoption decisions. Farmers in non-intervention sites favored the adoption of improved cowpea more than those in intervention sites. The results showed that long years of farming experience might not necessarily encourage adoption as inexperienced farmers tended to adopt improved varieties more than experienced ones. Visits by extension agents (AGRIEXT) encouraged adoption of the crop. As expected, costs of insecticide (INSECTIC) affected cowpea adoption negatively; the higher the cost, the less the probability of adoption of improved cowpea by farmers.

In the adoption of livestock technologies (e.g., improved breeds, drugs, supplementary feeds etc.) the significant factors included LGA, HHSIZE, TOTALLAND, AWARENEO, NO-FMIN, and TLABCOST.
The results indicated that farmers in non-intervention sites favored adoption more than those in intervention sites. Household size, awareness and availability of land for grazing, and non-farm income encouraged farmers' adoption decisions while labor costs did not discourage adoption of improved livestock technologies.

Major cropping systems

Major cropping systems practiced by the households were analyzed. Figures 4a and 4b present the major cropping systems practiced by farmers in the MLL IP and SLL IP.

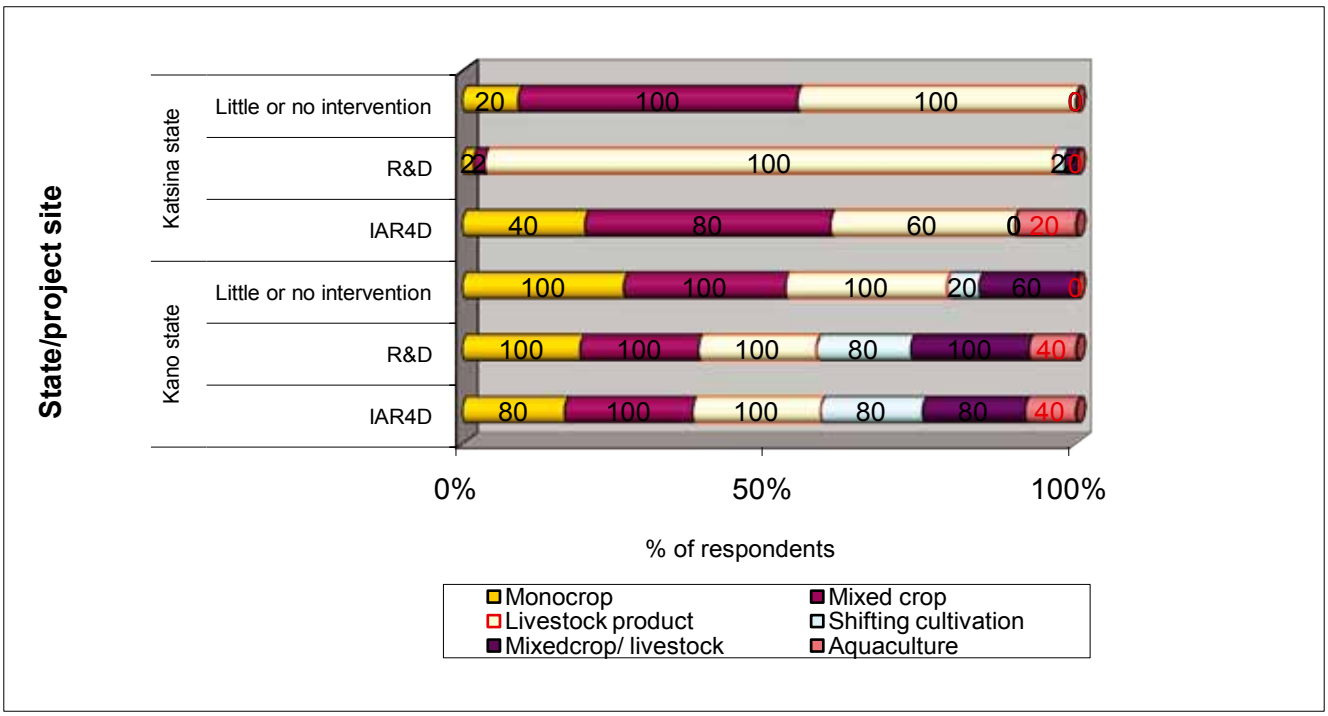

Figure 4a. Presents the distribution of farmers by major cropping systems in MLL IP.

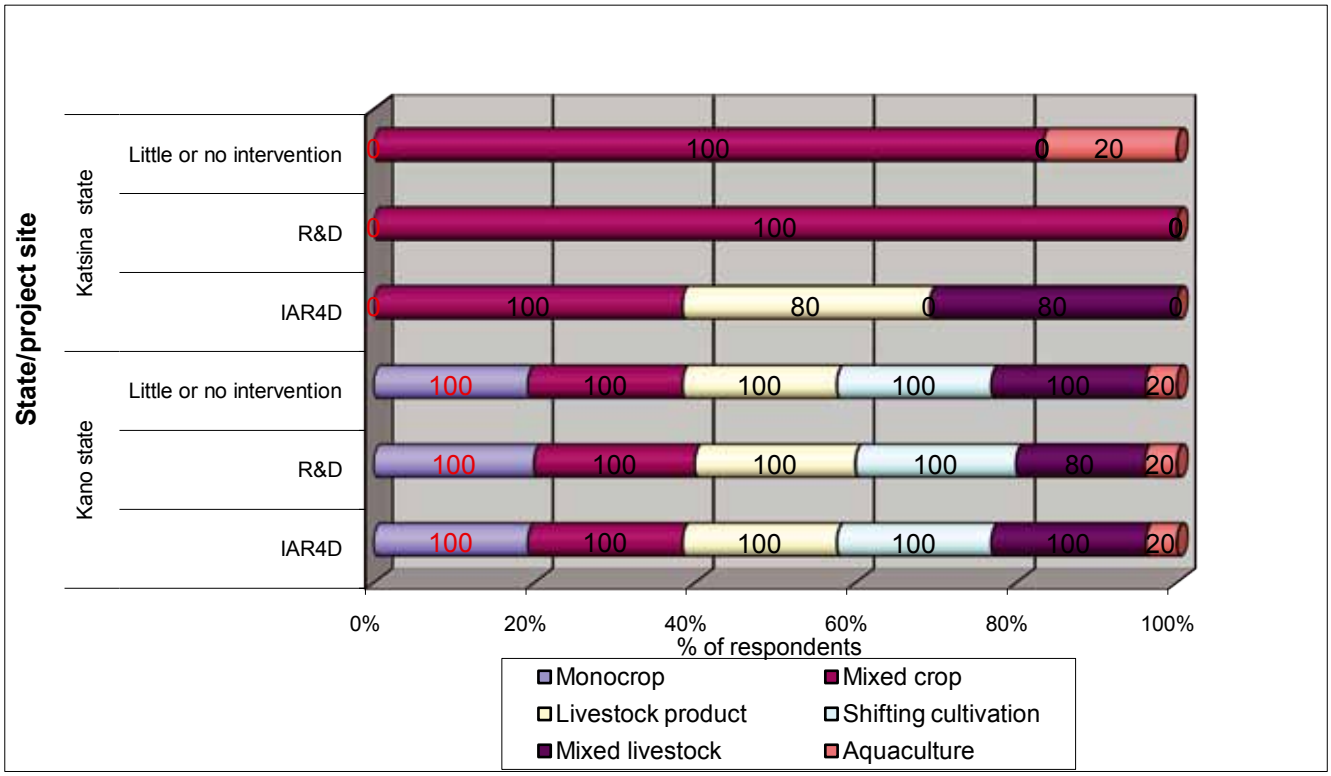

Figure 4b. Presents the distribution of farmers by major cropping systems in SLL LP.

According to the table, not less than 80% of the households practiced monocropping in all the sites in Kano State, but, monocropping was not popular in Katsina State. Mixed cropping was popular in Katsina and Kano states with the exception of the R&D sites in Katsina where 2% of the households undertook mixed cropping activities. The proportion of farmers involved in livestock keeping was significantly high as all the farmers in the IP partook in livestock production with the exception of IAR4D sites in Katsina where just 60% households were involved. However, shifting cultivation was only popular in IAR4D and R&D sites of Kano State (80% of households were involved). Mixed livestock activities were also common in Kano State of the IP as 80%, 100%, and 60% of the households in IAR4D, R&D, and little or no intervention sites, respectively, practiced in the system.

The analysis indicated that nearly all the farmers in IAR4D, R&D, and little or no intervention sites in Kano State practiced monocropping, mixed cropping, livestock production, and shifting cultivation as no less than 80% of the households were involved. In Katsina State, monocropping, livestock production, and mixed livestock production were only common in IAR4D sites. But all the farmers in R&D and little or no intervention sites practiced mixed cropping.

Crop distribution among cropping system

Table 19a (also Figures 5a and 5b) and 19b (Figures 5c and 5d) show crop distribution among cropping system of household in the maize–legume–livestock IP and sorghum–legume–livestock IP of Kano and Katsina states.

The result indicated that sorghum, cowpea, groundnut, maize, and millet were the main crops grown in IAR4D sites of Kano State in the maize–legume–livestock IP, while, cowpea, maize, and sorghum were the main crops in R&D sites of the state. However, in no or little intervention sites of the state, cotton, maize, and sorghum were the main crops grown. In Katsina State of the maize–legume–livestock IP, the main crops that farmers grew was groundnut, maize, millet, and sorghum in IAR4D sites, and groundnut, millet, and sorghum in R&D and little or no intervention sites.

Table 19a. Crop distribution among cropping system of the respondents (%) MLL IP.

Crop	Kano			Katsina		
	IR4D-Bunkure	Some R &D sites Karaye	Little or no intervention Karaye	IR4D-Musawa	Some R &D sites Dan Musa	Little or no intervention Dan Musa
N	50	50	50	50	50	50
Bambara	2	0	0	0	0	0
Cassava	32	0	0	2	0	4
Cotton	4	18	54	30	10	18
Cowpea	88	50	28	20	32	18
Groundnut	68	38	44	56	68	80
Maize	90	80	92	92	32	26
Melon	2	0	0	0	0	0
Millet	66	32	34	92	86	80
Okro	14	0	0	0	0	0
Onion	2	10	0	0	0	2
Pepper	12	6	0	0	8	2
Rice	44	20	8	6	8	8
Sorghum	96	72	70	64	96	88
Soybean	6	8	10	16	6	0
Tomatoes	24	12	0	0	4	4
Mango	0	0	0	12	0	0
Orange	0	0	0	4	0	0
Watermelon	3	0	0	0	0	2

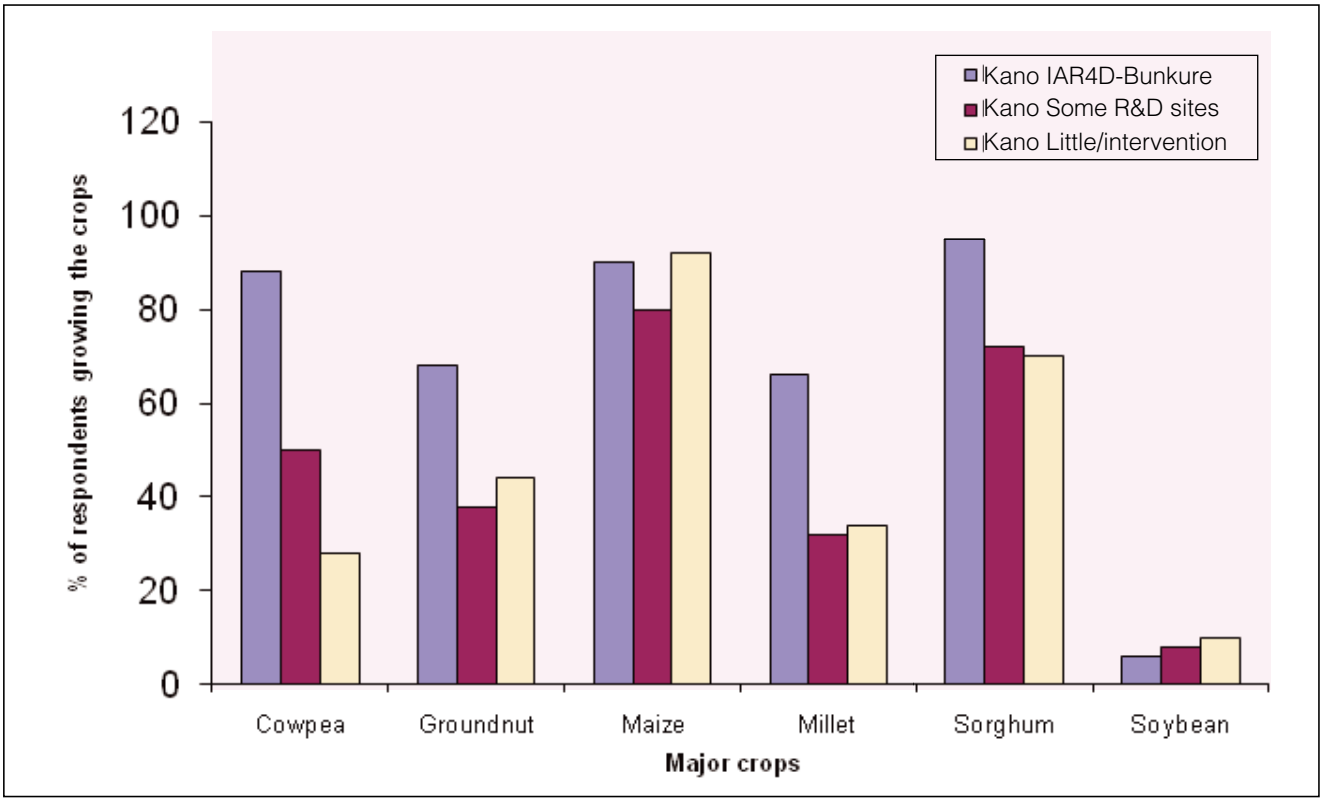

Figure 5a. Distribution of Major Crops In Kano State MLL IP.

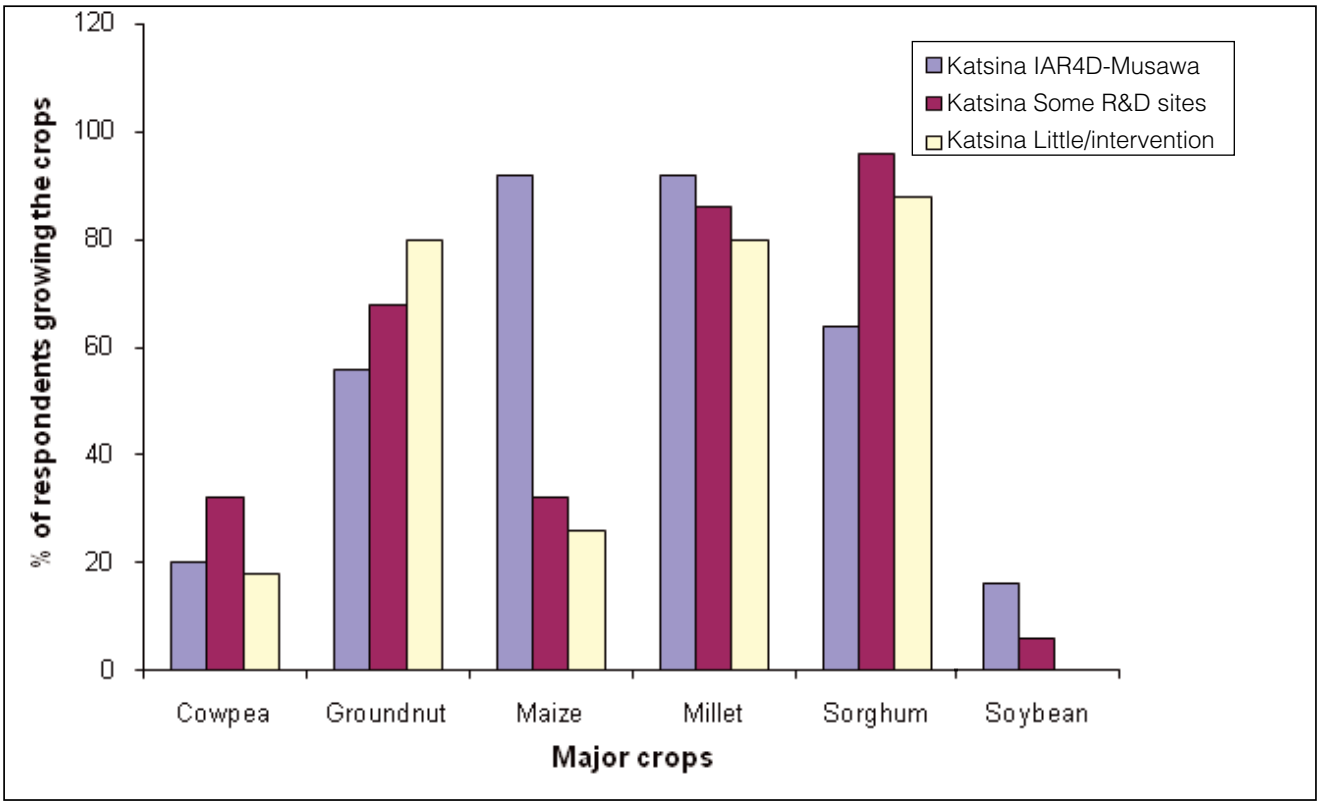

Figure 5b. Distribution of Major Crops In Katsina State MLL IP.

Table 19b. Crop distribution among cropping system of the respondents (%) SLL IP.

Crop	Kano			Katsina		
	IR4D Shanono	Some R &D sites Dawakin Tofa	Little or no intervention Dawakin Tofa	IAR4D Safana	Some R &D sites Ingawa	Little or no intervention Ingawa
N	50	50	50	50	50	50
Bambara					0	0
Cassava	4	10	2	0	0	0
Cotton	10	0	0	10	0	0
Cowpea	46	68	74	26	34	36
Groundnut	32	62	52	46	30	28
Maize	84	86	66	46	4	14
Melon					0	0
Millet	30	84	98	80	66	58
Okro					0	0
Onion	0	0	4	0	0	0
Pepper	0	8	0	2	0	0
Rice	16	4	8	0	2	0
Sorghum	64	86	94	96	44	40
Soybean	4	2	0	2	0	0
Tomatoes	0	14	12	2	0	0
Mango	8	0	0	0	0	0
Orange					0	0
Watermelon	0	0	0	0	0	0

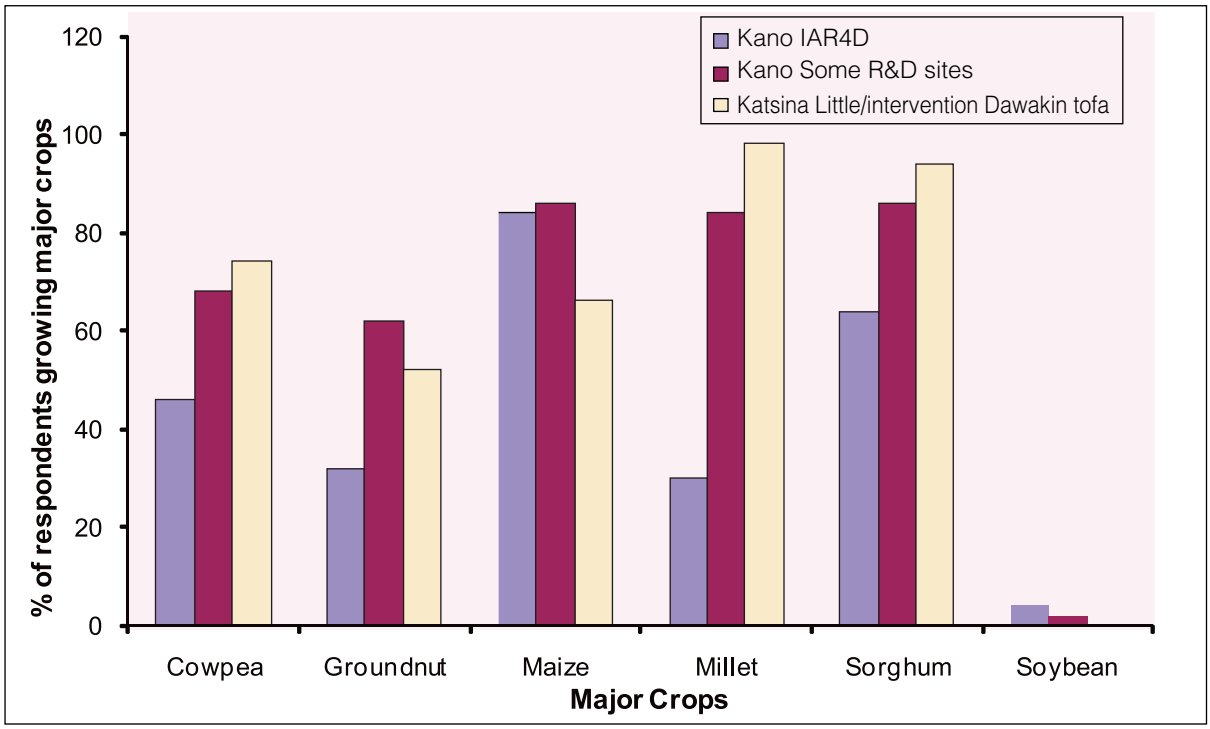

Figure 5c. Distribution of Major Crops in Kano State SLL IP.

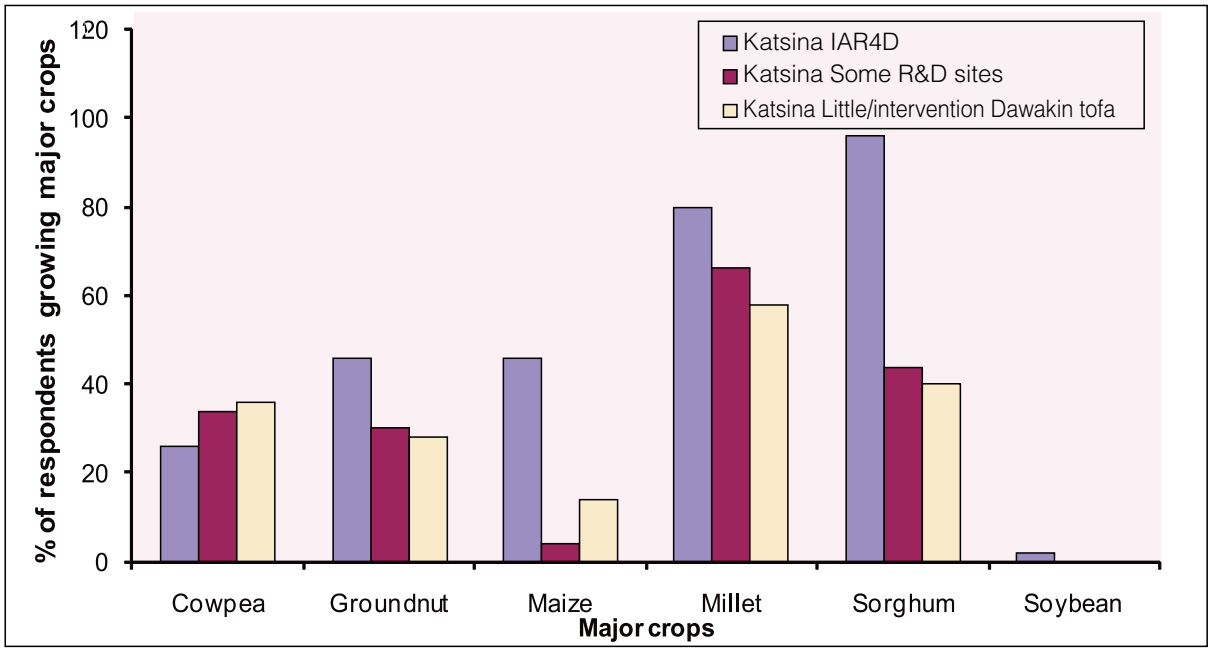

Figure 5d. Distribution of Crops in Katsina State SLL IP.

In the sorgSLL IP of Kano State maize and sorghum were the main crops grown in the IAR4D sites of Kano State. In the R&D and little or no intervention sites of the state, the main crops grown were cowpea, groundnut, maize, millet, and sorghum. However in IAR4D sites of Katsina State, millet and sorghum were the main crops while in the R&D and little no intervention sites, millet was the crop most grown by the farmers.

Access to farm inputs

As a way of accessing the problems confronted by farmers in procuring farm inputs, accessibility of farm inputs by farmers was analyzed. The inputs considered include fertilizer, herbicide, fungicide, insecticide manure, certified seed, seed dressing, postharvest insect control, farm equipment, supplementary livestock feed, and crops.

Cowpea seed field.

The results showed that in all the IPs maize–legume–livestock and sorghum–legume–livestock farmers had access to fertilizer, herbicide, and insecticide and that the main source of the farm inputs was from the local market (Tables 7 and 8 in the Appendix).

Use of livestock feed supplement

The feed supplement used includes concentrates, crop residues, grazed forage, green fodder, and tree leaves. In all the sites (IAR4D, R&D, little or no intervention sites) households that used feed supplements ranged from 25 to41% in the sorghum–legume–livestock IP. But in virtually all the sites of the maize–legume–livestock IP, not less than 30% of the households used feed supplement for adult males and young livestock. However, for adult female livestock there was as low as zero percent of households that used feed supplement for adult female livestock in IAR4D sites (Tables 9 and 10 in the Appendix).

Crop output marketing

MLL IP

Crop outputs marketed by the households were categorized into cereal, legume, fruit and vegetables, and roots and tubers. The cereal included maize, sorghum, millet, and rice while the legumes were cowpea and groundnut. Fruit and vegetables comprised pepper and tomatoes while cassava and sweetpotatoes constituted roots and tubers.

For maize, 78% of households traded in maize and traveled about 12 km on average to market and 82% of the households made average sales of about ₦3300 in IAR4D sites in Kano State. In the R&D sites, 54% of the households traveled about 15 km and 68% of households had a sales volume worth about ₦1009.41. However, the distance traveled to market by 64% of the households that traded in maize in little or no intervention sites in Kano was about 14 km and 66% of the households had an average sales volume worth about ₦ 4600.

In Katsina State the distance covered by the households (56%) in IAR4D sites trading in maize was smaller but they traded in almost goods worth the same volume as that of their Kano counterpart in the same IP of maize–legume–livestock. A lower proportion of the households traded in maize in the R&D sites of Katsina and they travelled about 13 km to market and 24% of households had an average sales volume of (about ₦1943.33). Almost the same, about ₦4800, was traded in little or no intervention sites of Katsina State as in R&D sites, though the distance to the market was about 30 km and about 8% of the households traded in maize.

For sorghum, 56% of the households in IAR4D sites travelled an average of about 24 km and 76% of the households had average sales of about ₦19 000 while about half of the households in IAR4D sites traded in maize. Table 20a presents the crop output marketing of MLL IP. The analysis showed that the major crops traded by farmers in Kano in IAR4D sites were maize, sorghum, and groundnut where more than 50% of the households were involved. Maize was the only commodity in both the R&D sites and little or no intervention sites. In all these sites the households travelled not less than 10 km to the nearest market and households had average annual sales of ₦3000 and above in maize marketing. In Katsina State it was only maize in the IAR4D sites in the maize–legume–livestock IP that had over 50% of the household trading in it. In every other site, the proportion of households that traded in all the crops was less than 50%.

SLL IP

Table 20b presents crop output marketing in the SLL IP in Kano and Katsina states.

Table 20a. Crop output marketing (MLL IP).

	Classes of crops	Crops	Distance to market		Average annual sales (Naira)
			Percent of household	Dist (km)	
Kano State IAR4D sites (Bunkure)	Cereals	Maize	78	12	3281
		Sorghum	56	24	1858
		Millet	40	14	4126
		Rice	46	23	2748
	Legumes	Cowpea	74	19	2672
		Groundnut	70	20	1942
Some R&D sites (Karaye)	Cereals	Maize	54	15	1009
		Sorghum	38	12	914
		Millet	18	21	9008
		Rice	12	18	167
	Legumes	Cowpea	32	18	859
		Groundnut	22	14	1077
Little or no intervention (Karaye)	Cereals	Maize	64	14	4558
		Sorghum	24	11	4941
		Millet	16	4	5370
		Rice	4	22	1417
	Legumes	Cowpea	22	12	10635
		Groundnut	42	8	6419
Katsina State Intervention (Musawa)	Cereals	Maize	56	7	3226
		Sorghum	34	9	2625
		Millet	58	8	3335
		Rice	6	12	5700
	Legumes	Cowpea	12	9	4183
		Groundnut	48	6	3496
Some R&D sites (Dan Musa)	Cereals	Maize	14	13	1943
		Sorghum	32	9	761
		Millet	32	8	1051
		Rice	10	10	2540
	Legumes	Cowpea	22	20	2281
		Groundnut	50	14	832
Little or no intervention (Dan Musa)	Cereals	Maize	8	30	1830
		Sorghum	36	11	1168
		Millet	34	7	1315
		Rice	6	36	4700
		Cowpea	12	24	3811
	Legumes	Groundnut	44	10	1293

Table 20b. Crop output marketing (SLL IP).

Kano State	Classes of crops	Crops	Distance to market		Average annual sales (Naira)
			Percent of household	Dist (km)	
IAR4D sites					
Intervention (Shanono)	Cereals	Maize	40	11	11650
		Sorghum	30	12	5194
		Millet	18	13	8100
		Rice	8	6	3125
	Legumes	Cowpea	36	21	6962
		Groundnut	26	11	2163
Some &D sites (Dawakin Tofa)	Cereals	Maize	34	4	2732
		Sorghum	28	6	3453
		Millet	22	11	2547
		Rice	2	1	600
	Legumes	Cowpea	34	24	4768
		Groundnut	58	18	3190
Little or no intervention (Dawakin Tofa)	Cereals	Maize	14	8	1341
		Sorghum	22	11	3630
		Millet	20	10	3541
		Rice	8	5	5000
	Legumes	Cowpea	16	11	1331
		Groundnut	34	8	3444
Intervention (Safana)	Cereals	Maize	40	10	3738
		Sorghum	76	10	3488
		Millet	80	10	3882
	Legumes	Cowpea	30	11	1824
		Groundnut	42	10	2007
Some R&D sites (Ingawa)	Cereals	Maize	2	7	5100
		Sorghum	26	8	7132
		Millet	50	9	4632
		Rice	2	4	16000
	Legumes	Cowpea	34	9	6830
		Groundnut	62	9	3164
Little or no intervention (Ingawa)	Cereals	Maize	2	14	7000
		Sorghum	36	8	9290
		Millet	64	7	8443
	Legumes	Cowpea	26	8	7132
		Groundnut	50	9	4632

The major crops traded in by the households were sorghum, millet, and groundnut. The marketing of these three crops was predominant in IAR4D, R&D sites, and little or no intervention sites of Katsina State where the proportion of the households that traded in those crops were more than 50%. They travelled to the market for a distance of more than 6 km to make average sales of ₦4000 and above per annum.

The marketing of groundnut by the households was also predominant in R&D sites in Katsina State.

Livestock output marketing

Table 21 with Figure 6a presents livestock output marketing in the MLL IP in Kano and Katsina states.

Table 21. Distribution of farmers by major type of livestock marketed in % (MLL IP).

Livestock type	Kano State			Katsina State		
	IAR4D	R&D	Little or no Intervention	IAR4D	R&D	Little or no Intervention
Crossbreed cattle	0	0	0	0	0	2
Local cattle	22	26	20	22	24	32
Improved goats	0	0	0	2	0	8
Local goats	50	48	54	52	46	42
Improved sheep	2	4	0	0	0	2
Local sheep	28	40	44	34	26	26
Improved chicken	0	0	0	4	0	0
Local chicken	18	8	10	28	34	22

Source: Field Survey 2008.

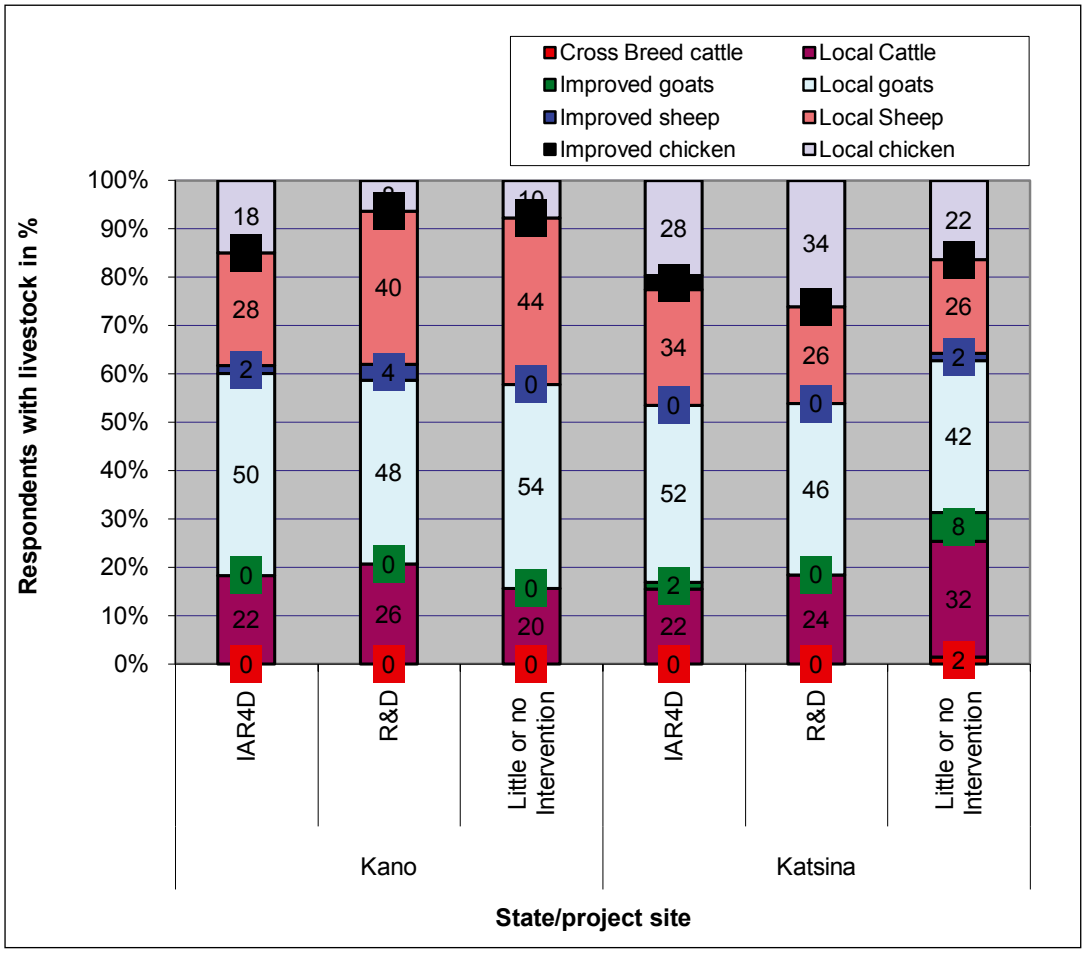

Figure 6a. Types of livestock MLL IP.

Major livestock traded by farmers in Kano State were local goats (> 48% of households) and local sheep (44%) in little or no intervention sites. Annual income for the average farmer from goats was ₦11 000 and above in little or no intervention sites in Kano State with an annual sale of about ₦36 000 which indicates that goats and sheep are major sources of revenue in the MLL IP of Kano State. It should however be noted that not less than 20% of households traded in local cattle in all the three kind of sites in the MLL IP with annual average sales of ₦54 000 and above.

In Kastina State, similar results were obtained. Local goats and sheep (in little or no intervention sites) dominated the market activities of the farmers. For livestock marketing, not less than 20% of the households were involved in local cattle trading, but the amount earned in cattle marketing ranged from ₦14 000 in IAR4D sites to ₦191 000 in little or no intervention sites.

Table 22 with Figure 6b presents livestock output marketing in the SLL IP in Kano and Katsina states.

The result indicated that local cattle (50%), local goats (80%), and local sheep (66%) dominated the livestock marketing in IAR4D sites of Kano State. Annual average income earned was about ₦82 000, ₦22 000, and ₦22 000 respectively in the site. Local chicken also feature predominantly with about 74% of households involved in its marketing with annual average sales of about ₦6000.

Table 22. Distribution of farmers by major type of livestock output marketed in % (SLL IP).

Livestock type	Kano State			Katsina State		
	IAR4D	R&D	Little or no Intervention	IAR4D	R&D	Little or no Intervention
Crossbreed cattle	0	4	0	0	0	0
Local cattle	50	2	18	18	14	10
Improved goats	2	48				
Local goats	80	2	78	52	72	68
Improved sheep	–	2	–	–	2	–
Local sheep	66	40	60	54	46	34
Improved chicken	0	12	0	0	0	2
Local chicken	74	44	52	48	12	16

Source: Field Survey 2008.

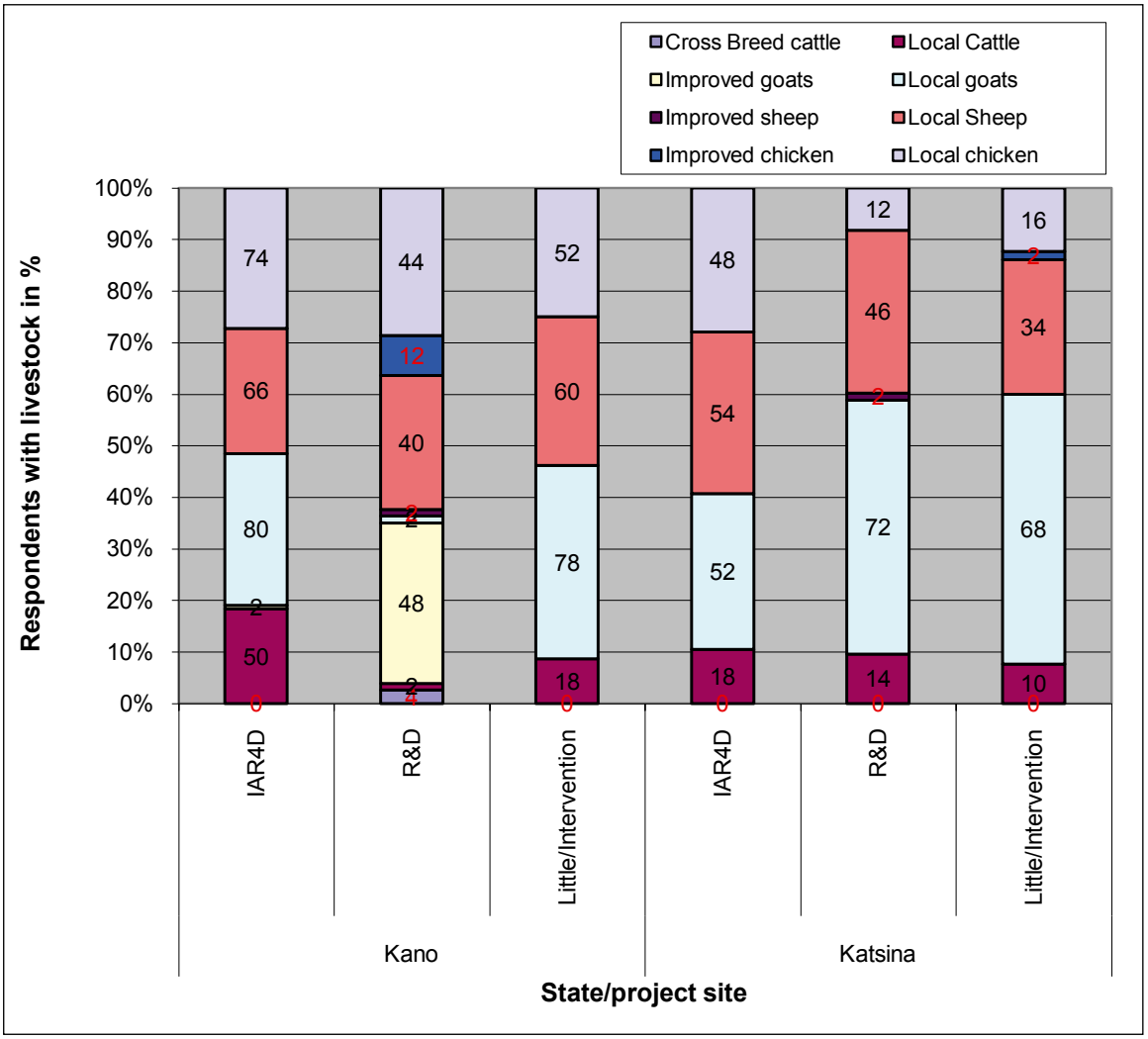

Figure 6b. Types of livestock SLL IP.

In the R&D sites of Kano State, improved goats and local sheep marketing were common (> 40%) among respondents with sales volume worth ₦22 000 in annual average earnings. However, in little or no intervention sites of the same state, local sheep (60% household) and local goats (78% household) were the main marketing items with annual average sales of about ₦50 000 and ₦38 000, respectively.

In Katsina State of the same IP local goats and local sheep were also the main marketing items especially in the IAR4D sites where 52 and 54% of households, respectively, were involved in the marketing. In R&D sites, 72 and 46%of households , respectively, were involved in marketing local goats and sheep. In all the sites in Katsina State no less than ₦15 000 annual average sales were earned from any of these enterprises.

Estimated gross margins in crop production

To evaluate the profitability of farm production activities, budgetary analyses were conducted involving the computation of gross margin (GM) and benefit cost ratio (BCR). These were carried out separately for crop and livestock production activities along the MLL IP and SLL IP. The monetized values of variable inputs and incidental production costs were subtracted from gross revenue (GR) to arrive at GM estimates for crop and livestock enterprises. The RPN was calculated by finding the ratio of the GM to the total variable cost (TVC) in each case. That is

GM =GR-TVC ---------- (4)

and BCR = GM/TVC ----------(5)

From the above, it was possible to carry out a sensitivity analysis by increasing the cost and decreasing the revenues by 10% and then recalculating the GM to see whether crop and livestock production still gave a positive GM in the face of changing cost and revenue scenarios, as suggested by Gittinger (1972).

Gross margin analysis of priority cereal crops

A summary of the gross margin analysis carried out on cereals in the study is presented in Tables 23 and 24.

Kano State MLL IP

In the cereal production of the MLL IP in Kano State, maize gave the highest yield (1108 kg/ha) and revenue (about ₦89 000) in the R&D site of Karaye LGA in Kano State. The lowest yield (631 kg/ha) and revenue (about (₦50 000) in millet production came from the same R&D sites. The revenue from IAR4D sites of Bunkure were ₦85 600, ₦72 640, and ₦63 760 for maize, sorghum, and millet, respectively. However, the revenue from little or no intervention sites in Kano State was ₦73 200, ₦71 680, and ₦51 840 for maize, sorghum, and millet, respectively. The variable costs of crop production did not vary widely across different enterprises. This was not surprising since most households could be expected to use similar variable inputs purchased at fairly similar prices and given that most parts of the project area practiced similar crop production systems. The most important item of variable costs was labor followed by fertilizer. Labor was highest (₦25 425) in maize production of the little or no intervention sites and lowest (₦5012) in Bunkure under millet production in the IAR4D site. The highest gross margin (₦64 557) in maize production and benefit-cost ratio (4.5) were obtained in the IAR4D sites of the IP while the lowest gross margin (about ₦10 000) and benefit–cost ratio (0.2) in millet production came from the R&D site of Karaye in the state.

Katsina State MLL IP

The highest yield (1558 kg/ha) and revenue (₦124 640 kg/ha) were obtained in maize production in R&D sites of Dan Musa LGA of Katsina State. The lowest yields and revenues were obtained in little or no intervention sites. However, the lowest variable cost item (labor) was highest also in R&D sites thereby reducing the gross margin in the area. The highest gross margin (₦87 217) and benefit–cost ratio (4.4) were obtained in maize production in IAR4D sites. The lowest gross margin (₦17 722) and benefit–cost ratio (0.4) came from millet production in the R&D sites of the state.

Kano State SLL IP

The gross margin analysis for cereal crops in the sorghum–legume–livestock IP is similar to the MLL IP in that maize gave the highest yield and revenue. The highest yield (1216 kg/ha) and revenue (₦97 280) were obtained from little or no intervention sites of Dawakin Tofa in Kano State. Labor was also the most important

Table 23. Gross margin analysis of priority cereal crops (MLL IP).

	IAR4D sites (Bunkure)			Some R&D sites (Karaye)			Little or no intervention (Karaye)		
Kano	Maize	Sorghum	Millet	Maize	Sorghum	Millet	Maize	Sorghum	Millet
Yield (kg/ha)	1070	908	797	1108	847	631	915	896	878
Revenue (Naira/ha)	85600	72640	63760	88640	67760	50480	73200	71680	51840
Total Variable Cost -TVC (Naira/ha)	21043	21639	11541	42324	41332	40462	45422	29425	27335
Gross Margin GM (Naira/ha)	64557	51001	52219	46316	26428	10018	27778	42228	24505
Benefit:Cost (GM/ TVC)	3.1	2.4	4.5	1.1	0.6	0.2	0.6	1.4	0.9
Katsina	IAR4D sites (Musawa)			Some R&D sites (Dan Musa)			Little or no intervention (Dan Musa)		
Yield (kg/ha)	1310	916	878	1558	908	757	1134	872	683
Revenue (Naira/ha)	104800	73280	70240	124640	72640	60560	90720	69760	54640
Total Variable Cost - TVC (Naira/ha)	19752	23186	19747	37423	37966	42838	41625	40629	12985
Gross Margin GM (Naira/ha)	87217	50091	50493	49095	34674	17722	42581	29131	41655
Benefit:Cost (GM/ TVC)	4.4	2.2	2.6	1.3	0.9	0.4	1.0	0.7	3.2

Table 24. Gross margin analysis of priority cereal crops (SLL IP).

	IAR4D sites (Shanono)			Some R&D sites (Dawakin Tofa)			Little or no intervention (Dawakin Tofa)		
Kano	Maize	Sorghum	Millet	Maize	Sorghum	Millet	Maize	Sorghum	Millet
Yield (kg/ha)	948	852	822	1156	796	725	1216	780	646
Revenue (Naira/ha)	75840	68160	65760	92480	63680	58000	97280	62400	51680
Total Variable Cost –TVC (Naira/ha)	33259	32874	23529	34995	31845	20613	45995	39880	41189
Gross Margin GM (Naira/ha)	57485	35286	42231	51285	31835	37387	43847	22520	10491
Benefit:Cost (GM/ TVC)	2.3	2.1	2.8	2.6	2.0	2.8	2.1	1.6	1.3
Katsina	IAR4D sites Safana			Some R&D sites Ingawa			Little or no intervention Ingawa		
Yield (kg/ha	957	1607	882	926	791	604	838	794	460
Revenue (Naira/ha)	76560	128560	70560	74080	63280	48320	67040	63520	36800
Total Variable Cost (Naira/ha)	32713	87679	28305	12108	12965	15233	31001	33177	19885
Gross Margin GM (Naira/ha)	43847	40881	42255	61972	50315	33087	36039	30343	16915
Benefit:Cost (GM/ TVC)	1.3	0.5	1.5	5.1	3.9	2.2	1.2	0.9	0.9

variable cost item and was highest (about ₦46 000) in maize production of the little or no intervention sites. The highest gross margin (about ₦57 000) came from the IAR4D site of Shanono but the highest benefit–cost ratio (2.8) came from millet in IAR4D and R&D sites in the state.

Katsina State SLL IP

In contrast to what obtained in other IPs, the highest yield (1607 kg/ha) and revenue (₦128 560) came from sorghum in the IAR4D site of Safana LGA. Labor was the most important cost item and was highest in the IAR4D site of Safana LGA. However, the highest gross margin (₦61 972/ha) were obtained in R&D sites of Ingawa LGA of the state. In all, the results show a lot of similarity in the enterprise gross margin for all the sites. However, Kano State villages and especially the MLL IP had better results than Katsina State sites; this may be due to village selection.

Gross margin analysis of priority legume crops

A summary of the gross margin analysis carried out on priority legume crops in the study is presented in Tables 25and 26.

Kano StateMLL IP

Groundnut produced the highest yield (752 kg/ha) and revenue (₦90 240/ha) in R&D site. The lowest yield (394 kg/ha) and revenue (₦39 400) were obtained in the IAR4D site of Bunkure LGA. Labor (the most important variable cost item) was highest in groundnut production of R&D site. However, the highest gross margin (about ₦65 000/ha and benefit–cost ratio (3.5) came from groundnut production in the IAR4D site.

Katsina State MLL IP

Considering legume production in this IP, groundnut also had the highest yield [730 kg/ha] and revenue of about N88 000/ha came from groundnut in the IAR4D site of Musawa LGA. The highest cost item (labor) had the highest value (about ₦32 000) in little or no intervention site of Karaye LGA of the state. Although, the highest gross margin (₦67 240) was obtained from groundnut but the highest benefit–cost ratio (4.1) came from cowpea production in the IAR4D site of the state.

Kano State SLL IP

Similarly, as in the MLL IP, groundnut had the highest yield (760 kg/ha) and revenue (about ₦91 200) in IAR4D sites of Shanono LGA of the state. The highest variable cost item (labor) was highest (about ₦24 000) in groundnut production in little or no intervention site of Dawakin Tofa LGA. The IAR4D site produced the highest gross margin (about ₦69 000) and benefit-cost ratio (3.1) in groundnut production in Shanono LGA in the IP.

Table 25. Gross margin analysis of priority legume crops (MLL IP).

	IAR4D sites (Bunkure)		Some R&D sites (Karaye)		Little or no intervention (Karaye)	
Kano	Cowpea	G/nut	Cowpea	G/nut	Cowpea	G/nut
Yield (kg/ha)	394	698	561	752	397	670
Revenue (Naira/ha)	39 400	83 760	56 100	90 240	39 700	80 400
Total Variable Cost – TVC (Naira/ha)	16 532	18 747	42 124	51 234	31 605	40 620
Gross Margin GM (Naira/ha)	22 868	65 013	13 976	39 006	8095	39 780
Benefit:Cost (GM/TVC)	1.4	3.5	0.3	0.8	0.3	1.0
Katsina	IAR4D sites Musawa		Some R&D sites Dan Musa		Little or no intervention Dan Musa	
Yield (kg/ha)	683	730	394	678	352	663
Revenue (Naira/ha)	68 300	87 600	39 400	81 360	35 200	79 560
Total Variable Cost (Naira/ha)	13 500	20 360	10 525	42 048	21 833	46 021
Gross Margin GM (Naira/ha)	54 800	67 240	28 875	39 312	13 367	33 539
Benefit: Cost (GM/TVC)	4.1	3.3	2.7	0.9	0.6	0.7

Cowpea seed field.

Table 26. Gross margin analysis of priority legume crops (SLL IP).

	IAR4D sites (Shanono)		Some R&D sites (Dawakin Tofa)		Little or no intervention (Dawakin Tofa)	
Kano	Cowpea	G/nut	Cowpea	G/nut	Cowpea	G/nut
Yield (kg/ha)	422	760	356	698	368	691
Revenue (Naira/ha)	42 200	91 200	35 600	83 760	36 800	82 920
Total Variable Cost (Naira/ha)	18 448	22 460	18 100	31 648	21 660	38 295
Gross Margin GM (Naira/ha)	23 752	68 740	17 500	52 112	15 140	44 625
Benefit:Cost (GM/TVC)	1.3	3.1	1.0	1.6	0.7	1.2
Katsina	IAR4D sites (Safana)		Some R&D sites (Ingawa)		Little or no intervention (Ingawa)	
Yield(kg/ha)	423	732	363	689	310	673
Revenue (Naira/ha)	42 300	87 840	36 300	82 680	31 000	80 760
Total Variable Cost (Naira/ha)	15 536	26 310	12 900	15 700	11 700	30 150
Gross Margin GM (Naira/ha)	26 764	61 530	23 400	66 980	19 300	50 610
Benefit:Cost (GM/TVC)	1.7	2.3	1.8	4.3	1.6	1.7

Katsina State SLL IP

As obtained in Kano State of the SLL IP, the highest yield (732 kg/ha) and revenue (about ₦88 000) were obtained in groundnut production in the IAR4D site of Safana LGA. The highest cost (labor) was recorded also in groundnut production in the little or no intervention site of Ingawa LGA. However, the highest gross margin (about ₦67 000) and benefit–cost ratio (4.3) were obtained in the R&D site of Ingawa LGA.

The values in Katsina State were lower. Given that the average fixed cost/ha does not normally vary widely when crop production systems are similar, as in the project area, it could be inferred that the profitability of crop farming was also highest in Kano State and in the MLL IP.

5. Income, expenditure, and food security

This chapter examines income sources, expenditure patterns, household perception of food security as well as coping strategies and wealth ranking.

Household income sources

Table 13 (in Appendix) and Figure 7a present the household income source in the MLL IP.

According to the table, sale of crops and livestock were the main income source for the vast majority of households in the IP. Not less than 68% of the households in all the three kinds of sites and both states got their income from sales of crops. About 44% of the households engaged in sales of livestock in the IAR4D site, 62% in R&D sites, and 74% in little or no intervention sites in Kano State. In Katsina State, 76%, 78%, and 98% of the households, respectively, generated their income from sales of livestock products. However in the two states of the IP, the contribution from the sales of crops and livestock to total household income was low expect in little or no intervention sites. Regular employment constituted the bulk of households' source of income (35%) in the IAR4D site of Kano State. Remittance was responsible for highest revenue in R&D sites of Kano State. In Katsina State, in the maize–legume–livestock IP, income from running their own businesses gave the highest contribution to the total household income. Similarly in the sorghum –legume–livestock IP, most farmers that had their income from agriculture-related activities of sales of crops and livestock were not less than 52% of the households in the IP that generated their income from the two enterprises. In all the sites of the IP, the two enterprises (sales of crops and livestock) constituted the highest proportion of household income in the IP except in little or no intervention sites where casual employment in agricultural activities made about 53% of the total income in Katsina State (Table 14 in Appendix and Figure 7b).

A farmer displaying improved sorghum varieties.

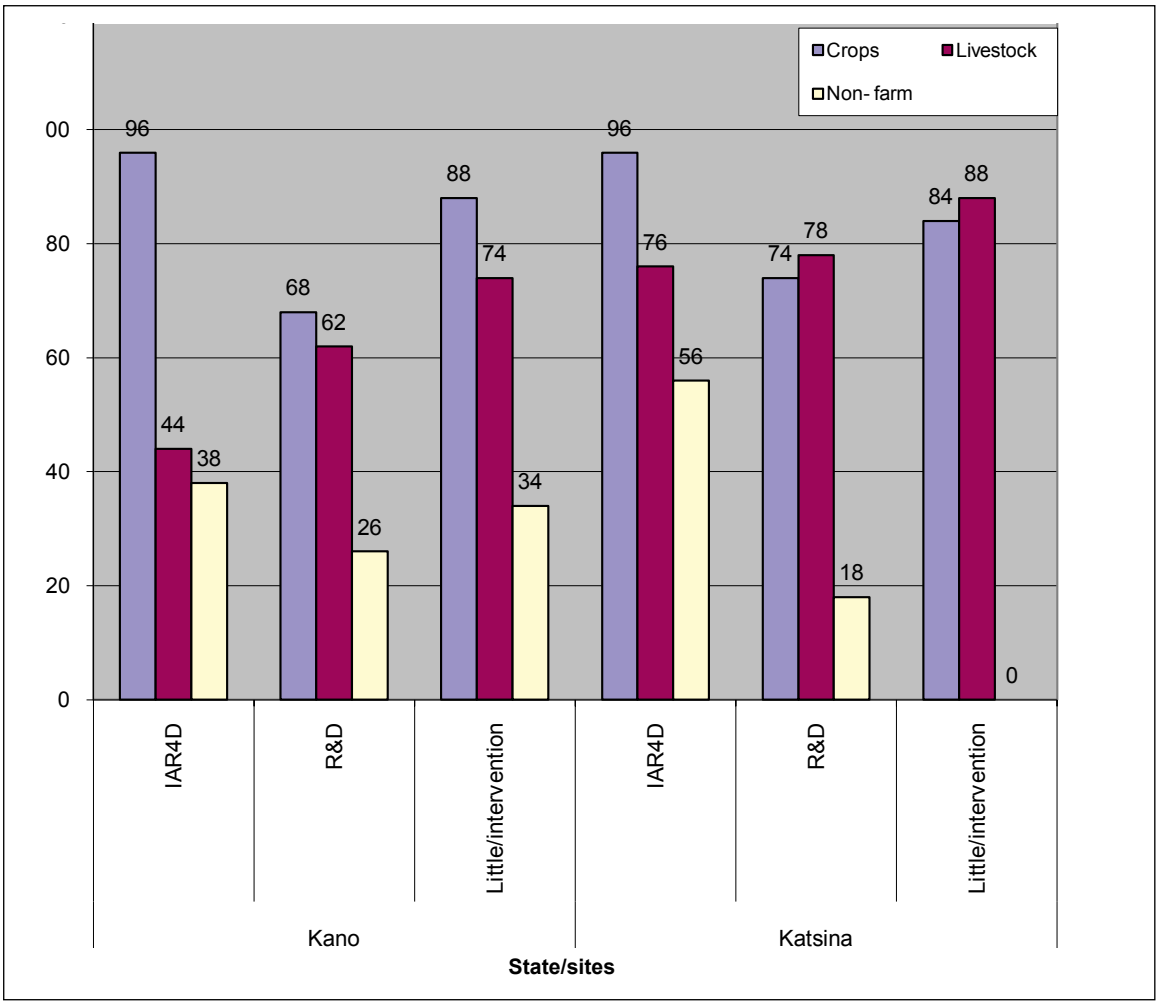

Figure 7a. Distribution of respondent by income sources MLL IP.

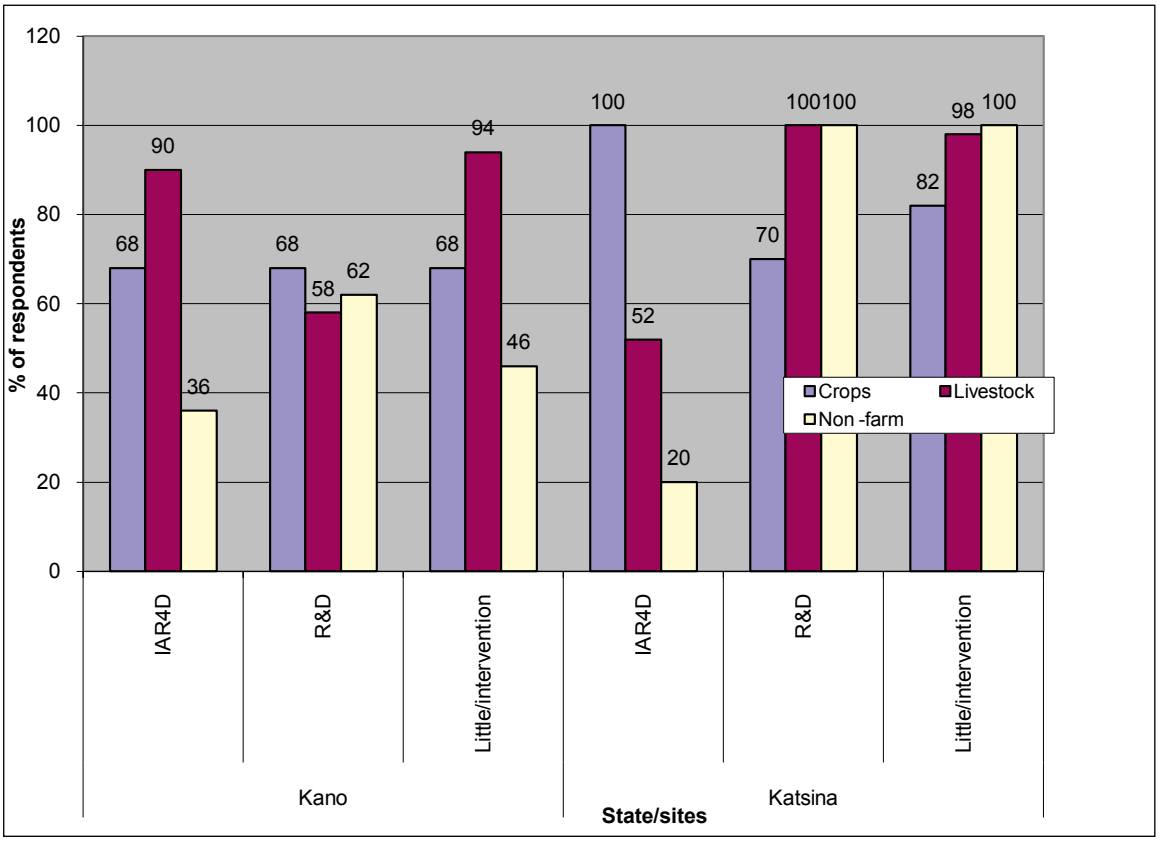

Figure 7b. Distribution of respondent by income sources SLL IP.

Household expenditure pattern

Table 27 shows the household expenditure pattern in the MLL IP. The analysis indicated that in the MLL IP of Kano and Katsina states no household spent more than 20% of their income on food, while in the SLL IP, especially in Kano State, households spent about 28%, 41%, and 97% of their income in IAR4D, R&D, and little or no intervention sites, respectively, on food. This might suggest that households in the SLL IP were the poorest in Katsina State. Of the SLL IP in Katsina, no household spent up to 20% of its income on food.

Farmer's perception of household food security

Table 28 with Figure 8a and Table 29 with Figure 8b show the farmers' perception of household food security in the MLL IP and SLL IP of Kano and Katsina states. The analysis indicated that farmers in IAR4D sites of Kano State were food secure only in the months of July, August, and September. In IAR4D sites food insecurity was highest in the months of April and May while in little or no intervention sites, it was highest in the month of January. The level of food insecurity was less than 50% in the R&D site of Kano State. In Katsina State the level of food insecurity was high from March till November in the IAR4D site of the MLL IP. However, it was 27% or less in all the months in R&D sites. In little or no interaction sites, households were food secure only in March and July but food insecure in the remaining months of the year. In the sorghum–legume–livestock IP farmers were food secure only in July and August in IAR4D sites while they were not in R&D and little or no intervention sites of Kano State. Farmers were food secure in April, May, July, August, September, and October in the IAR4D site while they were food secure only in July in R&D sites and July to September in little or no intervention sites.

Household coping strategies

Coping strategies of the household in time of food shortage were analyzed in order to know how farmers address the problem of food security in the study area.

The analysis indicates that very few farmers engaged in coping strategies. In the IAR4D site of the MLL IP of Kano State, predominant coping strategies included borrowing money to buy and/or buying food on credit, or buying cheaper food types (83% of 18 households). In R&D and little or no intervention sites of Kano State, no noticeable coping strategies were identified. In Katsina State in the MLL IP, buying cheaper food types and selling of assets were the coping strategies, whereas in R&D and little or no intervention sites of Katsina State of the MLL IP, no coping strategies were important (Table 30).

In the SLL IP of Kano and Katsina states, the households engaged no important coping strategies except in R&D sites of Kano State when borrowing money to buy food and buying food on credit and buying cheaper food types were key strategies of the households. However some farmers engaged in borrowing money from their neighbors in little or no interaction sites of Kano State during food shortages (Table 31).

Maize seed field.

Table 27. Distribution of households by expenditure pattern.

Kano State	Maize–Legume–Livestock		Sorghum–Legume–Livestock	
	Amount	Percent of total expenditure	Amount	Percent of total expenditure
IAR4D sites				
Food purchases	25000	15	81080	28
Repair of houses and other assets	26477	16	49632	17
Education	19106	11	30500	11
Health	13598	8	21806	8
Clothing & footwear	18927	11	18800	7
Other assets	24184	15	18800	7
Others	39026	23	66261	23
Some R&D sites				
Food purchases	33823	20	97131	27
Repair of houses and other assets	17329	10	29000	8
Education	10693	6	74519	21
Health	23169	14	49897	14
Clothing & footwear	16913	10	78083	22
Other assets	29889	18	10917	3
Others	38906	23	19412	5
Little or no intervention				
Food purchases	29669	10	19479	6
Repair of houses and other assets	18606	6	19285	6
Education	16289	5	72630	21
Health	25175	8	61110	18
Clothing & foo wear	21333	7	74526	22
Other assets	42896	14	22960	7
Others	146065	49	75500	22
Katsina State				
IAR4D sites				
Food purchases	13202	15	6822	14
Repair of houses and other assets	8232	9	9993	21
Education	8046	9	7426	15
Health	8405	10	937	2
Clothing & footwear	4490	5	5254	11
Other assets	13402	15	10531	22
Others	31139	36	7319	15
Some R&D sites				
Food purchases	13512	13	29635	19
Repair of houses and other assets	7143	7	2500	2
Education	15032	14	35724	23
Health	14291	14	13504	9
Clothing & footwear	14094	14	14195	9
Other assets	27958	27	24002	16
Others	11743	11	34351	22
Little or no intervention				
Food purchases	46472	16	20794	14
Repair of houses and other assets	7679	3	41022	28
Education	8788	3	2490	2
Health	25730	9	15681	11
Clothing & footwear	21998	8	15314	10
Other assets	31198	11	25286	17
Others	32229	11	27273	18
Casual employment (non agric)	34478	12	0	0
Running own business	45367	16	0	0
Remittances	27875	10	0	0

Source: Field Survey 2008.

Table 28. Farmers' perception of household food security (MLL IP).

Months	Percent of household food insecurity		
	IAR4D sites Bunkure	Some R&D sites Karaye	Little or no intervention Karaye
Kano State			
Jan	22(46)	39(31)	85(33)
Feb	23(43)	39(1)	18(33)
Mar	2(44)	42(31)	24(33)
Apr	96(44)	41(32)	21(33)
May	98(43)	42(31)	12(33)
Jun	2(45)	42(31)	13(32)
Jul	0	36(31)	0
Aug	0	42(31)	0
Sep	0	48(31)	0
Oct	14(44)	47(32)	0
Nov	54(43)	45(31)	0
Dec	51(45)	42(31)	6(32)
Katsina State	**IAR4D sites Musawa**	**Some R&D sites Dan Musa**	**Little or no intervention Dan Musa**
Jan	12(17)	7(4)	23(13)
Feb	47(17)	13(15)	92(13)
Mar	88(17)	20(15)	0
Apr	88(17)	19(16)	83(12)
May	88(17)	20(15)	77(13)
Jun	94(17)	20(15)	77(13)
Jul	94(17)	14(14)	0
Aug	94(17)	20(15)	8(4)
Sep	94(17)	20(15)	8(13)
Oct	82(17)	25(16)	33(12)
Nov	70(17)	27(15)	39(13)
Dec	29(17)	20(15)	39(13)

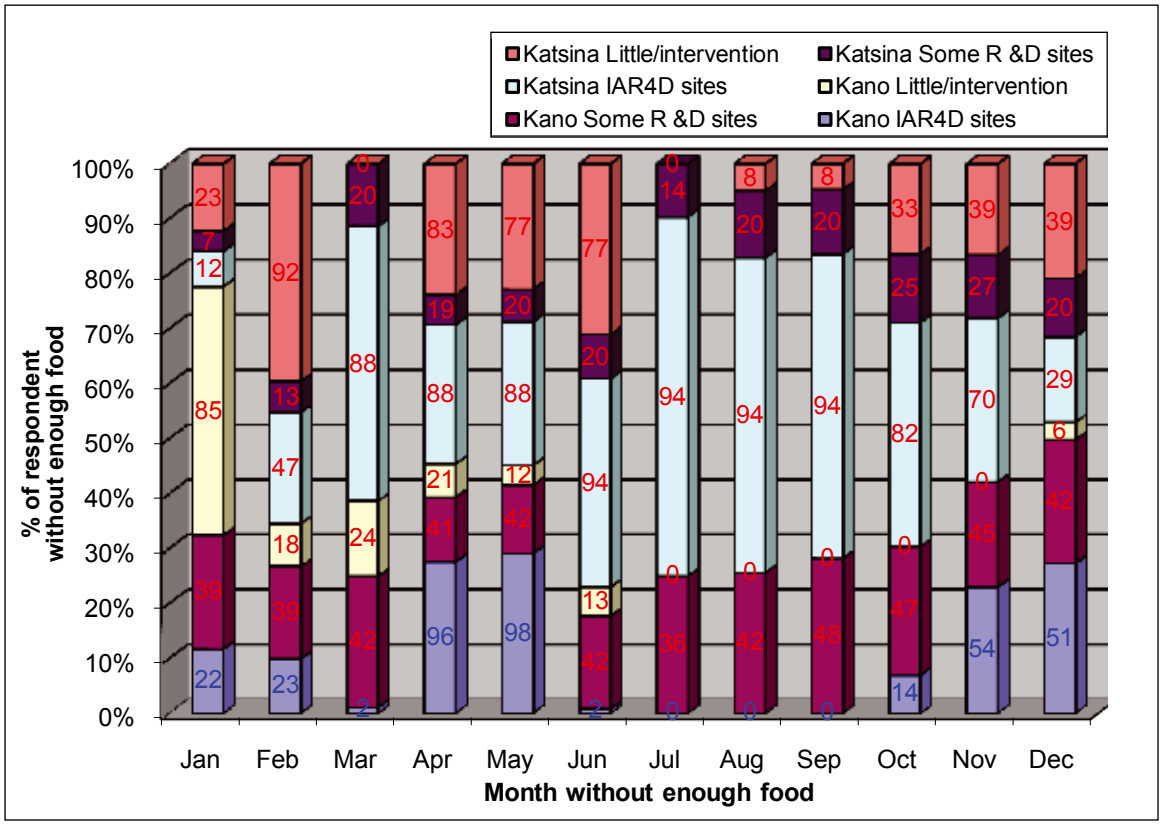

Figure 8a. Food insecurity among farming household in MLL IP.

Table 29. Farmers' perception of household food security (SLL IP).

Months	Percent of household food insecurity		
	IAR4D sites Shanono	Some R&D sites Dawakin Tofa	Little or no intervention Dawakin Tofa
Kano State			
Jan	7(27)	37(44)	`35(46)
Feb	52(27)	51(45)	37(46)
Mar	80(30)	32(44)	35(46)
Apr	84(31)	12(43)	9(46)
May	84(31)	9(43)	7(46)
Jun	3(31)	4(45)	4(47)
Jul	0	2(44)	4(46)
Aug	0	9(45)	7(46)
Sep	3(30)	14(44)	17(46)
Oct	32(31)	19(43)	22(46)
Nov	32(31)	23(43)	24(46)
Dec	36(31)	31(45)	26(47)
Katsina State	IAR4D sites Safana	Some R&D sites Ingawa	Little or no intervention Ingawa
Jan	3(31)	24(17)	11(19)
Feb	3(30)	25(16)	12(17)
Mar	92(26)	93(15)	93(15)
Apr	0	94(16)	88(16)
May	0	94(16)	89(18)
Jun	79(29)	78(18)	79(19)
Jul	0	0	0
Aug	0	6(16)	0
Sep	0	13(15)	0
Oct	0	13(16)	19(16)
Nov	4(23)	25(16)	17(18)
Dec	45(29)	22(18)	16(19)

Source: Field Survey 2008.

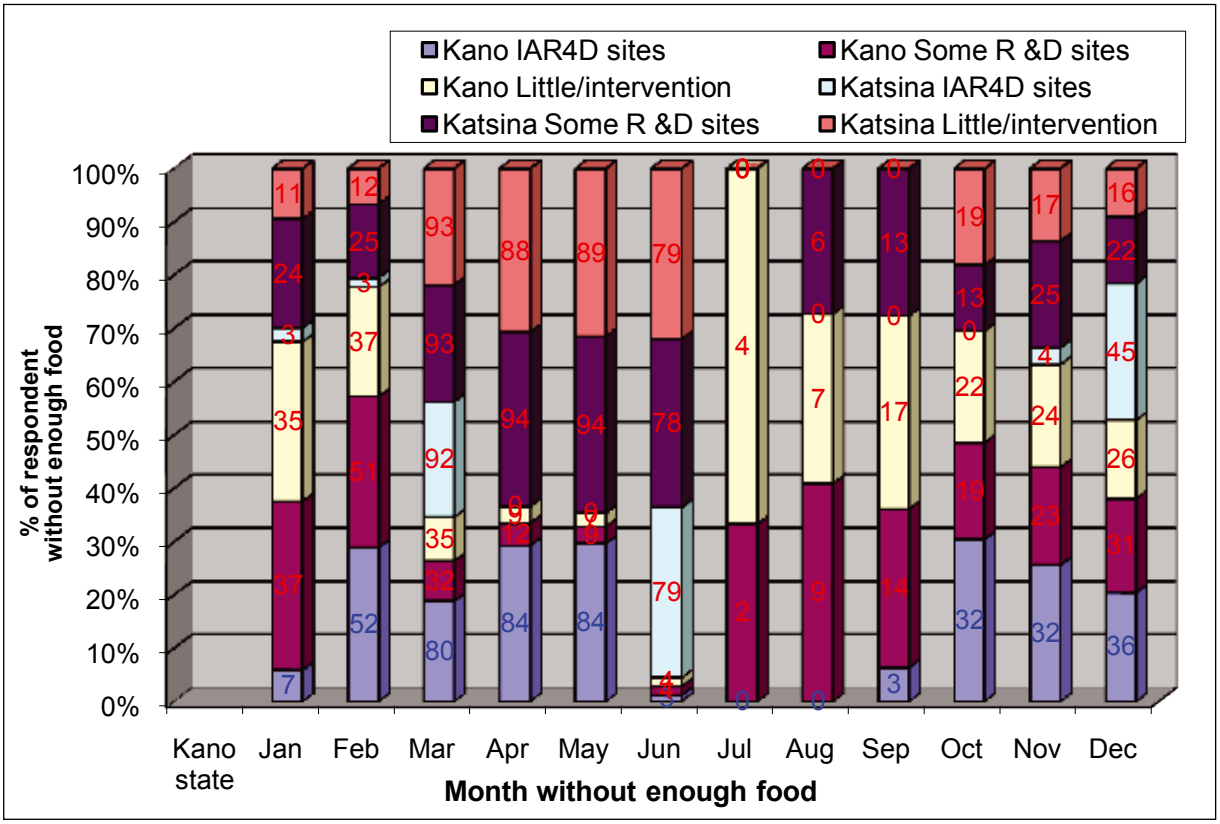

Figure 8b. Food insecurity among farming household in SSLL IP.

Table 30. Household coping strategies in case of food shortage(MLL IP).

Coping strategies	Percent of households		
	IAR4D sites Bunkure	Some R&D sites Karaye	Little or no intervention Karaye
Kano			
Borrowing money to buy food/food on credit	100(23)	30 (27)	5(22)
Reduction in number meals	0	7(27)	9(22)
Mother eats less	0	0	9(22)
Father eats less	0	0	9(22)
Children eat less	100(5)	0	0
Buy cheaper food types	83.3(18)	0	0
Modified cooking method	72.7(11)	22(27)	14(22)
Sell/mortgage assets	70(10)	4(27)	0
Borrow money from neighbor	24(4)	11(27)	5(22)
Food for work	25(4)	18(28)	0
Katsina	IAR4D sites Musawa	Some R&D sites Dan Musa	Little or no intervention Dan Musa
Borrowing money to buy food/food on credit	36(28)	64(11)	75(12)
Reduction in number meals	4(27)	38(8)	29(7)
Mother eat less	0	0	17(6)
Father eat less	4(27)	0	17(6)
Children eat less	0	0	17(6)
Buy cheaper food types	67(27)	29(7)	88(8)
Modified cooking method	44(27)	14(7)	17(6)
Sell/mortgage assets	50(28)	44(9)	86(7)
Borrow money from neighbor	4(27)	0	29(7)
Food for work	4(27)	0	44(9)

Note: figures in bracket are number of respondents. **Source**: Field Survey 2008.

Table 31. Household coping strategies in case of food shortage(SLL IP).

Coping strategies	Percent of households		
	IAR4D sites Shanono	Some R&D sites D/Tofa	Little or no intervention D/Tofa
Kano			
Borrowing money to buy food/food on credit	0	95(22)	0
Reduction in number meals	0	35(17)	0
Mother eats less	0	7(15)	0
Father eats less	0	13(15)	0
Children eat less	0	0	0
Buy cheaper food types	0	77(22)	0
Modified cooking method	0	71(14)	0
Sell/mortgage assets	0	60(15)	0
Borrow money from neighbor	75(4)	81(16)	76(21)
Food for work	0	21(14)	0
Katsina	IAR4D sites Safana	Some R&D sites Ingawa	Little or no intervention Ingawa
Borrowing money to buy food/food on credit	18(11)	0	0
Reduction in number meals	0	75(4)	0
Mother eats less	0	0	0
Father eats less	0	0	0
Children eat less	0	0	0
Buy cheaper food types	0	0	0
Modified cooking method	0	0	0
Sell/mortgage assets	0	0	0
Borrow money from neighbor	0	67(3)	0
Food for work	0	88(8)	0

Note: Figures in bracket are number of respondents. **Source**: Field Survey 2008.

6. Analysis of poverty status

This section analyzes the poverty status of the households.

Measurement of household poverty status

In the context of this study, poverty is defined as the inability of a household to satisfy its basic needs for food, clothing and shelter, its inability to meet its social and economic obligations, its lack of gainful employment, its deprived access to basic facilities such as education health, potable water and sanitation, and, hence its restricted welfare status (Obadan 1997; Englama and Bamidele 1997).

To determine the poverty status of households in the study area, a poverty line was constructed, using two-thirds of the mean per adult equivalent expenditure, below which a household was classified as being poor and above which a household was classified as being non-poor.

The use of monetary income or consumption to identify and measure poverty has a long tradition, right from the study of Rowntree (1901) up to the recent World Bank (1996) study on global income poverty. One interesting thing, however, is that most of these studies shared common approaches and methods. These studies were based on household income and expenditure surveys and this has made the approach to become the standard for quantitative poverty analysis (World Bank 2001).

In his early study, Rowntree (1901) defined poverty as a level of total earning that is insufficient to obtain the minimum necessities of life (including food, house rent, and other basic needs) and for the maintenance of physical efficiency. He generated different poverty lines for different families, depending on their sizes, and compared these with their earnings to arrive at their poverty status. The World Bank, on the other hand, has been assessing global income poverty by using expenditure data collected through household surveys. This is because consumption level, which is reflected in consumption expenditure, has been conventionally viewed as a preferred welfare indicator. Also for practical reasons of reliability, consumption expenditure level is thought to better capture long-run welfare level than current income levels (World Bank 2001). However, the literature is

Field day show-case improved technologies.

explicit on the fact that consumption expenditure may not fully capture a household's or an individual command over goods and services; but in the absence of more practical approaches, consumption expenditure has become the most widely used variable for determining the poverty line (Omonona 2001; World Bank 2001).

Empirical model for determinants of household poverty status

The Tobit model

The stochastic model underlying Tobit as according to Tobin (1958) may be expressed by the following relationship:

$$y_t = X_t\beta + u_t \quad \text{if } X_t\beta + u_t > 0$$

$$= 0 \qquad \text{if } X_t\beta + u_t \le 0$$

$$t = 1,2,...,N, \text{----------(6)}$$

Where N is the number of observations, y_t is the dependent variable, X_t is a vector of independent variables, β is a vector of unknown coefficients, and u_t is an independently distributed error term assumed to be normal with zero mean and constant variance σ^2. Thus the model assumes that there is an underlying, stochastic index equal to $(X_t\beta + u_t)$ which is observed only when it is positive, and hence qualifies as an observed, latent variable.

According to Tobin, the expected value of y in the model is

$$Ey = X\beta F(z) + \sigma f(z) \text{---------- (7)}$$

Where $z = X\beta/\sigma$, $f(z)$ is the unit normal density, and $F(z)$ is the cumulative normal distribution function (individual subscripts are omitted for notational convenience).

Furthermore the expected value of y for observation above the limit y^* is $X\beta$ plus the expected value of the truncated normal error term (Amemiya 1984):

$$Ey^* = E(y/y > 0)$$

$$= E(y/u > -X\beta)$$

$$= X\beta + \sigma f(z)/F(z) \text{---------- (8)}$$

Therefore, the basic relationship between the expected value of all observations, Ey, the value conditional upon being above the limit, Ey^*, and the probability of being above the limit, $F(z)$, is

$$Ey = F(z)Ey^* \text{---------- (9)}$$

According to McDonald and Moffit (1980), the equation (6–7) can be decomposed by considering the effect of a change in the ith variable of X on y:

$$\partial Ey/\partial X_i = F(z)(\partial Ey^*/\partial X_i) + Ey^*(\partial F(z)/\partial X_i) \text{---------- (10)}$$

Thus the total change in y can be disaggregated into two very intuitive parts: (1) the change in y of those above the limit, weighted by the probability of being above the limit and (2), the change in probability of being above the limit, weighted by the expected value of y if above.

The two partial derivatives are also calculable (McDonald and Moffit 1980):

$$\partial F(z)/\partial X_i = f(z)\beta_i/\sigma \quad \text{---------- (11)}$$

and, from equation (10),

$$\partial Ey^*/\partial X_i = \beta_i + (\sigma/F(z)\partial f(z)/\partial X_i - (\sigma f(z)/F(z)^2\partial F(z)/\partial X_i)$$

$$= \beta_i[1 - zf(z)/F(z) - f(z)^2/F(z)^2] \quad \text{---------- (12)}$$

using $F'(z) = f(z)$ for cumulative normal density and $f'(z) = -zf(z)$ for a unit normal density.

Measuring the poverty status of the respondents

The respondents' per capita expenditure was used in classifying them into two, namely:

1. Non-poor: These are farmers whose per capita expenditure is above two-thirds of the poverty line, i.e., NP >2/3 of the mean expenditure.
2. Poor: These are farmers whose expenditure is below the poverty line, i.e., P <2/3 of the mean expenditure.

The poverty line will be set at 2/3 of the mean expenditure. (World Bank/FOS/NPC 1998; FOS1999).

The P-Alpha measures of poverty

The poverty line was set at two-thirds of the mean per capita expenditure. The first three poverty means of the so-called FGT class (Foster, Greer, and Thorbecke 1984) namely; the poverty headcount, the poverty gap, and the squared poverty gap will be estimated.

Poverty headcount: This is the share of the population which is poor, i.e., the proportion of the population for whom consumption or income is less than the poverty line.

Poverty gap: This is often considered as representing the depth of poverty, it is the mean distance separating the population from the poverty line, with the non-poor given a distance of zero.

$$P_\alpha = 1/n \sum_{i=1}^{q} \left(\frac{Z\text{-}Y_i}{Z} \right)^\alpha \quad \text{---------- (13)}$$

Where Y_i is the consumption expenditure of individual i, the sum is taken only on those individuals who are poor, α is the FGT parameter, which takes the values of 0, 1 or 2 depending on whether we are measuring the incidence, depth or severity of poverty and Z is the poverty line. When there is no aversion to poverty, α = 0, index reduces to

$Po = 1/N^q = q/N = H.$ ---------- (14)

This is called the headcount ratio or incidence of poverty. This is the proportion of population for whom consumption expenditure Y is less than the poverty line (CBN 1998). If the degree of aversion to poverty α = 1 then index will be

$$P_1 = 1/n \sum_{i=1}^{q} \left(\frac{Z\text{-}Y_i}{Z} \right)^1 = HI \quad \text{----------(15)}$$

Table 32a. Mean poverty estimates of the farmers.

	Headcount Index L(0.5)	Estimated Poverty line (₦)	Poverty Gap Index	Equally Distributed Equivalent Index	Percentage of households below poverty line
Pooled data	0.304	3928.18	0.210	3928.17	78.3
IAR4D	0.252	4107.49	0.626	4107.47	80.5
R&D	0.289	2744.84	0.109	2744.83	78.5
Little or no intervention	0.297	4912.63	0.433	4912.61	78.0

Source: Data analysis (2009).

Table 32b. Mean poverty estimates of the farmers by IPs.

	Headcount Index L(0.5)	Estimated Poverty line (₦)	Poverty Gap Index	Equally Distributed Equivalent Index	Percentage of households below poverty line
Kano MLL	0.157	74 625.52	0.427	31 889.24	0.743
Katsina MLL	0.157	44 414.32	0.266	18 100.91	0.495
Kano SLL	0.119	65 011.05	0.323	20 974.32	0.526
Katsina SLL	0.171	25 373.20	0.246	6229.47	0.478

Source: Data analysis (2009).

$$I = (Z - Y_q) / Z \text{ where } Y_q = 1/q \sum_{i=1}^{q} Y_i \quad (11) \qquad \text{---------- (16)}$$

Y_q is the average expenditure of the poor. HI is referred to as poverty gap (World Bank 2004). The poverty gap is a useful statistic to assess how much resources would be needed to eradicate poverty through cash transfers perfectly targeted to the poor.

Squared poverty gap: This is often used to describe the measure of the severity of poverty. While the poverty gap takes into account the distance separating the poor from the poverty line, the squared poverty gap takes the square of that distance into account. Here, the poverty gap is weighted by itself so as to give more weight to the very poor (World Bank 2004).

$$P_2 = 1/n \sum_{i=1}^{q} \left(\frac{Z - Y_i}{Z} \right)^2 \qquad \text{----------(17)}$$

The DAD software was used to estimate the poverty status of the population and the result is presented in Tables 32a and 32b.

The mean poverty line ranged from ₦2744.84 per annum for the population exposed to the conventional research to ₦4912.63 per annum for the clean population.

The percentage of households below the poverty line ranged from 78% for clean villages to 80.5% for the IAR4D villages. The implication is that most of the respondents are poor. This is plausible since poverty in Nigeria has been noted to be not only rural but agriculturally based (World Bank1999). Further, the headcount index lends credence to the findings as about 70% of the whole population are classified as poor. However, the estimated poverty line shows that the poverty line for the clean villages is highest followed by those of IAR4D and finally the R&D sites.

The incidence of poverty is higher in the study area than that obtained for the North Central Zone of Nigeria (66.97%), Katsina State (71.66%), and Kano State (61.92%).

The estimates from the table show that the headcount index of the population ranges from 25% for the IAR&D population to about 30% for the clean population.

The implication of the estimate is that about 50% of the poorest individuals hold about 25% of total income among the IAR4D population and 30% among the clean population. The result of the headcount index shows that the index that obtained in the study area is more severe than that which obtains in Kano State (15.3%) and Katsina State (23.51%).

This implies that the population is generally poor. This result tallies with the general report that poverty is both agricultural and rural in Nigeria.

The results of the estimation of poverty indices of the farmers by IPs are presented in Table 32a. Results obtained revealed that the percentage of households below the poverty line ranged from 47.8% in Katsina (SLL) to 74.3% in Kano MLL sites. The results obtained suggest that farmers in Kano State are generally poorer than those in Katsina State in all the IPs. This is obvious since the estimated poverty line for Kano State MLL (₦75 000) is more than one and a half times than that of Katsina State MLL (about N44 000). Similarly, the estimated poverty line for Kano SLL (₦65 000) is more than twice that of Katsina SLL (₦25 000). The incidence of poverty in Kano MLL is higher than what obtained for the North Central zone of Nigeria, and Kano State (61.92%). The headcount index of the population ranged from 11.9% for Kano SLL to 17.1% for Kano MLL. The implication of the estimate is that about 50% of the poorest individuals held between 12 and 17% of the total income among the population. The result is in line with the acknowledged report that poverty is prevalent among rural farmers.

Determinants of poverty status

The Lorenz Curve is the most popular graphic tool for visualizing and comparing income inequality. It provides complete information on the whole distribution of incomes relative to the mean. It therefore gives a more comprehensive description of relative incomes; its popularity comes from its usefulness in establishing orderings of distributions in terms of inequality, orderings that can then be said to be “ethically robust”.

The Lorenz curve is defined as follows:

$$L(p) = \frac{\int_0^p Q(q)dq}{\int_0^1 Q(q)dq} = \frac{1}{\mu}\int_0^p Q(q)dq \quad \text{---------- (18)}$$

The numerator $\int_0^p Q(q)dq$ sums the incomes of the bottom *p* population (the poorest p %) of the population. The denominator $\mu\int_0^1 Q(q)dq$ sums the incomes of all. L(p) thus indicates the cumulative percentage of total income held by a cumulative population *p* of the population, when individuals are ordered in increasing income values.

A popular class of poverty gap indices that can obey all the commonly acceptable axioms is known as the Foster–Greer–Thorbecke (FGT) class. It differentiates its members using an ethical parameter $\mu \geq 0$ and is generally defined as

$$P(z:\alpha) = \int_0^1 (\frac{g(p:z)}{z})^{\alpha} dp$$ ---------- (19)

for the normalized FGT poverty indices and as

$$P(z:\alpha) = \int_0^1 g(p:z)^{\alpha} dp$$ ----------(20)

for the non- normalized version.

When $\alpha = 0$, the FGT index gives the simplest and mostly commonly used poverty index. It is called the poverty headcount ratio, and is simply the proportion of a population that is in poverty (those with a positive poverty gap), F(z). The "poverty headcount" is sometimes meant to indicate the absolute (as opposed to the relative) number of the poor in the population.

The other index, $\mu g(z)$, is the average poverty gap, $P(z:\alpha = 1)$,and is the average shortfall of income from the poverty line:

$$\mu^{g}(z) = p(z:\alpha = 1) = \int_0^1 g(p:z)dp$$ ---------- (21)

It shows the (absolute) contributions to total poverty $P(z:\alpha)$ of individuals at different ranks *p.*

The Distributive Analysis (DAD) software was utilized to achieve this objective.

NERICA rice in Katsina.

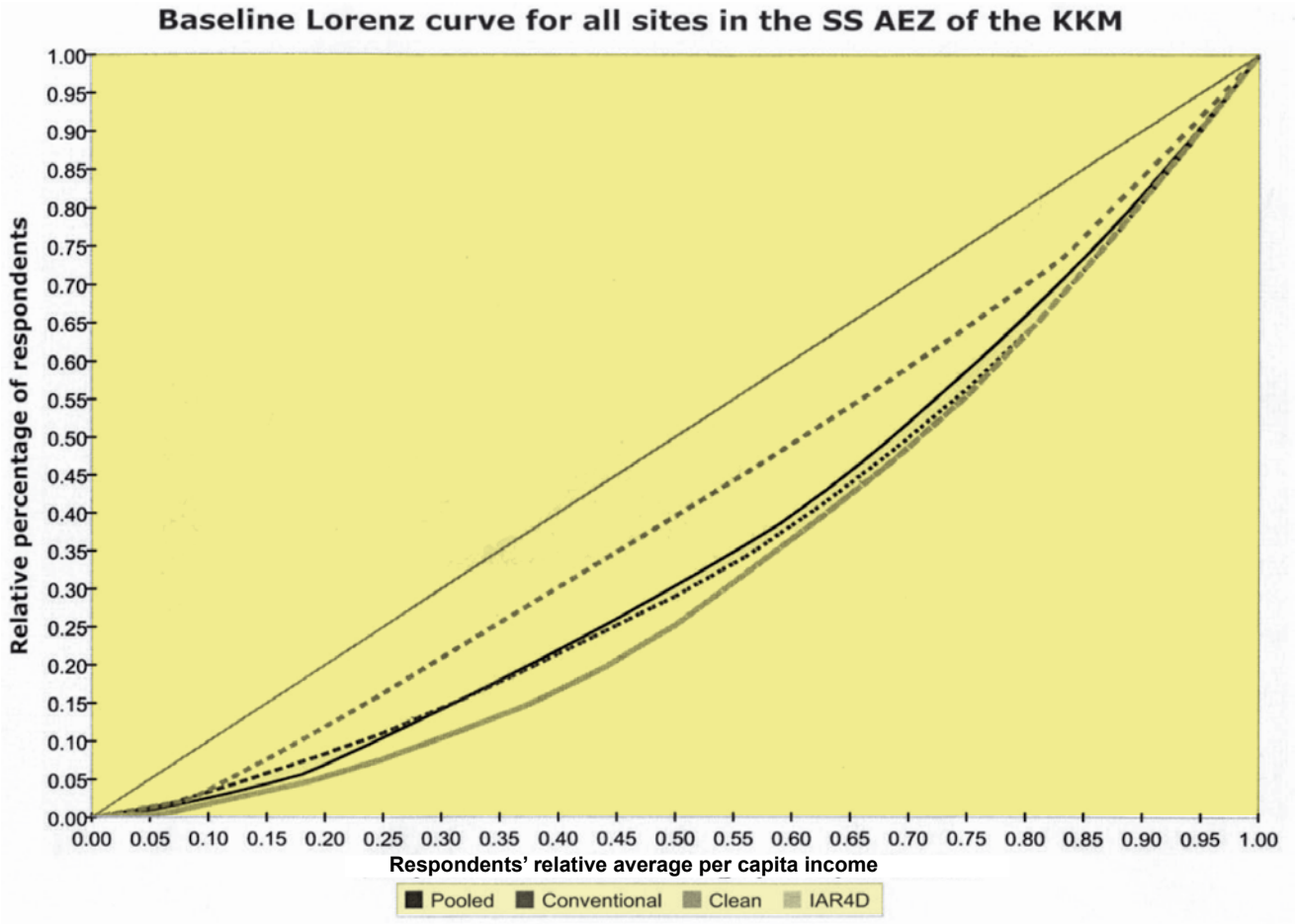

Figure 9. Baseline Lorenz curves for all sites in the SS AEZ of the KKM.

The Lorenz curve

While it is one thing to be poor, inequality is another issue entirely. The nature of resource distribution in the study area is explored with the use of the Lorenz curve. The Lorenz curve estimated for the respondents by category is shown in Figure 9.

The curvature of the Lorenz curve (Figure 9) is suggestive of the extent of inequality of a population. The general curvature of the Lorenz curve looks similar for the whole population. However, the curvature of the Lorenz curve for the IAR4D is nearer the equality line (45^{o} line) and everywhere above the curve for the other two populations including those of the pooled population.

The implication of this result is that the income in the IAR4D population is more equally distributed than in the other two populations. Hence, inequality in the other two populations (conventional and clean) is higher than for those in the IAR4D population.

Determination of household poverty intensity

A priori expectation for the explanatory variable in poverty status models

The a priori expectations with respect to the explanatory variable in both household food insecurity and household poverty models are presented as follows, based on classification of the variable into those relating to household demographic characteristics, household economic characteristics or activities, institutional factors affecting household poverty status, and household vulnerability factors.

Household demographic characteristics

These include the marital status and gender of head of household, household size, age of household head, and level of education of household head. Others include child dependency ratio and adult dependency ratio.

Marital status: The relationship between the marital status of a household head and the food insecurity and poverty level of the household has been found to be ambiguous in the sense that it can be positive or negative. For while some studies shows that households whose heads are married tend to be poorer than those with unmarried heads (Omonona 2001), other findings showed contrary tendencies (FOS 1999). Similarly, studies have not been able to consistently associate the level of household food insecurity with the marital status of the head of the household.

Gender: The relationship between the poverty status of a household and the gender of the head of the household cannot be determined a priori. This is because, while several studies have revealed that female-headed household are likely to be more food secure and less poor than male-headed households (World Bank 1992; Makinde 2001; Omonona 2001), others have found that female-headed households are likely to be more food insecure and poorer than male-headed households (Bennett 1992).

Household size: Household size could have a negative or positive correlation with household food insecurity status and the probability and intensity of poverty, depending on the dependency ratio, which is usually positively correlated with the intensity of poverty because the larger the number of less active adults (e.g., the old or the unemployed) and children in a household, the heavier the burden of the active members in meeting the cost of minimum household nutrition and, hence, the higher the level of food insecurity and the probability or intensity of poverty, and vice versa (Hassan and Bau 1999; World Bank 1996; FOS 1999; Omonona 2001). But, on the other hand, household size may be negatively correlated with household food insecurity and poverty status if the household dependency ratio is low.

Age: The relationship between the age of the head of a household and household food security status and poverty level may be difficult to determine a priori; for while the age of the head of household has been found to be negatively related to the probability and intensity of poverty in many studies, the World Bank (1996), Dercon and Krishman (1996), and Omonona (2001) have found the age of the head of household not to be a significant determinant of the poverty level among farming households. Also, no consistent pattern of association has been found between the age of the head of a household and the food security status of the household.

Formal education: The level of the formal education of a household head would tend to be a positive factor in the adoption of improved farm production and management techniques. Hence, it is hypothesized that the educational status of the head of household is positively correlated with household income earning capability and, therefore, negatively correlated with the food insecurity and poverty status of the household.

Several studies have revealed that the incidence of food insecurity and poverty is higher among people with little or no education (World Bank 1996; FOS1999; Omonona 2001).

Household economic characteristics

Household economic characteristics are described in terms of the employment status of the head of household, the level of food self-sufficiency of the household, and the ratio of food expenditure to total expenditure in the household. Other characteristics include the size of family labor, size of hired labor, household production enterprise portfolio (i.e., whether or not the household engages in other occupations outside farming), total household farm size, access to agricultural extension service, degree of diversification on farm production, and period of farm cultivation.

Research team inspecting demonstration plots.

Employment: The employment status of the head of a household is crucial to the well-being of the household. Employment status is expected to be negatively correlated with poverty intensity, that is, if a household head is employed, the probability and intensity of poverty would tend to be lower. Empirical studies have confirmed this negative correlation between the employment status of the household (Hassan and Bau 1999; FOS 1999; Omonona 2001). Similarly, the employment status of the head of a household is expected to be negatively correlated with the food insecurity status of the household.

Level of food self-sufficiency: Level of food self-sufficiency is defined as the ratio of the quality of own-produced food consumed to the total quality consumed by a household. This variable is expected to be inversely related to the household food insecurity level. That is, a household that produced a large share of its food consumed would tend to be more food secure than a household that is more dependent on food purchased, as it is likely to be more able to cater for itself in times of general food shortages. Hassan and Babu (1991) have also found that there exists a negative relationship between the food self-sufficiency ratio and poverty level of household in rural Sudan.

Ratio of food expenditure to total household expenditure: This is hypothesized to have a positive correlation with the household food insecurity level and poverty status, based on Engle's law which says the higher the income, the lower the proportion of such income that is spent on food, and vice versa. Studies have shown that the higher the ratio of food expenditure is to total household expenditure (or income), the higher the probability and intensity of poverty and food insecurity (Hassan and Babu 1991).

Household labor size: The number of persons available for work in a household determines the total income of the household. Therefore, the number available for family labor may be inversely related to the food insecurity level and poverty status of the household, ceteris paribus, as higher income will leave the household with

higher disposable income to acquire more food and other household goods and services that will enhance the welfare of the household. However, because large household labor size is often associated with large household size, and vice versa, there may also be a positive correlation between household labor size and household food insecurity level and poverty status (World Bank 1996).

Hired labor size: The amount of hired labor that a household employs has a negative effect on the disposable income available to the household and, hence, has a positive relationship with the food insecurity and poverty status of the household. Literature has shown that the greater the amount of hired labor employed by a household, the lower the disposable income available to the household and, hence the more intense poverty in the household is likely to be, and vice versa (Dercon and Krishman 1996).However the amount of hired labor may also exhibit a negative correlation with food insecurity and poverty status as it may tend to increase household productivity and income in the absence of adequate family labor to work during the peak farming season (Reardon 1997; Leavy and White 2000).

Household production activities or occupation: Among the rural people, those who engage in agriculture as a single and sole source of income tend to be poorer and more prone to food insecurity than those who combine agricultural and non-agricultural activities. That is, rural households, which are engaged in other occupations, in addition to farming, are often less poor and less prone to food insecurity than households that are engaged in farming alone (Omonona 2001). Hence the literature has reported an increased engagement of rural households in non-agricultural income earning activities in recent years in Nigeria (Meludu 1993; Jambiya 1998; Yunusa 1999).

Total household farm size: The total size of a household farm is inversely related to the food insecurity level and poverty status of the household. It has been found that, given other factors, the larger the farm size of a household, the lower the probability of such a household being poor, and vice versa (FOS 1999; Omonona 2001). Similarly, the larger the size of a household farm, the lower the probability of the household being food insecure, and vice versa.

Degree of diversification of farm production: Generally, agricultural intensification and diversification have often been recommended to promote income growth and stability. Agricultural enterprise diversification ensures that the farmer derives income from a wide range of sources, thereby reducing income instability. Diversification has, therefore, been found to reduce household food insecurity and poverty levels among farming households in Nigeria (Omonona 2001).

Period of annual farming activities: The length of the period of the year in which a farm household can engage in farming activities is another important factor that affects household poverty status. A household that is able to produce or cultivate throughout the year is expected to be better off than the household whose production period is dependent on the rains and restricted to the rainy season alone. The length of period of farming activity also affects the amount and stability of off-farm income available to the household and, therefore, influences the food security and poverty status of the household (Hassan and Babu 1991).

Degree of commercialization of farm production: The degree of commercialization of farm production, which is a measure of the percentage of total farm produce marketed, influences the food insecurity status of a household. It is hypothesized that the extent of agricultural output commercialization would tend to be positively related to household food security, since most households in the project area might not be able to generate agricultural products in adequate quantities to provide marketable surpluses after making allowance for home consumption. Hence, such households might often be forced to sell food output meant for home consumption to meet household needs, such as the education of children and medical expenses. This may tend to reduce the food security status of the household.

Table 33. Result of Tobit regression analysis of household poverty intensity.

Variable	Maximum likelihood estimate	t- value
Constant	0.8298**	9.162
Age	–0.3026	1.530
Education	–0.1092***	2.609
CDR	0.1091*	1.851
Gift	0.6880	1.317
HH size	0.3230*	1.721*
Experience	0.42235	0.209
Asset	0.1339	0.856
Input Dist	0.4948	0.107
Output Dist	0.9515	0.674
Farm Inc	–00.3949***	4.159
FARMEN	–0.6655*	1.604
Nonfm Inc	–0.1008***	5.364
Farm size	–0.2297**	2.079
Extension	–0.8143***	2.170
	Log likelihood function = -385 Z = –26.9 F(z) = 0.99 f(z) = 0.10 σ = 0.42 n = 600	

Source: Data analysis (2009).
*** Significant at 1%, ** Significant at 5%, *Significant at 10%

The literature has shown that the poverty status of a household and the extent of commercialization of farm production may be a positive or negative relationship, whereby the higher the extent of commercialization, the higher the income accruable to the household and, hence, the lower the probability of poverty, given other factors.

Institutional factors

Institutional factors which influence or reflect the level of household food security and poverty, include membership of cooperative societies, and access to farm services (extension services, credit facilities, fertilizer supply, etc).

Membership of cooperative societies: Membership of one or more cooperative societies is beneficial in many ways. It improves the access of members to many facilities, which can enhance their farm productivity and income. Studies have showed that membership of cooperative societies or farmers' associations exhibit a negative correlation with the food insecurity and poverty status of a household. It has been shown that the probability of households whose heads are members of cooperative societies being food insecure or being poor are lower than that of household whose heads who are not members (FOS 1999; Omonona 2001).

Access to farm services: Farm services, such as agricultural extension services, credit facilities, and efficient supply of improved inputs (e.g., fertilizers, herbicides, and planting materials), are very important in enhancing farm productivity. Hence, it has been established by studies that access to all or some of these services would tend to reduce the incidence and severity of household food insecurity and poverty (FOS 1999; Omonona 2001).

In this section, the factors that affect household poverty status and the elasticities that show the degree and direction of the responses of poverty level changes in these variables are presented. Two types of elasticities were generated from the Tobit regression model used: the elasticity of the probability of a household being poor and the elasticity of the intensity of poverty of a household that is already poor.

Table 34. Elasticity estimates of household poverty intensity.

Variable	Elasticity of probability of poverty	Elasticity of intensity (B)	Total elasticity (a+b)
Child dependency ratio	0.123	0.109	0.232
Household size	3.645	0.323	3.968
Farm income	–0.449	–0.397	–0.846
Non-farm income	–0.114	–0.100	–0.214
Farm size	–0.259	–0.230	–0.489

Source: Computed from Tobit regression results.

In the Tobit regression analysis used, only poor households were considered. Hence, the dependent variable (as defined earlier) measured the intensity of poverty among households in the project area. The values of the dependent variables ranged between 0 and 1, the farther away the value is from 0, the worse the poverty situation. The result of the regression analysis is presented in this section.

A multi-colinearity test was first carried out on the variables included in the Tobit model and, as a result, some of the explanatory variables initially proposed for inclusion were dropped from the analysis.

The results of the Tobit regression analysis are presented in Table 33 and show various parameter estimates from the Tobit regression. The table reveals that eight out of the 14 explanatory variables related to household livelihoods included in the model had statistically significant coefficients at between 1% ($P < 0.01$) and 10% ($P < 0.1$), representing about 59% of all the explanatory variables. Also, the sigma (6) value was 0.42, with a t-value 26.9. This was statistically significant at the $P < 0.01$ level, thus indicating that the model had a good fit to the data. Furthermore, the log likelihood was –385.

The eight explanatory variables, which were found to significantly affect household poverty intensity, are discussed as follows:

Household head education (Education): Households with educated farmers as household heads had a lower intensity of poverty than those with little or no education. The education variables have a regression coefficient of –0.109, meaning that a unit increase in education level of the household head would bring about a decrease of about 11% in the probability of household poverty, and vice versa. The coefficient is negative and statistically significant at 1%.

Child dependency ratio (CDR): The degree of child dependency of a household is believed to affect the poverty level of such a household. A high dependency ratio was found to be inimical to households' poverty level. In this study, the child dependency ratio was found to have positively affected the poverty. The regression coefficient of 0.1091 for the child dependency ratio would increase the probability of poverty intensity by 0.109 in an average household in the study area.

Household's size (HH size): Households with large sizes had a higher intensity of poverty than those with smaller sizes. The household size variable has a regression coefficient of 0.323, measuring that a unit increase in household size would bring about an increase of 0.323 in the probability of household poverty, and vice versa. The coefficient is positive and statistically significant at 10%.

Farm Income (Farm Inc): Farm income was one of the highly significant factors affecting the intensity of poverty among households in the project area. Households with larger farm income were, on the average, less poor than those with lower farm income. This was because households with larger farm income were

able to generate larger expenditure thereby improving their poverty status. The regression coefficient is –0.3949, meaning that a unit increase in the size of household's farm income would lead to a reduction in the probability of household poverty by 0.395, and vice versa. The coefficient is negative and statistically significant at 1%.

Household production enterprise portfolio (FARMEN): Households whose enterprise structure was not restricted to farm production alone had a lower intensity of poverty than those that depended solely on farm production. The intercept dummy of –0.665 implies that the probability of poverty intensity was autonomously reduced by 0.665 among households whose enterprise structure was not restricted to farm production alone in the study area, compared with households having only farm production enterprises.

Nonfarm Income (Nonfarm Inc): Households that had additional sources of income apart from farming had a lower intensity of poverty than those engaged only in farming activities. The regression coefficient of –0.1008 implies that one unit increase in non-farm income decreased household probability of poverty intensity by about 10%.

Household farm size (farm size): Household farm size was one of the important factors affecting the intensity of poverty aiming household in the project area. Households with larger farm sizes were, on average, less poor than those that cultivated smaller farm sizes. This was because households with larger farm holdings were expected to generate more income that would improve their household poverty status. The regression coefficient is –0.229, meaning that a unit increase in the size of farm holding would lead to a reduction in the probability of household poverty by about 23%, and vice versa.

Extension Contact (Extension): Households that had regular contact with extension agents were on the average less poor than the household that did not. An intercept dummy of –0.814 implies that the probability of poverty intensity was autonomously reduced by –0.814 among households that had regular contact with extension agents.

Elasticities of household poverty intensity: Elasticity coefficients were computed only for five of the variables included in the model because other variables with statistically significant coefficients were dummies. Elasticities computed were those of child dependency ratio, household size, farm income, non-farm income, and farm size.

As shown in the Table 34, only the coefficient of household size was elastic (i.e., >1) out of the five computed.

The important factors that reduced household poverty intensity, in order of importance, were farm income, farm size, and nonfarm income.

A 1% increase in farm income will reduce the intensity of poverty by about 0.8%; while the same change in farm size and nonfarm income will result in about 0.49% and 0.21% reduction, respectively, in poverty level.

However, some variables were found to increase poverty intensity. These, in order of importance were, household size and child dependency ratio. It can be deduced that a 1% increase in household size would increase poverty intensity by about 3.96% while the same increase in child dependency ratio would increase household poverty by about 0.23%, and vice versa.

7. Major findings and Recommendations

The study was aimed at reporting the baseline conditions of the opportunities the IAR4D concept is introducing. Based on the results of the analysis of the survey data the following are the major findings:

- Results showed that the average ages of the households in all the locations were between 40 and 55; indicating that the farmers were in their highly productive age. They were yet to enter into dependent ages. The values may also imply that there was little or no difference in age across IPs and states.
- The implication of the above results is that the basic household socioeconomic characteristics of farmers in both the MLL IP and SLL IP are very similar with little statistically significant difference.
- With the age range between 47 and 51 years, farming experience 27 to 31 years, household size ranging between 12 and 17, the percentage who had primary school education was different at the different IPs: Kano MLL (24–36%); Kano SLL (32–50%); Katsina MLL (36%) and Katsina SLL (20%). The incidence of polygamy, percentage of male-headed households, and housing properties were also similar among the IPs. This may be because the sample was chosen within the same agroecological zone or sociocultural background.
- The small proportion of households that owned draft cattle, draft donkeys, and tractors in all the sites in the project area was indicative of the fact most farming households did not practice mechanized or semi-mechanized farming. Instead, they relied on hand implements in their farming activities. All the sites of both MLL IP and SLL IP in Kano and Katsina states had similar asset ownership distribution.
- The results showed that more farmers in the MLL IP in Katsina State had access to credit, but farmers in the SLL IP in Kano State obtained higher amounts of credit.
- Most (79%) of the farmers prefer to make a request for training from their neighbors in the SLL IP, while 54% made requests from the ADP. In essence, more farmers in the SLL IP requested for training than in the MLL IP.

A visiting researcher from CIAT being shown cowpea varieties by IITA researcher.

- Access to and use of extension services was generally low in all the IPs irrespective of the sites. In the MLL IPs and SLL IPs, access to credit was only noticeable in the use of fertilizer, improved varieties, and pest and disease management with 24%, 24%, and 16%, respectively, in IAR4D, R&D, and little or no intervention sites having contact with extension services. The same pattern was recorded in SLL IP in the IAR4D sites with 30%, 30%, and 24% access as regards the use of fertilizer, improved varieties, and pest and disease management, respectively.
- Farmers in MLL IP in IAR4D sites of Kano and all the sites in Katsina State perceived the interaction business transactions and material exchange had on all these factors to be moderate. However, farmers in R&D sites of Kano State perceived interactions on business transaction and material exchange to be very strong.
- In the SLL IP, farmers in IAR4D sites perceived that interactions on information exchange and business transactions to be strong while in other factors they were moderate in Kano State.
- In the two IPs membership of farmer organizations was generally low; the few that joined farmer organizations were principally men in the IAR4D and R&D sites in Kano and Katsina and they joined for production purposes.
- The analysis indicated that farmers had not been carried along in the research and development of new technology in all the IPs and sites. Research, technology transfer, and technology used have been treated as independent activities whereby research-derived knowledge consisting of large prescriptive technology packages flows inwardly from researchers to farmers through extension agents.
- The analysis showed that in Kano State in MLL IP farmers have been having some degree of interaction with other farmers and farmer groups but the occurrence had been average or below. However, in Katsina State with the exception of IAR4D sites, the interaction had been very low; a similar result was recorded in the SLL IP in both Kano and Katsina states.
- The result of the analysis showed that in both IPs farmers used hired labor. However the proportion that used hired labor in Kano State (> 62%) were more than those that used them in Katsina State (< 60]) in all the sites. All the farmers in the two IPs had a sizeable proportion of their households aged 16 years and above. This suggests the availability of members of the households as a source of labor on the farm.
- Household priority crops in the two IPs included maize, sorghum, millet, cowpea, and groundnut. In SLL IP little or no intervention sites produced the highest yields in maize and groundnut while IAR4D sites produced the average yields in sorghum, and R&D sites produced the highest yields in cowpea in Kano State. But in Katsina State, the highest yields in all the crops were produced in IAR4D sites.
- The results obtained for priority cereal crops in all the sites show a lot of similarity in enterprise gross margin for all the sites. However, Kano State villages and especially the MLL IP had better results than Katsina State sites. For priority legume crops, the results show that gross margin values obtained in Katsina State were lower, and therefore it could be deduced that the profitability of crop farming was highest in Kano State especially in the MLL IP sites.
- Nearly all farmers in the IAR4D, R&D, and little or no intervention sites in Kano State practiced monocropping, mixed cropping, livestock production, and shifting cultivation because not less than 80% of the households were involved. In Katsina State monocropping, livestock production, and mixed livestock production were only common in IAR4D sites. All the farmers in the R&D and little or no intervention sites practiced mixed cropping.
- In all IPs farmers had access to fertilizer, herbicide, and insecticide, but the main source of farm input was the local market. Households that use feed supplements in all the sites ranged between 25 and 41% in SLL IP while not less than 30% used feed supplements in the MLL IPs.

- The major crops traded by farmers in Kano in IAR4D sites were maize, sorghum, and groundnut where more than 50% of the households were involved. Maize was the only commodity traded in large amounts in both the R&D and little or no intervention sites.
- Results obtained for livestock output marketing shows that local goats and local sheep were the major livestock traded by farmers in both Kano and Katsina states with annual sales in the little or no intervention sites being highest for the MLL IP. In all the sites of the SLL IP, Katsina State farmers earned the lowest annual average sales from livestock sales of less than N15 000.00.
- In terms of household income sources, the two enterprises (sales of crops and livestock) constituted the highest proportion of household income in all the IP sites except in little or no intervention sites where casual employment in agricultural activities made up about 53% of the total income in Katsina State.
- In the MLL IP of Kano and Katsina states, no household spent more than 20%
- of their income on food, while in the SLL IP especially in Kano State, households spent about 28% of their income on food in IAR4D sites, 41% in R&D sites, and 97% in little or no intervention sites,.
- The analysis indicated that farmers in IAR4D sites of Kano State were food secure only in the months of July, August and September. In IAR4D sites food insecurity was highest in the month of April and May while in little or no intervention sites, it was highest in the month of January. The level of food insecurity was less than 50% in R&D sites of Kano State. In Katsina State the level of food insecurity was high from March till November in the IAR4D site of the maize–legume–livestock IP.
- The analysis indicated that very few farmers engaged in coping strategies. In the IAR4D site of the maize–legume–livestock IP, predominant coping strategies included borrowing money to buy and or buying food on credit, or buying cheaper food types (83% of 18 household). In R&D and little or no intervention sites no noticeable coping strategies were identified.
- The main crops grown in all the sites of the two IPs are maize and sorghum. Cultivation of other crops varies amongst the various sites with cowpea and groundnut featuring most in IAR4D sites and cotton and millet in other sites.
- However, the estimated poverty line showed that the poverty line for the little or no intervention sites was highest followed by those of IAR4D and finally the R&D thus indicating that poverty is highest in the little or no intervention villages compared to the other sites. The incidence of poverty in the study area is higher than that obtained in North Central Zone of Nigeria, in Kano and Katsina states.
- The estimates from Tables 32a and 32b showed that the headcount index of the population ranged from 25% for the IAR4D population to about 30% for the little or no intervention sites. The implication of this result is that the income in the IAR4D population is more equally distributed than in the other two kinds of sites. Hence, inequality in the other two populations (R&D and little or no intervention) was higher than for those in the IAR4D population.
- The key and significant variables determining the adoption decision of R&D innovation were age of the household head and education. The results indicated that as the farmers in the study area grow older the probability of adopting R&D innovation increased. A year increase in the age of the head of the households increases the probability of adoption of R&D innovation by about 1.2%.
- As farmers' level of education increases, the probability of adoption R&D innovation also increased. An increase in the level of education by one year results in about 46% increase in the probability of adoption of R&D innovations. The result is in agreement with (a priori) expectation that as the age of the household and level of education increase the likelihood of adoption of innovation also increased.

- Under general crop analysis, farmers in non-intervention sites favored the adoption of improved crop varieties more than those in intervention sites. But, as household size and awareness increased, tendency to adopt new varieties increased. The result revealed that distance to input and output markets did not affect probability of adoption negatively. However, frequency of extension visit, non-farm income, and amount of credit secured tended to affect the crops' adoption positively. Farmers in intervention sites were more favorably disposed to adopting new maize varieties compared to non-intervention sites and as farmers grew older, the tendency to adopt new maize varieties decreased; but increases in other cost of production did not affect adoption negatively. For the adoption of improved cowpea, farmers in non-intervention sites favored the adoption of improved cowpea more than those in intervention sites. Long years of farming experience did not affect adoption decisions but visits by extension agents encouraged adoption of the crop. As expected, costs of insecticide affected cowpea adoption negatively. In the adoption of livestock technologies, the results indicated that farmers in non-intervention sites favored the adoption more than those in intervention sites. Household size, awareness, and availability of land for grazing and nonfarm income encouraged farmers' adoption decisions while labor cost did not discourage adoption of improved livestock technologies.
- Results of the Tobit analysis explaining the factors determining the intensity of household poverty shows that eight explanatory variables affect household poverty intensity viz: Household Head Education (–0.109); Child Dependency Ratio (0.109); Household Size (0.323); Farm Income (–0.394); Household Production Enterprise Portfolio (–0.6650; Non-Farm Income (–0.101); Household Farm Size (–0.229), and Extension Contact (–0.814).
- According to the results obtained from the elasticity coefficients the important factors that reduce household poverty intensity in the study area were farm income, farm size, and non-farm income in order of importance. Factors that increase poverty intensity were household size (3.96%) and child dependency ratio (23%).

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Appendix

Table 1a. Villages and their status.

State	LGA	Villages	IP	Status
Kano	Bunkure	Kumurya	Maize/Legume/Livestock	Intervention
		Kulluwa	Maize/Legume/Livestock	Intervention
		Zanya	Maize/Legume/Livestock	Intervention
		Gabo	Maize/Legume/Livestock	Intervention
		Satigal	Maize/Legume/Livestock	Intervention
	Shanono	Kuraku	Sorghum/Legume/Livestock	Intervention
		Goron Dutse	Sorghum/Legume/Livestock	Intervention
		Alajawa	Sorghum/Legume/Livestock	Intervention
		Kundila	Sorghum/Legume/Livestock	Intervention
		Faruruwa	Sorghum/Legume/Livestock	Intervention
	Dawakin Tofa	Jemomi	Sorghum/Legume/Livestock	Clean
		Danbaje	Sorghum/Legume/Livestock	Clean
		Dan Dalama	Sorghum/Legume/Livestock	Clean
		Dan Bazau	Sorghum/Legume/Livestock	Clean
		Farigo	Sorghum/Legume/Livestock	Clean
		Kwa	Sorghum/Legume/Livestock	Conventional
		Bagadawa	Sorghum/Legume/Livestock	Conventional
		Kunawa	Sorghum/Legume/Livestock	Conventional
		Gabari	Sorghum/Legume/Livestock	Conventional
		Gwamai	Sorghum/Legume/Livestock	Conventional
	Karaye	Kwanyawa	Maize/Legume/Livestock	Clean
		Bauni	Maize/Legume/Livestock	Clean
		Madubawa	Maize/Legume/Livestock	Clean
		Kadafa	Maize/Legume/Livestock	Clean
		Kumbugawa	Maize/Legume/Livestock	Clean
		Tudun kaya	Maize/Legume/Livestock	Conventional
		Yola	Maize/Legume/Livestock	Conventional
		Daura	Maize/Legume/Livestock	Conventional
		Karaye	Maize/Legume/Livestock	Conventional
		Unguwa Haji	Maize/Legume/Livestock	Conventional
Katsina	Safana	Kunamawa A	Sorghum/Legume/Livestock	Intervention
		Kanbiri	Sorghum/Legume/Livestock	Intervention
		Dogon Ruwa	Sorghum/Legume/Livestock	Intervention
		Mai Jaura	Sorghum/Legume/Livestock	Intervention
		Kwamawa B	Sorghum/Legume/Livestock	Intervention
	Musawa	Jimkashi	Maize/Legume/Livestock	Intervention
		Tabbani	Maize/Legume/Livestock	Intervention
		Bakan	Maize/Legume/Livestock	Intervention
		Yarkanya	Maize/Legume/Livestock	Intervention
		Gin-Gin	Maize/Legume/Livestock	Intervention
	Dan Musa	Garaji	Maize/Legume/Livestock	Clean
		Barza	Maize/Legume/Livestock	Clean
		Tasha kaura	Maize/Legume/Livestock	Clean
		Chakau	Maize/Legume/Livestock	Clean
		Yantumaki	Maize/Legume/Livestock	Clean
		Sanawa	Maize/Legume/Livestock	Conventional
		Nasarawa	Maize/Legume/Livestock	Conventional
		Shema	Maize/Legume/Livestock	Conventional
		Shantalawa	Maize/Legume/Livestock	Conventional
		Karofi	Maize/Legume/Livestock	Conventional
	Ingawa	Yandoma	Sorghum/Legume/Livestock	Clean
		Kandawa	Sorghum/Legume/Livestock	Clean
		Gamda	Sorghum/Legume/Livestock	Clean
		Kurfeji	Sorghum/Legume/Livestock	Clean
		Irawa	Sorghum/Legume/Livestock	Clean
		Yargora	Sorghum/Legume/Livestock	Conventional
		Masibil	Sorghum/Legume/Livestock	Conventional
		Manomawa	Sorghum/Legume/Livestock	Conventional
		Shibdawa	Sorghum/Legume/Livestock	Conventional
		Gobirawa	Sorghum/Legume/Livestock	Conventional

Source: Field Survey Data, 2008.

Table 1b. Asset ownership (physical equipments) (Maize–legume-livestock IP).

Asset	Kano State Treatment LGA			Katsina State Treatment LGA		
	Bunkure IAR4D sites	Karaye Some &D sites	Karaye No (little) intervention	Musawa IAR4D sites	DanMusa Some &D sites	DanMusa No (little) intervention
Agric. Asset	Average Qty	Average Qty	Average Qty	Average Qty	Average Qty	Average Qty
Hoe/cuttlass	10(50)	11(50)	13(49)	5(50)	9(49)	10(49)
0xplough	3(17)	2(23)	3(27)	1(28)	2(28)	2(27)
Draft cattle	8(6)	2(16)	5(20)	2(17)	2(8)	5(7)
Draft donkeys	1(3)	–	1(1)	1(5)	1(1)	1(4)
Tractor	1(4)	–	–	2(1)	–	–
Wheel barrow	2(7)	1(8)	1(1)	2(3)	1(7)	2(9)
Transport equipment	4(1)	2(4)	–	–	1(5)	1(1)
Non-Agric. Asset						
Sewing machine	2(30)	1(26)	2(18)	1(12)	2(26)	2(18)
Ox-cart	2(1)	3(1)	–	–	1(11)	1(7)
Car	3(6)	2(9)	2(4)	1(4)	2(3)	3(6)
Bicycle	2(42)	2(40)	2(42)	1(38)	2(36)	2(37)
Motor-cycle	2(22)	2(21)	2(31)	1(33)	1(29)	2(27)
Radio	3(43)	3(42)	3(43)	2(46)	2(42)	2(40)
Television	2(12)	2(20)	2(12)	1(10)	2(16)	1(7)
Fish-boat	7(2)	2(1)	0	2(2)	–	1(2)
Mobil phone	2(15)	2(17)	1(13)	1(31)	2(19)	2(9)
Stove	2(29)	3(12)	1(1)	1(4)	1(13)	2(6)
Sofa/chair	4(18)	10(12)	2(4)	4(9)	4(18)	5(11)

Figures in brackets are number of respondents.

Table 2. Asset ownership (physical equipment) (Sorghum–legume–livestock IP).

Asset	Kano State Treatment LGA			Katsina state Treatment LGA		
	Shanono IAR4D sites	Dawakin Some &D sites	Dawakin No (little) intervention	Safana IAR4D sites	Ingawa Some R&D sites	Ingawa No (little) intervention
Agric. Asset	Average Qty	Average Qty	Average Qty	Average Qty	Average Qty	Average Qty
Hoe/cuttlass	10(49)	22(48)	20(50)	6(50)	6(50)	7(50)
0xplough	2(7)	2(11)	2(10)	1(31)	1(22)	2(27)
Draft cattle	2(29)	2(6)	2(6)	–	2(22)	3(20)
Draft donkeys	1(6)	1(4)	2(12)	1(2)	1(6)	1(4)
Tractor	–	2(1)	–	–	1(2)	–
Wheel barrow	1(1)	2(22)	1(18)	–	1(5)	1(8)
Transport equipment	1(3)	2(4)	2(3)	1(1)	1(8)	1(12)
Non-Agric. Asset						
Sewing machine	1(16)	1(18)	1(13)	1(13)	1(8)	1(17)
Ox-cart	1(1)	1(3)	2(2)	1(1)	1(5)	1(12)
Car	1(2)	1(5)	–	1(1)	2(2)	2(5)
Bicycle	2(44)	2(38)	3(39)	1(37)	1(33)	2(35)
Motorcycle	1(33)	2(23)	2(29)	1(19)	1(20)	1(25)
Radio	3(45)	4(37)	3(42)	3(44)	2(36)	2(35)
Television	1(6)	2(7)	1(5)	2(4)	2(7)	1(11)
Fish-boat	–	2(19)	2(23)	–	–	1(1)
Mobil phone	2(14)	2(20)	2(19)	–	2(6)	2(13)
Stove	1(4)	8(34)	12(28)	2(21)	1(5)	2(9)
Sofa/chair	3(6)	1(7)	1(11)	6(24)	5(12)	3(13)

Figures in brackets are number of respondents.

Table 3. Farmer access to agricultural training (Maize-legume-livestock IP).

	LGA	Service provider	Training topic	Perception on methods used	Farmers request for training (%)	Usefulness of the training	Timeliness of the training
Kano State							
IAR4D sites	Bunkure	ADP	Crop mgt.(20)	Good (5) Very good (15)	–	Useful(1) Very useful(19)	Timely(20)
		LGA	Crop mgt. (8)	Very good (15)	–	Very useful(8)	Timely(8)
Some R&D sites	Karaye	ADP	Crop mgt. (16) Pest & diseases control (6)	Good(22)	16	Not useful(6)Useful(8) Very useful(8)	Not always timely(8) Timely(14)
		Neighbor	Crop mgt. (16)	Good (16)	16	Not useful(8) Useful(8)	Not always timely(16)
No (little) intervention	Karaye	ADP	Crop mgt. (42)	Very poor(8) Good(25) Very good(9)	11	Useful(25) Very useful(17)	Not always timely(24) Timely(18)
		LGA	Crop mgt. (47) Agric. tech	Good(58)	8	Somehow useful(33) Useful(32) Very useful(8)	Always provided late(8) Not always timely(30) Timely(17)
Katsina State							
IAR4D sites	Musawa	ADP	Crop production(8)	Good(8)	Yes(8)	Useful(8)	Not always timely(8)
		Neighbor	Crop production(7) Pest & disease control(8) Agric.tech.(16)	Poor(7)Good(16) Very good(8)	Yes(16)	Somehow useful(7) Very useful (24)	Untimely(8)Always provided late(4) Timely(16)
Some &D sites	Dan Musa	Extension	Crop(7)	Good(7)	Very poor(7)	–	–
		IFAD	Others(8)	Good(8)	Very poor(8)	Very useful(8)	Timely(8)
Little or no intervention		LGA	Crop(3)	Good(3)	Very poor(3)	Useful(1)	Timely(1)
	Dan Musa	Extension	Crop(5)	Good(5)	Very poor(5)	Useful(8)	Not always timely(5)
		IFAD	Crop(18)	Good(8)	Very poor(8)	Useful(8)	Not always timely(8)
		LGA	Others(2)	Good(2)	Very poor(2)	Useful(2)	Timely(2)

Figures in brackets are number of respondents.

Table 4. Farmer access to agricultural training (Sorghum-legume-livestock IP).

	LGA	Service provider	Training topic	Perception on methods used	Farmers request for training (%)	Usefulness of the training	Timeliness of the training
Kano State							
IAR4D sites	Shanono	ADP	Crop mgt.(25)	Good (25)	37	Useful(32)	Not always timely(25)
			Pest & disease control(8)				
			Agric.tech.(17)	Very good(25)		Very useful(18)	Timely(25)
		IITA	Crop production(4)	Poor(4)	4	Somehow useful(4)	Untimely(4)
Some &D sites	D/tofa	ADP	Crop mgt.(16)	Good(16)	–	Useful(16)	Timely(16)
		AFAN	Crop mgt.(8)	Good(8)	8	Useful(8)	Always provided late(8)
		FARM	Crop mgt.(5)	Good(5)	5	Very useful(5)	Timely(5)
		IITA	Pest & disease control(2)	Good(8)	8	Useful(8)	Always provided late(8)
		Neighbor	Crop mgt.(10)	Good(34)	40	Somehow useful(9)	Not always timely(18)
			Agric.tech.(35)	Very good(17)		Useful(25)	Timely(32)
						Very useful(16)	
No (little) intervention	D/tofa	ADP	Crop mgt.(30)	Good(46)	6	Useful(38)	Timely(46)
						Very useful(8)	
		Neighbor	Crop mgt.(13)	Good(13)	16	Useful(16)	Always provided late(7)
			Pest & disease control(8)	Very good(16)		Very useful(13)	Not always timely(16)
			Livestock(8)				Timely(6)
Katsina State							
IAR4D sites	Safana	–	–	–	–	–	–
Some R &D sites	Ingawa	ADP	Agric.tech.(4)	Good(4)	Yes(4)	Somehow useful(4)	Always provided late(4)
		Neighbor	Crop production(11)	Good(16)	Yes(16)	Somehow useful(11)	Always provided late(16)
						Useful(5)	
	Ingawa	ADP	Livestock(5)	Good(7)	Yes(7)	Useful(7)	Timely(7)
			Pest & disease control(7)				
		LGA	Pest & disease control(1)	Good(1)	Yes(1)	Useful(1)	Timely(1)
Little or no intervention		Neighbor	Livestock(7)	Good(7)	Yes(7)	Useful(7)	Always provided late(7)
		IFAD	Crop(18)	Good(8)	Very poor(8)	Useful(8)	Not always timely(8)
		LGA	0thers(2)	Good(2)	Very poor(2)	Useful(2)	Timely(2)

Figures in brackets are number of respondents.

Table 5. Respondent interaction with other farmers & farmers' group (Maize–legume–livestock IP).

Treatment	Aspect	How would you rate the occurrence						
		Never happens	Poor	Average	V. good	Excellent	Total	Frequency
Kano State								
IAR4D sites	Participated in community development activity	–	3	24	13	10	50	5
(Bunkure)	Made financial contribution for community activities or collective problems	3	17	12	6	–	38	2
	Been involved in settling conflicts or disputes among people	2	8	19	6	2	37	3
	Visited other farmers within your community to learn about agriculture	2	15	8	8	–	33	2
	Visited other farmers outside your community to learn about agriculture	10	–	1	1	–	12	4
	Visited a research station to learn about agriculture	7	2	2	2	–	13	3
	Visited an extension office to learn about agriculture	3	6	5	5	2	21	3
Some R &D	Participated in community development activity	1	1	3	26	10	41	4
sites (Karaye)	Made financial contribution for community activities or collective problems	8	1	1	18	10	38	3
	Been involved in settling conflicts or disputes among people	10	1	–	17	10	38	4
	Visited other farmers within your community to learn about agriculture	21	3	–	12	2	38	4
	Visited other farmers outside your community to learn about agriculture	33	–	5	–	–	38	3
	Visited a research station to learn about agriculture	35	–	1	2	–	38	6
	Visited an extension office to learn about agriculture	32	–	1	5	–	38	4
Little or no	Participated in community development activity	2	4	20	7	3	36	23
intervention	Made financial contribution for community activities or collective problems	7	15	9	5	–	36	9
(Karaye)	Been involved in settling conflicts or disputes among people	14	10	6	2	4	36	20
	Visited other farmers within your community to learn about agriculture	31	3	1	–	–	35	2
	Visited other farmers outside your community to learn about agriculture	32	2	–	–	–	34	–
	Visited a research station to learn about agriculture	31	3	1	–	–	35	2
	Visited an extension office to learn about agriculture	27	4	3	–	–	34	2
Katsina state								
IAR4D sites	Participated in community development activity	6	2	17	16	–	41	3
(Musawa)	Made financial contribution for community activities or collective problems	5	3	15	18	–	41	3
	Been involved in settling conflicts or disputes among people	20	6	9	4	2	41	2
	Visited other farmers within your community to learn about agriculture	12	3	13	8	5	41	3
	Visited other farmers outside your community to learn about agriculture	14	3	16	5	3	41	3
	Visited a research station to learn about agriculture	35	1	3	1	1	41	2
	Visited an extension office to learn about agriculture	37	1	1	1	1	41	2

Table 5. Respondent interaction with other farmers & farmers' group (Maize–legume–livestock IP). Contd.

Treatment	Aspect	How would you rate the occurrence						
		Never happens	Poor	Average	V. good	Excellent	Total	Frequency
Some R&D sites (Dan Musa)	Participated in community development activity	–	–	2	9	8	19	
	Made financial contribution for community activities or collective problems	4	4	4	4	2	18	
	Been involved in settling conflicts or disputes among people	5	1	3	7	2	18	
	Visited other farmers within your community to learn about agriculture	7	5	1	5	–	18	
	Visited other farmers outside your community to learn about agriculture	13	–	1	–	–	14	
	Visited a research station to learn about agriculture	14	–	1	–	–	15	
	Visited an extension office to learn about agriculture	12	1	1	2	2	18	
Little or no intervention (Dan Musa)	Participated in community development activity	–	1	4	8	3	16	4
	Made financial contribution for community activities or collective problems	1	2	4	6	2	15	3
	Been involved in settling conflicts or disputes among people	1	–	2	6	2	11	3
	Visited other farmers within your community to learn about agriculture	6	1	2	3	–	12	2
	Visited other farmers outside your community to learn about agriculture	8	–	–	1	–	9	2
	Visited a research station to learn about agriculture	8	1	1	–	–	10	2
	Visited an extension office to learn about agriculture	7	1	–	2	–	10	3

Table 6. Respondent interaction with other farmers & farmers' group (Maize–legume–livestock IP).

Treatment	Aspect	How would you rate the occurrence						
		Never happens	Poor	Average	V. good	Excellent	Total	Frequency
Kano State								
IAR4D sites (Shanono)	Participated in community development activity	–	1	10	25	14	50	7
	Made financial contribution for community activities or collective problems	–	–	12	26	12	50	9
	Been involved in settling conflicts or disputes among people	–	5	5	26	14	50	5
	Visited other farmers within your community to learn about agriculture	5	8	28	4	2	47	2
	Visited other farmers outside your community to learn about agriculture	3	21	16	6	1	47	2
	Visited a research station to learn about agriculture	10	19	10	7	1	47	2
	Visited an extension office to learn about agriculture	8	13	12	9	4	46	2
Some R&D sites (Dawakin tofa)	Participated in community development activity	–	1	11	32	3	47	4
	Made financial contribution for community activities or collective problems	1	2	12	26	6	47	3
	Been involved in settling conflicts or disputes among people	4	1	17	24	1	47	3
	Visited other farmers within your community to learn about agriculture	15	–	16	13	3	47	2
	Visited other farmers outside your community to learn about agriculture	35	1	5	6	–	47	3
	Visited a research station to learn about agriculture	38	–	5	2	1	46	2
	Visited an extension office to learn about agriculture	24	–	9	11	2	46	4
Little or no intervention (Dawakin Tofa)	Participated in community development activity	1	2	16	27	1	47	6
	Made financial contribution for community activities or collective problems	1	1	15	28	2	47	5
	Been involved in settling conflicts or disputes among people	6	1	16	20	4	47	4
	Visited other farmers within your community to learn about agriculture	9	1	6	27	2	45	4
	Visited other farmers outside your community to learn about agriculture	28	2	4	10	1	45	5
	Visited a research station to learn about agriculture	39	2	2	2	–	45	5
	Visited an extension office to learn about agriculture	24	2	4	14	1	45	3
Katsina state IAR4D sites (Safana)	Participated in community development activity	–	–	40	8	1	49	4
	Made financial contribution for community activities or collective problems	–	–	17	4	1	32	7
	Been involved in settling conflicts or disputes among people	–	2	3	3	1	9	2
	Visited other farmers within your community to learn about agriculture	–	–	–	–	–	–	–
	Visited other farmers outside your community to learn about agriculture	–	–	–	–	–	–	–
	Visited a research station to learn about agriculture	–	–	–	–	–	–	–
	Visited an extension office to learn about agriculture	–	–	–	–	–	–	–
Some R&D sites (Ingawa)	Participated in community development activity	–	3	33	1	–	37	4
	Made financial contribution for community activities or collective problems	–	6	16	9	–	31	4
	Been involved in settling conflicts or disputes among people	11	7	10	–	–	28	2
	Visited other farmers within your community to learn about agriculture	–	3	16	4	–	23	5
	Visited other farmers outside your community to learn about agriculture	1	6	2	–	–	9	–
	Visited a research station to learn about agriculture	3	–	–	–	–	3	–
	Visited an extension office to learn about agriculture	3	4	–	–	–	7	2
Little or no intervention (Ingawa)	Participated in community development activity	–	2	29	4	–	35	7
	Made financial contribution for community activities or collective problems	–	3	19	12	–	34	5
	Been involved in settling conflicts or disputes among people	9	3	17	3	–	32	4
	Visited other farmers within your community to learn about agriculture	2	3	17	9	–	31	5
	Visited other farmers outside your community to learn about agriculture	7	7	4	3	–	21	4
	Visited a research station to learn about agriculture	13	2	1	–	–	16	1
	Visited an extension office to learn about agriculture	9	3	4	–	–	16	5

Table 7. Household access to farm input (Maiz– legume–livestock).

Farm inputs	IAR4D sites						Some R&D sites						Little or no intervention					
Kano State	Number of HH using from (Bunkure)						Number of HH using from (Karaye)						Number of HH using from (Karaye)					
	Km	1	2	3	4	5	K m	1	2	3	4	5	Km	1	2	3	4	5
N		50	50	50	50	50	50	50	50	50	50	50		50	50	50	50	50
Fertilizer	14(49)	49	0	1	18	2	11.5(48)	44	0	0	6	1	11.11(49)	44	0	0	6	0
Herbicide	14(49)	50	0	1	15	2	12.3(26)	25	0	0	4	0	11.12(36)	34	0	0	2	0
Fungicide	14(49)	50	0	1	14	2	10.3(21)	22	0	0	1	0	9.5(31)	31	0	0	0	0
Insecticide	14(49)	49	0	1	14	2	13.2(34)	30	0	0	6	0	8.1(39)	38			2	0
Manure	8.8(20)	19			1		6.1(28)	28	0	2	0	0	1.00(35)	5	1	1	0	0
Certified seed	8.6(40)	41	0	1	12	2	11.7(22)	21	0	0	4	1	23.9(9)	4	1	0	4	0
Seed dressing	8.7(28)	28	0	1	9	2	19.9(6)	4	0	0	1	0	96(1)	1	0	0	0	0
Pos harvest insect control	11.5(17)	20	0	0	4	0	11(22)	24	0	0	0	0	9.5(31)	31	0	0	0	0
Farm equipment	16.9(38)	38	0	0	3	0	9(27)	29	0	0	0	0	9.2(32)	32	0	0	0	0
Water pumps	26.8(19)	20	0	0	2	0	9.5(4)	6	0	0	0	0	3.9(3	11	0	0	19	0
Supplementary livestock feeds	9.33(15)	19	0	0	3	0	10(14)	16	0	1	0	0	9.5(30)	30	0	0	0	0
Livestock drugs	32.3(15)	16	0	0	2	0	11.2(7)	14	0	0	0	0	9.5(31)	31	0	0	0	0
Others																		

Farm inputs	IAR4D sites						Some R &D sites						Little or no intervention					
	Percent of HH using from Musawa						Percent of HH using from Dan musa %						Percent of HH using from Musawa (Bunkure) % of HH using from					
Katsina State	Km	1	2	3	4	5	K m	1	2	3	4	5	Km	1	2	3	4	5
Fertilizer		47	0	1	32	1	12.7(45)	26	1	16	8	0	8.6(43)	28	2	17	4	0
Herbicide	9.1(49)	0	0	0	0	0	25.1(16)	15	0	1	1	0	11.6(15)	14	0	1	3	0
Fungicide		14	0	0	0	0	25.1(16)	15	0	1	1	0	11(15)	13	0	2	3	0
Insecticide	100(2)	43	0	0	0	0	14(36)	22	0	14	2	0	11.5(28)	19	0	12	3	0
Manure	4.5(14)	26	0	2	0	0	2.9(16)	12	0	3	0	0	6(15)	8	0	4	0	0
Certified seed	0.00(2)	1	0	0	0	0	7.6(8)	6	0	0	2	0	17.6(6)	7	0	0	2	0
Seed dressing		1	0	0	0	0	8(5)	3	0	2	0	0	20.9(11)	6	0	5	1	0
Postharvest insect control	1.00(1)	17	0	0	0	0	7.9(11)	11	0	0	1	0	15.2(11)	10	0	1	2	0
Farm equipment	4.3(17)	28	0	0	0	0	15.2(33)	26	0	12	0	0	6.9(27)	23	0	12	1	0
Water pumps	3.6(25)	3	0	0	0	0	80.3(4)	1	0	0	0	0	27.8(3)	3	0	0	1	0
Supplementary livestock feeds	10.9(3)	2	0	0	0	0	6.6(28)	15	0	15	1	0	6.8(24)	17	0	12	1	0
Livestock drugs	15(2)	2	0	0	0	0	29.7(38)	26	0	14	1	0	6.5(22)	16	0	11	0	0
Others																		

Note: 1–5 = Sources of Fertilizer; 1 = Fm Mkt, 2 = Fm Stockists, 3 = Fm Other Farmers, 4 = Fm Govt., 5 = Fm NGOs

Table 8. Household access to farm input (Sorghum–legume–livestock).

Farm inputs	IAR4D sites						Some R &D sites						Little or no intervention					
Kano state	Number of HH using from (Shanono)						Number of HH using from (D/tofa)						Number of HH using from (D/tofa)					
	Km	1	2	3	4	5	K m	1	2	3	4	5	Km	1	2	3	4	5
N		50	50	50	50	50		50	50	50	50	50		50	50	50	50	50
Fertilizer	15(50)	50	0	0	2	0	7.7(49)	47	0	0	2	0	17(50)	41	0	1	6	3
Herbicide	19.8(28)	26	2	0	0	0	7.3(33)	33	0	0	0	0	20.9(28)	26	0	2	1	1
Fungicide	9.5(20)	20	1	1	0	0	15(3)	3	0	0	0	0	18.7(3)	3	0	0	0	0
Insecticide	13.2(38)	38	2	0	0	0	7.3(36)	35	0	0	1	0	22(39)	29	0	1	5	2
Manure	3(34)	13	1	22	0	0	1.9(43)	36	0	6	0	0	7(43)	32	0	4	0	1
Certified seed	20.8(19)	14	2	1	3	0	5(1)	1	0	0	0	0	25(3)	2	0	0	1	1
Seed dressing	8.8(4)	2	2	0	0	0	5.8(17)	15	0	1	0	0	26.7(18)	17	0	1	0	1
Pos harvest insect control	1(1)	0	1	0	0	0	8(9)	9	0	0	1	0	18.4(8)	7	0	0	0	1
Farm equipment	118.7(6)	7	0	0	0	0	2.8(11)	10	3	0	0	5	12.7(12)	8	1	0	2	0
Water pumps	42(3)	3	0	0	0	0	5.6(7)	7	0	0	0	0	13.8(4)	4	0	0	0	0
Supplementary livestock feeds	9.6(42)	42	1	0	0	0	6.3(29)	28	0	0	1	0	8.4(20)	19	0	1	0	0
Livestock drugs	9.6(40)	40	1	0	0	0	4.9(39)	39	0	0	1	0	16.1(31)	30	0	1	1	0
Others																		

Farm inputs	IAR4D sites						Some R&D sites						Little or no intervention					
Katsina State	Percent of HH using from (Safana)						Percent of HH from (Ingawa)						Percent of HH from (Ingawa)					
	Km	1	2	3	4	5	K m	1	2	3	4	5	Km	1	2	3	4	5
Fertilizer	9(49)	41	4	0	0	0	8.6(49)		0	0	28	0	8(50)	40	0	2	31	1
Herbicide	.00(2)	0	0	0	0	0	4.5(2)	1	0	0	1	0	6.8(4)	3	0	0	2	0
Fungicide	4.5(14)	0	0	0	0	0	4.8(4)	3	0	0	1	0	0	0	0	0	0	0
Insecticide	7.4(29)	14	6	0	0	0	6.7(24)	21	0	0	4	0	6(25)	18	1	1	4	1
Manure	9(49)	9	0	20	0	0	3(24)	8	4	13	0	0	1.7(27)	4	7	15	2	0
Certified seed	.00(2)	1	0	0	0	0	6(14)	6	0	0	8	0	5.7(18)	7	0	2	8	1
Seed dressing	4.5(14)	7	6	0	0	0	7.5(26)	21	0	0	4	0	6.5(4)	26	0	1	4	1
Postharvest insect control	7(39)	6	0	0	0	0	7(22)	21	0	0	4	0	6(25)	19	0	1	1	0
Farm equipment	4.5(26)	1	0	0	0	0	7.9(28)	27	0	0	1	0	1.7(27)	24	0	1	1	0
Water pumps	1(1)	0	0	0	0	0	10.6(15)	13	0	0	2	0	5.7(18)	16	0	1	1	0
Supplementary livestock feeds	4.3(17)	1	0	0	0	0	7(21)	21	0	0	1	0	6.5(32)	24	0	0	2	0
Livestock drugs	3.6(25)	9	1	0	0	0	7(29)	27	0	0	1	0	6(21)	31	0	0	0	0
Others																		

Note: 1–5 = Sources of Fertilizer; 1 = Fm Mkt, 2 = Fm Stockists, 3 = Fm Other Farmers, 4 = Fm Govt., 5 = Fm NGOs

Table 9. Use of livestock feed supplement.

Kano State	LGA	Feed supplement (FS)	Type of animal (*)	Frequency	Percent
IAR4D sites	Bunkure	Concentrates	Adult female	33	32
			Adult male	35	34
			Young stock	35	34
		Crop residue	Adult female	59	32.2
			Adult male	62	33.9
			Young stock	62	33.9
		Grazed forage	Adult female	59	32.2
			Adult male	62	33.9
			Young stock	62	33.9
		Green fodder	Adult female	41	32.8
			Adult male	42	33.6
			Young stock	42	33.6
		Tree leaves	Adult female	52	32.9
			Adult male	53	33.5
			Young stock	53	33.5
Some R &D sites	Karaye	Concentrates	Adult female	11	29.7
			Adult male	13	35.1
			Young stock	13	35.1
		Crop residue	Adult female	38	28.4
			Adult male	55	41
			Young stock	41	30.6
		Grazed forage	Adult female	29	29.6
			Adult male	40	40.8
			Young stock	29	29.6
		Green fodder	Adult female	16	29.6
			Adult male	21	38.9
			Young stock	17	31.5
		Tree leaves	Adult female	17	25.8
			Adult male	27	40.9
			Young stock	22	33.3
Little or no intervention	Karaye	Concentrates	Adult female	65	32.8
			Adult male	68	34.3
			Young stock	65	32.8
		Crop residue	Adult female	75	32.9
			Adult male	78	34.2
			Young stock	75	32.9
		Grazed forage	Adult female	66	32.8
			Adult male	69	34.3
			Young stock	66	32.8
		Green fodder	Adult female	71	32.9
			Adult male	74	34.3
			Young stock	71	32.9
		Tree leaves	Adult female	57	32.9
			Adult male	58	33.5
			Young stock	58	33.5

Table 9. Use of livestock feed supplement (contd).

Katsina State	LGA	Feed supplement (FS)	Type of animal (*)	Frequency	Percent
IAR4D sites	Musawa	Concentrates	Adult female	1	4.5
			Adult male	11	50
			Young stock	10	45.5
		Crop residue	Adult female	1	4.3
			Adult male	12	52.2
			Young stock	10	43.5
		Grazed forage	Adult female	-	-
			Adult male	12	57.1
			Young stock	9	42.9
		Green fodder	Adult female	1	4.2
			Adult male	13	54.2
			Young stock	10	41.7
		Tree leaves	Adult female	2	8.3
			Adult male	12	50
			Young stock	10	41.7
Some R &D sites	Dan musa	Concentrates	Adult female	7	31.8
			Adult male	8	36.4
			Young stock	7	31.8
		Crop residue	Adult female	29	33.3
			Adult male	33	37.9
			Young stock	25	28.7
		Grazed forage	Adult female	14	33.3
			Adult male	14	33.3
			Young stock	14	33.3
		Green fodder	Adult female	8	30.8
			Adult male	8	30.8
			Young stock	10	38.5
		Tree leaves	Adult female	37	33.9
			Adult male	41	37.6
			Young stock	31	28.4
Little or no intervention	Dan musa	Concentrates	Adult female	1	33.3
			Adult male	2	66.7
			Young stock	-	-
		Crop residue	Adult female	16	30.2
			Adult male	21	39.6
			Young stock	16	30.2
		Grazed forage	Adult female	9	31.0
			Adult male	11	37.9
			Young stock	9	31
		Green fodder	Adult female	6	35.3
			Adult male	4	23.5
			Young stock	7	41.2
		Tree leaves	Adult female	38	33
			Adult male	40	34.8
			Young stock	37	32.2

Table 10. Use of livestock feed supplement (Sorghum–legume–livestock IP).

Kano State	LGA	Feed supplement (FS)	Type of animal (*)	Frequency	Percentage
IAR4D sites	Shanono	Concentrates	Adult female	52	29.9
			Adult male	68	39.1
			Young stock	54	31
		Crop residue	Adult female	53	30.3
			Adult male	68	38.9
			Young stock	54	30.9
		Grazed forage	Adult female	54	29.8
			Adult male	71	39.2
			Young stock	56	30.9
		Green fodder	Adult female	53	30.3
			Adult male	68	38.9
			Young stock	54	30.9
		Tree leaves	Adult female	51	29.8
			Adult male	67	39.2
			Young stock	53	31
Some R&D sites	DawakinTtofa	Concentrates	Adult female	26	34.7
			Adult male	28	37.3
			Young stock	21	28
		Crop residue	Adult female	28	34.6
			Adult male	30	37
			Young stock	23	28.4
		Grazed forage	Adult female	25	35.7
			Adult male	27	38.6
			Young stock	18	25.7
		Green fodder	Adult female	34	34.7
			Adult male	36	36.7
			Young stock	28	28.6
		Tree leaves	Adult female	28	33.3
			Adult male	30	35.7
			Young stock	26	31
Little or no intervention	Dawakin Tofa	Concentrates	Adult female	36	30.8
			Adult male	48	41
			Young stock	33	28.2
		Crop residue	Adult female	28	32.2
			Adult male	37	42.5
			Young stock	22	25.3
		Grazed forage	Adult female	28	29.2
			Adult male	40	41.7
			Young stock	28	29.2
		Green fodder	Adult female	28	31.1
			Adult male	38	42.2
			Young stock	24	26.7
		Tree leaves	Adult female	23	31.1
			Adult male	32	43.2
			Young stock	19	25.7

Table 10. Use of livestock feed supplement (Sorghum–legume–livestock IP) (Contd).

Katsina State	LGA	Feed supplement (FS)	Type of animal (*)	Frequency	Percentage
IAR4D sites	Safana	Concentrates	Adult female	13	32.5
			Adult male	15	37.5
			Young stock	12	30
		Crop residue	Adult female	29	30.5
			Adult male	37	38.9
			Young stock	29	30.5
		Grazed forage	Adult female	44	31.2
			Adult male	55	39
			Young stock	42	29.8
		Green fodder	Adult female	23	31.9
			Adult male	28	38.9
			Young stock	21	29.2
		Tree leaves	Adult female	35	30.2
			Adult male	46	39.7
			Young stock	35	30.2
Some R&D sites	Ingawa	Concentrates	Adult female	32	29.4
			Adult male	45	41.3
			Young stock	32	29.4
		Crop residue	Adult female	43	25.3
			Adult male	71	41.3
			Young stock	56	32.9
		Grazed forage	Adult female	39	29.5
			Adult male	53	40.2
			Young stock	40	30.3
		Green fodder	Adult female	36	29.8
			Adult male	49	40.5
			Young stock	36	29.8
		Tree leaves	Adult female	36	29.8
			Adult male	49	40.5
			Young stock	36	29.8
Little or no intervention	Ingawa	Concentrates	Adult female	36	29.3
			Adult male	50	40.7
			Young stock	37	30.1
		Crop residue	Adult female	39	24.2
			Adult male	66	41
			Young stock	56	34.8
		Grazed forage	Adult female	37	29.4
			Adult male	51	40.5
			Young stock	38	30.2
		Green fodder	Adult female	37	29.6
			Adult male	51	40.8
			Young stock	37	29.6
		Tree leaves	Adult female	35	29.4
			Adult male	49	41.2
			Young stock	35	29.4

Table 11. Awareness and adoption of technologies (% of household) (MLL IP).

Technologies	IAR4D sites (Bunkure)			Some R &D sites (Karaye)			Little or no intervention (Karaye)		
	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted
	2007/08			2007/08			2007/08		
Soil & water mgt.									
Mulching	3(100)	3(100)	2(66.7)	7(100)	13(100)	0	0	0	0
Water harvesting	2(100)	2(100)	2(100)	7(100)	13(100)	0	0	0	0
Trenches	1(100)	1(100)	1(100)	7(100)	13(100)	0	0	2(14.3)	0
Irrigation	17(100)	17(94.1)	17(94.1)	9(44.4)	2(14.3)	3(11.1)	14(14.3)	1(7.1)	0
Conservation	1(100)	1(100)	1(100)	0	1(7.1)	7(100)	4(7.1)	0	1(7.1)
Crop protection									
Fungicide use	0	0	0	0	0	0	0	14(60.9)	0
Herbicide use	0	0	0	0	0	0	23(73.9)	0	27(36.8)
Insecticide use on fields	47(100)	47(100)	40(83.0)	32(93.8)	14(60.9)	19(70.4)	38(92.1)	34(87.2)	27(28.2)
Insecticide use for storage	46(97.9)	46(97.9)	38(78.7)	39(89.7)	34(89.5)	5(41.7)	39(89.7)	1(6.7)	2(11.8)
Botanical pesticides	36(97.3)	46(97.9)	38(78.7)	27(85.2)	34(87.2)	2(18.2)	17(17.6)	0	1(6.7)
Other diseases & control	28(96.6)	36(97.3)	31(83.8)	12(41.7)	2(11.8)	17(61.5)	15(6.7)	2(13.3)	0
Crop mgt practices									
Row planting	8(88.9)	28(96.6)	24(82.8)	11(18.2)	1(6.7)	50(98.0)	23(92.0)	23(78.3)	2(28.6)
Planting density	1(100)	8(88.9)	9(100)	26(88.5)	15(100)	42(95.3)	4(66.7)	0	0
Thinning	15(100)	27(96.4)	22(75.0)	9(22.2)	13(100)	20(35.0)	4(66.7)	7(28.6)	0
NPK	38(100)	1(100)	1(100)	0	13(100)	25(48.0)	0	7(28.6)	0
N (Urea)	39(100)	15(100)	15(93.3)	47(100)	46(93.9)	0	0	5(20)	5(100)
DAP	9(100)	38(100)	31(73.7)	23(100)	27(81.8)	23(91.3)	3(11.1)	14(14.3)	1(7.1)
SSP	6(100)	39100)	31(74.4)	4(100)	0	20(75.0)	7(100)	4(7.1)	0
Animal manure	48(1000	6(1000	7(77.8)	9(100)	26()86.7)	22(86.4)	1(69.6	0	0
Composting & organic residue mgt.	8(100)	48(90.9)	5(83.3)	44(100)	18(78.3)	47(100)	47(100)	40(83.0)	32(93.8)
Legume-cereal rotation	11(9.1)	8(100)	43(81.9)	5(20)	5(100)	46(97.9)	46(97.9)	38(78.7)	39(89.7)
Mthd of fert. Application	7(90.9)	11(99.9)	7(87.5)	24(92.0)	2(28.6)	36(97.3)	46(97.9)	38(78.7)	27(85.2)
Cover crops	15(100)2	15(100)	11(81.8)	5(66.7)	2(28.6)	28(96.6)	36(97.3)	31(83.8)	12(41.7)
Postharvest technology									
Drying	2(71)	39(100)	2(18.2)	17(17.6)	0	1(6.7)	22(95.5)	2(14.3)	3(11.1)
Threshing equipment	11	19(94.7)	17(61.5)	15(6.7)	2(13.3)	0	39(100)	1(7.1)	7(100)
Improved storage sytem	31(74.4)	4(100)	0	20(75.0)	7(100)	4(7.1)	20(75.0)	7(100)	4(7.1)
Pest control	17(100)	17(94.1)	17(94.1)	9(44.4)	2(14.3)	3(11.1)	14(14.3)	1(7.1)	5(44)
Grading	1(100)	1(100)	1(100)	0	1(7.1)	7(100)	4(7.1)	0	50(95)
Improved breeds/livestock									
Improve cattle breeds	125(76.0)	13(11.1)	14(60.9)	1(100)	1(100)	1(100)	25(72)	25(34)	7(56)
Livestock drugs	14(14.3)	1(7.1)	0	3(100)	3(100)	2(66.7)	7(100)	25	9
Livestock supplementary feeds	19(100)	20(75.0)	7(100)	0	5(45.2)	0	0	25	0

Table 11. Awareness and adoption of technologies (% of household) (MLL IP). Contd.

Technologies	IAR4D sites (Bunkure)			Some R &D sites (Karaye)			Little or no intervention (Karaye)		
	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted
		2007/08			2007/08			2007/08	
Katsina State		Musawa			Dan Musa			Dan Musa	
Soil & water mgt.									
Mulching	25(76.0)	2(22.2)	0	27(96.4)	22(75.0)	9(22.2)	13(100)	20(35.0)	4(66.7)
Water harvesting	23(47.8)	0	15(13.3)	47(100)	47(100)	40(83.0)	38(100)	1(100)	1(100)
Trenches	24(70.8)	45(93.6)	0	46(97.9)	46(97.9)	38(78.7)	39(100)	15(100)	15(93.3)
Irrigation	32(96.9)	19(82.6)	0	36(97.3)	46(97.9)	38(78.7)	9(100)	38(100)	31(73.7)
Conservation	20(85.0)	1(25.0)	49(95.9)	28(96.6)	36(97.3)	31(83.8)	20(75.0)	7(100)	
Crop protection									
Fungicide use	0	0	0	11(18.2)	1(6.7)	0	0	23(78.3)	1(100)
Herbicide use	0	0	29(90.0)	26(88.5)	15(100)	0	0	0	15(100)
Insecticide use on fields	50(98.0)	23(92.0)	23(78.3)	9(22.2)	13(100)	20(35.0)	4(66.7)	7(28.6)	38(100)
Insecticide use for storage	42(95.3)	4(66.7)	0	0	13(100)	25(48.0)	0	7(28.6)	39100)
Botanical pesticides	20(35.0)	4(66.7)	7(28.6)	47(100)	46(93.9)	8(88.9)	13(100	5(20)	6(1000
Other diseases & control	25(48.0)	0	7(28.6)	23(100)	27(81.8)	1(100)	3(11.1)	14(14.3)	48(90.9)
Crop mgt practices									
Row planting	23(91.3)	3(11.1)	14(14.3)	9(100)	26()86.7)	22(86.4)	1(69.6	0	23(100)
Planting density	20(75.0)	7(100)	4(7.1)	44(100)	18(78.3)	47(100)	47(100)	40(83.0)	4(100)
Thinning	22(86.4)	1(69.6	0	5(20)	5(100)	46(97.9)	46(97.9)	38(78.7)	9(100)
NPK	48(100)	28(84.4)	0	24(92.0)	2(28.6)	36(97.3)	46(97.9)	38(78.7)	44(100)
N (Urea)	47(100)	33(79.5)	23(73.9)	5(66.7)	2(28.6)	28(96.6)	36(97.3)	31(83.8)	5(20)
DAP	1(100)	19(70.4)	38(92.1)	47(100)	40(83.0)	38(100)	1(100)	1(100)	20(75.0)
SSP	22(95.5)	5(41.7)	39(89.7)	8(100)	18(90.9)	5(83.3)	44(100)	18(78.3)	47(100)
Animal manure	39(100)	2(18.2)	17(17.6)	19(100)	20(75.0)	39(100)	2(18.2)	17(17.6)	
organic residue mgt.	19(94.7)	17(61.5)	15(6.7)	14(14.3)	1(7.1)	19(94.7)	17(61.5)	15(6.7)	7(100)
Legume-cereal rotation	19(100)	20(75.0)	7(100)						
Mthd of fert. Application	18(94.4)	22(86.4)	1(69.6	4(66.7)	7(28.6)	2(14.3)	3(11.1)	14(14.3)	0
Cover crops	15(80.0)	48(100)	28(84.4)	0	7(28.6)	1(7.1)	7(100)	4(7.1)	4(100)
Postharvest technology				13(100	5(20)	6(1000	13(100)	47(100)	8(100)
Drying	22(75.0)	9(22.2)	13(100)	3(11.1)	14(14.3)	48(90.9)	46(93.9)	28(84.4)	19(100)
Threshing equipment	7(28.6)	0	5(41.7)	0	13(100)	25(48.0)	27(81.8)	3(11.1)	14(14.3)
Improved storage sytem	7(28.6)	0	2(18.2)						
Pest control	5(20)	5(100)	17(61.5)	8(100)	43(81.9)	5(20)	5(100)	46(97.9)	1(6.7)
Grading	14(14.3)	1(7.1)	1	46(97.9)	46(97.9)	38(78.7)	39(100)	24(92.0)	2(28.6)
Improved breeds/livestock				36(97.3)	46(97.9)	38(78.7)	9(100)	5(66.7)	2(28.6)
Improve cattle breeds	0	0	14(60.9)						
Livestock drugs	40(83.0)	32(93.8)	34(89.5)	27(96.4)	22(75.0)	9(22.2)	13(100)	20(35.0)	4(66.7)
Livestock supplementary feeds	38(78.7)	39(89.7)	34(87.2)	47(100)	47(100)	40(83.0)	38(100)	1(100)	1(100)

Note: figures in bracket are percentages while figures outside are the numbers of respondents, e.g., 17(94) means 94% of 17 respondents adopted.

Table 12. Awareness and adoption of technologies (% of household) (SLL IP).

Technologies	IAR4D sites Shanono			Some R&D sites D/Tofa			Little or no intervention D/Tofa		
	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted
	2007/08			2007/08			2007/08		
Soil & water mgt.									
Mulching	39(100)	39(100)	13(100)	20(35.0)	4(66.7)	7(28.6)	2(28.6)	0	19(70.4)
Water harvesting	1(6.7)	22(95.5)	13(100)	25(48.0)	0	7(28.6)	0	2(28.6)	5(41.7)
Trenches	14(14.3)	1(7.1)	0	3(100)	027(74.1	7(28.6)	0	2(28.6)	2(18.2)
Irrigation	13(100)	20(35.0)	4(66.7)	7(28.6)	26(69.2)	7(28.6)	0	0	17(61.5)
Conservation	1(69.6	0	0	0	3(100)	17(17.6)	0	1(6.7)	22(95.5)
Crop protection									
Fungicide use	3(100)	3(100)	2(66.7)	7(100)	13(100)	4(7.1)	0	1(7.1)	2(100)
Herbicide use	2(100)	2(100)	2(100)	7(100)	13(100)	0	0	0	1(100)
Insecticide use on fields	1(100)	1(100)	1(100)	7(100)	13(100)	0	14(60.9)	0	17(100)
Insecticide use for storage	6(100)	39100)	31(74.4)	4(100)	0	20(75.0)	7(100)	4(7.1)	47(100)
Botanical pesticides	1(100)	1(100)	1(100)	0	1(7.1)	38(92.1)	34(87.2)	27(28.2)	47(100)
Other diseases & control	2(11.8)	17(61.5)	15(6.7)	2(13.3)	0	39(89.7)	1(6.7)	2(11.8)	1(100)
Crop mgt. practices									
Row planting	1(6.7)	50(98.0)	23(92.0)	23(78.3)	2(28.6)	15(6.7)	2(13.3)	0	39(100)
Planting density	47(100)	47(100)	40(83.0)	32(93.8)	14(60.9)	7(100)	4(7.1)	0	19(94.7)
Thinning	46(97.9)	46(97.9)	38(78.7)	39(89.7)	34(89.5)	1(69.6	0	0	2(100)
NPK	36(97.3)	46(97.9)	38(78.7)	27(85.2)	34(87.2)	28(84.4)	0	14(60.9)	1(100)
N (Urea)	3(100)	28(84.4)	0	14(60.9)	0	5(20)	5(100)		
DAP	3(100)	33(79.5)	23(73.9)	34(89.5)	27(36.8)	36(97.3)	46(97.9)	38(78.7)	27(85.2)
SSP	14(60.9)	19(70.4)	38(92.1)	34(87.2)02(11.8)	27(28.2)	15(100)	42(95.3)	4(66.7)	4(7.1)
Animal manure	34(89.5)	5(41.7)	39(89.7)	1(6.7)	2(11.8)	36(97.3)	46(97.9)	38(78.7)	27(85.2)
Composting & organic residue mgt.	34(87.2)	2(18.2)	17(17.6)	0	1(6.7)	46(93.9)	18(94.4)	22(86.4)	1(69.6
Postharvest technology									
Drying	39100)	31(74.4)	4(100)	0	20(75.0)	17(61.5)	15(6.7)	2(13.3)	39(100)
Threshing equipment	31(83.8)	12(41.7)		11(99.9)	7(87.5)	24(92.0)	2(28.6)	36(97.3)	19(94.7)
Improved storage sytem	23(78.3)	2(28.6)	15(6.7)	2(13.3)	28(96.6)	24(82.8)	11(18.2)	1(6.7)	2(100)
Pest control	32(93.8)	14(60.9)	7(100)	4(7.1)	8(88.9)	9(100)	26(88.5)	15(100)	1(100)
Grading	15(80.0)	48(100)	28(84.4)	19(100)	27(96.4)	22(75.0)	9(22.2)	13(100)	0
Improved breeds/livestock									
Improve cattle breeds	2(100)	7(100)	13(100)	0	0	5(41.7)	39(89.7)	34(89.5)	5(41.7)
Livestock drugs	1(100)	7(100)	13(100)	0	14(60.9)	2(18.2)	17(17.6)	34(87.2)	2(18.2)
Livestock supplementary feeds	31(74.4)	4(100)	0	20(75.0)	7(100)	17(61.5)	15(6.7)	33(79.5)	23(73.9)
Soil & water mgt.									
Mulching	20(75.0)	7(100)	15(100)	00	2(13.3)	0	0	0	0
Water harvesting	5(83.3)	44(100)	18(78.3)	46(93.9)	0	0	0	0	0
Trenches	43(81.9)	5(20)	5(100)	27(81.8)	0	0	0	2(14.3)	0
Irrigation	7(87.5)	24(92.0)	2(28.6)	0	38(36.7)	3(11.1)	14(14.3)	1(7.1)	0
Conservation	11(81.8)	5(66.7)	2(28.6)	26(86.7)	21(9.1)	7(100)	4(7.1)	0	1(7.1)

Table 12. Awareness and adoption of technologies (% of household) (SLL IP). Contd.

Technologies	IAR4D sites Safana			Some R&D sites Ingawa			Little or no intervention Dan Musa		
	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted	Awareness	Adoption	Adopted
	2007/08			2007/08			2007/08		
Crop protection									
Fungicide use	0	0	0	0	0	0	0	0	0
Herbicide use	0	0	0	0	0	0	23(73.9)	0	27(36.8)
Insecticide use on fields	15(100)	27(96.4)	22(75.0)	2(28.6)	0	19(70.4)	38(92.1)	34(87.2)02(11.8)	27(28.2)
Insecticide use for storage	38(100)	1(100)	1(100)	0	2(28.6)	5(41.7)	39(89.7)	1(6.7)	2(11.8)
Botanical pesticides	39(100)	15(100)	15(93.3)	0	2(28.6)	2(18.2)	17(17.6)	0	1(6.7)
Other diseases & control	9(100)	38(100)	31(73.7)	0	0	17(61.5)	15(6.7)	2(13.3)	0
Crop mgt. practices									
Row planting	48(1000	6(1000	7(77.8)	1(7.1)	0	3(100)	3(100)	2(66.7)	7(100)
Planting density	8(100)	48(90.9)	5(83.3)	0	1(7.1)	2(100)	2(100)	2(100)	7(100)
Thinning	11(9.1)	8(100)	43(81.9)	0	0	1(100)	1(100)	1(100)	7(100)
NPK	7(90.9)	11(99.9)	7(87.5)	14(60.9)	0	17(100)	17(94.1)	17(94.1)	9(44.4)
N (Urea)	15(100)2	15(100)	11(81.8)	34(89.5)	27(36.8)	1(100)	1(100)	1(100)	0
DAP	23(91.3)	3(11.1)	14(14.3)	34(87.2)	27(28.2)	47(100)	33(79.5)	23(73.9)	34(89.5)
SSP	7(100)	4(7.1)	47(100)	1(6.7)	2(11.8)	1(100)	19(70.4)	38(92.1)	34(87.2)02(11.8)
Animal manure	15(80.0)	48(100)	28(84.4)	0	1(6.7)	22(95.5)	5(41.7)	39(89.7)	1(6.7)
Composting & organic residue mgt.	27(81.8)	23(91.3)	3(11.1)	2(13.3)	0	39(100)	2(18.2)	17(17.6)	0
Postharvest technology				4(7.1)	0	19(94.7)	17(61.5)	15(6.7)	2(13.3)
Drying	22(75.0)	9(22.2)	20(35.0)	0	0	2(100)	2(100)	2(100)	17(100)
Threshing equipment	47(100)	40(83.0)	25(48.0)	0	14(60.9)	1(100)	1(100)	1(100)	23(73.9)
Improved storage sytem	46(97.9)	38(78.7)	8(88.9)						
Pest control	24(92.0)	2(28.6)	1(100)	28(96.6)	24(82.8)	11(18.2)	1(6.7)	50(98.0)	2(66.7)
Grading	38(100)	1(100)	1(100)	8(88.9)	9(100)	26(88.5)	15(100)	42(95.3)	2(100)
Improved breeds/livestock				27(96.4)	22(75.0)	9(22.2)	13(100)	20(35.0)	1(100)
Improve cattle breeds	38(78.7)	27(85.2)	2(11.8)	1(100)	1(100)	0	13(100)	25(48.0)	17(94.1)
Livestock drugs	43(81.9)	5(20)	5(100)	15(100)	15(93.3)	47(100)	46(93.9)	0	
Livestock supplementary feeds	7(87.5)	24(92.0)	2(28.6)						

Note: Figures in bracket are percentages.

Table 13. Distribution of household by income sources (MLL IP).

Items	Kano State			Katsina State		
	IAR 4 D	R&D	Little or no intervention	IAR 4 D	R&D	Little or no intervention
Crops	96	68	88	96	74	84
Livestock	44	62	74	76	78	88
Non-farm	38	26	34	56	18	

Source: Field Survey 2008.

Table 14. Distribution of households by income sources (SLL IP).

Items	Kano State			Kaduna State		
	IAR4 D	R&D	Little or no intervention	IAR4 D	R&D	Little or no intervention
Crops	68	68	68	100	70	82
Livestock	90	58	94	52	100	98
Non-farm	36	62	46	20	100	100

Source: Field Survey 2008,

Table 15. Household socioeconomic characteristics (Maize–legume–livestock IP).

Treatment	LGA	Age HH	Farm exp	HH Size	EDUCAT. HH (% literate-primary)	Polygamy (%)	Male headed HH (%)	Cement Floor (%)	Roofing (%) (Iron Sheet)	Wall (%) (cement)
Kano State										
IAR4D sites	Bunkure	48 [11.2]	30 [11.4]	14 [9.4]	24 (12)	44(22)	94(47)	28(14)	26(13)	6(3)
Some R&D sites	Karaye	46 [14.0]	28 [12.3]	12 [5.8]	36(18)	62(31)	82(41)	64(32)	38(19)	18(9)
No (little) intervention	Karaye	45 [13.7]	27 [13.6]	13 [8.7]	28(14)	50(25)	90(45)	72(36)	36(18)	30(15)
Katsina state										
IAR4D sites	Musawa	50 [10.0]	31 [10.1]	12 [5.5]	26(13)	52(26)	84(42)	64(32)	18(9)	14(7)
Some R&D sites	Dan Musa	49 [14.5]	35 [12.5]	13 [7.2]	36(18)	48(24)	60(30)	74(37)	18(9)	6(3)
Little or no intervention	Dan Musa	52 [15.6]	35 [14.0]	15 [10.8]	28(14)	46(23)	54(27)	70(35)	24(42)	6(3)

Figures in parentheses are standard errors; Figures in brackets are N values for frequency.

Table 16. Household socioeconomic characteristics (Sorghum–legume–livestock IP).

Treatment	LGA	Age HH	Farm exp	HH Size	EDUCAT. HH (% literate-primary)	Polygamy (%)	Male headed HH (%)	Cement Floor (%)	Roofing (%) (Iron Sheet)	Wall (%) (cement)
Kano State										
IAR4D sites	Shanono	50 [13.7]	31 [12.7]	17 [8.1]	50(25)	32(16)	94(47)	62(31)	48(24)	20(10)
Some R&D sites	Dawakin Tofa	51 [14.4]	32 [15.7]	16 [15.9]	44(22)	38(19)	92(46)	80(40)	60(30)	38(19)
No (little) intervention	Dawakin Tofa	50 [13.9]	32 [14.9]	15 [14.7]	32(16)	44(22)	82(41)	68(34)	28(14)	16(8)
Katsina State										
IAR4D sites	Safana	47 [13.4]	28 [13.9]	13 [7.0]	20(10)	44(22)	98(49)	20(10)	94(47)	4(2)
Some R &D sites	Ingawa	47 [12.6]	28 [10.8]	17 [21.5]	40(20)	42(21)	78(39)	62(32)	68(34)	14(7)
Little or no intervention	Ingawa	51 [13.1]	35 [14.9]	22 [20.1]	40(20)	50(25)	80(40)	82(41)	66(33)	18(9)

Figures in parentheses are standard errors; Figures in parbrackets are N values for frequency.