SENEGAL CLUSTER BASELINE REPORT

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AICCRA
Accelerating Impacts of CGIAR Climate Research for Africa

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Highlights

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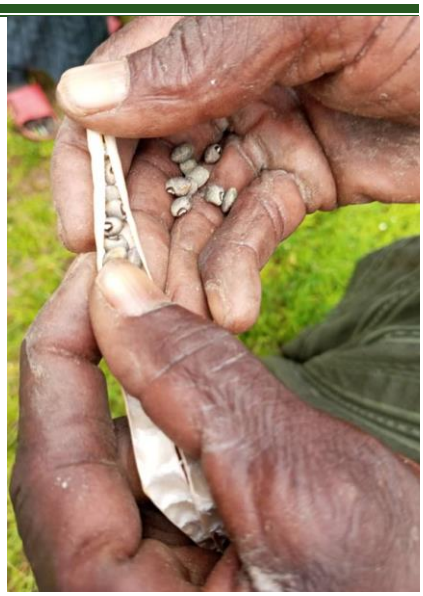

Majority of farmers perceive climate change as a major risk adversely impacting agriculture and their livelihoods.

Peanuts and sorghum are most impacted due to increased climate risk mainly causing moisture deficit and only few farmers have access to irrigation

Access to seeds for main crops is a major challenge for at least 70% of farmers every year in AICCRA intervention areas

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Acknowledgements

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[1] Project ID 173398

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AICCRA	**Accelerating Impacts of CGIAR Climate Research in Africa**
ANACIM	Agence Nationale de L'Aviation Civile et de la Météorologie
ANCAR	Agence Nationale de Conseil Agricole et Rural
CCAFS	The CGIAR Research Program on Climate Change, Agriculture and Food Security
CERAAS	Centre d'étude régional pour l'amélioration de l'adaptation à la sécheresse
CIAT	The International Centre for Tropical Agriculture
CINSERE	Climate information services for increased resilience and productivity
CIS	Climate Information Services
CS	Climate-Smart
CSA	Climate-Smart Agriculture
EGAB	Entente des Groupements Associés pour le développement à la Base
FCFA	The West African CFA Franc
GIE	Le groupement d'intérêt économique
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDA	International Development Association
ILRI	The International Livestock Research Institute
IRI	International Research Institute
ISRA	Senegalese Institute of Agricultural Research
NARS	National Agricultural Research Systems
PSM	Propensity Score Matching
SD	Standard Deviation
SMS	Short Message/Messaging Service
TV	Television
URAC	Union des Radios Communautaires du Sénégal
USAID	The United States Agency for International Development
VC	Value Chain
WA	West Africa

Executive summary

This report presents the socio-demographic and economic situation of farmers in the context of farming systems and climate change in the intervention areas of the AICCRA-Senegal project. It also highlights the baseline situation of the key performance indicators of agriculture and livestock value chains, plus the use of climate information and climate-smart agriculture (CSA) innovations. The report has been developed based on the primary data collected from 503 farm households covering both the treatment and control villages in the study region-peanut basin of Senegal. The introductory chapter covers the context of the project, its objectives and methodological aspects. The second part presents characteristics of farms, plus farmers and livestock keepers. The third section describes agricultural systems for the three main agricultural crop value chains, the following section focuses on livestock systems; The fifth and final section is devoted to presentation of the level of knowledge and use of climate information. It also highlights the status of vulnerability/resilience in the face of climate change and variability.

The millet, peanuts, cowpea and maize are main crops of the study area- the dryland region of Senegal. Almost all the farmers were cultivating millet (92%) and peanut (93%) crops followed by cowpea crop (50%) as their main crop. With average cultivated areas in 2021 comprising 3 hectares for millet, 3.1 hectares for peanuts and 1.6 hectares for cowpea in the intervention areas, the average yield across all intervention households was 339 kg/ha for millet, 360 kg/ha for peanuts and 597 kg/ha for cowpea. It is worth noting that the particularly poor crop yield reported by the Thies cluster was due to the drought experienced during the crop season of 2021.

The study areas were mainly crop-livestock farming systems with animal husbandry a secondary activity for majority of the participants. About 1/3rd of the farm households owned cattle, more than 70% sheep, 35% owned goats as well as poultry bird by more than 50% of the households. Horse and donkey were other important livestock mainly used for transportation and ploughing. The livestock was considered an important source of livelihood by about 2/3rd of the farm households in the study region however it was a main source of income only for 12% of households. Cattle, sheep, horse, donkey and goats are the main livestock along with few poultry birds.

With an average of 14 members per household and constituting 7 female members, the men were involved in almost all the activities of the household related to crop farming and livestock. Contributions of women were observed more in crop harvesting, post-harvest handling and also in milk processing, for those farms that owned dairy cattle.

The farmers in study areas (>90%) are well aware of climate change phenomena and reported experiencing its impacts on their farm production activities and more widely on their livelihoods. The increased water scarcity for agriculture and extreme weather events resulting in decreased crop yields and loss of income for farmers are consequences of climate change. In addition, an increase in the number of conflict incidents between farmers and livestock breeders/herders, the decline in quantity and quality of fodder for animals and the increase in bovine diseases are also

impacts of climate change. A large majority of the farmers were getting climate information through radio/mobile phone. However very few (<20%) ever heard about climate smart agriculture. During the year 2021, a long dry spell during the rainy season caused significant losses in crop production e.g. peanuts and millets particularly in the Thies region with more than 50% of farmers having zero-yield. In other regions the crop yield ranges from 402 to 1200 kg/ha regardless of the crop which remains below the potential yield for the three priority crops. Maintaining milk production from cows appears to be a challenge particularly in dry season resulting in low milk yields of less than 3 L per day. Inherently poor access to feed and fodder has been further worsening due to increased climatic variability and resulting in lower livestock yields.

The vulnerability analysis indicates that farmers are vulnerable to climate change and other shocks in general. For more than 50% of households the level of vulnerability was worse. The Louga cluster had the highest level of vulnerability followed by Kaffrine and Thies clusters.

With the up-scaling of Climate Information Services and prioritized Climate Smart Agricultural technologies (CSA), AICCRA in its SENEGAL cluster has a very good potential to contribute to enhanced resilience of farming and livelihood systems in the face of climate change and variability. The CSA technologies/practices include natural resource management technologies, resilient cultivars, diversification, and improved access to feed and fodder to for livestock besides context specific climate information services. The analysis also highlights the need for interventions that promote greater availability of milk in the dry season by making suitable feed accessible during these periods.

I. Introduction

I.1. Background and AICCRA-Senegal intervention logic

AICCRA (Accelerating Impacts of CGIAR Climate Research in Africa), is a three-year project (2021-2023) funded by the World Bank (IDA) in six African countries: Ethiopia, Kenya, Zambia, Ghana, Mali and Senegal. The main objective of AICCRA at the global level is to strengthen the technical, institutional and human capacity needed to enhance transfer of climate-relevant information, decision-making tools and technologies in support of scaling efforts in IDA-eligible countries in Africa. The project comprises four main components:

- Knowledge generation and sharing
- Strengthening partnerships for delivery of climate-smart innovations in agriculture
- Validating climate-smart agricultural innovations through piloting, and
- Project management.

At the Senegal Cluster level, AICCRA is expected to strengthen the systemic capacity of national partners and the private sector to promote climate adaptation in agriculture and dissemination of key results of CGIAR climate research. Led by ICRISAT until December 2021 and then by ILRI since January 2022, with partners like Alliance Bioversity and CIAT, AICCRA-Senegal builds on existing work funded by USAID (Developing Sustainable Market-based Weather and Climate Information Services in Senegal (CINSERE-Plus)) implemented by CCAFS WA and the National Agency of Civil Aviation and Meteorology (ANACIM).

AICCRA-Senegal focuses on semi-arid crops, crop-livestock farming and livestock systems to develop climate-informed agro-advisories tailored for value chain players (farmers, livestock keepers, input and service providers, extension services, youth enterprises, etc.), and evaluate and promote CSA options for building resilient farming systems. The program enhances weather forecasting and weather recording capabilities of ANACIM and supports them through capacity development provided by the International Research Institute (IRI), Columbia University. The collaboration with the Regional Center of Excellence on dry cereals and associated crops of the Senegalese Institute of Agricultural Research (ISRA/CERAAS) has introduced the latest crop-based innovations including germplasms, best proven cropping systems and integrated soil fertility options that could improve productivity while increasing the system's resilience to climate change. AICCRA-Senegal has also partnered with Agence Nationale de Conseil Agricole et Rural (ANCAR) and private sector ag-techs like JOKALANTE and the URAC (Union of local radios), to build modern extension systems that reach thousands of smallholder crop and livestock farmers in Senegal's intervention areas.

I.2. Baseline study objectives

A two-day (June 15-16, 2021) participatory workshop2 with stakeholders was held in Thies. The aim was to build a quantifiable ranking system to prioritize crop-livestock value chains. Using the long list of key crops and livestock value chains (VCs) in the drylands of Senegal, the list was further narrowed down to four value chains based on the following criteria: climatic, social, economic and equity. These value chains comprise: Millet, Groundnuts, Cowpea, plus Dairy and Beef Cattle.
As per the context of the value chains, different climate-smart (CS) interventions were planned based on the challenges faced by stakeholders. Further, the delivery of Climate Information Services (CIS) was designed to support the scaling up of identified CS interventions, in partnership with ANACIM, CERAAS, ANCAR and other private partners.
The main objectives of this reference study are to:

- Contribute, as the first step of the impact assessment process of the different AICCRA-Senegal cluster interventions in the AICCRA areas, by collecting baseline indicators relevant to the project goals.
- Survey the current situation of farm and agro-pastoral households in the intervention areas regarding climate challenges, climate risks faced and shocks, level of vulnerability to the shocks, plus adaptation strategies.

More specifically, the baseline aims to:

- Determine the socio-economic state and production systems of smallholder farmers and livestock keepers in the intervention areas.
- Assess the climate change perception by targeted farmers and their adaptation strategies.
- Assess the level of knowledge and use of CIS and CSA technologies in the study areas.
- Measure the reference values of millet, peanut and cowpea production performances.
- Measure the reference values of dairy production performances for various seasons.
- Assess the overall vulnerability of populations to climate change.

This baseline study was conducted at household level and provides an extensive understanding of the farming systems and major crop-livestock value chains of the project area. It has been useful not only in designing the project interventions but also provide baseline information on the monitoring-evaluation indicators for the project activities. The report also provides a preliminary analysis of survey data conducted in the three regions of the peanut basin in Senegal

[2] https://cgspace.cgiar.org/handle/10568/119736

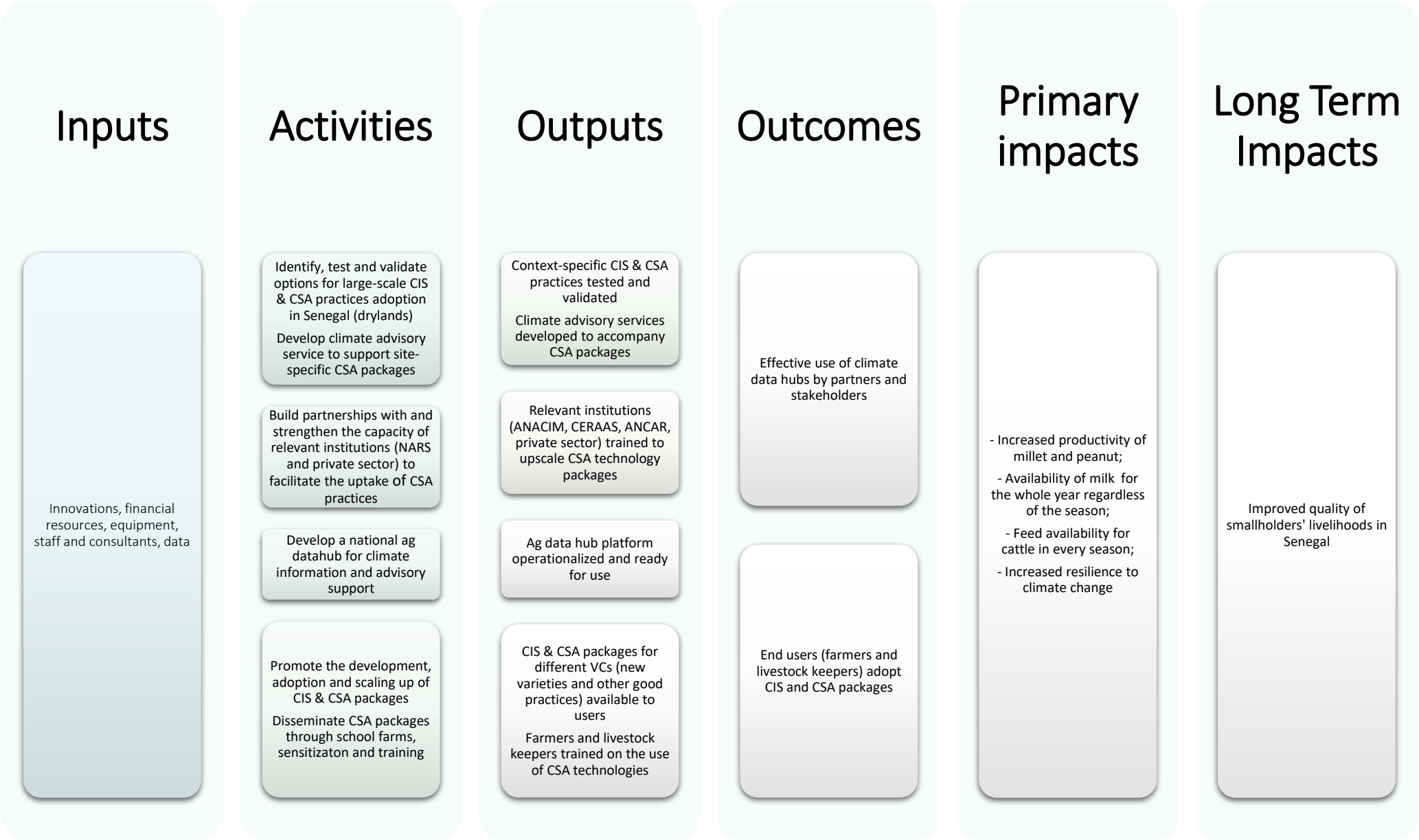

Figure 1: Theory of change of AICCRA-Senegal cluster

I.3. Intervention areas and sampling design

The intervention area covered 18 villages divided into three clusters representing the 3 of the 14 regions in Senegal, namely Kaffrine, Louga and Thies. The selection of the villages is in line with the logic of the interventions. Indeed, for the year 2022, three main sites were selected from each of the three regions. These comprise Daga Birame in Kaffrine, Thiel in Louga and Meouane in Thies region. In these three sites, CERAAS supported by ICRISAT and ILRI has been implementing 108 field demonstrations and three technology parks in order to validate a set of CSA technologies. Within a reasonable radius around the main sites, ANCAR has been organizing farmers' field schools to promote the innovations introduced in the main villages.

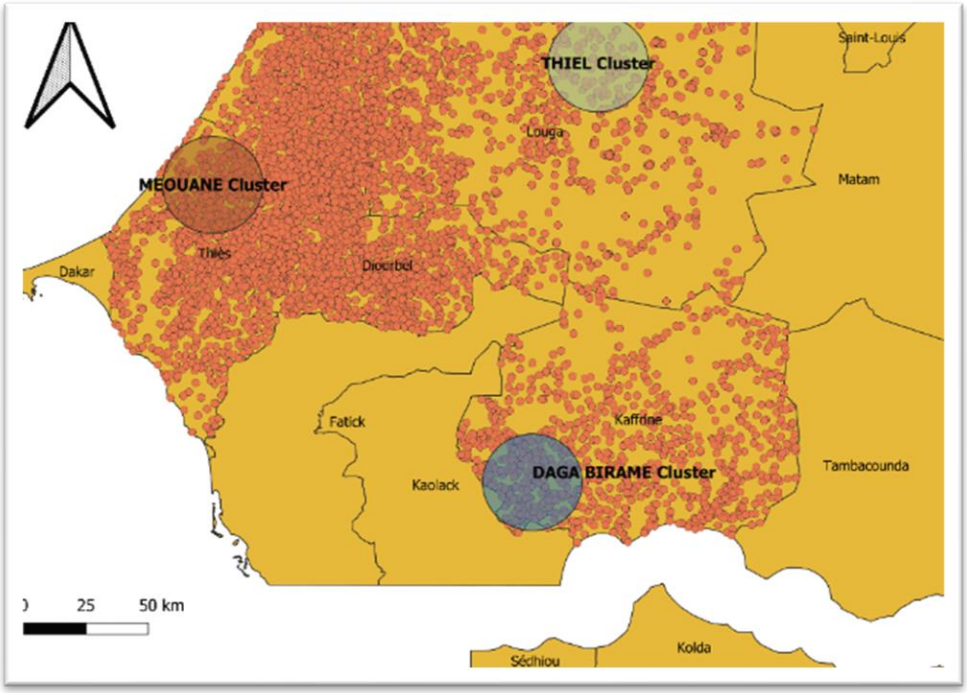

Figure 2: Three clusters of intervention in 2022. Red dots represent villages.

Since the intervention villages were not selected through a randomized process, the propensity score matching (PSM) method was adopted for impact assessment of the different interventions. In line with this method, surveys were deployed in another 18 villages – "control" areas where there were no interventions. In total, 503 households/farms were surveyed. The control sample size is deliberately bigger than the treatment sample. The aim is to facilitate later use of the PSM method. Table 1 summarizes the number of households surveyed by village and according to the treatment or control sample.

Table 1: Villages covered by the survey

Treatment		Control	
Villages	Number of households	Villages	Number of households
Nandjigui	13	Hodioldé Peulh	10
Keur Sawely	13	Ndiakhate	10
Darou Nandjigui	12	Sine Kane	12
Diatta Fakha	13	Baytite	13
Mbeuleup	12	Touba Fall	14
Simbara	12	Touba Darou Rahmane	14
Ainoumane	12	Darou Nahim Firewalls	16
Borin	12	Sylhate Wolof	16
Ndombil	12	Kethiewane Peulh	17
Ndiouffene	14	Diamacolong	18
Ndiane	12	Loncane Mbeuleup	18
Meouane (Mbelgore)	12	Ndiobene Taiba	18
DaroU Nahim Danedji	14	Koky Keur Babou Khore	18
Touba Danedji	10	Ndeukou	18
Touba Ndiagne	10	Leona	18
Mola	12	Dioulky	18
Thiel Serere	12	Sine Abdou Moussa & T	19
Hodiolded 3	10	Patakour	19
Total	217	Total	286

I.4. Data collection and ethical aspects

Data collection took place from May 23 to June 8, 2022. This occurred just before the beginning of on-ground activities of AICCRA which coincides with the onset of the rainy season. The questionnaire was administered through a data entry application implemented on Kobo toolbox and Xls forms. This baseline assessment directly contributed in designing need-based resilience enhancing interventions as part of AICCRA.

Prior to data collection, interviewers were trained for three days on the topics covered in the questionnaire, how to use the data collection application and the importance of confidentiality.

Since participation in the survey was not compulsory, before any interview, respondents were requested to give an oral consent after they were made aware of the objectives of the survey. They were free to either participate or decline using a pre-designed consent form. The instruments/questionnaires used for the primary survey of the farm households were reviewed by the Ethics Committee of ICRISAT and found to comply with the guidelines laid down in the ICRISAT's Principles and Procedures for the Protection of Human Research (IEC Clearance Number is IEC-ICRISAT/30082022/06).

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II. Characteristics of surveyed households

II.1. Gender, age and marital status of household heads

On average across the control and treatment samples, males headed the majority (96%) of the households interviewed with women heading only 4%. According to the two samples (treatment and control), women-headed households were slightly less represented in the control than in the treatment (7% difference, rejection of equality of proportions at the 5% threshold). Percentage of women-led household is less than 10% in Senegal according to representative surveys conducted by the national statistics agency. In our study, it was 3.2% in Kaffrine, 10% in Thies and 9% in Louga. In many villages there was not even a single woman headed household doing one of the crops targeted by the project (millet, groundnut, cowpea) or livestock keeping.

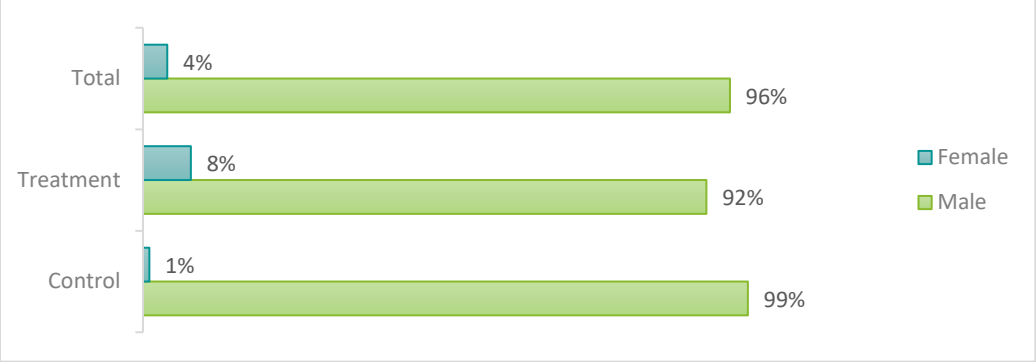

Figure 3: Distribution of household heads by sex

The average age of the head of the household interviewed was 53 years, the youngest being 21 and the oldest, 99. While the average age in the control group was 55 years, the treatment group registered an average of 50 years. However, the mean comparison test concluded that the mean ages were equal at the 5% level. Wolof is the main language spoken in the study areas, covering about 71% of households. This was followed by Poular and Serer, with a 14% coverage each.

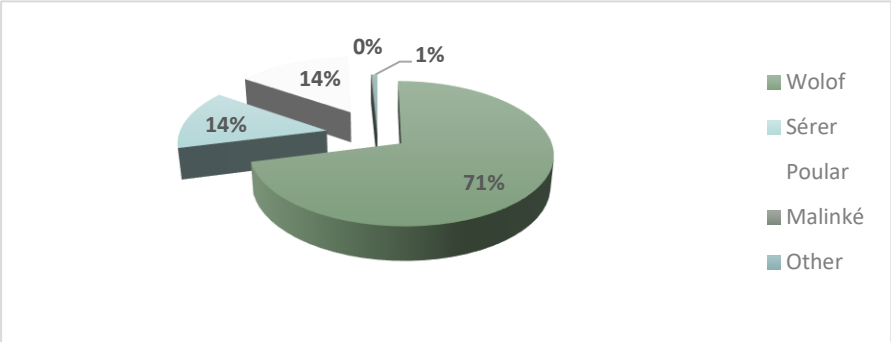

Figure 4: Language spoken in the study area

With regard to the marital status, almost all household heads were married, and this was not dependent on the sample considered (P-value=0.6, implying non-rejection of the independence hypothesis).

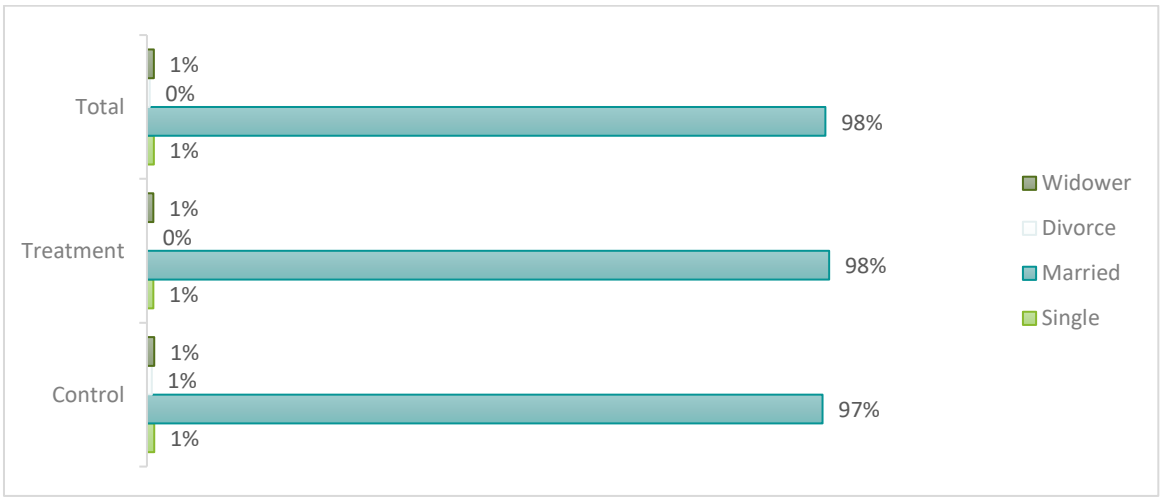

Figure 5: Marital status of the head of households

II.2. Education and activities

Household heads were generally literate (could read and write) in Arabic in at least six cases out of 10. Then came those who could neither read nor write in any language. The latter represented at least two cases out of 10.

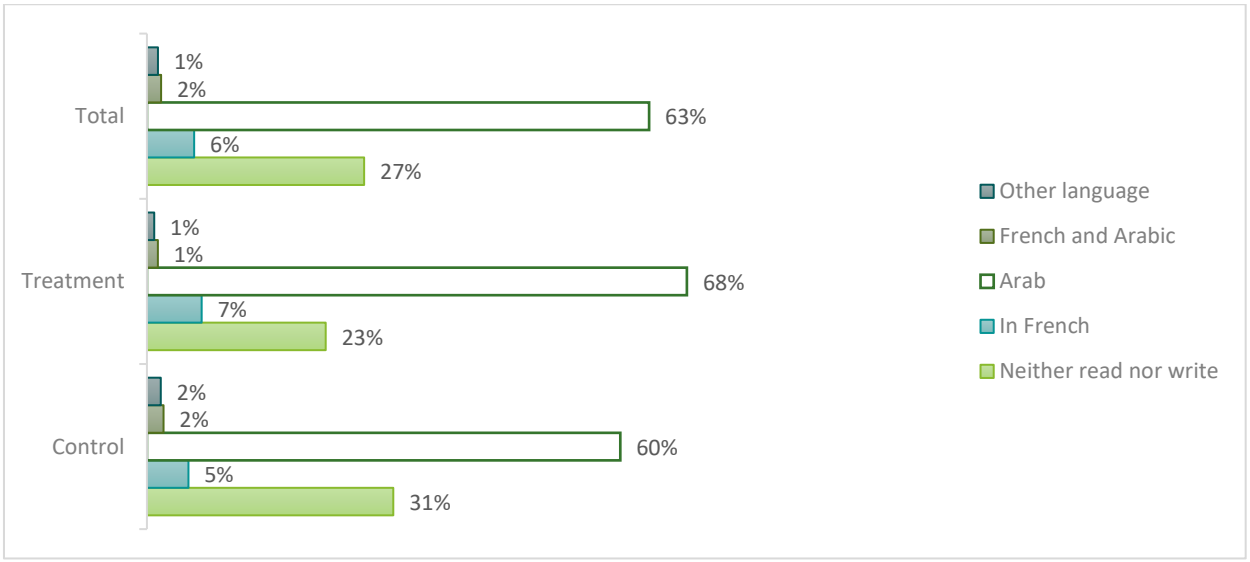

Figure 6: Literacy level of head of households

When asked about their key activities, about eight out of 10 household heads claimed that their main source of livelihood was agriculture.

Table 2: Main occupations of the head of the farm households (% household)

Main occupation	Control	Treatment	Overall
Agriculture	79%	91%	84%
Livestock rearing	12%	4%	9%
Market gardening	1%	0%	1%
Fishery	0%	0%	0%
Trade	2%	1%	2%
Arts and crafts	0%	0%	0%
civil service	1%	1%	1%
Others	5%	3%	3%
Total	100%	100%	100%

Agriculture therefore appears to be the predominant activity in the study area. Households devote most of their time to it (72%) and also draw most of their income from this activity (67%). Livestock breeding was second, and served as the main source of income for more than 21% of households. The other activities appeared as secondary. One out of four households were not involved in any secondary activity, that is, 125 household heads from the whole sample. The statistics relating to secondary activities/occupation has been summarized below.

Table 3: Secondary occupations of the heads of the farm households (% household)

Secondary occupation	**Control**	**Treatment**	**All**
Agriculture	25%	11%	19%
Livestock farming	39%	32%	36%
Market gardening	1%	1%	1%
Fishing	2%	0%	1%
Trade	9%	7%	8%
Arts and crafts	3%	5%	4%
Civil service	0%	0%	0%
Others	1%	11%	6%
None	20%	33%	25%

It is clear from Table 3 that the agriculture in 1/5th of the households and livestock rearing in more than 1/3rd of the households was the secondary sources of income. A smaller proportion of households involved in trade, crafts and other minor activities as secondary occupations. Thus a majority of household heads were either fully focused on agriculture or on animal husbandry and also significant proportion of them practiced both at the same time. The other sources of income were not common in the area, with trade practiced by 8% of farmers, and artisanship by 4%.

II.3. Membership in farmer organizations

Majority of the crop-livestock farmers were not part of any farmers' organization. Only a small proportion of them (13-14%) were members of any farmer organization.

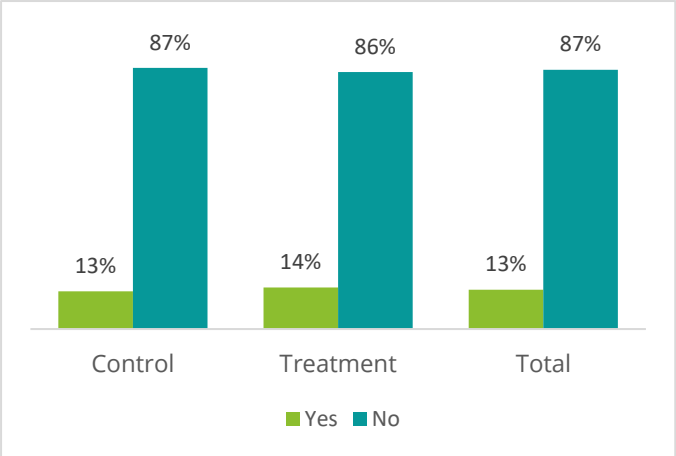

Figure 7: Membership in farmers producer organizations

The main farmers producer organizations to which they belonged are summarized in Figure 8. The GIE Diambar, Bokk Diom, EGAB, IGPM, Réseau Mil de Mabo and the Kouloussar association are the main organizations present in the study regions.

Figure 8: Main farmer organizations

II.4. Household size

Each household on average had 14 members(see Table 4). The size of different households ranged from as low as 1 member to 48 members.

Table 4: Size of Household in the study region

Category	Average household size	Standard deviation	Minimum	Maximum
Households- Control	15	7	3	46
Households- Treatment	14	7	1	48
All	14	7	1	48

III. Farming systems for the Three CROP value chains

III.1. Main crops

The main products grown in the survey areas comprise millet, peanuts, cowpea and maize. Millet and peanuts are grown by more than 90% of farmers, while cowpea is grown by half of the producers. Maize is also a significant crop, grown by 46% of producers during the 2021 rainy season. There is no significant difference between treatment and control regarding this structure of products.

Table 5: Diversity of crops grown by farmers during the 2021 season (% households)

Crops	Control	Treatment	All
Millet	92%	96%	94%
Peanut	93%	96%	94%
Cowpea	50%	51%	50%
Sorghum	2%	2%	2%
Maize	44%	48%	46%
Watermelon	8%	9%	8%
Cassava	10%	17%	13%
Patate	0%	0%	0%
Vegetables	5%	9%	7%
Others	6%	12%	9%

III.2. Organization of crop production

Farm activities comprised field preparation, harvesting and shelling, sowing, weeding and pre-harvest maintenance. Table 6 summarizes the roles of various individuals (by gender) in the production process for the operations related to millet (n=472), peanut (n=474) and cowpea (n=224) crops.

Table 6: Distribution of farm tasks among different family members and hired labour

		Percent of Household in treatments					
Tasks	**Who manages?**	**Millet**		**Peanut**		**Cowpea**	
		%	***P-value**	**%**	***P-value**	**%**	***P-value**
Land preparation	Household men	96%	0.02**	96%	0.17	96%	0.27
	Household women	15%	0.24	16%	0.00**	16%	0.32
	Child	32%	0.91	31%	0.74	38%	0.28
	External men (paid)	6%	0.84	5%	0.52	5%	0.90
	External women (Paid)	0%	0.11	0%	0.26	0%	0.43
Sowing	Household men	97%	0.08	97%	0.05**	95%	0.78
	Household women	22%	0.17	23%	0.03**	28%	0.96
	Child	36%	0.89	35%	0.25	41%	0.33
	External men (paid)	5%	0.67	6%	0.42	4%	0.26
	External women (Paid)	0%	0.11	0%	0.70	0%	0.26
		Percent of Household in treatments					
Tasks	**Who manages?**	**Millet**		**Peanut**		**Cowpea**	
		%	***P-value**	**%**	***P-value**	**%**	***P-value**
Weeding and pre-harvest maintenance	Household men	97%	0.37	97%	0.84	96%	0.43
	Household women	41%	0.23	42%	0.28	45%	0.00**
	Child	37%	0.83	36%	0.31	42%	0.11
	External men (paid)	5%	0.26	6%	0.64	4%	0.09
	External women (Paid)	1%	0.26	1%	0.71	1%	0.78
Harvest	Household men	97%	0.17	98%	0.68	84%	0.22
	Household women	41%	0.00**	48%	0.09	55%	0.24
	Child	36%	0.81	35%	0.53	39%	0.74
	External men (paid)	7%	0.94	7%	0.52	5%	0.14
	External women (Paid)	1%	0.26	1%	0.86	0%	0.11
Threshing	Household men	78%	0.45	93%	0.44	72%	0.30
	Household women	49%	0.00**	36%	0.15	55%	0.00**
	Child	24%	0.52	31%	0.24	38%	0.44
	External men (paid)	9%	0.52	9%	0.76	6%	0.02**
	External women (Paid)	1%	0.26	0%	0.40	0%	0.26
**P-value of the comparison test between treatment & control* ***Significant difference at 5% level*							

Although the households surveyed were, on average, made up of men and women in equal proportion, men in the households were better represented throughout the production process, with a participation rate generally above 90%. As for the women, their contribution ranged from 15 to 16% in preparation of land; from 22 to 28% for sowing, from 37 to 42% for weeding; from 41 to 55% for harvesting and from 49 to 55% for shelling. Thus, their contribution seems to increase as they progress through the production process. Children were also involved, with their contribution ranged from 24 to 41% depending on the stage of production and the crop. In very rare cases, the services of female labourers were used, particularly in weeding or harvesting. Only a small proportion of households hired male labourers which ranged from 4 to 9%. They were hired by 4 to

6% of the households for land preparation to weeding. At the harvesting and shelling stages, this value ranged from 5 to 9%.

III.3. Cultivated area and crop yields

During the 2021 winter season, farmers cultivated on average 3.0 ha millet, 3.1 ha peanuts and 1.6 ha cowpea in the AICCRA project areas. This allocation of land to crops, however, varied from one cluster to another (see Table 7).

Table 7: Area in hectares of cultivated land during the rainy season (2021)

	Millet		Peanut		Cowpea	
Region	**Control**	**Treatment**	**Control**	**Treatment**	**Control**	**Treatment**
Kaffrine	4.0	2.5	4.2	3.3	0.7	8.5
Thies	3.5	3.9	2.9	3.7	1.0	1.3
Louga	3.3	2.7	3.1	2.5	1.4	1.4
All	3.6	3.0	3.5	3.1	1.2	1.6

Average yield for all intervention households was 339 kg/ha for millet (against 356 in the control group), 360 kg/ha for peanuts (against 413 in the control) and 597 kg/ha for cowpea (same value for the control). However, these averages disclose significant differences, particularly between clusters. In particular, the proportion of farms with zero yield in the 2021 season is informative. For all the crops in the Thies cluster, more than half of the farmers in the treatment group recorded zero yield. This figure is at least 78% in the control group. The situation is explained by the unexpected drought during the 2021 season, which resulted in enormous losses in this region. The Louga cluster was also affected, but much less than Thies.

For households who managed to get a non-null yield, the Thies cluster had a millet yield of 111 kg/ha in the intervention group against 700 kg/ha in Kaffrine and 402 kg/ha in Louga. For peanut, while Thies cluster achieved a yield of 104 kg/ha, Kaffrine and Louga respectively had 658 kg/ha and 578 kg/ha. Finally we observed a cowpea yield of 228 kg/ha when 427 kg/ha and 1200 kg/ha are observed in Kaffrine and Louga (see Table 8).

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Table 8. This situation is illustrative of the dependence of farming on the climatic vagaries in a population whose main source of livelihood (with few alternatives) is agriculture.

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Table 8: Level of yield of major crops across clusters

		Millet		Peanut		Cowpea	
Regions		Control	Treatment	Control	Treatment	Control	Treatment
Kaffrine	Average Yield	532	700	500	658	1918	427
	Sd of yield	450	687	499	835	1298	669
	Median of yield	450	500	360	450	1667	42
	Prop of zero yield	0%	0%	0%	0%	0%	0%
Thies	Average Yield	58	111	82	104	83	228
	Sd of yield	26	62	64	104	71	237
	Median of yield	50	90	65	67	50	200
	Prop of zero yield	79%	59%	80%	55%	78%	51%
Louga	Average Yield	424	402	581	597	1147	1200
	Sd of yield	418	333	576	737	1029	909
	Median of yield	300	333	481	333	800	1000
	Prop of zero yield	1%	0%	1%	0%	3%	0%

Table 9: Income from crop production activity across clusters (FCFA)

Clusters		**Control**	**Treatment**
Kaffrine	Average	695,568	614,697
	SD	805,484	642,483
	Median	500,000	350,000
Thies	Average	35,589	72,041
	SD	119,351	260,113
	Median	0	0
Louga	Average	287,297	369,640
	SD	547,181	977,367
	Median	100,000	156,000

IV. Livestock systems

IV.1. Main farm animals

The study areas were essentially not pastoral regions. Animal husbandry was a secondary activity for majority of the participants. Table 10 presents the percentage of households owning different categories of animals. In the intervention zones, less than three out of 10 farmers owned cattle. Seven out of 10 farmers owned sheep, while 35% owned goats. Horses were owned by nearly eight out of 10 farmers and were mainly used for transportation and ploughing. Donkeys generally served the same purpose and were owned by 57% of farms.

Table 10: Diversity of animals maintained by farm households (% households)

	Control	Treatment
Cattle Local breed	39%	27%
Cattle Mixed breed	2%	3%
Sheep Local breed	76%	70%
Sheep Cross breed	3%	5%
Goats Local breed	52%	35%
Goats Mixed breed	3%	2%
Horses	77%	78%
Equine Cross-breed	0%	0%
Donkeys	65%	57%
Asins Mixed breed	0%	0%
Pigs Local breed	0%	0%
Pigs Cross-breed	0%	0%
Poultry	56%	41%
None	2%	8%

The local breeds of cattle, sheep or goats were more common. Exotic breeds were very rare (3%, 5% and 2% respectively, of cattle, sheep and goats in the treatment group). Finally, it is worth noting that poultry farming was practiced by 41% of households. The following Table 11 summarizes the average number of animal of each category possessed by a household. As expected, Louga's cluster which is the closest to Senegal pastoralist areas shows the highest number of animals possessed with 26 cattle, 64 sheep and Goats, 3 horses, 4 donkeys and 20 poultries on average.

Table 11: Size of livestock holding across three clusters (No. per farm household)

Livestock species	Kaffrine	Thies	Louga	Total
Cattle	12	10	26	18
Sheep & Goat	10	9	64	32
Horse	2	1	3	2
Donkey	2	1	4	3
Poultry	16	16	20	18

For the majority of farmers, i.e. more than 90%, livestock was important (all degrees of importance included) in household activities (Figure 9). Livestock was an economic activity of extreme importance for 36% of them. There was no significant difference regarding this fact between the control and treatment samples.

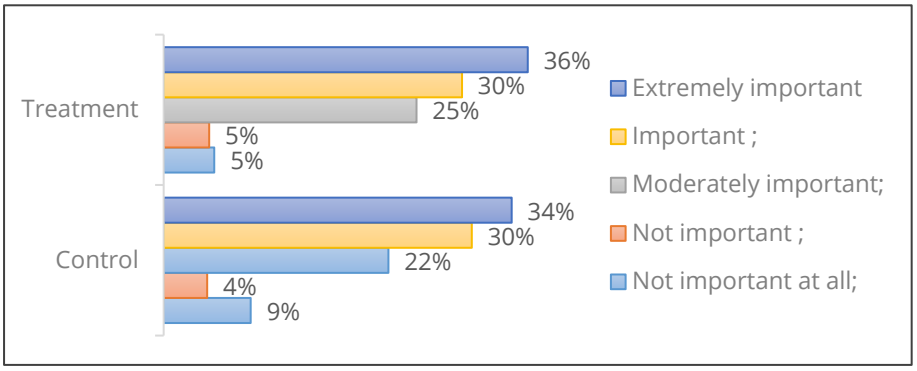

Figure 9: Farmers perception of important of livestock activities for the household

IV.2. Organization of animal husbandry

Various tasks in animal husbandry include, among others, handling and maintaining livestock, milking, selling and processing milk into various products. As Illustrated in the table, men were primarily responsible for managing the majority of tasks. Indeed, in 90% of households, men were responsible for maintaining the herd. In 6% of cases, the households even hired external hired labour for this activity.

Children also played a significant role; in 22% of households, they were responsible for a range of activities. From milking to processing, women also played a key role and even took the lead in some cases especially in milk marketing and processing. For example, 61% of farms entrusted milk processing to women. The use of paid female labour was as rare in livestock breeding as in agriculture. Cattle fattening was practiced by about 36% of the households.

Table 12: Who manages what in livestock rearing?

Activities	Labour category	% of households	
		Control	Treatment
The livestock maintenance	Household men	90%	90%
	Women in the household	20%	27%
	Child	18%	28%
	External men (paid)	5%	8%
	External women (paid)	0%	0%
Milking	Household men	56%	76%
	Women in the household	42%	29%
	Child	16%	12%
	External men (paid)	9%	21%
	External women (paid)	1%	0%
Milk marketing	Household men	54%	72%
	Women in the household	52%	34%
	Child	6%	7%
	External men (paid)	7%	14%
	External women (paid)	1%	0%
Milk processing	Household men	33%	57%
	Women in the household	65%	50%
	Child	6%	4%
	External men (paid)	6%	14%
	External women (paid)	2%	0%

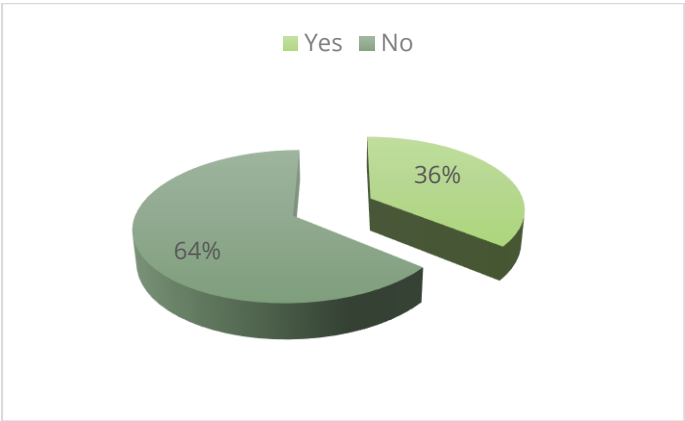

Figure 10: Share of household practicing cattle fattening

Table 13. In 2021, households in the intervention group earned an average of 177,489 FCFA, however with high variability (standard deviation of 453,396). More than 50% of farmers who practiced livestock keeping reported zero income from this activity. This could be explained by the fact that they did not sell any livestock and related products during this period. In the Louga cluster, which is close to the pastoral zone of the country, the variations were less significant with an average income of 178,635 FCFA.

Table 13: Household's average income from livestock in FCFA

Cluster		Control	Treatment
Kaffrine	Average	123,238	166,991
	SD	246,371	460,660
	Median	0	0
Thies	Average	67,686	185,524
	SD	150,487	559,497
	Median	0	0
Louga	Average	489,885	178,635
	SD	725,511	308,692
	Median	250,000	67,500
All	Average	233,942	177,489
	SD	495,682	453,396
	Median	25,000	0

IV.3. Milk production

Of all the 503 households covered in the survey, 173 farms owned cattle, i.e. 34.3%. Of these, 118 farm households had calves born in 2021 (dry season or rainy season).

In the intervention areas and during the dry season, the most productive cows produced an average of 1.9 L of milk per day compared to 0.75 L per day for the least productive. During the winter season, the quantity of milk doubled to approximately 3.5 L for the most productive cows and 1.6 L for the least productive cows. Milk production performances were similar for both the control and treatment samples. Information on milk production is provided in .
Table 14.

Table 14: Average quantity of milk per cow, per day (in litres)

Clusters	Seasons	Production	Control		Treatment	
			Average	SD	Average	SD
Kaffrine	Dry season	High production	1.98	1.98	1.86	1.07
		Lower production	1.11	1.25	0.71	0.76
	Rainy season	High production	2.88	2.30	1.86	1.07
		Lower production	1.88	1.73	1.00	0.58
Thies	Dry season	High production	2.29	3.55	2.82	2.14
		Lower production	0.50	0.76	0.82	1.78
	Rainy season	High production	2.50	1.00	4.36	3.83
		Lower production	0.75	0.50	1.45	2.62
Louga	Dry season	High production	1.70	1.34	1.28	1.02
		Lower production	0.78	0.90	0.74	0.90
	Rainy season	High production	2.74	1.76	3.60	4.60
		Lower production	1.56	1.80	2.00	2.33

The overall milk yields were quite low. The average daily milk production was relatively higher in the Thies cluster than the other clusters, all seasons combined. It varied from 2.82 L (0.82 L for the least productive) in the dry season to 4.36 L (1.46 L for the least productive) in the rainy season. Second was the cluster of Louga, followed by Kaffrine.

The drastic drop in quantity of milk produced from the dry season to the winter season is one of the main motivations for the intervention planned under the AICCRA project for the milk value chain. Regarding the length of milk production period for cows, it turns out that the animals remain productive during the dry season for 3.7 months on average for the most productive cows and 3 months for the least productive. In the winter season, these durations are 4.1 months and 2.5 months, respectively. Production period remained similar for all three clusters (Table 15).

Table 15: Average duration of cow milk production (in months)

Clusters	Seasons	Production	Control		Treatment	
			Average	SD	Average	SD
Kaffrine	Dry season	High production	3.38	1.84	3.00	1.91
		Lower production	3.90	2.13	1.71	1.60
	Rainy season	High production	3.54	2.02	3.14	1.95
		Lower production	3.31	2.17	1.86	1.46
Thies	Dry season	High production	3.43	3.21	3.82	2.89
		Lower production	2.14	2.73	1.91	3.02
	Rainy season	High production	3.00	0.00	4.00	2.57
		Lower production	2.00	1.63	1.64	1.96
Louga	Dry season	High production	3.61	2.49	3.89	2.83
		Lower production	3.26	2.80	4.22	3.25
	Rainy season	High production	3.67	2.28	4.67	2.32
		Lower production	2.58	2.14	3.40	2.13

IV.4. Livestock feed and fodder

Livestock feed consists mainly of cut and carry grass (76% of smallholders), natural pasture (31%) and groundnut meal (16%). Other types of feeds used by farmers are summarized in Table 16.

Table 16: Type of feed and fodder utilized for livestock (% households)

Feed and fodder type	Control	Treatment	Total
Cut and carry grass from common lands	**77%**	**75%**	**76%**
Rice straw	0%	0%	0%
Cowpea fodder	3%	5%	4%
Panicum spp.	0%	0%	0%
Maize silage	4%	2%	3%
Woody plants	3%	0%	2%
Natural pasture	**39%**	**20%**	**31%**
Cultivated pasture	1%	4%	2%
Groundnut meal	**18%**	**13%**	**16%**
Wheat bran	7%	9%	8%
Cotton seed cake	4%	3%	3%
Rice bran/nepess	6%	5%	5%
Other	29%	42%	34%

For the most consumed animal fodder (mowed grass), 90.4% of smallholders stated that it is available in sufficient quantity during the rainy season. This percentage decreases to 61.8% during the dry season. We observed the same for natural pasture, the second most important source of fodder. Conversely, the cotton seed cake seems to be more utilized during the dry season. However, only 3% of livestock keepers feed the cottonseed cake to their animals.

Table 17: Availability and use pattern of animal feed and fodder

Feed and fodder	Eaten by cattle ?/Yes		Available sufficiently in dry season?/Yes		Available sufficiently in winter season?/Yes	
	Control	Treatment	Control	Treatment	Control	Treatment
Cultivated pasture	0%	14%	0%	71%	0%	71%
Bran	20%	58%	65%	65%	40%	60%
Cotton seed cake	50%	33%	50%	83%	60%	50%
Peanut meal	36%	26%	55%	67%	33%	59%
Rice bran/nepess	19%	27%	6%	9%	13%	9%
Corn silage	20%	0%	9%	67%	27%	66%
Fodder cowpea	0%	25%	22%	50%	56%	66%
Mowed grass	29%	27%	54%	62%	79%	90%
Natural pasture	33%	29%	49%	66%	84%	90%
Woody	71%		63%		88%	
Other	29%	26%	76%	79%	87%	83%

One of the objectives of AICCRA livestock interventions is to contribute to filling this gap of feed unavailability for animals, mainly during the dry season, in order to ensure adequate milk and meat production even during the lean season, particularly for cattle. According to Table 17, 26.6% of smallholders feed their cattle with mowed grass while 29.3% feed them with natural pasture.

V. Climate change and adaptation

V.1. Knowledge of climate change

Climate change adaptation is the major focus of the AICCRA project. The main purpose of its interventions is to increase the resilience of the target populations and agricultural value chains. We have there collected information to understand farmers' knowledge of climate change and its adaptation.

From the analysis, it is clear that more than 90% of the respondents have heard of climate change and believe that it happening. Eighty-seven percent (87%) of the households were able to relate various extreme weather events like increased frequency of droughts, flash floods, rising temperature, etc with climate change.

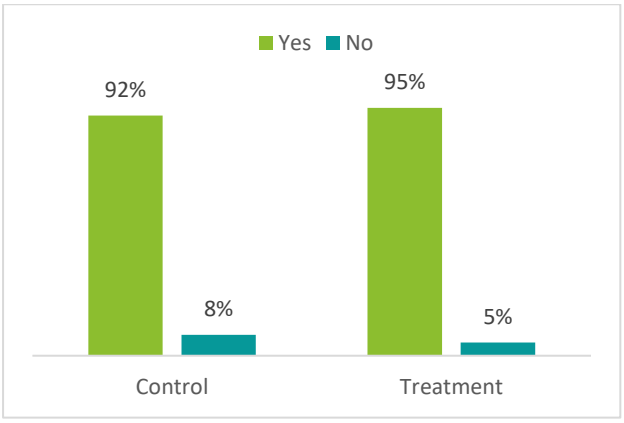

Figure 11: Farmers awareness about climate change

Table 18 summarizes the perceived effects of climate variability and change in recent years. Specifically, it shows the extent to which farmers are affected because of various known consequences of climate change.

For all perceived effects, more than 50% of farmers either strongly agreed or very strongly agreed with this occurrence. Among the most striking effects in the agricultural field, it is clear that climate change has exacerbated water scarcity, leading to a drop in production, loss of income from agriculture, a drop in the quality of agricultural products, often because of early interruption of the rainy season. There has also been an increase in the number of conflict incidents involving farmers and livestock breeders, a decline in the quality of fodder for animals and an increase in cases of bovine diseases.

More than eight out of 10 producers said they regularly receive climate information. An analysis by cluster indicates that the Kaffrine cluster has more farmers who receive this kind of information. In contrast to climate information, more than 80% of respondents had never heard of climate-smart agriculture.

Table 18: Farmers perceptions on the consequences of climate change

Perceptions of impact of climate variability and change	Control		Treatment	
Did climate change cause these consequences?	**Strongly**	**Very strongly**	**Strongly**	**Very strongly**
Increased water scarcity for agriculture	41%	36%	30%	32%
Timing of sowing has become more erratic in recent years	37%	31%	34%	29%
Cropped yields decreasing	42%	33%	38%	32%
Extreme weather events result in major revenue losses for the farm	39%	36%	32%	31%
The frequency of diseases and crop pests increased	34%	30%	30%	29%
The quality of agricultural products is affected	41%	32%	39%	28%
The soil condition becomes unsuitable for planting	39%	31%	35%	29%
Increase in the frequency of droughts	37%	33%	38%	28%
Early end to the rainy season	39%	34%	40%	31%
Drying up of water ponds for livestock watering	36%	35%	31%	28%
Unavailability of quality fodder for livestock	32%	32%	33%	24%
Deterioration of the nutritional quality of available fodder	36%	34%	33%	29%
Disappearance/rarity of certain fodder species	35%	35%	32%	28%
Increase in long-distance transhumance	30%	41%	36%	29%
More conflicts between farmers and herders	30%	34%	38%	30%
Increase in animal/cattle diseases	31%	33%	35%	28%
Deteriorating milk quality	29%	32%	28%	31%
Reduction in quantity of milk produced per animal per day	30%	32%	25%	26%

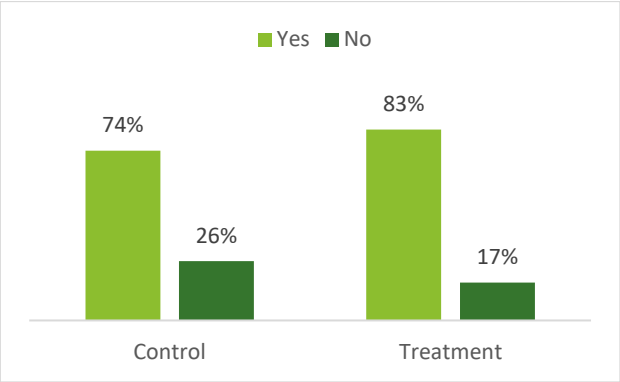

Figure 12: Do you usually receive weather information?

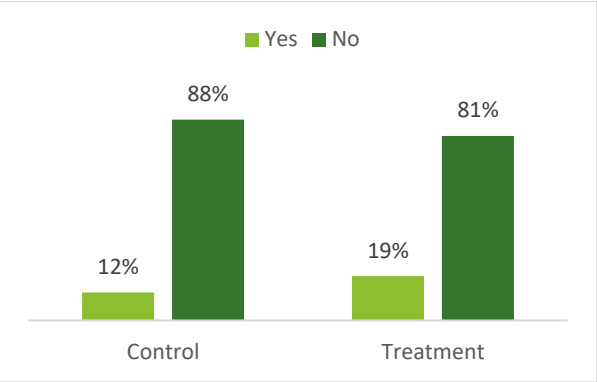

Figure 13: Have you or someone in your household heard of climate-smart agriculture (CSA)?

Looking at the distribution by cluster, there are minor differences, especially in the Kaffrine cluster where at least 20% of respondents claimed to be aware of climate-smart agriculture. It should be noted that this cluster has hosted several CCAFS interventions in the past. Next was the cluster of Thies (11% of respondents) then Louga (8%) in the AICCRA project intervention areas.

Table 19: Farmers awareness of Climate Smart Agriculture by cluster

	Control		Treatment	
	Yes	No	Yes	No
Kaffrine	20%	80%	25%	49%
Thies	8%	92%	11%	70%
Louga	9%	91%	8%	66%

There are many channels for receiving climate information, the most widespread being radio, through which more than 85% of households' access information. This is followed by television at 28%, then family/friends. Receiving information through phone calls is the least frequent.

Table 20: Channels of information about climate

Sources	Control	Treatment	All
TV	24%	33%	28%
Radio	88%	85%	86%
Internet	3%	0.6%	2%
Family/friend	12%	20%	15%
Technical agents of agriculture	2 %	7 %	5%
SMS	6%	17%	11%
Phone call	2%	3%	2 %

For the respondents, however, the most preferred media was radio (at least 74% of cases), while television and SMS were the least preferred (at least 11% of cases).

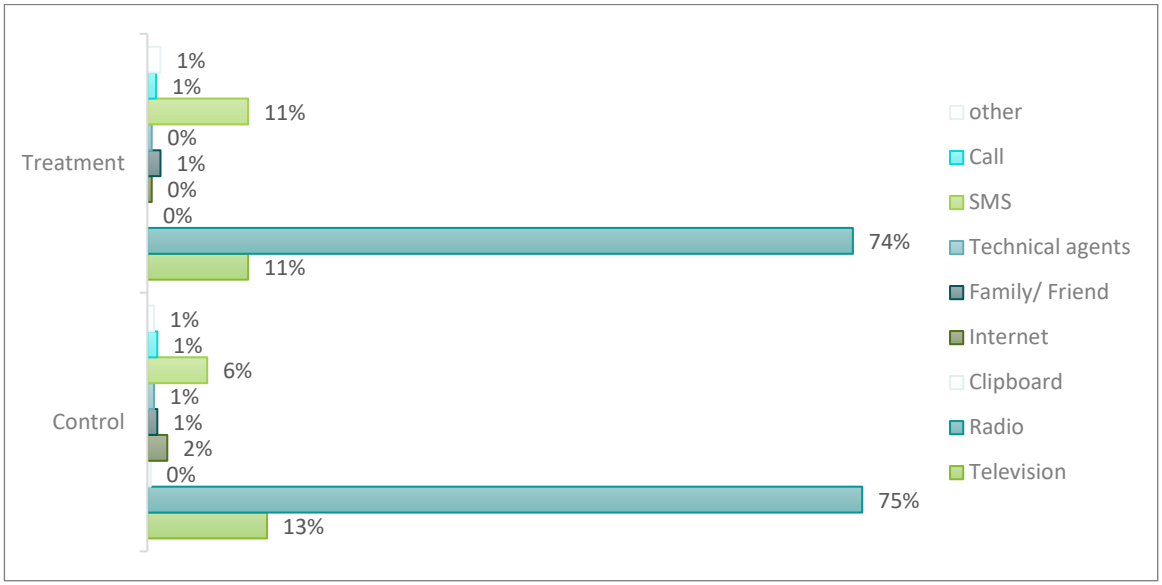

Figure 14: Preferred channels to receive climate information services (CIS)

Finally, when asked about the quality of the climate information received, more than half of the respondents believed that the information was frequently reliable, while 41% thought it was sometimes reliable. Barely 5% thought that the information provided was rarely reliable.

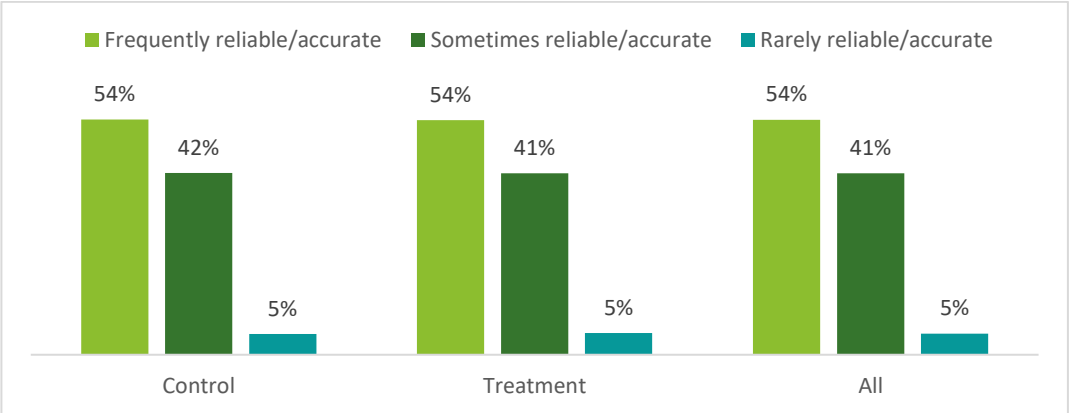

Figure 15: Perception on reliability of information received (% households)

VI. Vulnerability of households to climate change

An indicator of vulnerability/resilience to climate change was constructed using a subjective approach. This indicator provides information on the self-assessed capacity of farmers to prepare for climatic shocks, to cope with when these occur or to recover and resume a normal life after the occurrence of such shocks. The composite indicator takes values from -2 to 2. The household is most resilient when it has values close to 2 and most vulnerable when the value is close to -2. The analysis of the indicator shows that, in general, the vulnerability index of the farms surveyed was -0.2, identical in both the treatment and control groups. This indicates that, on average, farmers are vulnerable. Nonetheless, certain farmers are highly vulnerable. More than 50% of households had a level of vulnerability worse than -0.8. There were, however, differences between clusters. The vulnerability/resilience structure by cluster in the survey areas is summarized in **Error! Reference source not found.**

Region		Control	Treatment
KAFFRINE	Mean	-0.1	0.0
	p25	-0.5	-0.3
	Median	0.0	-0.1
	p75	0.3	0.2
THIES	Mean	-0.1	-0.2
	p26	-0.7	-1.0
	Median	-0.3	-0.5
	p76	0.7	0.7
LOUGA	Mean	-0.4	-0.3
	p27	-0.8	-0.8
	Median	-0.5	-0.3
	p77	0.2	0.2

Figure 16: Perceptions on vulnerability to climate hazards

The Thies cluster appears to be the least vulnerable, followed by the Kaffrine cluster. Indeed, these two clusters had a level of vulnerability (-0.1) that is higher than the overall average. In addition, the median value at Kaffrine was higher than that of the other clusters and close to zero value, meaning that half of the households were close to coming out of the vulnerability state. The Louga cluster had the highest level of vulnerability (-0.4). The most vulnerable – 25% of farmers had an index lower than -0.8, while the most vulnerable, 50% among all farmers in the cluster, had a vulnerability level that was less than -0.5.

Conclusions

This report presents an analysis of the dryland region of Senegal where the main crops are millet, peanuts, cowpea and maize. Almost all the farmers were cultivating millet (92%) and peanut (93%) crops followed by cowpea crop (50%) as their main crops. With average cultivated areas in 2021 comprising 3 hectares for millet, 3.1 hectares for peanuts and 1.6 hectares for cowpea in the intervention areas, the average yield across all intervention households was 339 kg/ha for millet, 360 kg/ha for peanuts and 597 kg/ha for cowpea. It is worth noting that the particularly poor crop yield reported by the Thies cluster was due to the severe drought experienced during the crop season of 2021. The study areas essentially crop-livestock mixed systems. Animal husbandry was a secondary activity for majority of the participants. About 1/3rd of the farm households owned cattle, more than 70% had sheep, 35% owned goats as well as poultry birds by more than 50% of the households. Horse and donkey were other important livestock mainly used for transportation and ploughing. The livestock was considered as an important source of livelihood by about 2/3rd of the farm households in the study region however it was a main source of income only for 12% of households. Cattle, sheep, horse, donkey and goats are the main livestock along with few poultry birds.

With an average of 14 members per household and constituting 7 female members, the men were involved in almost all the activities of the household related to crop farming and livestock. Contributions of women were observed more in crop harvesting, post-harvest handling and also in milk marketing and processing. The farmers in study areas (>90%) are well aware of climate variability and change phenomena and experiencing its impacts on their farm production activities and more widely on their livelihoods. The increased water scarcity for agriculture and extreme weather events resulting in decreased crop yields and loss of income for farmers are the main consequences of climate change in farmers' perception. In addition, an increase in the number of conflict incidents between farmers and livestock breeders/herders, the decline in quantity and quality of fodder for animals and the increase in bovine diseases are also the perceived impacts of climate change. A large majority of the farmers were getting climate information through radio, TV and mobile phone. However only a small proportion (<20%) of farmers ever heard about climate smart agriculture approach or practices. During the year 2021, a long dry spell during the rainy season caused significant losses in crop production e.g. peanuts and millets particularly in the Thies region with more than 50% of farmers having zero-yields. In other regions the crop yield was generally less than 1000 kg/ha regardless of the crop which remains below the potential yield for all the three different crops. Maintaining milk production from cows appears to be challenge particularly in dry season resulting low milk yields of less than 3 liters per day. Inherently poor access to feed and fodder has been further worsening due to increased climatic variability and resulting in lower livestock yields.

The vulnerability analysis indicates that farmers are vulnerable to climate change and other shocks in general. For more than 50% of households the level of vulnerability was worse. The Louga cluster had the highest level of vulnerability followed by Kaffrine and Thies clusters. With the up-scaling of Climate Information Services and prioritized Climate Smart Agricultural technologies (CSA), AICCRA in its SENEGAL cluster has a very good potential to contribute to enhanced resilience of farming and livelihood systems in the face of climate change and variability. The CSA technologies/practices include natural resource management technologies, resilient cultivars, diversification, and improved access to feed and fodder for livestock besides context specific climate information services. The analysis also highlights the need for interventions that promote greater availability of milk in the dry season by making suitable feed and fodder accessible during these periods.

About AICCRA

Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) is a project that helps deliver a climate-smart African future driven by science and innovation in agriculture.

It is led by the Alliance of Bioversity International and CIAT and supported by a grant from the International Development Association (IDA) of the World Bank.

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