

## Survey on Crop Residues for Cattle Feeding in Niger

Ousmane Seyni Diakite<sup>1</sup>, Niaba Teme<sup>2</sup>, Mamadou Aissata<sup>1</sup>, Abdoul Kader Mahamane<sup>1</sup>,  
Garba Seidou<sup>1</sup>, Tongoona Pangirayi<sup>3</sup>

<sup>1</sup>Institut National de la Recherche Agronomique du Niger (INRAN) Niger. BP 429 Niamey

<sup>2</sup>Institut d' Economie Rurale (IER) BP 258 Rue Mohamed V. Bamako Mali.

<sup>3</sup>University of Ghana, West Africa Centre for Crop Improvement (WACCI). PMB LG 30, Legon Accra Ghana

---

### ABSTRACT

A cattle farming is a major component in Niger rural production system. In this system, local pearl millet and sorghum stovers are essential sources for feeding cattle during dry season. These stovers are however known for their low nutritional quality, consequently reducing cattle productivity. The objectives of this survey were to generate information on cattle feeding using stover and its trading patterns. A Participatory Rural Appraisal (PRA) consisting of a Focus Group Discussion (FGD) in three different agro-ecological areas of Soumarana, Konni and Lossa, followed by Semi Structured Interviews (SSI) on 91 randomly selected farmers and 24 forage traders, was conducted. Results revealed that farmers cultivate sorghum for dual purpose (grain and stover) with high preference for sorghum stover compared to pearl millet for cattle feeding. Farmers complained of feed shortage during dry season coupled with poor quality of their millet and sorghum stovers. Stover trading was a growing business despite the traditional poor management practices. Both farmers and traders main criteria for forage quality traits were higher biomass, juiciness, stay-green and enough green leaves. The prospect for breeding dual purpose sorghum with higher stover nutritional value was laid out as an alternative to meet feed shortage.

**KEYWORDS:** Farmers, stover, traders, criteria, dual purpose, PRA.

---

### INTRODUCTION

Cattle contributes significantly to rural populations' livelihood in Niger. It is a major component of the farming system and is considered as main source of income, thrift, or simply farmers' self-insurance. In central Sahel region, cattle production is largely based on pastoralist systems which are traditionally nomadic and transhumant ([1]. Nutrition of cattle is essentially based on natural pasture and crop residues. [2] reported that Nigerien livestock production is based on extensive grazing but climatic vagaries, the extent and quality of pastures, sanitary and economic constraints set limit to its performance. For [3], the common problems with these resources are marked variation in availability, quality and seasonal shortage.

Cereal stovers are a significant source of feed for livestock during dry season for small scale farmers' in Niger particularly in the context of limited availability of natural pasture. The correct nutrition of their livestock for more productivity in terms of fattening, milk or field work is a challenge that faces the major part of farmers. [4] claimed that pasture and crop residues represent about 90% of feed for large ruminant animals in Niger. In this context, sorghum, the second cereal crop cultivated for dual purpose in the country constitutes a good candidate for growing feed demand. Moreover, [5] highlighted that in the view of the pressing demand for fodder coupled with the importance of the grain of sorghum for people in South Saharan African (SSA), it is imperative to reconsider the present mono-commodity breeding strategy of sorghum. Furthermore, between 2005 and 2030, meat and milk consumption in Africa will grow respectively by 2.8 and 2.3% per year [4]. Thus, Africa's livestock producers are currently not able to meet this rising demand. In particular, providing Africa's livestock with sufficient quantity and quality feed which is a critical issue that researchers, Non-Governmental Organizations (NGO) and policymakers, amongst others have to address. To comprehend well livestock feeding, Participatory Rural Appraisal (PRA) is a strong and a very attractive method that can help plant breeders to understand framers needs and then to include in their breeding programs farmers' empirical views in 'ideal' variety.

The objectives were to generate information on farmer cattle feeding during dry season using stover and stover trading patterns.

The specific objectives were to:

- i. Identify farmers' stover production conditions
- ii. Identify farmers' preferences on stover sorghum varieties
- iii. Identify the stover trading characteristics in Niger

---

**Corresponding author:** Ousmane Seyni Diakite, Institut National de la Recherche Agronomique du Niger (INRAN) Niger. BP 429 Niamey

## MATERIAL AND METHOD

### Study area:

The participatory rural appraisal (PRA) was conducted in the following villages: Soumarana (13°26'38'' North and 6°54'11'' East), Dolli (13°47'30'' North and 5°15' 00'' East), Konni (13°47'23'' North and 5°14' 57'' East) and Lossa (13°56'2'' North and 1°34'29'' East).

Average annual rainfall is 504.1mm with a mini of 8.4°C and a maxi of 45.2°C at Soumarana. At Dolli, the average annual rainfall is 502.8mm with a mini of 9.4°C and a maxi of 47°C. While at Lossa, the annual average rainfall is 412.1 mm with a mini of 10.8°C and a maxi of 48.3°C.

### Material

Material was composed of discussion guides, *bmr* sorghum pictures, poster on sorghum life cycle, stover sorghum picture, tape recorder, global positioning system for each village geo-referencing, camera and computer for data loading.

### Methodology

In collaboration with rural agricultural development extension services, three villages were sampled in different agro ecological areas of Niger well known for their livestock rearing and sorghum production. Firstly, local extension service agents were used as resource persons to introduce the survey team to villages' leaders and to identify target farmers with intensive experience. Then in each village, Focus Group Discussion (FGD) with an average of 10 to 12 participants was used to identify specific topics for information collection on local farming system and constraints management. During the FGD, male and female groups were separated for women free expression. Ranking and enumeration were the method used to evaluate topics. Finally, a semi structured interview (SSI) based on farmer identification, main activities, sorghum production and livestock rearing (constraints, opportunities, contribution in income, etc...) was conducted to selected farmers.

Stover traders were identified through rural meetings moderated by extension agents in each village. Census of traders allowed establishment of contacts (name and cell phone numbers) and shop locations. A questionnaire based on identification, supply, storage management and stover profitability activity was set up to collect information using a SSI.

The survey was conducted after harvest period (between October and November 2016) to ensure farmers and stover availability.

Data on the weather was collected at the national weather office.

National languages (Djerma and Hausa) were used during the survey for data collections

### Data analysis

Excel software was used for means and percentage calculations.

## RESULTS

### Focus Group Discussion

Mixed crop livestock farming was the most system found in all 3 villages with millet and sorghum being the main cereal crops. Sorghum stover occupies a major choice in livestock feeding. In indeed, at Dolli and Soumarana, sorghum stover is the main feed whereas at Lossa millet comes first.

Farmers are well aware of livestock grazing constraints (stover) during a particular period (dry season) of the year. Indeed they revealed feed shortage, poor nutritional quality of their stover and pasture shortage for their livestock. Pasture scarcity impacts negatively milk production and draught animal's maintenance (farm work). During the dry season, milking cows benefit first of the sorghum stover before bullocks and draught. Drought was reported as the main constraint for sorghum production in all 3 sites. In addition to drought, sorghum midge was cited as source of low grain production in Dolli and Soumarana.

Large plant biomass is the first attribute of preference for farmers. The exposition of brown midrib varieties' poster revealed that they are not aware of this type of sorghum varieties and their attributes. In fact farmers noticed in their farms the existence of white and yellow midribs, not the brown type. After the FGDs a list of sorghum farmers rearing cattle in each village was recorded from which 30 farmers per village were randomly sampled. The total number of stover traders was 24.

**Table 1: summary of FGDs on stover survey conducted in three Niger villages (Soumarana, Dolli and Lossa) in 2016.**

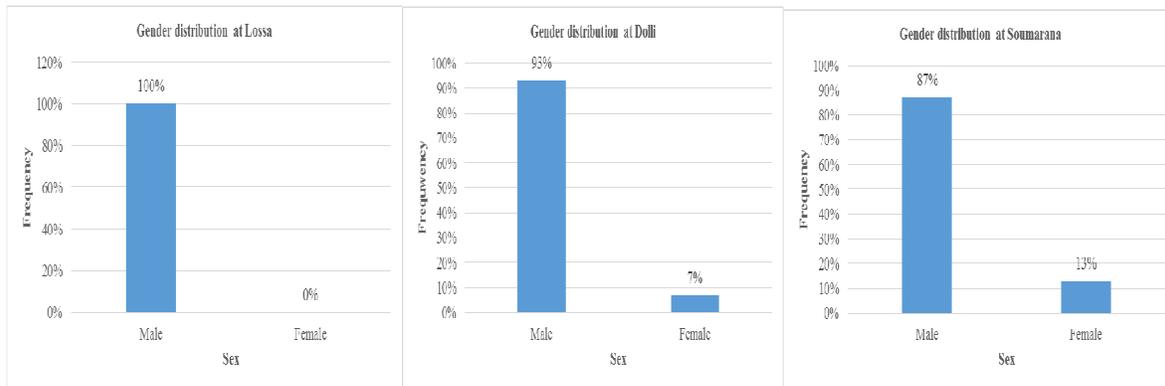
Topics	Methods		Results /ranking
Importance of sorghum crop in the area compared to other cereals	Ranking:	Millet	Sorghum ranks second after pearl millet.
		Sorghum	
		Maize	
Sorghum production system	Ranking:	Pure Association with cowpea	Mostly sorghum is cultivated in pure
Main sorghum production constraints (grain/stover)	Ranking:	Lack of Fertilizer	1 <sup>st</sup> Drought 2 <sup>nd</sup> Disease 3 <sup>th</sup> weeds
		Diseases	
		Drought	
		Soil unproductive	
		Other: (weeds, inputs)	
Sorghum stover utilization	Ranking:	Domestic utilization	Livestock feeding is the main utilization of the stover
		Animal feeding	
		Commercialization	
		Other	
Importance in animals feeding compared to millet	- Enumeration		Sorghum is first at Dolli and Soumarana and second at Lossa
Livestock feeding constraints	- Enumeration		-Shortage of feed -Poor quality of stover - Lack of pasture -Higher cereal bran price
Farmers' empirical preferences for specific traits and attributes of stover sorghum	Ranking:	Stay green	1 <sup>st</sup> Biomass 2 <sup>nd</sup> palatability 3 <sup>th</sup> stay-green
		Palatability	
		Biomass	
		Other	
Brown midrib sorghum	Awareness	Yes	Farmers are not aware of its existence
		No	
Which cow is fed during the dry season?	Ranking:	Draught cow	1 <sup>st</sup> Milking cow 2 <sup>nd</sup> Bullock and draught
		Gestating cow	
		Milking cow	
		Bullock	
How is cow fed during the dry season with stover?	Enumeration: -Whole stems without chopping put on ground -Chopped stems put on ground -Stem chopped and put container		Whole stem without chopping put on ground

**Farmers Semi Structured Interview**

The individual interview was conducted based on a questionnaire structured on 4 majors' points:

**Identification**

Out of 91 farmers interviewed, 93% were males and 7% were females (Figure 1). There were 27 males and 4 females at Soumarana; 28 males and 2 females at Dolli; 30 males at Lossa. No female sorghum farmer was found at Lossa. The average farm size was 4.59ha per farmer.



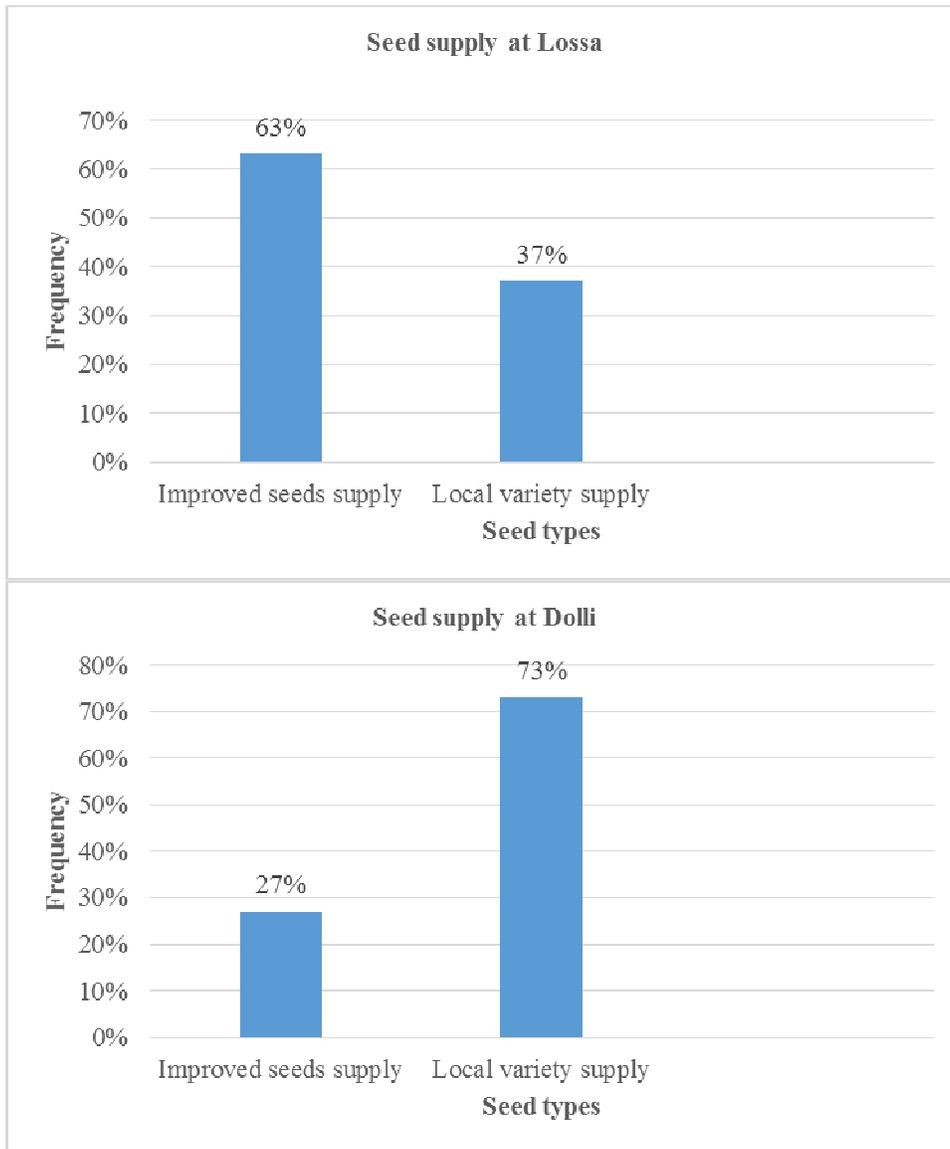
**Figure 1: Gender distribution of farmers in Lossa, Dolli and Soumarana, sites of Niger in 2016.**

**Main activities**

Among the interviewees', twenty nine farmers, thus thirty two percent (32%) were sorghum farmer while sixty two (68%) combined trading or livestock fattening to farming in order to increase their income. There are more trading farmers at Dolli (24 thus 80%) compared to Soumarana (22 thus 71%) and 16 at Lossa (53%).

**Sorghum production**

The survey revealed that all farmers produce sorghum for a dual purpose. Dual purpose lines are very important for farmers who care equally for stover and grain yields. It is important to note that 86% of investigated farmers favored adoption of improved varieties. Right now, 46% buy improved seeds every year (Figure 2).



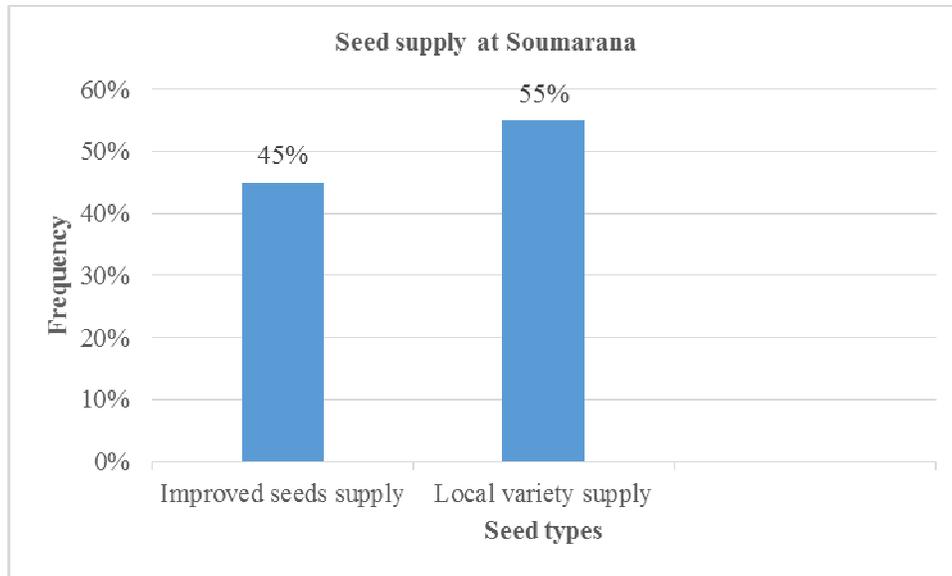
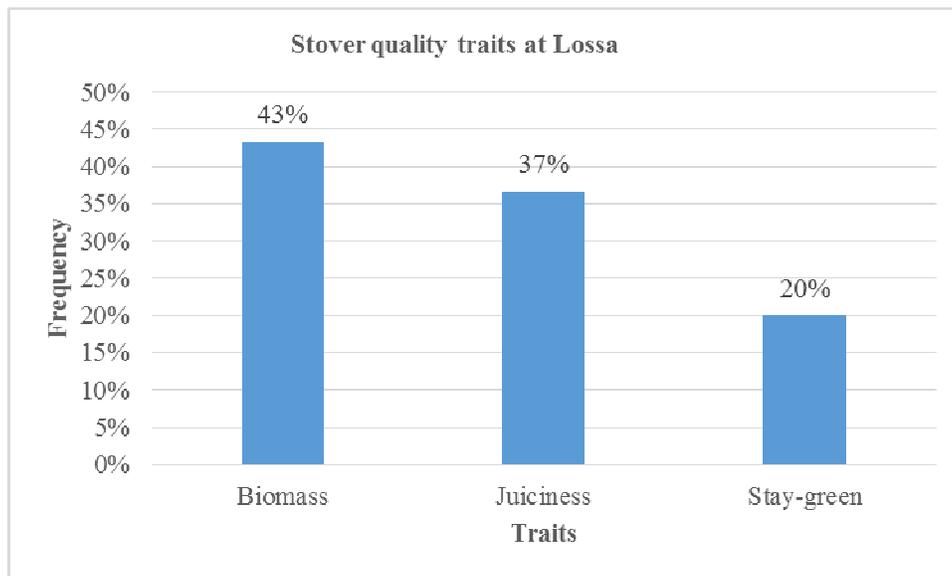


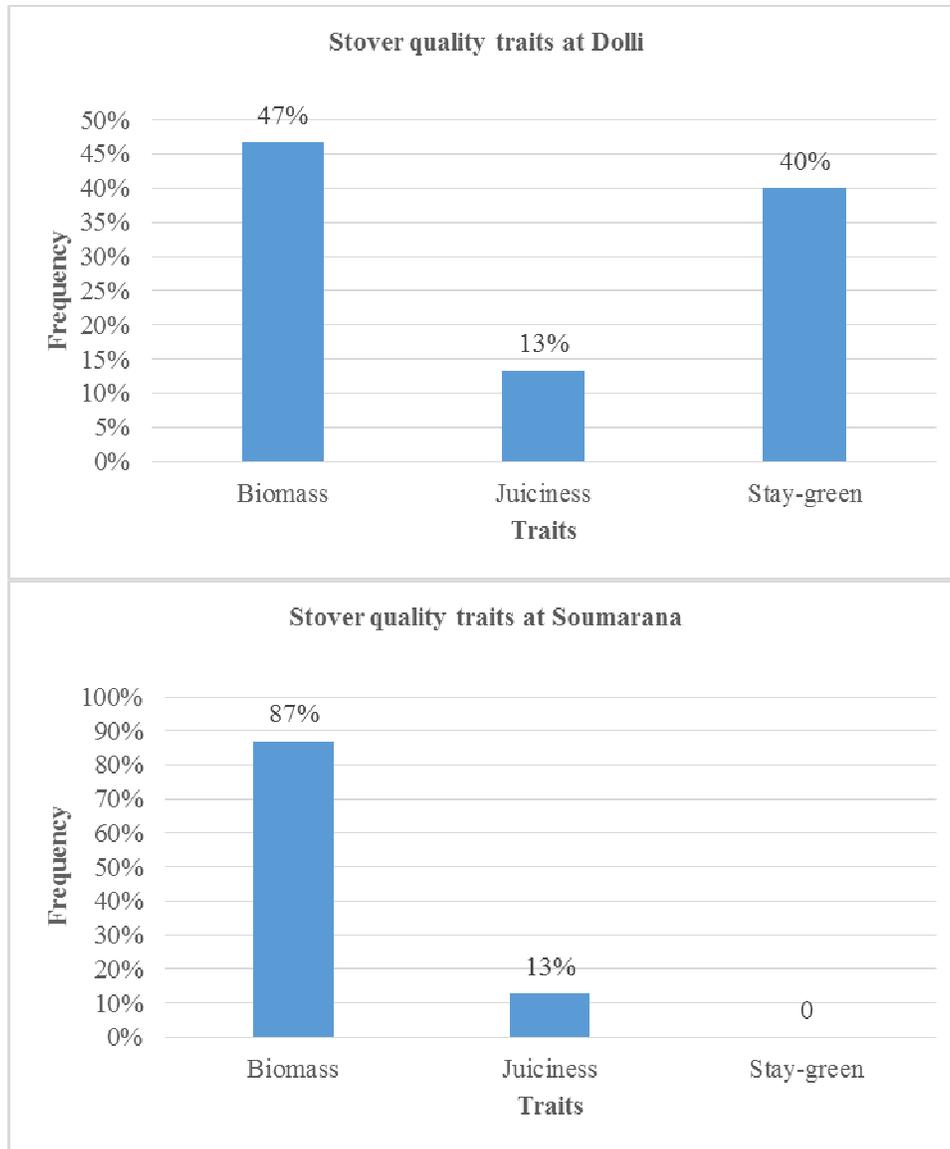
Figure 2: Frequencies of farmers' seeds supply in Lossa, Dolli and Soumarana in 2016.

### Cattle rearing

Cattle rearing includes number of topics such as farmer perceptions on stover quality trait, milk production constraints, and fattening activities advantages.

- **Stover quality trait:** Farmers were asked to give their appreciation on sorghum stover traits that influence palatability and intake by their cattle. Three answers were given: biomass (59%), juiciness (21%) and leaves greenness (stay-green) (20%). (Figure 3).





**Figure 3: Farmers perception on stover quality trait from survey conducted in Niger in three villages (Lossa, Dolli and Soumarana) in 2016.**

- **Milk production:** Milk production was limited by forage shortage (64%), cow malnutrition (15%) and expensive cereal bran price (12%). However 8% out of the 100% of farmers do not have milk production constraints. Comprehensive analysis revealed that those farmers with no milk production constraints are mostly from Soumarana and rear small herd (5 to 2 cattle). They keep them in village throughout the year and use industrial feed as supplement in addition to cereal bran for their diet.

- **Fattening:** Fattening is a lucrative activity well practiced by farmers in Niger. Indeed 69% of investigated farmers carryout this activity. Moreover, sixty eight percent (68%) responded that fattening is an important source of income and for 1% this activity is a thrift for their self-insurance. The remaining farmers (31%) do not practice fattening and thus did not have a particular view.

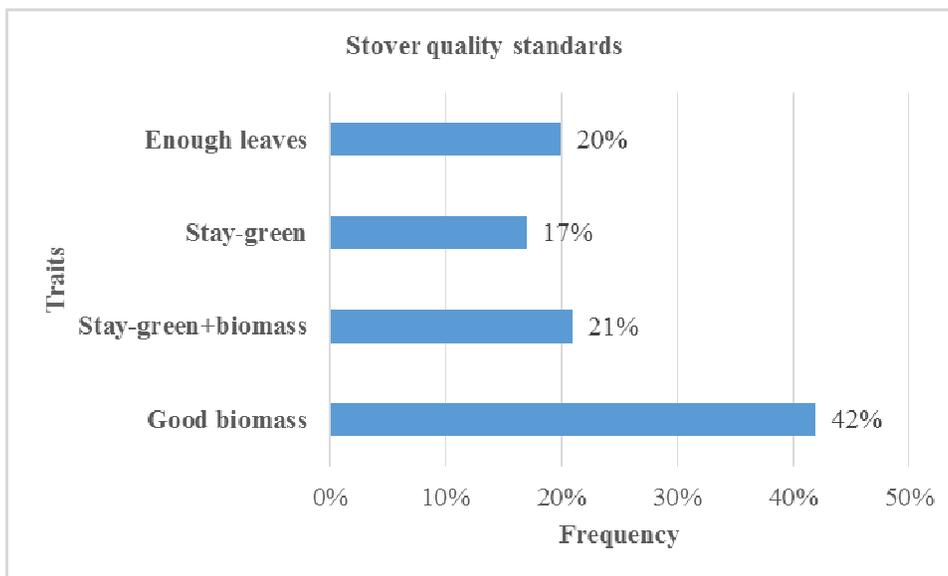
**Traders Semi Structured Interview Identification**

A total of 24 stover sellers were identified of which 21 were from Konni (14 km from Dolli) and 3 at Soumarana village. No stover trader was found at Lossa and its surroundings. Each salesman runs his own business and never

received training. Sorghum and millet stovers are sold in bundles followed by ground nut and cowpea hays and their pod shells and cereals brans in bags.

**Supply and standard**

In Konni, traders are supplied by other farmers opposed to Soumarana where traders sell their own products. Bundles of 18 to 20 kg each on average are bought traders at the harvest time with cost ranging from 250FCFA to 300FCFA (\$USD 0.40-0.48). The standards qualities (Figure 4) requested when purchasing stover were the good biomass (42%), stay-green+biomass (21%), stover with enough green leaves (20%) and stay-green (17%).



**Figure 4: quality requirements of purchased stover in Lossa, Dolli and Samourana by traders, in Niger in 2016. In good biomass, traders referred to stems with more green leaves after harvest.**

**Storage**

Out of two traders at Soumarana who lay on shade their stover, the remaining pile up their stover bundles in front of their business on open air. Stover shelf life was difficult to determine, since selling could happen at any time. But in case of poor sale, stover could be stored for a year. In such circumstances, traders complain rodents, mites, thieves, and fire or rain damages. Unfortunately, 50% of traders do not have any solution for those constraints management whereas 29% utilize chemicals to control termites and rodents attacks. The remaining 21% rely on regular vigilant stock inspection.

**Sales**

Traders affirmed that the busiest selling period is from April to July. During this particular period, stover bundle price triples its purchased price and was comprised between 750-1000F CFA (\$1.20-1.61). Selling price is mostly dependent on stover quality, supply and demand. Seventy five percent (75%) of traders generate their income selling stover, while 25% do it to ensure their family daily expenditure. In fact 75% have rolling fund for this activity.

**DISCUSSION**

Sorghum shows a good adaptation despite the harsh environmental conditions in Niger. It plays a strategic role in food and feed security. [6] claimed that farmers used mostly traditional varieties. Of its dimension, the [7] indicates that drought is the major abiotic constraint in addition to diseases. During our survey, Forty six percent (46%) of investigated farmers affirmed frequent use of improved seed. This is more than 2.5 folds reported by [8] in a previous study for improved sorghum varieties utilization (17.10%) in Niger. Among yield/stover production constraints, farmers cited drought as major limitation followed by sorghum midge at Soumarana and Dolli. Farmer claim was supported by [9] who reported that farmers from Maradi and konni attributed low sorghum grain yield by sorghum midge. PRA results on land tenure in the three villages showed that farmers had their land from the

redistribution of their family lands. This is consistent with [10] who explained that land inheritance is patrilineal in Niger. In addition, the average farm size held by men is 4.59 ha. [11] revealed that defining the farm size in Africa is country-specific and depends on the self-assessment of the households, further they affirmed that the average farmed land area of small farms in Niger is 5.5ha or less.

All investigated farmers grow local sorghum for dual purpose. Dual purpose lines are very important for farmers in Niger because they care equally for grain yield and stover. Our result is in coherence with that of [12] who claimed that mixed crop-livestock system is well practiced and continues to be a substantial area of interest where farmers can harvest one product for human consumption and the residues for feeding their livestock. Furthermore, [13] indicated that yield and quality of sorghum and millet straws sometimes played a role in the choice of new crop varieties for adoption by crop-livestock farmers in semi-arid India.

In the Sahel region, [1] affirmed that animal nutrition and growth are limited by the level of crude protein (CP) availability. This was clearly confirmed by our farmers' empirical attributes for stover poor nutritional quality. Indeed they used sorghum biomass, juiciness and stay-green as main parameters to evaluate their stover quality; they mentioned the current mere quality of their sorghum stover. In addition they revealed a shortage of feed during the dry season and poor animal health; consequently, cow milk production was limited. [14] found a remarkable feed scarcity from April to June in two villages in Maradi region while [15] reported that cattle breeding activity is seriously affected by decrease of fodder production and the reduction of pastoral areas as a result of climatic events in Niger.

To improve their livelihood, most farmers (68%) practice secondary activities. Among these activities, fattening is in good position. Fattening is practiced by 69% and its contribution to income improvement is important for 76% among the 69%. This finding is in agreement with [14] who confirmed that livestock are kept by most farmers to complement crop activities, because ruminants provide manure for crop production and are valuable assets readily liquidated to meet household and farm financial obligations.

Currently in Niger big cities, there are small shops specialized in stover trade on road sides and in markets in an informal system. Farmers are the main suppliers of stover market. Among traders, 87% acquire their stover particularly at the harvest time, which is in agreement with [16] findings. Indeed this author affirmed that un-chopped stover are purchased by traders from small farmers and brought to Hyderabad (India). Crop residues trading surveys in South Saharan Africa (SSA) and India showed that fodder traders and customers were well aware of fodder quality from crop residues of different crops. This statement is in conformity with standard qualities requested by traders at Konni and Soumarana where 42% required a good biomass first, then stay-green+biomass (21%), stay-green (17%) and stover with enough leaves (20%).

Our survey revealed that 92% of local traders pile up their stover outside open airs with no respect to conservation and storage techniques. [16] confirmed that for different feed resources, trade and marketing, conservation, storage and processing technologies to mitigate spatial and temporal imbalances in feed supply and demand are not well understood in East Africa (Ethiopia and Tanzania) and South Asia (India and Bangladesh). Despite lack of an appropriate training, stover trading is a source of livelihood for many farmers and traders in Konni and Soumarana. This view is in agreement with [17] who confirmed stover selling, transporting, trading and use in dairy production support the livelihood of many people from producers (farmers) to the end users in Hyderabad (India).

### **Conclusion and perspective**

Feed shortage during the dry season was claimed as the main constraint for livestock rearing by framers. Sorghum and millet stover trading is a growing business in the center and southern part of the country. No modern or acceptable storage technique was available. Improvement of storage manners can prevent stover quality reduction. Farmers and traders empirical preferences traits on stover qualities can be included in breeding improved new dual purpose sorghum for better quality feed availability on behalf of cattle farmers and stover traders of Niger.

### **Acknowledgements**

I am grateful to SMIL/USAID for my scholarship grant, WACCI for PhD training. I would also like to thank farmers, stover traders, and resource persons for their sincere implication throughout this survey.

### **REFERENCES**

- [1] Senock R. S., and Pieper R. D. 1990. Livestock production constraints in the Sahel. *Rangelands* 12(4) 225-229.  
 [2] Diester G and Hassane D. 2006. Niger: Country pasture/Forage resource profiles. FAO. 24p.

- [3]Teferedegne B. 2000. New perspectives on the use of tropical plants to improve ruminant nutrition. *Proc. Nutr. Soc*, 59: 209-214.
- [4]Spore February-March 2015. Feeding Africa's Livestock. Fodder and forage solutions.
- [5]Suad A. H., Maarouf I. M., Samia O. Y. 2015. Breeding for dual purpose attributes in sorghum: Effects of harvest option and genotype on fodder and grain yields. *Journal of plant breeding and crop science*. Vol 7(4) 101-106.
- [6]JAICAF (Japan Association for International Collaboration of Agriculture and Forestry) 2009. Minor cereal in Niger: Focusing on pearl millet and sorghum. 117 pages.
- [7]World Bank. 2013. Agricultural sector risk assessment in Niger. Moving from crisis response to long-term risk management. Report number 74322-NE. 90p.
- [8]Olembo K. N., M'mboyi F., Kiplagat S., Sitiency J., K and Oyugi F., K. 2010. Sorghum breeding in Sub-Saharan Africa: The success stories. The African Biotechnology Stakeholders Forum (ABSF). 40p.
- [9]Kadi Kadi AH. 1993. Rapport de campagne 1993: Entomologie du sorgho. INRAN CERRA, Maradi, Niger.
- [10]Terraciano A. M. 1998. "Contesting land, contesting laws: tenure reform and ethnic conflict in Niger." (In: *Columbia Human Rights Law Review*, 29:3 723-754p.
- [11]Waha K., Zipf B., Kurukulasuriya P. and Hassan R. M. 2016. An agricultural survey for more than 9,500 African households. *Scientific Data*. 8p.
- [12]Thornton, P. K., Kristjanson, P. M. and Thorne P. J. 2003. Measuring the potential impacts of improved food-feed crops: methods for ex ante assessment. *Field Crops Res*. 84: 199–212.
- [13]Kelley T.G. and Parthasarathy Rao P. 1994. Yield and quality characteristics of improved and traditional sorghum cultivars: farmers' perceptions and preferences. In: Joshi A.L., Doyle P.T. and Oosting S.J. (eds), *Variation in the Quantity and Quality of Fibrous Crop Residues*. Proceedings of a National Seminar held at the BAIF Development Research Foundation, Pune, India pp. 133–145.
- [14]Tunde A. A. and Augustine A. 2014. Assessment of existing and potential feed resources to improve livestock productivity in dryland areas of Niger. ILRI project report. 29p.
- [15]United Nations Development Program (UNDP). 2006. National Adaptation Program of Action. 83p.
- [16]Mohammad A. J. 2008. Feed and fodder markets in South Asia and East Africa: A synthesis of four PRA case studies. International Livestock Research Institute. 34p
- [17]Tesfaye A. 1998. Economics of milk production in and around Hyderabad of Andhra Pradesh. M.Sc. Thesis, Acharya NG Ranga Agricultural University, Hyderabad 500 030, India.