

Baseline Survey of Sorghum and Pearl Millet Production in Burkina Faso

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**Harnessing Opportunities for Productivity Enhancement of
Sorghum and Millets in Sub-Saharan Africa and South Asia -
HOPE Project**

September 2015



**International Crops Research Institute
for the Semi-Arid Tropics**



**RESEARCH
PROGRAM ON
Dryland Cereals**

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Abbreviations and acronyms

ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
WCA	West and Central Africa
ESA	Eastern and Southern Africa
SA	South Asia
SSA	Sub-Saharan Africa
FAO	Food and Agricultural Organization of the United Nations
FAOSTAT	FAO Statistics
INERA	Institut de l'Environnement et de Recherches Agricoles
AMSP	Association Mining Song Panga
UGCPA	Union des Groupements pour la Commercialisation des Produits Agricoles
FEPAB	Fédération des Professionnels Agricoles du Burkina Faso
DGPER	Direction Générale de la Promotion de l'Economie Rurale
NGO	Non-Governmental Organization
FCFA	Franc de la Communauté Française Africaine
US\$	United States dollar
NARS	National Agricultural Research Systems

Acknowledgements

We wish to thank Dr. Roger Zangre (the National HOPE Project Coordinator), for facilitating this study during the survey period. We also appreciate the work done by a large team of staff from Institut de l'environnement et de Recherches Agricoles (INERA) of Burkina Faso who conducted the baseline survey in the five regions of Burkina Faso.

We would also like to thank all HOPE project partners of Burkina Faso including Association Minim Song Panga from Kaya (AMSP), Union des Groupements pour la Commercialisation des Produits Agricoles (UGCPA) from Dedougou and Federation des Professionnels Agricoles du Burkina Faso (FEPAB) from Ouagadougou, with who we closely worked for the implementation of the baseline survey.

Last but not least, we are acknowledge and appreciate Dr. George Okwach, the HOPE Project Manager, for the valuable guidance and encouragement the team received throughout the study.

Executive summary

The HOPE project is an ICRISAT assisted project implemented in West and Central Africa (Mali, Niger, Burkina Faso, Nigeria), Eastern and Southern Africa (Ethiopia, Eritrea, Kenya, Southern Sudan, Tanzania, Uganda), and South Asia (India). The project aims to increase the productivity of dryland sorghum, pearl millet and finger millet cereal production systems in dryland South Asia and sub-Saharan Africa in order to increase incomes and food security.

During its first phase (2009-2013), the project had for objective to increase farmer yields by 30% or more, benefiting 110,000 households in sub-Saharan Africa and 90,000 in South Asia. Within ten years the project will benefit 1.1 million households in sub-Saharan Africa and 1.0 million in South Asia. The HOPE project is a supplementary phase (1st January 2014 – 30 June 2015).

This report presents a reference situation of new intervention sites for the preparation of the second phase of the HOPE project in Burkina Faso. It highlights the socio-demographic and economic characteristics of pearl millet and sorghum producers in the surveyed villages. The report is informed by data collected in the main regions producing pearl millet and sorghum in Burkina Faso in October 2014. Other information has been obtained from project documentation, national partner organizations and discussions with ICRISAT scientists.

The results showed that pearl millet and sorghum producers in the surveyed in Burkina Faso were poor in terms of number and value of their livelihood assets. A few members in household received a formal education. On a total of 14 members in household, about 5 members received a formal education. The production equipment was mainly consisted of daba, machete, axe, plough, pickaxe, donkey cart, and animal traction (beef and donkey). The main durable assets owned by households were bicycle, motorcycle, radio, television, telephone, and banco home. The durable assets value recorded during the survey period was low. They are estimated to about \$US 3.471 and \$US 4.168 for pearl millet and sorghum farmers respectively. The surveyed households had a limited access to credit (less than 50%). The lack of credit is a major constraint to increasing in pearl millet and sorghum production and incomes. The proportion of households having access to market was low. The marketable surplus of pearl millet was lowest compared to those of sorghum, maize, rice, groundnut, cowpea, and sesame. We also note that the marketable surpluses of groundnut, cowpea, and sesame were highest. This could be explained by the fact that pearl millet and sorghum are mainly self-consumption products in Burkina Faso. The results highlighted a low use of improved varieties due to unavailability of seeds, non-resistance to insects, late maturity of varieties, and low yielding of varieties. The low rate of adoption of modern varieties could also explained by the low level of educated farmers. There are little educated households who are receptive to new technologies. The varieties the most adopted in the surveyed villages in 2013/2014 were IKMP5 (10%), Misari1 (10%), and IKMV8201 (6%) for pearl millet. Improved sorghum variety the most adopted was Kapelga with 20% of planted areas. With regard to soil fertility, on average, the surveyed households thought that their plots had a medium fertility. Intercropping was only practiced on less than 25% of plots. About 90%

of plots practiced rotation. The results also showed that less than 20% of the surveyed households in had experienced food insecurity problem during more than one month in 2013.

Overall, efforts are to make in the framework of the second phase of HOPE project for a wide adoption of improved varieties and use of modern technologies in pearl millet and sorghum production in order to increase yields. There is also a need to facilitate access to credit and access to market to enable to farmers to increase their production and incomes, and to improve food security.

1. Introduction

The HOPE project is an ICRISAT assisted project that officially started on July 1, 2009. This project is being implemented in three regions of world: West and Central Africa (Mali, Niger, Burkina Faso, Nigeria), Eastern and Southern Africa (Ethiopia, Eritrea, Kenya, Southern Sudan, Tanzania, Uganda), and South Asia (India). The direct beneficiaries of the project are poor smallholder farmers producing millets and sorghum and their households, and others involved in the crop commodity value chain. Consumers benefit indirectly through more stable and lower prices and better quality grain and products for their essential foodstuffs.

The main objective of the HOPE project is to increase the productivity of dryland sorghum, pearl millet and finger millet cereal production systems in dryland South Asia and sub-Saharan Africa in order to increase incomes and food security. To achieve this vision, six specific objectives have been defined: 1) target opportunities for technology development and delivery to maximize adoption and impacts of innovations on livelihoods in WCA, ESA and SA; 2) improve sorghum cultivars and management options to increase productivity in WCA, ESA and SA; 3) improve pearl millet cultivars and management options to increase productivity in WCA and SA; 4) improves finger millet cultivars and management options to increase productivity and production in ESA; 5) discover and develop improved market strategies for sorghum, pearl millet and finger millet to stimulate adoption of improved technologies in WCA, ESA and SA; 6) enable technology adoption of sorghum, pearl millet, and finger millet by improving access to inputs and markets differentiated according to both women and men's needs in WCA, ESA and SA.

The first phase of project covered the period 2009-2013. This phase had for objectives to increase farmer yields by 30% or more, benefiting 110,000 households in sub-Saharan Africa and 90,000 in South Asia. Within ten years the project will benefit 1.1 million households in sub-Saharan Africa and 1.0 million in South Asia.

The HOPE project is currently in a supplementary phase. In order to prepare the second phase of project in Burkina Faso, a baseline survey has been conducted in the new intervention sites. The baseline survey was carried out at household and plot levels. They contain information on monitoring-evaluation indicators that will enable to provide a reference situation of the sites where the HOPE project – phase 2 will be implemented.

The rest of report focuses on analysis of survey data. The report is organized as follow. Section 2 describes the study area – infrastructure and production environment. Section 3 reviews sorghum and pearl millet projects/programs implemented in Burkina Faso which could directly affect the success of the HOPE project – phase 2. Section 4 presents survey methodology by highlighting the objectives of the survey, sampling procedure and data collection procedure. Section 5 provides the statistical results and discussions. Section 6 concludes the baseline report.

2. The study area – Infrastructure and production environment in Burkina Faso

Burkina Faso is a predominantly agricultural country. The primary sector including agriculture and livestock employs about 85% of the workforce. It contributes to 33% of Gross Domestic Product and 80% of export earnings (Direction générale de la promotion de l'économie rurale, 2011). Agriculture is essentially a subsistence farming based on food grains (sorghum, millet, maize, rice). Cereals occupy more than 80% of cultivated land and play a crucial role in food security. About 90% of heat demand of the population comes from grain intake with on average 180 kg per person and per year (FAO, 2009).

Millet and sorghum are traditionally grown in the most of regions in Burkina Faso. Millet is grown in all agro-climatic zones of the country (from 400 mm to more than 900 mm of rainfall). The main regions producing sorghum include Western, North Central, and Eastern of Burkina Faso. Over the period 2011-2010, millet accounted for 39% and 32% of cereal area and cereal production respectively. In 2011, sorghum production accounted for 64% of cereal production, and more than 40% of cereal area planted. However, the yield levels remain low. They are estimated to less than 700 kg/ha for pearl millet and less than 1000 kg/ha for sorghum at the national level. The marketable surplus of millet and sorghum are also low. In 2008, they were estimated to about 7% and 10% for millet and sorghum respectively (DGPER, 2008). Marketing channels are relatively informal between producers and urban centers. This is due to irregularity of supply, weak demand in urban centers, distances between producing areas and urban centers, and transport costs. The production system is extensive with a production mainly used for human food. The fertilization rates and adoption of modern technologies remains low.

In most of Sahelian countries and particularly in Burkina Faso, millet and sorghum production increased in the last decade, but this is more related to the increase in cultivated areas than that of the yields. The main constraints to millet and sorghum production are: (i) poor soils and low use of inputs, sorghum and millet adapt to difficult conditions, consequently farmers do not think to make the necessary fertilizers; (ii) unpredictable rainfall, millet and sorghum do not benefit from additional water outside the rainfalls which are generally irregular; (iii) low productivity of local varieties which account for over 90% of the area; (iv) sensitivity to pests; and (v) weakness of the market and the value-added processing.

To be sustainable, production systems of millet and sorghum must be intensified. Thus, fertilization policy, management and water conservation, seed system very organized, supports to dissemination and training to improved agricultural practices are necessary.

3. Sorghum and pearl millet projects and programs in Burkina Faso

This section presents sorghum and pearl millet projects/programs implemented in West and Central Africa countries which could directly affect the success of the HOPE project – phase 2.

- **West Africa Community of Practice (Waf-CoP)** is part of McKnight Foundation Collaborative Crop Research Program. The Waf-CoP includes a series of projects that focus on improving food security and nutrition for smallholder farming families in Burkina Faso, Mali, and Niger through projects on sorghum- and pearl millet-based agricultural systems.
- **Program for African Seed Systems (PASS)** is funded by B&MGF, under the umbrella of the Alliance for a Green Revolution for Africa (AGRA). PASS has for objective to train scientists to breed improved varieties of Africa's 10 indigenous and staple food crops in 15 Sub-Saharan Africa countries and to build the capacity of national research systems in plant breeding and seed production. PASS also helps private African seed companies and farmer cooperatives to produce, distribute and market improved seed. The project contributes to strengthen networks of village-based agro-dealers. PASS promotes policies that accelerate the release of new varieties, strengthens seed regulatory systems and harmonizes regional seed laws.
- **Sorghum and Millets Innovation Laboratory (INTSORMIL)** is funded by United States Agency for International Development (USAID). This project has for objective to provide research, training and capacity building that addresses hunger and poverty where sorghum and millet are important food crops. INTSORMIL and HOPE project involved in almost the same countries.
- **PROMISO2** is jointly funded by European Union and Food Facility program for West and Central Africa of International Fund for Agricultural Development (IFAD). PROMISO2 is the second phase of PROMISO. It is a project targeting seed delivery to rural communities through participatory variety selection and farmer cooperative seed production systems.
- **West African Seed Alliance (WASA)** was funded by USAID and AGRA and implemented with ICRISAT partners and Iowa State University. This project had to objective to modernize seed distribution systems, facilitate access to improved seed varieties, improve seed production technologies, strengthen links to credit and markets, improve seed policy and harmonize release procedures.

4. Overview of survey methodology

4.1.Objectives of the survey

The aim of this baseline survey is to provide an analysis describing the situation prior to implementation of the HOPE project in Burkina Faso. This benchmark data will enable to evaluate the extent to which its objectives have been achieved. A number of possible outcome indicators have been defined. This baseline study provides benchmark data against which achievements can be evaluated especially in respect to the set indicators. The major evaluation questions include:

- Estimate the value of livelihood assets owned by pearl millet and sorghum producing households in 2009/10;
- Estimate the level of investment (cost of pearl millet or sorghum production) made by households on sorghum and pearl millet production
- Estimate the yield/productivity from pearl millet and sorghum production at farm level;
- Estimate the pearl millet or sorghum production at household level
- Assess the level of exposure and adoption of improved varieties;
- Identify the pearl millet and sorghum traits preferred by households;
- What are the proportions of households using organic and inorganic fertilizer use?
- What are the proportion and level of pearl millet or sorghum marketable surpluses derived by households?
- Where are farmers sourcing sorghum and pearl millet seed?
- What are the different seed transactions used by households to obtain their seed?
- What is the proportion of households who has access to credit from formal sources?
- What are the major sources of credit –and amount obtained from different sources of households in the project and non-project sites?
- Estimate the levels of profitability of pearl millet and sorghum with respect to other products;
- Estimate the total value of production (agriculture, livestock and non-agricultural activities);
- Estimate the welfare of households producing pearl millet and sorghum.
- Estimate the food security indexes of pearl millet an sorghum producing households

4.2.Sampling procedure and data collection

The report comes from a multi-dimensional survey in five regions of Burkina Faso including Boucle du Mouhoun, North Central, West Central, Plateau Central, and East Central. This report is informed by data collected at household and plot levels. The survey covered 50 villages and 500 households producing pearl millet and sorghum (table 1). The five selected regions

accounted for about 48% of pearl millet area harvested and 53% of pearl millet production in 2008/2009. These regions accounted for about 50% of sorghum area harvested and 49% of sorghum production in 2008/2009. The selected villages consisted of 32 project villages, and 18 control villages. Thus, 20 villages were selected in Boucle du Mouhoun, 6 villages in North Central, 20 villages in West Central, 2 villages in Plateau Central and 2 villages in East Central.

The baseline survey adopted a sampling strategy that ensures that all respondents at household level obtain an equal chance of being selected. Simple random sample strategy was used to obtain household respondents. This strategy minimized bias and simplified analysis of results. On average 10 households were selected in each village. Most of households interviewed are both sorghum and pearl millet producers. A total of 500 households were interviewed of which 355 households were pearl millet producers and 480 were sorghum producers. Table 1 below presents the distribution of households producing pearl millet and sorghum by region and by type of village.

Table 1: Distribution of households by region, 2013/2014

<i>Type of producer/type of village</i>	Surveyed Regions					Total
	Mouhoun	North Central	West Central	Central Plateau	East Central	
<i>Pearl millet producers</i>						
Project village	73	53	87	18	9	240
Non-project village	65	1	46	0	3	115
<i>Sub-Total</i>	138	54	133	18	12	355
<i>Sorghum producers</i>						
Project village	95	59	129	20	10	313
Non-project village	88	1	68	0	10	167
<i>Sub-Total</i>	183	60	197	20	20	480

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Data were collected at household and plot levels. At household level, data were gathered on household socio-demographic and economic profile, land stocks and agricultural equipment, diffusion mechanism of sorghum and pearl millet varieties, varieties grown during the last 3 years, participation in technology transfer activities, social capital, crop production and stocks, livestock production and stocks, assets owned, sources and access to credit, crop and livestock transactions, and household perception of welfare changes.

Plot information included plot characteristics, use of inputs, sources of seed, organic and inorganic fertilizers, quantities of inputs applied, farmers' perception of fertility level and production level.

5. Results and discussions

A household can be defined as an economic unit where the members are linked by an economic relationship such as producing together, sharing the money earned and sharing the home. In this part, it will be presented descriptive statistics on demographic and socio-economic characteristics of households producing pearl millet and sorghum in Burkina Faso in 2013-2014.

5.1. Livelihood assets owned by households

This section presents the different types of livelihood assets¹ owned by households. These assets include human capital, natural assets, physical assets, social assets and financial assets.

5.1.1. Human capital: Socio-demographic profile of Sorghum and pearl millet producers

The human capital is the set of skills, knowledge, ability to labour and good health important to the ability to pursue different livelihood strategies. This section presents the socio-demographic profile of pearl millet and sorghum producers in terms of: household size, gender composition, education, sex and age of household head, and marital status.

a) Household size and gender composition

Table 2 presents the household size of the surveyed farmers in Burkina Faso. The results show that the household size among pearl millet and sorghum producers was on average 14 members per household. The estimated household size was 13 members in project villages against about 14 members in non-project villages. Among sorghum producers, the household size was respectively 13 and 15 in project and non-project villages with a significant difference.

The total workforce proxied by the number of adult equivalents is estimated to about 8 adult equivalents both among pearl millet and sorghum producers. However, there were more 9 adult equivalents in control villages. Dependency ratio² was above 1 both in project and non-project villages. This low ratio means that the population is young in Burkina Faso. This is an advantage in terms of production.

Regarding the gender composition, the results indicate that there were more women than men both among pearl millet and sorghum producers in Burkina Faso (about 52%). Among sorghum farmers from control villages, the percentage of women was less 51%.

¹ Livelihood assets represent the five types of capital upon which livelihoods are built (human capital, natural capital, physical capital, social capital and financial capital).

² The dependency ratio is a measure showing the number of dependents (aged 0-14 and over the age of 65) to the total population (aged 15-64).

Table 2: Size and gender composition of households producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	(240)	(313)	(115)	(167)	(355)	(480)
Household size	13.57	13.08**	14.23	15.47	13.78	13.91
Number of adult equivalent	8.02	7.69***	8.35	9.5	8.13	8.32
Percentage of women (%)	52.57	52.31	51.27	50.74	52.15	51.76
Dependency ratio	1.65	1.73	1.90	1.7	1.73	1.72

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

b) Level of education of pearl millet and sorghum producers

The level of education plays a major factor explaining uptake of technologies and innovations. More educated members are more receptive to technology adoption than those that are not. Table 3 presents the distribution of households by level of education and education of household heads. The number of educated members among pearl millet and sorghum farmers varies according to the gender. The results indicate that the number of educated males was higher than that of females in Burkina Faso. In the surveyed villages, there were on average 2.77 educated male against 2.22 educated female among pearl millet farmers. The results also indicate that there was a significant difference between the number of educated women in project villages (2.34) and those from non-project villages among pearl millet farmers (1.97). Among sorghum producers, the number of educated women was estimated to 2.18 and that of men to 2.79. There was a significant difference among educated men between project (2.56) and non-project villages (3.22). Overall, the level of education was low among pearl millet and sorghum producers in Burkina Faso. This could negatively influence the adoption of improved varieties because less educated members are less receptive to new technologies.

Table 5 also shows that 22% and 23.11% of household heads producing pearl millet and sorghum in Burkina Faso respectively received formal education in 2013. Less than 10% of household heads producing pearl millet and sorghum received koranic education. In the non-project villages, the rate of koranic education was 16% and 14.46% among pearl millet and sorghum farmers respectively. The results indicate a high proportion of household heads illiterate among the pearl millet (46%) and sorghum (43.70%) producers. The rate of adult literate was on average 22% both among pearl millet and sorghum farmers. This rate is above sample average in project villages (24%).

Table 3: Education of households producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Number of educated members	5.03	4.77	4.90	5.34	4.99	4.97
Number of educated male	2.69	2.56 ^{***}	2.93	3.22	2.77	2.79
Number of educated female	2.34 [*]	2.20	1.97	2.12	2.22	2.18
Educated household head (%)	23.00	23.23	21.00	22.89	22.00	23.11
Illiterate (%)	47.00	44.19	43.00	42.77	46.00	43.7
Koranic education (%)	5.00 ^{***}	7.10 ^{**}	16.00	14.46	9.00	9.66
Adult literate (%)	24.00	24.84 [*]	18.00	18.07	22.00	22.48

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ^{***}, ^{**}, ^{*} represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

c) *Sex, Age and marital status of household head*

Many studies on gender issue in the African context highlight the fact that the majority of households are headed by a man. The results from table 4 respectively show that 82% and 81.46% of pearl millet and sorghum farmers were headed by a man. These results confirm those obtained in the previous studies on the gender analysis. Table 4 also shows that the average age of pearl millet producers was about 47 years in Burkina Faso. However, there was a significant difference between project and non-project villages. The average age of pearl millet farmers living in control villages (45 years) was lower than the sample average. Regarding sorghum producers, the average age was on average 45 years. The results also showed that 95% and 96% of pearl millet and sorghum farmers in Burkina Faso respectively are married. The rate was on average 98% in non-project villages. Overall, the surveyed households in Burkina Faso are young, headed by a man and the household heads are married. The fact that the household heads are young and married is a real advantage in terms of production. Indeed, in the African context, women play an important role in production activities.

Table 4: Age, sex and marital status of household heads producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Age of household head (years)	47.64**	45.74	44.86	44.1	46.74	45.16
Gender of household head (% male)	85.00**	83.39	75.00	77.84	82.00	81.46
Household head married (%)	94.00*	95.18*	98.00	98.20	95.00	96.23

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.1.2. Natural capital

The natural capital represents the stocks of natural resource from which resource flows useful for livelihoods are derived (e.g. land, water, wildlife, biodiversity, environmental resources). In this study, the natural assets are depicted by land stocks of different types owned by households. The types of land include area for sorghum production, area for pearl millet production, cultivated land, and fallow land. Table 5 shows that pearl millet producers in Burkina Faso owned on average 11.47 ha of cultivated land, with 2.64 ha and 1.89 ha for sorghum and pearl millet production respectively. Regarding sorghum producers, cultivated land was estimated to about 12 ha with 2.87 ha and 1.36 ha for sorghum and pearl millet production respectively. Table 6 reveals that cultivated land per adult equivalent was estimated to 1.69 ha and 1.74 ha among pearl millet and sorghum producers respectively in Burkina Faso. However, areas for pearl millet and sorghum production were less than 1 ha per adult equivalent.

Table 5: Land stocks owned by households producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Sorghum land	2.22***	2.42***	3.53	3.72	2.64	2.87
Millet land	1.94	1.43	1.8	1.22	1.89	1.36
Cultivated	11.16	11.12	12.11	13.45	11.47	11.93
Fallow land	2.79*	2.8	1.77	2.17	2.46	2.58
Total land	11.55	11.84***	13.5	15.34	12.18	13.06

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 6: Land stocks owned by adult equivalents producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Sorghum land	0.34***	0.41*	0.52	0.5	0.40	0.44
Millet land	0.28	0.21	0.28	0.19	0.28	0.20
Cultivated	1.69	1.83	1.68	1.59	1.69	1.74
Fallow land	0.36	0.4	0.29	0.29	0.33	0.36
Total land	1.67*	1.87	1.97	1.88	1.77	1.88

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.1.3. Physical assets

The physical assets depict the basic infrastructure (transport, shelter, water, energy and communications) and the production equipment and means which enable people to pursue livelihoods. Physical assets owned by pearl millet and sorghum farmers included agricultural equipment, livestock, and durable assets.

a) Agricultural equipment

Table 7 indicates that several types of agricultural equipment³ were used by the surveyed households for their production activities. The results respectively show that 100%, 92% and 89% of pearl millet producers in Burkina Faso use daba, machete and axe in agriculture. The same results are recorded for sorghum producers. More than half of pearl millet producers owned at least a plough (86%), a donkey cart (79%), and a pickaxe (85%), with significant differences between villages. For example, the proportion of households who had at least one pickaxe in control villages (97%) was significantly higher than project villages, where the rate was of 80%. Fewer households owned at least one sprayer (44%), one wheel barrow (27%) and one multicultureur (26%). The results obtained for sorghum farmers are almost similar excepted for households owning at least one sprayer (more than 50% in 2013/2014). Regarding animal traction, about 72% and 85% of pearl millet farmers respectively had at least one beef and donkey as animal traction for their agricultural activities. However, one notes that 82% of pearl millet living in control villages had at least one beef as animal traction against 67% in project villages. The results are almost similar for sorghum producers in the surveyed villages.

³ There are also the traditional equipment such as daba, machete, and axe. We present here agricultural equipment more and less modern.

Table 7: Agricultural equipment owned by households producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
<i>Agricultural equipment</i>						
Daba	100.00	99.68	100.00	100.00	100.00	99.79
Machete	93.00	92.97	90.00	91.02	92.00	92.29
Axe	90.00	90.42	86.00	88.02	89.00	89.58
Oxen cart	4.00	3.19	1.00	1.20	3.00	2.50
Donkey cart	76.00**	78.59**	86.00	86.83	79.00	81.46
Horse cart	4.00	3.51	2.00	1.20	3.00	2.71
Tractor	1.00	0.96**	1.00	4.19	1.00	2.08
Wheel barrow	30.00*	26.52	21.00	26.35	27.00	26.46
Plough	83.00*	86.26	90.00	90.42	86.00	87.71
Multiculteur	22.00***	17.89***	36.00	37.13	26.00	24.58
Sprayer	36.00***	44.09***	60.00	68.86	44.00	52.71
Seed drill	3.00	3.19	3.00	6.00	3.00	4.17
Pickaxe	80.00***	82.11***	97.00	97.01	85.00	87.29
Sheller	1.00	0.96	0.00	0.00	1.00	0.63
Pump	1.00	1.92	0.00	4.19	1.00	2.71
Thresher	0.00	0.32	0.00	0.00	0.00	0.21
Tiller	0.00	0.32	0.00	0.00	0.00	0.21
Threshing machine	3.00	2.56	3.00	5.39	3.00	3.54
Other equipment	18.00	19.49*	18.00	12.57	18.00	17.08
<i>Animal traction</i>						
Beef	67.00***	69.97***	82.00	82.04	72.00	74.17
Donkey	84.00	85.30	89.00	89.22	85.00	86.67
Horse	3.00*	2.24	0.00	0.60	2.00	1.67
Camel	0.00	0.00	0.00	0.00	0.00	0.00
Other traction	0.00	0.00	1.00	0.60	0.50	0.21

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

b) Livestock

Tables 8 and 9 respectively highlight the proportion of pearl millet and sorghum farmers who owned at least one type of livestock in 2013/2014. The proportion of pearl millet farmers who had at least one beef, one mouton, one goat, one chicken, one pig and one donkey is estimated to about 73%, 74%, 79%, 79%, 26%, and 79% respectively. Pearl millet farmers engaged in poultry

and cattle had on average 34 chickens, 9 beefs, 12 moutons, 10 goats, 5 pigs and 2 donkeys. The same results are recorded for sorghum farmers in Mali and Northern Nigeria.

Table 8: Proportion of pearl millet households who own at least one type of livestock, 2013/2014

Variables	Type of village					
	Project village		Control village		Sample overall	
	%	Mean	%	Mean	%	Mean
	240		115		355	
Beef	70.00*	7.54**	79.00	11.12	73.00	8.81
Mouton	74.00	12.11	75.00	12.98	74.00	12.39
Goat	80.00	10.64	75.00	10.33	79.00	10.54
Chicken	83.00***	27.80	71.00	49.05	79.00	33.98
Pig	27.00	5.13	25.00	6.17	26.00	5.45
Donkey	78.00	1.87	81.00	1.81	79.00	1.85
Camel	0.00**	na	3.00	1.33	1.00	1.33
Horse	3.00	1.25	1.00	1.00	3.00	1.22
Other animals	5.00	19.50	2.00	23.00	4.00	20.00

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 9: Proportion of sorghum farmers who own at least one type of livestock, 2013/2014

Variables	Type of village					
	Project village		Control village		Sample overall	
	%	Mean	%	Mean	%	Mean
	313		167		480	
Beef	71.88***	7.20***	82.63	12.39	75.62	9.17
Mouton	72.84	11.80	75.45	13.44	73.75	12.38
Goat	79.23	10.35	75.45	11.26	77.92	10.66
Chicken	84.35***	28.92	74.25	42.77	80.83	33.35
Pig	25.88	4.96**	25.75	7.28	25.83	5.77
Donkey	77.32	1.84	80.84	1.74	78.54	1.89
Camel	0.32*	4.00*	0.18	1.33	0.83	2.00
Horse	2.56	1.25	0.12	1.50	2.08	1.30
Other animals	5.11**	21.69	0.12	23.00	3.75	21.84

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

c) Durable assets

Table 10 presents the proportion of households owning at least one type of durable assets in Burkina Faso in 2013/2014. About 92% and 64% of pearl millet farmers owned at least one bicycle and one motorcycle respectively as major means of transport. However, in project villages, the proportion of pearl millet producers who had one bicycle (95%) was above the average of overall sample. The similar results are obtained for sorghum producers. Overall, the results show that in the surveyed villages the vehicle was rarely used as means of transport among pearl millet and sorghum producers in 2013/2014. The main mean of transport was the bicycle.

To access information, 72% of pearl millet farmers in Burkina Faso owned at least one radio and 25% had at least one television. The same results are found for households producing sorghum. The radio was the main means to access information in the surveyed villages in 2013/2014.

Other durable assets owned by households were consisted of telephone, bed, improved stove, home, town house and other thinks. The cell phone penetration in West Africa has been relatively high. Results show that the proportion of pearl millet farmers using telephone as means of communication in 2013/2014 is estimated to about 93% in Burkina Faso. The total value of durable assets is estimated to about 2,000,000 FCFA (US\$ 3,471). Similar trend is recorded for households producing sorghum in the surveyed villages. However, the value of durable assets of sorghum farmers (2,400,000 FCFA ~ US\$ 4,168) was relatively high compared to that of pearl millet farmers. Overall, durable assets owned by pearl millet and sorghum in the surveyed villages in Burkina Faso are mainly consisted of transport and communication means (bicycle, motorcycle, radio and telephone).

Table 10: Durable assets owned by households producing pearl millet and sorghum, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Improved stove	12.92	10.86	9.57	13.17	11.83	11.67
Warming	4.58	3.83	3.48	5.39	4.23	4.37
Wood metal bed	53.75**	53.99*	42.61	45.51	50.14	51.04
Radio	74.17	76.04*	66.96	68.86	71.83	73.54
Television	22.50	22.36	28.70	26.95	24.51	23.96
Phone	94.17	95.21	91.3	92.81	93.24	94.37
Bicycle	95.00***	95.85***	85.22	82.63	91.83	91.25
Moto	65.00	67.09	60.87	64.07	63.66	66.04
Vehicle	0.42	0.32**	0.00	2.4	0.28	1.04
Hard home	20.83	19.17	17.39	16.17	19.72	18.12
Banco home	90.83	91.37**	86.09	85.03	89.30	89.17
Town house	20.00	21.09	18.26	21.56	19.44	21.25
Other assets	6.25	7.67	5.22	5.39	5.92	6.88
Total value of durable assets (FCFA)	2000000	2400000	1900000	2200000	2000000	2400000

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.1.4. Social assets

The social capital which represents the social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of livelihoods. In this study, social asset is defined as a set of social relations that the household head or household members have with farmers' associations or other groups. Social assets are proxied by the proportion of households having at least one member affiliated to social group or economic interest group in 2013/2014. Table 11 shows social assets of households producing pearl millet and sorghum. The results obtained indicate that about 80% pearl millet farmers had at least one member affiliated to one social or economic group, with a significant difference between project and non-project villages. We note about 95% of pearl millet producers living in non-project villages were affiliated to a social group against only 73% in project villages. However, pearl millet producers in the surveyed villages tended to be affiliated to agricultural production associations (53%), agricultural production and marketing (24%), agricultural product marketing (14%), mutual support groups (5%), seed production (3%). There were very little households affiliated to credit associations. The similar results have been recorded for sorghum producers. Overall, the results show that pearl millet and sorghum producers tended to be affiliated to associations related to production and marketing of agricultural products.

Table 11: Proportion of households producing pearl millet and sorghum having at least one member affiliated to one social group, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
UPA affiliated to at least one org.	72.92***	77.00***	94.78	88.62	80.00	81.04
Credit	2.92	3.19	1.74	4.79	2.54	3.75
Seed production	4.58*	4.47	0.87	5.39	3.38	4.79
Agricultural production	48.75**	48.88	61.74	52.10	52.96	50.00
Agricultural marketing	14.17	16.93	13.04	11.98	13.8	15.21
Agricultural production and marketing	18.33***	21.09***	34.78	38.32	23.66	27.08
Mutual support group	4.58	4.47	6.96	4.19	5.35	4.37
Other social group	5.42	4.47	1.74	2.40	4.23	3.75

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.1.5. Financial assets/capital

The financial capital depicts the financial resources which are available to people (whether savings, supplies of credit or regular remittances or pensions) and which provide them with different livelihood options. This section describes the sources and use of credit contracted by pearl millet and sorghum farmers from Burkina Faso in 2013/2014. The sources of credit will be presented, followed by the amount and maturity of loans, and finally the use of credit.

a) Credit institutions

A better access to credit can enable to farmers to develop their production activity by investing in agricultural inputs. Table 12 presents the sources of credit contracted by households producing pearl millet and sorghum. In the surveyed villages, about 43% of pearl millet producers had contracted loans in 2013/2014 with a significant difference between project (38%) and non-project villages (55%). The main credit source was microfinance institution (44%). The proportion of pearl millet farmers who contracted credit to microfinance institution is estimated to about 52% in project villages against 32% in non-project villages. Other credit sources include friends/family (8.5%), development project (6%), commercial banks (4.58%), and NGOs (4%). The results obtained for sorghum farmers show that they were 47% to submit a credit demand in 2013/2014. About 36% of sorghum farmers had benefited a credit from microfinance institutions. Other results are almost similar to those obtained for pearl millet farmers. Overall, pearl millet and sorghum farmers in the surveyed villages in Burkina Faso have a limited access to credit. The previous studies obtained the same result in the context West African (Fall, 2011;

MAFAP, 2013). The lack of credit is a major constraint to the increase in productivity and incomes.

b) Amount and maturity of loan

Table 13 presents amounts of loans contracted, proportion by credit source, and loan maturity in Burkina Faso in 2013/2014. The results indicate that both pearl millet and sorghum farmers benefited on average from 9 months of credit for a total amount of 430 000 FCFA and 400 000 FCFA respectively. Table 14 indicates that the majority of pearl millet and sorghum producers had contracted a mid-term credit. In addition to limited access to credit, the amounts of loans were low. These effects combined are the major constraints to development of pearl millet and sorghum sector in West Africa and particularly in Burkina Faso.

c) Use of credit contracted

Table 15 below shows the use of credit contracted by pearl millet and sorghum producers in the surveyed villages in Burkina Faso. The results indicate that credit contracted by pearl millet farmers was mainly used for purchase of fertilizers (66%) and to invest in trade (11%). Other uses of credit include food (3.90%), livestock (2.42%), and work force (2.22%). The proportions of credit affected to investment in agricultural activities and consumption are estimated to about 70% and 5% respectively. The results obtained for sorghum farmers are relatively similar. About 77% of credit has been allocated to purchase of fertilizers. The results show that pearl millet and sorghum farmers have contracted credit for production needs.

Table 12: Credit sources of households producing pearl millet and sorghum, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
<i>Type of crops</i>						
	240		115		355	
Household contracting credit	37.92***	43.77**	54.78	53.89	43.38	47.29
Friends/Family	7.78	5.15	9.52	8.89	8.5	6.64
Microcredit institution	52.22**	39.71	31.75	32.22	43.79	36.73
Banks	2.22*	1.47**	7.94	7.78	4.58	3.98
NGOs	4.44	6.62	3.17	3.33	3.92	5.31
Development projects	6.67	4.41	4.76	3.33	5.88	3.98
Other credit sources	47.78	58.82*	47.62	46.67	47.71	53.98

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 13: Amount of credit and proportion by source of households producing pearl millet and sorghum, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
<i>Type of crops</i>	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240		115		355	
Friends/Family	7.69	5.11	9.52	8.89	8.44	6.61
Microcredit institution	39.60	30.31	27.78	30.98	34.77	30.57
Banks	2.20*	1.46**	7.93	7.78	4.55	3.97
NGOs	4.40	6.57	3.17	3.34	3.90	5.29
Development projects	3.10	1.61	4.40	3.34	3.63	2.3
Other credit sources	41.92	54.21	47.18	45.69	44.07	50.83
Total credit contracted (FCFA)	470000	410000	380000	380000	430000	400000
Credit duration (months)	8.70	8.79	9.00	8.84	8.83	8.81

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 14: Credit duration in the surveyed villages, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
<i>Type of crops</i>	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240		115		355	
Less than 6 months	11.00	8.03	7.94	6.67	9.74	7.49
Between 6 and 24 months	89.00	91.20	87.30	90.00	88.31	90.75
Long term	0.00**	0.73	4.76	3.34	2.00	1.76

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 15: Use of credit of households producing pearl millet and sorghum, 2013/2014

Variables Type of crops	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Food	3.30	2.19	4.76	3.34	3.90	2.64
work force	2.65	3.05	1.59	3.44	2.22	3.2
Health expenses	2.35	1.46	0.00	0.00	1.40	0.88
School fees	3.28	2.18	0.00	0.00	1.94	1.31
Trade	11.11	7.45	11.27	7.89	11.18	7.63
Fertilizers	64.32	73.95	68.89	73.67	66.19	73.84
Livestock	4.08*	3.27*	0.00	0.00	2.42	1.98
Build house	2.20	1.46	1.59	1.12	1.95	1.32
Reimbursed other credits	1.10	0.72	0.00	0.00	0.65	0.44
Saving	0.00	0.00	0.00	1.12	0.00	0.44
Consumption goods	1.22	0.81	0.00	0.00	0.72	0.49
Labour	2.20	1.63	1.59	1.12	1.95	1.42
Other uses	1.10**	1.10*	7.14	5.00	3.57	2.64
Investment (fertilizers, equipment and livestock)	70.60	78.84	70.48	74.78	70.55	77.24
Consumption (food and consumption goods)	4.51	3.00	4.76	3.34	4.61	3.13

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.2. Market transactions of sorghum and millet producers

This section focuses on the analysis of market transactions of pearl millet and sorghum producers in the surveyed villages in 2013/2014. First the market position of farmers is presented, followed by the amount of marketable surplus, the sales of agricultural products, the sales of livestock products, and food expenditures.

5.2.1. Net seller / net buyer of agricultural products

Households who sold more of a product than they purchase during the cropping season are considered net sellers of the product and those who purchased more of a product than they sold are net buyers. Table 16 indicates that pearl millet farmers were net sellers of pearl millet (43.38%), sorghum (47.32%), maize (33.80%), cowpea (58.02%), groundnut (49.01%) and sesame (54.93%). However, we note that in non-project villages, the proportion of net sellers was more important for pearl millet (54%), sorghum (62%), maize (44.35%), and sesame (63%). Otherwise, the results emphasize that pearl millet producers were net buyers of rice (16.05%). The similar results are obtained for sorghum farmers (table 17). The proportions of net sellers were respectively of 31%, 57%, 42%, 54%, 48%, and 57% for pearl millet, sorghum, maize,

cowpea, groundnut, and sesame. Overall, the results show that the proportion of market participants was on average about 50%.

Table 16: Proportion of net seller/net buyer of pearl millet producers, 2013/2014

Variables	Type of village					
	Project village		Control village		Sample overall	
	Net seller	Net buyer	Net seller	Net buyer	Net seller	Net buyer
	240		115		355	
Millet	38.33 ^{***}	4.16	53.91	2.61	43.38	3.66
Sorghum	40.42 ^{***}	12.08	61.74	7.83	47.32	10.7
Maize	28.75 ^{***}	18.34	44.35	14.78	33.80	17.18
Rice	13.34	19.58 ^{***}	16.52	8.7	14.37	16.05
Cowpea	57.92	2.08	58.26	0.00	58.02	1.41
Groundnut	50.00	1.25	46.96	0.00	49.01	0.85
Sesame	50.83 ^{**}	0.00	63.48	0.00	54.93	0.00
Other crops	14.58	0.00	18.26	0.87	15.77	0.28

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 17: Proportion of net seller/net buyer of sorghum producers, 2013/2014

Variables	Type of village					
	Project village		Control village		Sample overall	
	Net seller	Net buyer	Net seller	Net buyer	Net seller	Net buyer
	313		167		480	
Millet	29.39	4.47	34.13	2.39	31.04	3.75
Sorghum	51.11 ^{***}	9.90	68.86	6.59	57.29	8.75
Maize	39.94	14.37	46.71	13.17	42.29	13.96
Rice	14.06	23.64 ^{***}	13.77	9.58	13.96	18.75
Cowpea	54.95	2.56	50.90	1.20	53.54	2.08
Groundnut	48.56	2.24	46.11	0.60	47.71	1.67
Sesame	55.59	0.00	59.28	0.00	56.87	0.00
Other crops	16.93	0.00	20.36	0.60	18.12	0.21

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.2.2. Marketable surplus and agricultural products sales

Marketable surplus is defined as the share of production allocated to market. Table 18 shows marketable surplus of the pearl millet and sorghum producers in the surveyed villages in Burkina Faso. The results indicates that pearl millet producers allocated to market on average 16.41%,

22.06%, 18.88%, 22.92%, 42.12%, 58.37% and 77.75% of their production of pearl millet, sorghum, maize, rice, cowpea, groundnut, and sesame respectively. However, in control villages, marketable surpluses of pearl millet and sorghum were of 20.80% and 27.22% respectively. The similar results are obtained for sorghum farmers. Overall, results showed that marketable surpluses of pearl millet, sorghum and maize are the lowest. This explains by the fact that in most of the sub-Saharan Africa countries, these three crops are grown for food.

With regard to agricultural products sales, table 19 shows that pearl millet farmers sold on average 303 kg of pearl millet, 586 kg of sorghum, 900 kg of maize, 694 kg of groundnut, 317 kg of sesame. The lowest sales include cowpea and rice for 152 kg and 43 kg respectively. However, non-project villages recorded sales of sorghum and sesame estimated to about 904 kg and 493 kg respectively. The average value of sales is estimated to US\$ 1,250 (720 000FCFA) with a significant difference between project (620 000 FCFA \approx US\$ 1,076) and non-project villages (950 000 FCFA \approx US\$ 1,650). Regarding sorghum farmers, they sold on average 213 kg of pearl millet, 842 kg of sorghum, 2 tons of maize, 583 kg of groundnut, and 519 kg of sesame. The sales of rice and cowpea are estimated to about 55 kg and 139 kg respectively. The average value of sales is estimated to US\$ 1,650 (950 000FCFA). We find that in non-project villages, the average value of sales was of US\$ 2,084 (1 200 000 FCFA) against US\$ 1,372 (790 000 FCFA) in project villages.

Table 18: Marketable surplus of agricultural products of pearl millet and sorghum producers, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Millet	14.36**	13.32*	20.80	19	16.41	15.13
Sorghum	19.56**	25.81*	27.22	32.14	22.06	28.03
Maize	17.92	23.41	20.66	21.12	18.88	22.58
Rice	23.06	23.76	22.64	16.85	22.92	21.08
Cowpea	43.05	41.7	39.95	36.02	42.12	39.82
Groundnut	59.81	57.05	54.94	55.15	58.37	56.44
Sesame	76.22	76.69	80.58	77.63	77.75	77.03

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 19: Sales of agricultural products (kg and FCFA) of pearl millet and sorghum producers, 2013/2014

<i>variables</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Millet	273.82	207.92	364.09	223.81	303.06	213.45
Sorghum	434.22***	619.27***	903.58	1300	586.26	841.64
Maize	831.92	2200	1041.65	1700	899.86	2000
Rice	38.9	49.34	52.96	64.61	43.45	54.66
Cowpea	150.49	133	153.91	151	151.6	139.39
Groundnut	910.5	738.13	243.82	291.13	694.54	582.61
Sesame	233.17***	251.33***	493.39	446.45	317.47	319.22
Other crops	322.47	389.12*	335.75	710.57	326.77	500.96
Total value of sales (Naira)	620000**	790000**	950000	1200000	720000	950000

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.2.3. Sales of livestock heads

Table 20 below presents the sales of animals recorded in 2013/2014. The results indicate that animals sold by pearl millet farmers in the surveyed villages were mainly consisted of beef, mouton, goat, chicken, pork and donkey for an average value of US\$ 347.179 (200 000 FCFA). Regarding sorghum farmers, the average value of sales was of US\$ 400.989 (231 000 FCFA). Overall, results show that the sales were relatively low over the period.

Table 2: Sales of livestock of pearl millet and sorghum producers, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Beef	1.79	2.12	1.84	1.95	1.81	2.05
Mouton	3.29	3.55	3.7	3.91	3.44	3.68
Goat	3.42	3.87	3.62	3.82	3.48	3.85
Chicken	12.21	13.05	11.58	11.93	12.01	12.66
Pork	2.67	3.17	2.73	3.07	2.69	3.14
Donkey	1.43	1.40**	1	na	1.37	1.4
Total value of sales (FCFA)	193000	232000	214000	229000	200000	231000

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.3. Food expenditures

Table 21 depicts expenditures food of pearl millet and sorghum farmers in 2013/2014. The results indicate that the average food expenditures of pearl millet farmers were of US\$ 97.244 (56000 FCFA) in the surveyed villages. Food expenditures were mainly consisted of the purchases of millet, sorghum, maize, rice, cowpea, and groundnut. Table 21 also shows that the highest purchases were those of pearl millet. The similar are obtained for households producing sorghum with the average expenses of US\$ 88.556 (51000 FCFA).

Table 21: Food expenditures (kg and FCFA) of pearl millet and sorghum producers, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Millet	698.72	517.40	130.00	144.00	547.07	424.05
Sorghum	288.06	306.67	301.54	276.00	292.04	297.08
Maize	204.45	204.57	243.89	250.87	215.55	219.79
Rice	84.14	83.86	132.69	113.16	94.16	89.66
Cowpea	106.14	93.30	n.a	123.00	106.14	98.25
Groundnut	268.34	178.50	n.a	15.00	268.34	163.64
Other crops	n.a	235.00	100.00	100.00	100.00	167.5
Food expenditures (FCFA)	54000	50000**	60000	53000	56000	51000

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.4. Exposure and adoption of improved sorghum and pearl millet varieties

This section analyzes the exposure and adoption of improved sorghum and pearl millet varieties by pearl millet and sorghum producers in the surveyed villages in 2013/2014. Exposure to modern varieties will be presented, followed by the adoption of the improved varieties by type of variety, and finally the constraints to adoption of improved varieties.

5.4.1. Exposure of farmers to improved sorghum and pearl millet varieties

Exposure to improved varieties is one of the first essential factors to adoption of these varieties. Farmers must first know about the variety and after take the decision to adopt or not. The rate of exposure to a variety is defined as the proportion of pearl millet and sorghum producers who have heard or seen the seeds and/or cultural management practices.

Tables 22 and 23 present the rate of exposure to improved pearl millet and sorghum varieties in 2013/2014. The results show that about 21% of pearl millet farmers were exposed to IKMP5, more than 15% to Misari1, about 11% to IKMV8201, and less than 6% to Sosatc88. There are however differences between project and non-project villages. The rate of exposure to IKMP5

was significantly higher in project villages (24%) than in control villages (14%). The rate of exposure to Sosatc88 was significantly lower in project villages (4%) than in control villages (10%). Fewer pearl millet farmers were exposed to other modern varieties such as IKMP1, and CIVT. About 49% of pearl millet farmers knew at least one modern variety. Among sorghum farmers, about 42% were exposed to Kapelga, 11% to Gnessiconi, 9% to Flagnon, 8% to Sarioso11, 7.50% to ICSV1049 and 6% to Framida. Fewer sorghum producers were exposed to other modern varieties such as Sarioso14, Flagnon, and Grinkan. The results also indicate that 60% of sorghum farmers were exposed to at least one improved sorghum variety in 2013/2014. Overall, the rate of exposure to improved varieties considerably varies according to variety. IKMP5 and Kapelga were respectively the improved pearl millet and sorghum varieties the most knew.

Given the low rates of exposure, there is a need of wide diffusion of modern technologies in Burkina Faso in the framework of the HOPE project – phase 2 in order to increase the rate of exposure to improved varieties.

Table 22: Proportion of farmers reporting knowing pearl millet varieties, 2009/2010

<i>Pearl millet varieties</i>	Type of village		
	Project village 240	Control village 115	Sample overall 355
CIVT	0.42	0.87	0.56
HKP	0.00	0.00	0.00
ICMV IS 89305	0.00	0.00	0.00
IKMP1	6.25	2.61	5.07
IKMP5	24.17**	13.91	20.85
IKMV8201	10.00	12.17	10.70
Misar1	13.75	19.13	15.49
Sosatc88	3.75**	10.43	5.92
Zatib	0.00	0.00	0.00
Kazouimiougou	32.92	37.39	34.37
Kazouipelga	29.17	32.17	30.14
Kazouizouwogdo	20.42***	7.83	16.34
Naado	2.92	2.61	2.82
Other local varieties	43.33	37.39	41.41
Improved varieties	49.17	47.83	48.73
Local varieties	84.58	80.00	83.10

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 23: Proportion of farmers reporting knowing sorghum varieties, 2013/2014

<i>Sorghum varieties</i>	Type of village		
	Project village	Control village	Sample overall
	313	167	480
Kapelga	40.58	44.31	41.88
Sarioso11	8.95	6.59	8.13
Sarioso14	5.11	6.00	5.42
ICSV1049	8.63	5.39	7.50
Framida	6.07	6.59	6.25
Gnossiconi	11.18	10.78	11.04
Flagnon	8.95	8.98	8.96
Grinkan	0.64	0.60	0.63
Bema	0.64	0.00	0.42
Kourbouli	5.43	3.59	4.79
Pisnou	0.64*	2.40	1.25
Karaga	1.92*	0.00	1.25
Bananga	31.31	30.54	31.04
Pagrayi	0.96	0.60	0.83
Kazinga	43.45*	34.73	40.42
Other local varieties	48.56*	57.49	51.67
Improved varieties	62.30	55.09	59.79
Local varieties	86.58**	79.04	83.96

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.4.2. Adoption of improved sorghum and pearl millet varieties

Exposure is highly correlated with adoption of improved varieties. This section will first present the proportion of farmers having adopted improved pearl millet and sorghum varieties, followed by the proportion of areas planted with improved varieties and the seed sources in 2013-2014.

a) Household having adopted improved varieties

Tables 24 and 25 present the proportions of pearl millet and sorghum farmers in the surveyed villages having adopted the modern varieties by variety in 2013/2014. Among pearl millet producers, about 34% adopted the modern varieties. However, the rate of adoption was of 32% in project villages and 39% in control villages. Table 24 also shows that 13% of farmers adopted IKMP5, 11% Misari1, and 6% IKMV8201. Among sorghum farmers, the rate of adoption was about 28%, 5% and 4% for the varieties Kapelga, Flagnon and Gnossiconi (table 25). Overall, about 42% of sorghum producers adopted the modern varieties, with no significant differences between project and non-project villages.

Results showed that in the surveyed villages in Burkina Faso, the rates of adoption of improved pearl millet and sorghum varieties were low in 2013/2014. A particular attention should be focused on this aspect in the framework of HOPE project – phase 2 in the order to increase the rate of adoption of new pearl millet and sorghum varieties and to improve the productivity of these crops.

Table 24: Proportion of farmers having planted pearl millet varieties, 2013/2014

<i>Pearl millet varieties</i>	Type of village		
	Project village 240	Control village 115	Sample overall 355
CIVT	0.00	0.87	0.28
HKP	0.00	0.00	0.00
ICMV IS 89305	0.00	0.00	0.00
IKMP1	1.25	3.48	1.97
IKMP5	14.58	8.70	12.68
IKMV8201	5.83	7.83	6.48
Misar1	8.33**	15.65	10.70
Sosatc88	2.08	3.48	2.54
Zatib	0.00	0.00	0.00
Kazouimiougou	23.75	20.00	22.54
Kazouipelga	17.08	13.91	16.06
Kazouizouwogdo	5.00	6.09	5.35
Naado	0.00	0.00	0.00
Other local varieties	30.83	30.43	30.70
Improved varieties	32.08	39.13	34.37
Local varieties	72.50	66.96	70.70

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 25: Proportion of farmers having planted sorghum varieties, 2013/2014

<i>Sorghum varieties</i>	Type of village		
	Project village	Control village	Sample overall
	313	167	480
Kapelga	25.88	32.93	28.33
Sarioso11	2.88	1.20	2.29
Sariosa14	1.60	1.80	1.67
ICSV1049	3.51*	0.60	2.50
Framida	1.92	3.00	2.29
Gnossiconi	5.75***	0.60	3.96
Flagnon	6.07	4.19	5.42
Grinkan	0.64	0.60	0.63
Bema	1.60	0.00	1.04
Kourbouli	4.47*	1.20	3.34
Pisnou	0.32	0.00	0.21
Karaga	2.88	3.00	2.92
Baninga	24.60	20.96	23.33
Pagrayi	0.00	0.00	0.00
Kazinga	26.52	20.96	24.58
Other local varieties	31.63***	49.10	37.71
Improved varieties	43.45	39.52	42.08
Local varieties	70.93*	78.44	73.54

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

b) Area planted with improved varieties

Area planted with improved varieties is the most important indicator of adoption of improved varieties. The rate of adoption of modern varieties is calculated as the ratio of area planted with modern varieties on the total area planted to sorghum.

Tables 26 and 27 present the rates of adoption of improved sorghum and pearl millet varieties in the surveyed villages. Table 26 indicates that about 31% of pearl millet areas were planted with modern varieties. The rate of adoption was of 29% in project villages. The varieties IKMP5 and Misari1 were the most adopted accounting for each 10% of areas planted with modern varieties. The other improved pearl millet varieties including IKMV8201, Sosatc88, IKMP1, and CIVT which accounted for 6%, 2.20%, 1.86%, and 0.28% of areas respectively. Table 27 shows that about 33% of sorghum areas were planted with modern varieties. However, there were 28% of areas planted with improved varieties in non-project villages against 35% in project villages respectively. Modern sorghum variety the most adopted was Kapelga with 20% the areas. Overall, the results show that the improved sorghum varieties were more adopted in project

villages while areas under improved pearl millet varieties were more important in non-project villages.

Table 26: Proportion of area (%) planted with pearl millet varieties, 2013/2014

<i>Pearl millet varieties</i>	Type of village		
	Project village 240	Control village 115	Sample overall 355
CIVT	0.00	0.88	0.28
HKP	0.00	0.00	0.00
ICMV IS 89305	0.00	0.00	0.00
IKMP1	1.27	3.09	1.86
IKMP5	11.90	6.64	10.20
IKMV8201	5.94	6.28	6.05
Misar1	8.26**	15.19	10.50
Sosatc88	1.78	3.10	2.20
Zatib	0.00	0.00	0.00
Kazouimiougou	21.86	17.61	20.48
Kazouipelga	16.05	11.95	14.72
Kazouizouwogdo	4.38	6.19	4.97
Naado	0.00	0.00	0.00
Other local varieties	28.58	29.05	28.72
Improved varieties	29.15	35.19	31.10
Local varieties	70.85	64.80	68.90

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 27: Proportion of area (%) planted with sorghum varieties, 2013/2014

<i>Sorghum varieties</i>	Type of village		
	Project village	Control village	Sample overall
	313	167	480
Kapelga	19.02	21.28	19.82
Sarioso11	1.53	0.90	1.31
Sariosa14	1.19	1.20	1.20
ICSV1049	1.36*	0.15	0.93
Framida	1.36	1.73	1.49
Gnossiconi	5.27***	0.30	3.53
Flagnon	5.27	2.35	4.24
Grinkan	0.19	0.60	0.33
Bema	1.47	0.00	0.95
Kourbouli	3.13*	0.53	2.22
Pisnou	0.09	0.00	0.06
Karaga	2.61	3.01	2.75
Bananga	16.85	16.28	16.65
Pagrayi	0.00	0.00	0.00
Kazinga	14.23	10.70	13.00
Other local varieties	26.40***	40.94	31.51
Improved varieties	35.21	28.52	32.86
Local varieties	64.79	71.48	67.14

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.5.Sources of seed supply

One of crucial elements of adoption of modern varieties is seed availability. This section presents the sources of seed supply in 2013/2014. Table 28 shows that 70% of pearl millet farmers in the surveyed villages obtained the seeds from another farmer or their relatives with a significant difference between project and non-project villages. There were more than 82% of pearl millet farmers living in non-project villages who obtained the seeds from another farmer or their relatives against 65% in project villages. About 23 % of pearl millet farmers used their own seeds. However, the rate was of 29% in project villages against less than 10% in non-project villages. Other seed sources include extension services (5%), grain traders (1.69%), cooperatives (1.69%), and seed companies (0.85%). Less than 1% of farmers obtained the seeds through on-farm trials (0.28%). Table 28 shows that more than 67% of sorghum producers obtained seeds from another farmer or their relatives, and 28% used their own seeds. In project villages, more than 37% of sorghum farmers used their own seeds against 10% in non-project villages.

Table 28: Sources of seed supply of pearl millet and sorghum producers, 2013/2014

<i>Seed sources</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	(240)	(313)	(115)	(167)	(355)	(480)
On-farm trials	0.42	0.00	0.00	0.00	0.28	0.00
Another farmer/relative	64.58***	58.49	82.61	84.75	70.42	67.88
Own saved seed	29.17***	37.74***	9.57	10.17	22.82	27.88
Grain trader	2.08	0.00	0.87	1.69	1.69	0.61
Extension services	4.17	4.72	5.22	1.69	4.51	3.64
Cooperatives	2.08	0.94	0.87	0.00	1.69	0.61
Seed companies	0.83	0.94	0.87	0.00	0.85	0.61

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.6. Constraints to adoption of improved sorghum and pearl millet varieties

Several constraints limit the adoption of the modern pearl millet and sorghum varieties. Table 29 presents the factors preventing the adoption of modern varieties in 2013-2014. The results show that the main reasons of the non-adoption of modern varieties by pearl millet producers in the surveyed villages were unavailability of seeds (50%), non-resistance to insects (13%), and late maturity of varieties (11%). The same reasons were recorded for sorghum producers. However, there were 34% of sorghum farmers who indicated unavailability of seeds as main constraint to adoption of improved varieties. Other constraints include low yield of varieties (9%), use of many fertilizers (8%), non-adapted to food patterns (5%), low resistance to drought (2%), and high cost of seeds (1.66%). Efforts should be made in the framework of the HOPE project – phase 2 to eliminate all these constraints in order to facilitate a better adoption of modern pearl millet and sorghum varieties in Burkina Faso.

Table 29: Constraints to the adoption of improved pearl millet and sorghum varieties, 2013/2014

<i>Constraints</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	(240)	(313)	(115)	(167)	(355)	(480)
Seed not available	48.44	33.00	54.72	38.00	50.28	34.67
High cost of seeds	2.34	1.50	0.00	0.00	1.66	1.00
Low yields	9.38	9.00	7.55	8.00	8.84	8.67
Low resistance to diseases	0.00	0.00***	1.89	8.00	0.55	2.67
Low resistance to drought	3.13	2.00	0.00	1.00	2.21	1.67
Lack of info about management	0.00	0.50	0.00	1.00	0.00	0.67
Low resistance to insects	10.94	12.00	16.98	16.00	12.71	13.33
Late maturity	12.50	12.00	7.55	7.00	11.05	10.33
Require many fertilizers	8.59	5.00	7.55	4.00	8.29	4.67
Non-adapted to food patterns	3.91	4.00**	9.43	10.00	5.52	6.00
Other constraints	15.63	34.50*	16.98	25.00	16.02	31.33

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.7. Sorghum and pearl millet production systems

This section presents plot characteristics and production systems of pearl millet and sorghum producers in the surveyed villages in 2013-2014.

5.7.1. Sorghum and pearl millet plot characteristics

The plot characteristics include the number of varieties planted, cropping system, practice of rotation, plot status, and plots with Striga. As regards the number of improved and local varieties planted, one considers farmers who planted these varieties in their plot. Table 30 shows that pearl millet farmers in the surveyed villages planted on average 1.00 and 1.17 improved and local pearl millet varieties respectively. Table 30 also shows that 19% of pearl millet plots were intercropped with other crops and 88% practiced crop rotation. However, there were 25% of plots in project villages against 5% in non-project villages that were intercropped. Only 20% of plots were individual and 32.53% had been attacked by Striga. Similar results are recorded for sorghum plots except for plot status and plots with Striga. The proportion of individual plot was about 12%, and that of plots with Striga was about 39%.

Table 30: Pearl millet and sorghum plots characteristics, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Number of modern varieties	1.00	1.06	1.00	1.05	1.00	1.06
Number of local varieties	1.25	1.13	1.00	1.19	1.17	1.15
Cropping system (%)	25.00***	26.59**	5.26	18.23	19.02	23.82
Practice of rotation	85.46***	86.00***	94.16	93.33	88.31	88.58
Plot status (% individual)	21.22	14.29***	17.29	7.26	19.95	11.83
Plots with Striga (%)	31.97	39.57	33.96	38.14	32.53	39.12

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.7.2. Sorghum and pearl millet production systems

This section presents the perception of farmers of their production and soil fertility, the use of fertilizers on the pearl millet and sorghum plots, the type of variety and quantity of seeds used by farmers, yield per hectare and quantities produced in 2013-2014.

a) Perception of farmers on production and soil fertility

Table 31 presents the perception that pearl millet and sorghum producers had of their production and soil fertility. The results indicate that pearl millet farmers in the surveyed villages thought that 31% of their plots would give a good production against 56% of average production and 13% of low production. Regarding sorghum farmers, about 49% had a good perception of their production, 45% had an average perception, and 6% had a low perception. However, we note that in non-project villages, 53% of plots would give a good production. As regards soil fertility, pearl millet farmers thought that 61% of their plots would have medium fertility against 22% of low fertility, 16% of good fertility, and 0% of very good fertility. There are however significant difference between project and non-project villages. The pearl millet farmers living in non-project villages thought that 30% and 10% of their plots would have respectively low and good fertility. The results for the sorghum plots respectively show that 20%, 54%, 25%, and 1% of plots would have low, medium, good, and very good fertility. However, in project villages, sorghum farmers thought that 15% and 29% of their plots had respectively low and good fertility.

Table 31: Perception of pearl millet and sorghum farmers of production and soil fertility, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
<i>Production</i>						
Good production (%)	29.89	46.40*	34.13	53.14	31.20	48.76
Average production (%)	57.30	46.85	53.97	41.42	56.27	44.95
Low production (%)	12.81	6.76	11.90	5.44	12.53	6.3
<i>Soil fertility</i>						
Low fertility (%)	18.86**	15.23***	29.93	27.39	22.49	19.53
Medium fertility (%)	62.29	54.77	59.85	53.53	61.48	54.33
Good fertility (%)	18.86**	29.32***	10.22	17.43	16.03	25.11
Very good fertility (%)	0.00	0.68	0.00	1.66	0.00	1.03

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

b) Use of inputs

This section presents the proportion of plots on which fertilizers and/or manure were used in 2013/2014. Table 32 shows that 23% and 18% of plots of pearl millet producers in the surveyed villages were under fertilizer and manure respectively. Costs of fertilizers and manure were on average US\$ 80.40 (46100 FCFA) and US\$ 33.49 (19200 FCFA) respectively. About 27% and 21% of plots of sorghum producers were under fertilizer and manure respectively. Costs of fertilizers and manure are estimated to US\$ 77.26 (44300 FCFA) and US\$ 30.00 (17200 FCFA) respectively. Overall, the results show a low use of fertilizers in pearl millet and sorghum production. A high use of fertilizers could have a positive effect on productivity and production, and could contribute to achieve food security in the framework of the HOPE project.

c) Type of variety used

This section presents the proportion of plots on which were planted local and improved varieties in the surveyed villages in 2013/2014. Table 33 shows that 25% of pearl millet plots were under local variety and 57% under improved variety with no significant difference between project and non-project villages. Regarding sorghum plots, about 25% and 60% were under local and improved varieties respectively.

5.8. Yield and production

This section presents yields and production of pearl millet and sorghum productions in the surveyed villages. Table 34 shows that pearl millet farmers produced on average 1.270 tons of pearl millet with yields of 721 kg/ha with no significant difference between project and non-

project villages. Sorghum production is estimated to 873 kg with yields of 503 kg/ha. However, farmers from project villages produced about 927 kg of sorghum with yields of 535 kg/ha. Yields obtained are below national averages that are estimated to 853 kg/ha and 1077.8 kg/ha in 2013 for pearl millet and sorghum respectively (FAOSTAT, 2014). Overall, in the surveyed regions, yields of pearl millet and sorghum were low. These findings contribute to reinforce the implementation of the HOPE project – phase 2 in Burkina Faso. One of objectives of project is to help smallholder farmers increase pearl millet and sorghum productivity and increase their incomes.

Table 32: Proportion of pearl millet and sorghum plots under fertilizer and manure, 2013/20114

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240		115		355	
Fertilizer						
Use of fertilizer (%)	25.70**	28.48	16.79	23.67	22.80	26.77
Cost of fertilizer	36100	37400	87500	61500	46100	44300
Manure						
Use of manure (%)	20.42*	26.46***	13.14	12.24	18.05	21.42
Cost of manure	18700	16700***	21900	19700	19200	17200

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 33: Proportion of pearl millet and sorghum plots under local and improved varieties, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	(240)	(313)	(115)	(167)	(355)	(480)
Local variety (%)	24.65	26.46	27.01	23.67	25.42	25.47
Improved variety (%)	59.51	60.99	53.28	57.96	57.48	59.91

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significativity at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 34: Pearl millet and sorghum production (kg) and yields (kg/ha), 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240		115		355	
Production	1297.70	927.05	1204.57	772.6	1267.53	873.32
Yield	737.71	534.92	686.92	443.28	721.25	503.05

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.9. Food security, vulnerability and sources of off-farm income of sorghum and pearl millet producers

Improvement in food security is at the heart of all agricultural development programs in development countries. This section describes food security situation, vulnerability status, causes of food insecurity, and sources of off-farm income in the surveyed villages in Burkina Faso.

5.9.1. Food security situation and vulnerability status

Food security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life” (FAO 1996). Several indicators are defined to describe household food security. The indicator used in this study is Food Consumption Score that is defined as a score calculated using the frequency of consumption of different food groups consumed by a household during the 7 days before the survey. It has for objective to approach an indicator of food consumption that can be used to make comparisons between different zones and situations. In addition, food consumption score can be used to determine the vulnerability status of household.

Table 35 presents food security situation and vulnerability status of pearl millet and sorghum farmers. The results show that 19% of pearl millet producers experienced a food security problem during more than 45 days in 2013. However, in project villages, about 23% of households were in food security against 11% in non-project villages. Consumption score is estimated to 33.59, which was between the standard cut-offs (28⁴ and 42⁵) recommended by Vulnerability Analysis and Mapping Unit of World Food Programme. This means that pearl millet producers had not poor food consumption. Food consumption score is estimated to 32.42 in project villages and was significantly higher than that obtained in control villages (36.02). The

⁴ A score below 28 means that household is expected not to eat at least staple and vegetables on a daily base and therefore considered to have poor food consumption.

⁵ A score between 28 and 42, household is assessed having borderline food consumption, while households that score above 42 are estimated having acceptable food consumption.

results obtained for sorghum farmers are almost similar. Vulnerability analysis show that 1.13% of pearl millet farmers were in food security, 10.42% were at risk i.e. they could any time be in food insecurity, 49.58% were in moderate food insecurity, and 38.87% in severe food insecurity in terms of food intake. The results obtained for sorghum producers are similar to those of pearl millet producers.

Table 35: Food security and vulnerability status of pearl millet and sorghum producers, 2013/2014

<i>Variables</i>	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	(240)	(313)	(115)	(167)	(355)	(480)
<i>Food security</i>						
Food security problem (%)	22.92 ^{***}	18.53 ^{***}	11.30	6.59	19.15	14.37
Number of hunger months	1.20 ^{**}	1.21	1.69	1.36	1.49	1.23
Food Consumption score	32.42 ^{**}	35.11	36.02	37.00	33.59	35.77
<i>Vulnerability status</i>						
Severe (%)	42.50 ^{**}	36.74	31.30	31.14	38.87	34.79
Moderate (%)	47.92	50.16	53.04	52.10	49.58	50.83
At risk (%)	8.33 [*]	10.54	14.78	14.37	10.42	11.87
Food secure (%)	1.25	2.56	0.87	2.40	1.13	2.50

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ***, **, * represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

5.9.2. Causes of food insecurity

Table 36 depicts the causes of food insecurity among pearl millet and sorghum producers in the surveyed villages in Burkina Faso. Production shortfall is appeared as the main cause of food insecurity among pearl millet producers (73.53%). Other causes of food insecurity identified by farmers include loss of non-farm income (31%), increase in food prices (29%), and decrease in production prices. In project villages, other causes were estimated to 24%, 20%, and 5% respectively. The results are almost similar for sorghum producers in the surveyed villages.

5.10. Alternative sources of income of sorghum and pearl millet producers

Pearl millet and sorghum farmers do not only depend on incomes from sales of agricultural products. They have other activities that generate them additional incomes. This section describes the alternative sources of income of pearl millet and sorghum producers. Table 37 shows that the main sources of off-farm income of pearl millet producers in the surveyed villages in Burkina Faso include trade (45%), and migration (15%). For example, income from migration accounted for 26% of the total amount of off-farm income. Pearl millet farmers also derived incomes from financial assistance of friends, hunting/picking, and salary. The same results are recorded for sorghum producers.

Table 36: Causes of food insecurity among pearl millet and sorghum producers, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	115	167	355	480
Production shortfall	76.36	75.86	61.54	63.64	73.53	73.91
Decrease in output prices	5.45 ^{***}	1.72 ^{***}	46.15	36.36	13.24	7.25
Increase in food prices	20.00 ^{***}	15.52 ^{***}	69.23	63.64	29.41	23.19
Loss of non-farm income	23.64 ^{**}	20.69 ^{**}	61.54	54.55	30.88	26.09
Other causes	14.55 ^{**}	10.34 ^{**}	46.15	36.36	20.59	14.49

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ^{***}, ^{**}, ^{*} represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

Table 37: Sources of off-farm income of pearl millet and sorghum producers, 2013/2014

Variables	Type of village					
	Project village		control village		Sample overall	
	Millet	Sorghum	Millet	Sorghum	Millet	Sorghum
	240	313	155	167	355	480
Migration	39700	29700	33800	23100	37800	27500
Salary	18300 [*]	20300	2084	6325	13000	15700
Financial assistance of friends	16800	12800	16300	18600	16600	14700
Gold panning	0000 ^{***}	0000 ^{**}	4584	6927	1503	2290
Hunting/picking	6309	10400 ^{***}	27300	33400	13200	18000
Trading	151000	119000	28200	43400	111000	93900
Other revenue sources	60700	59100	45500	37800	55700	52100
Total of non-farm revenues	293000	251000	158000	169000	249000	224000

Note: Sample size in parentheses. The stars represent the difference between project village and control project. ^{***}, ^{**}, ^{*} represent respectively significance at 1%, 5% and 10% levels.

Source: constructed using survey data carried out in Burkina Faso over the period 2013-2014.

6. Concluding remarks

Household baseline survey conducted in Burkina Faso in 2014 in the framework of the HOPE project is a component of monitoring and evaluation activities. This survey constitutes a major reference that will enable to assess the performance and impact of project on its beneficiaries.

The survey generated a lot of data of which analyses revealed interesting information on the socio-economic characteristics of pearl millet and sorghum producers in Burkina Faso. The surveyed households were poor with regard to number and value of their livelihood assets. The rate of formal education was low in 2013/2014. The yield levels of pearl millet and sorghum

were low. This could be explained by the lack of credit, low use of improved varieties, and low mechanization of the production systems. Less than of half the surveyed households had access to credit in the surveyed villages in Burkina Faso. The results showed that the marketable surpluses of pearl millet and sorghum were low compared to other products such rice, cowpea, groundnuts, and sesame. This could be explained by the fact that pearl millet and sorghum are mainly self-consumption products in most of the West African countries, only a small share is allocated to market.

With regards to rate of adoption of modern varieties, the results revealed that pearl millet and sorghum producers in Burkina Faso had planted a few improved varieties in their plots. Several reasons explain this low rate of adoption of modern varieties, the most known of which being unavailability of seeds, low resistance of varieties to insects, late maturity of varieties, and low yielding of varieties. Other reasons could also explain the low ratio of adoption such as low level of education of producers and limited access to credit. Less educated households are less receptive to new technologies. The lack of credit is a major constraint to increasing in production and incomes.

Efforts should be made in the framework of the HOPE project – phase 2 for ensuring better access to good quality seeds and facilitate a wider adoption of improved of pearl millet and sorghum and use of modern technologies. The challenges of access to credit and markets by pearl millet and sorghum producers should be addressed to enable them to increase their production and incomes, and to improve food security.

As regards the data collection, project managers should be ensure that villages and households of baseline survey are selected and interviewed in future surveys that will serve to assess the impact of project. This is to ensure that baseline data constitute a good benchmark to impact analysis.