Volume 2 No: 18 (2018)

Innovation Opportunities in Sorghum Production in Uganda

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April 2018

PARI

FARA
Forum for Agricultural Research in Africa

Zentrum für Entwicklungsforschung
Center for Development Research
University of Bonn

ISSN 2550-3359

Citation
Tenywa, M.M., Nyamwaro, S.O., Kalibwani, R., Mogabo, J., Buruchara, R. and Fatunbi, A.O. (2018). Innovation Opportunities in Sorghum Production in Uganda. FARA Research Reports Vol 2 (18): pp 20.

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ISSN: 2550-3359

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Abstract

Sorghum (*Sorghum bicolor*) (L.) (Moench) is cultivated worldwide in a wide range of environments. Because of its resistance to drought, high production potential and low inputs use, sorghum is cultivated in the tropical, subtropical and temperate areas in warmer semi-arid regions of the world. In Uganda, sorghum is grown mainly in the southwestern highlands, especially in Ntungamo and Kabale districts, and in the lowland areas of eastern and northern regions of Uganda. The main objective of this research was to undertake a rapid sorghum VCA in Uganda toward identifying innovation opportunities to expand its production and marketing. Although considered a minority crop, sorghum is the third most important staple cereal food crop where it occupies up to 400, 000ha of arable land. While this area has remained stable over the years, sorghum production in Uganda has declined from 457,000 tons in 2007 to 299,000 tons in 2013. Notwithstanding, Uganda is the second largest producer of sorghum after Tanzania, in the EAC. The economic importance of sorghum is given by its large variety of uses. Sorghum grains are used for human nutrition, where it is transformed into flour for producing bread, porridge and other dishes. It is now increasingly becoming the foundation for food and beverage industries. Sorghum has high nutritional value, with high levels of unsaturated fats, protein, fiber, and minerals. Sorghum production in Uganda is faced with many constraints including lack of national policy to support its production and marketing, limited ready markets, pests and diseases, and limited use of inorganic fertilizers. Sorghum VCA undertaken at the Bubaare Sorghum IP points that the chain starts with seed production and distribution to small-holder IP farmers who are the main players in production and marketing. Based on the VCA, innovation opportunities exist in Uganda that can influence expansion of sorghum VC for enhanced socio-economic gains of all the actors. Some of the identified opportunities among others include increasing farm level production through enacting supportive policy and providing support to KAZARDI and other NARS in seed production and distribution, introduction of small scale sorghum processing, and increasing their capacity as well as that of the existing processing entities.

Key words: Sorghum, Innovation Platform, Uganda, VCA, Innovation opportunities

Acknowledgements

Authors of this report give acknowledgements to FARA for establishing and supporting Sub-Saharan Africa Challenge Program (SSA CP) and collaborating with the Humid-tropics Collaborative Research Project (CRP) toward providing funding for the research activities on the IPs. CIAT and partners especially Makerere University Kampala (MUK) are also acknowledged for coordinating and facilitating project activities in the LKPLS. In particular, efforts of Messrs Rick Kamugisha and Moses Sabiiti are highly appreciated by the authors for the good supervision of research activities in Uganda during this particular research.

Introduction

Sorghum (*Sorghum bicolor*) (L.) (Moench) is cultivated in all the continents. Although primarily in the warmer semi-arid parts of the world, it is cultivated in the tropical, subtropical and temperate areas due to its resistance to drought, production potential, low inputs and production cost. The United States is the world's largest producer followed by India. In Africa, Nigeria is the largest producer of the grain (ICRISAT, 2002). The plant is drought resistant and is therefore an extremely important commodity that provides necessary food and feed for millions of people living in semi-arid environment worldwide (Adebiyi *et al.,* 2005). It can also survive in cool weather as well as in waterlogged habitats (Dial, 2012; Popescu and Condei, 2014). Although it grows in a wide variety of soils and is more drought-resistant than other summer grains, it does better when the soil is enriched with compost or fertilisers prior to planting. Due to this adaptability to a wide range of ecological conditions, at world level it ranks fifth after maize, rice, wheat and barley in production and consumption for more than 500 million people in more than 30 countries (USAID, 2010). Up to 50% of sorghum is grown directly for human consumption. It is one of the major staple foods in Africa, Middle East and Asia (Adebiyi *et al*., 2005). Although still largely subsistence, sorghum is increasingly becoming the foundation for food and beverage industries (USAID, 2010), and an alternative to maize as substituent in animal diets (Popescu and Condei, 2014).

In Uganda sorghum is the third most important staple cereal food crop where it occupies up to 400, 000ha of arable land (UBoS, 2010). The crop is grown mainly in the south western highlands, in the districts of Ntungamo and Kabale, and in the lowland areas of eastern and northern regions of Uganda (Fig. 1). The main growing districts are however Kabale and Ntungamo (Ebinyau *et al.,* 2005; UBoS, 2010).

Agronomy and Production trends

Sorghum bicolor grows at an optimal annual temperature range between 22-35 degrees Celsius, and rainfall between 400-600mm, at an altitude between 0-2,500m above sea level. The crop is best propagated using seeds, cultivated in rows spaced at 50-60cm apart with hill-to-hill spacing of 12-15cm (Rao *et al.,* 2008). A plot of sorghum bicolor is shown in Figure 2. Weeds in sorghum can be controlled through chemical sprays. The crop is affected by major pests at different stages of growth including cutworms, armyworms, and seed beetles, as well as foliar diseases such as leaf blight and dwarf mosaic where rainfall and humidity are high (Rao *et al.,* 2008). The crop matures after four months, although traditional varieties in Kabale can take up to seven months before they mature.

Although it is one of the traditional crops grown and consumed in Uganda, it is considered a minority crop (USAID, 2010). The area planted to sorghum has hence remained stable over the years, while production has declined from 457,000 tons in 2007 to 299,000 tons in 2013 (Table 1; FAOSTAT, 2016). Nonetheless, Uganda is the second largest producer of sorghum after

Tanzania, in the East African Community (EAC) (Fig. 3). There is therefore opportunity for Uganda to supply the grain and/or products to neighboring countries in trade.

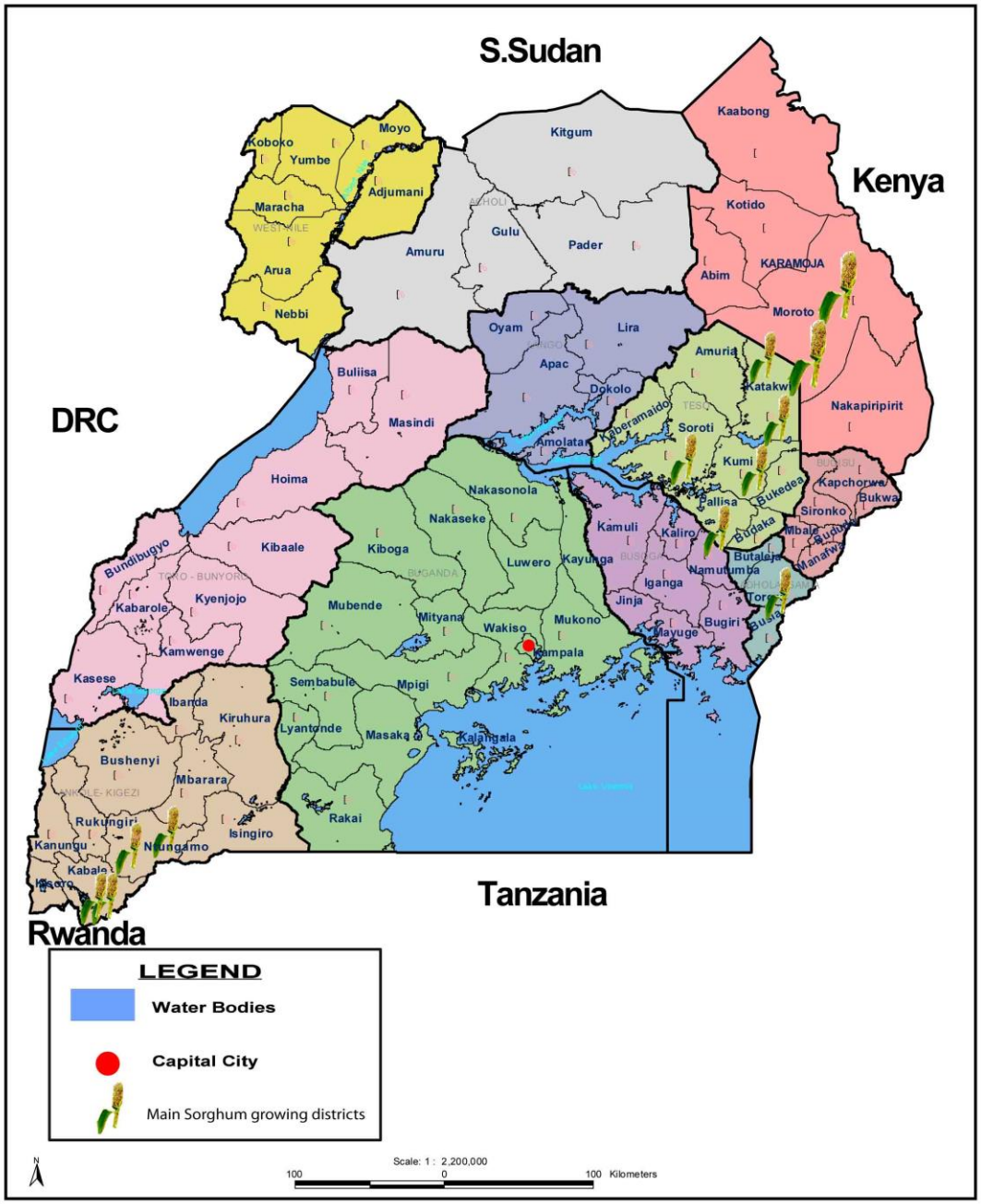

Figure 1. Map of Uganda showing the main sorghum growing areas

Figure 2. A plot of *Sorghum bicolor* in Kabale, Uganda

Table 6.1. Production of sorghum (tons) in the EAC countries

Year	Uganda	Kenya	Tanzania	Rwanda	Burundi
2000	361,000	81,536	598,200	155,106	60,980
2001	423,000	116,607	691,690	175,904	69,074
2002	427,000	115,584	635,740	184,351	73,246
2003	421,000	127,215	198,870	171,587	71,471
2004	399,000	69,508	648,540	163,772	74,171
2005	449,000	49,656	729,740	227,927	77,231
2006	440,000	131,188	711,631	187,380	82,249
2007	457,578	147,365	971,198	164,000	85,565
2008	42,286	54,316	551,270	144,000	79,818
2009	374,309	99,000	709,310	174,553	81,176
2010	390,779	164,066	798,540	161,229	83,023
2011	437,000	159,877	806,575	151,754	86,854
2012	336,000	166,627	838,717	138,695	31,527
2013	299,000	168,857	832,084	157,492	31,453
2014	299,000	177,553	840,000	145,000	22,354

Source: FAOSTAT (2016)

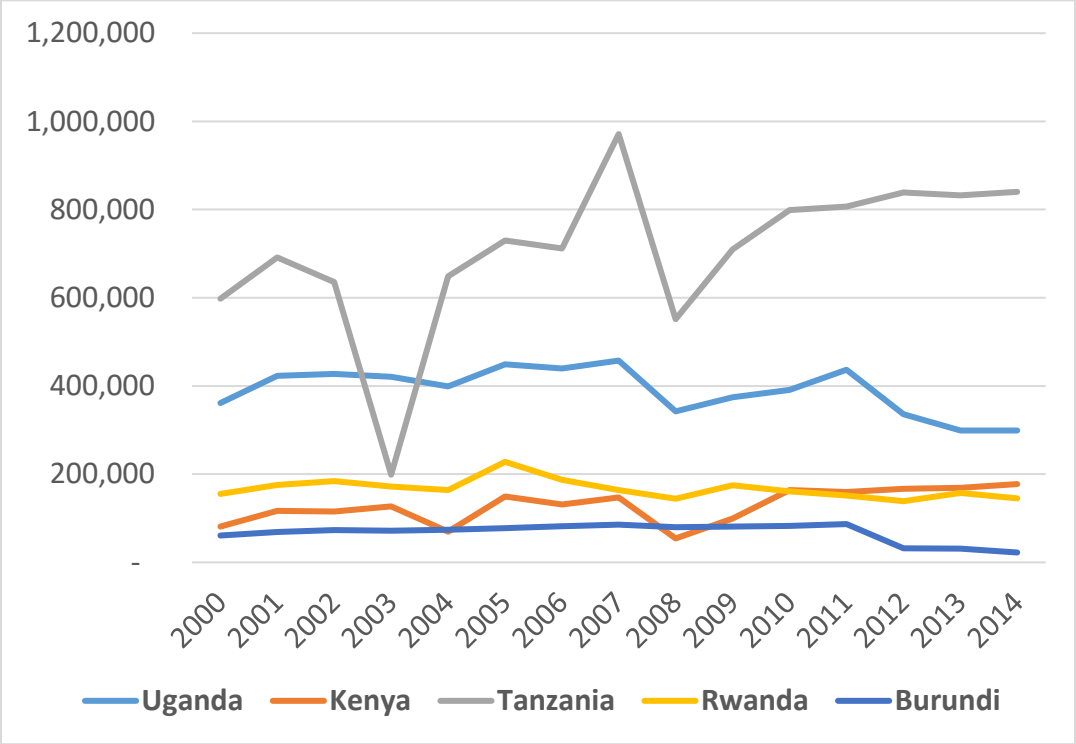

Figure 6.3 Production of sorghum (in tonnes) by the countries of the EAC

Although widely grown in Uganda, the annual sorghum tonnage has not increased much over the years as a result of lack of a ready market since sorghum was only used for food and brewing at household level (Ebinyau *et al*., 2005). The slight increase in tonnage and acreage has been a result of the new demand by the brewing industry. It is anticipated that with increased production, the commodity will be used to make ethanol, which may be mixed with petrol to form a good fuel with reduced polluting emission gases. There is a ready market for this type of sorghum *(Epuripur*) but the challenge remains in increasing production (USAID, 2010).

Importance and role of sorghum in the food chain

The economic importance of sorghum is given by its large variety of uses. Sorghum grains are used for human nutrition all over the world, especially in Africa and Asia, where it is transformed into flour for producing bread, porridge and other dishes (Popescu and Condei, 2005). In Uganda, sorghum is a main staple food in the northern, north-eastern and south-western parts of the country. It is mainly consumed in Katakwi, Kumi, Soroti, Pallisa and Tororo districts in the east, in Karamoja sub-region of the north-east, parts of northern Uganda and in the highlands of south western Uganda. It is pressed into a wide variety of nutritious traditional foods such as semi-leavened bread, dumplings, fermented and non- fermented porridge (USAID, 2010). Since 2002, Nile Breweries Ltd has been promoting the cultivation of *Epuripur* type of sorghum, which is used

to make Eagle Extra and Eagle Lager beers both for the local and export markets. Apart from the beer brewing industry, sorghum is also gaining markets in the production of dietary packed foods for children (Fig. 4). It is anticipated that with increased production the commodity will be used to make ethanol, which may be mixed with petrol to form a good fuel with reduced polluting emission gases. There is a ready market for this type of sorghum (Epuripur) but the challenge remains in increasing production (USAID, 2010). Sorghum is used in the food industry for producing malted and distilled beverages, used as animal feed for pig and cattle fattening, as well as growing poultry. It is also used in producing bioethanol and green energy (Popescu and Condei, 2014).

Figure 4. 1kg packets of malted and un-malted sorghum flour, Bubaare IP, sw Uganda

Nutritional value of sorghum

Sorghum has high nutritional value, with high levels of unsaturated fats, protein, fiber, and minerals like phosphorus, potassium, calcium, and iron. Its high nutritional value and other health benefits recommend it as a replacement for rice or corn among the general population as well (Pontieri *et al*., 2013). Sorghum has been found to be gluten-free and a suitable alternative grain for people with gluten intolerance (Pontieri *et al*., 2013). Moreover, the processes of malting and wet-milling so often used for sorghum seem to improve the nutritional value of the proteins of sorghum by improving the total protein content and quality (Obizoba, 1988).

Production Constraints and Identified Hindrances to Productivity and Profitability

As mentioned above, the area planted to sorghum has remained stable over the years with a decline in production. Besides, the lack of ready markets also constrains both production and profitability. In the areas where it is grown, the major production constraints hindering productivity include the lack of use of inorganic fertilizer. Fertilizer use on sorghum is rare and many farmers do not even use the available manure. Sorghum yields tend to remain low because the crop is mostly adapted to and is grown in drier, drought prone regions in Uganda, where consequently it is known as a food security crop (Ebinyau, *et al.*, 2005).

At the Bubaare IP in Kabale district, given that improved sorghum varieties have been availed to the Self-Help Groups (SHGs) by Kachwekano Zonal Agricultural Research and Development Institute (KAZARDI), production would be greatly enhanced by the use of optimal quantities of inorganic fertilizers, as well as consistent use of soil and water conservation (SWC) practices. With the use of these soil fertility enhancements, production costs are likely to increase as revealed by the findings of the survey, that costs were significantly higher for the IP households than their non-IP counterparts. The prices at which the sorghum is sold, and the market outlets are then likely to be critical for profitability. Households that sold in the local markets sold at relatively lower prices compared with those who sold to HUNTEX Ltd, a private sector food processing outfit in Kabale district. The sorghum needs to be sold at a price that can reward the investment made in terms of soil fertility enhancement and access to improved seed.

Innovation Opportunities

Innovation opportunities to enhance sorghum production in Uganda exist both in production and on the market side. In terms of policy, the country's National Development Plan (2015/16-2019/20) focusses on 12 prioritized crops including; cotton, coffee, tea, maize, rice. cassava, beans, fish, beef, milk, citrus and bananas (RoU, 2015). The absence of a priority focus at the policy level, for a crop considered to be a minority crop, implies that government resources are not directed towards its production and development. As such, the NARS are not well facilitated to support its development. The NARS including KAZARDI in Kabale are capable of developing improved varieties, distributing them to groups for multiplication, but they do not have the funds for regular monitoring in the farmers' fields. This emphasis at the national level would go a long way to promote sorghum production in the country.

On the market side, while sorghum products are nutritious and have potential in the local and regional markets, sorghum processors are very few. In Kabale, HUNTEX Ltd is the only known existing processor, but needs to expand its capacity to handle increased production of sorghum from the farmers. While its current capacity is illustrated by the size of equipment in Figures 5 and 6, the story of HUNTEX Ltd is briefly described in Box 1. Support to expand its capacity, as well as build the capacity of other potential young processors in the area, as well as in other localities where sorghum is grown, would enable an increase of the market outlets with

competitive prices to the farmers. Contractual arrangements between such processors and the farmers would have the same effect.

Figure 5. Water treatment system (450lt capacity)

Figure 6. Boiler and fermentation tank (left); and filling and sealing machine (right)

Box 1. Huntex Ltd; a private sector partner of the Bubaare IP

When sorghum value chain development was identified to be a major focus of the Bubaare IP activities, it was necessary to find a processor to partner with so as to purchase the sorghum produced by the IP members. Huntex Ltd, already involved in food processing at the time, was identified and interested in partnering with the IP in order to process sorghum into a good quality beverage. Huntex Ltd has since (2008) been the major processor and market outlet for the IP sorghum.

Huntex Ltd produces a drinking porridge beverage, *Mamera.* However, a range of other products could be made from sorghum including flour, and baby foods. Other products that have been developed by research include ice cream cones, breakfast cereals, and sorghum based fish feeds (Okori *et al*., 2012). When Julius Byamukama, the Managing Director of Huntex Ltd. (Fig. 5, second from left), was identified to join the IP as a member of the private sector, sorghum was not among his priority commodities for investment. He says that young members of private sector do not always have the time and finances to invest in research for new products and their market. But he has since obtained training in quality assurance from Makerere University Department of Food Science and Technology, Business Planning, and has been assisted to obtain the S and Q marks from the Uganda National Bureau of Standards (UNBS). Attaining the required quality standards will enable the beverage to be marketed within and outside the country in the East African region.

Similarly, support to other private sector actors is essential for the development of the sorghum value chain. Support will enable them to venture into new products, which at the moment cannot be produced for lack of information, time and financial resources required. This would increase market outlets for the farmers. At the same time, support to establish complementary enterprises by private sector such as the production of packaging materials, would facilitate marketing of the products to affluent markets outside the district and the country.

In addition, there are complementary services that would be required even when processors are available. Most crucial among these, is the production of packaging materials for the processed products if they are to access affluent markets. This has been a challenge to HUNTEX Ltd., to obtain suitable bottles for the *Mamera* drink, processed from dried sorghum. The materials used are obtained from as far as Kampala (6 hours away from Kabale town), and some have been obtained from neighboring Kenya, at exorbitant prices. Some of the bottles that have been used before are shown in Figures 7 and 8. Young entrepreneurs in the country could be supported to begin enterprises of such materials, within the localities where the farmers grow sorghum and processors have been established. This would support private sector processing and increased production from the farmers.

Figure 7. *Mamera* in different packaging materials

Figure 8. *Mamera* in a supermarket in Kabale town (different sorghum varieties produce different colours of the beverage)

Value Chain Analysis

This value chain analysis (VCA) is based on a household survey that was conducted at the Bubaare IP from December 2015-January 2016. A sample of 142 households was randomly taken from 11 parishes of Bubaare sub-county of which 64 households were IP members and 78 were non-IP members. One hundred and twenty six households were male-headed, while only 16 households were female-headed. Information concerning their socio-economic characteristics, sorghum production and marketing among others, was obtained. Sorghum production activities were considered for two planting seasons; August 2014 and July 2015. Key informant interviews (KIIs) were held with various IP stakeholders including IP leaders, the main private sector representative, Huntex Ltd., and members of the KAZARDI. Selected socio-economic characteristics of the respondents are shown in Tables 2 and 3, while a map of the actors, processes and support services of the value chain is shown in Figure 9.

Table 2. Selected socio-economic characteristics of the respondents

Characteristic	N	Min.	Max.	Mean	Std. Dev
Age (yrs)	141	23	89	49.11	14.5
Education level (yrs)	141	0	18	6.54	5.95
Total land owned (ha)	142	0	4	1.12	0.95
Parcels accessed (no.	142	0	8	3.14	1.69
Area under sorghum (ha)	142	0	1.3	0.4	0.29

Notes: yrs=years, ha=hectare, no.=number
Source: Survey Data (2015)

The mean age of the household heads was 49 years. On average the household heads attained 7 years of education. (Table 2). The IP member household heads were found to have attained significantly more years of education (at the 10% level) than their non-IP counterparts (Table 3). The IP members had at least completed primary school. They also owned significantly more land, on average 1.31ha compared with 0.95ha owned by non-IP members, accessed more parcels, on average four compared with three, although the area under sorghum was not significantly different between the two household categories. The mean area under sorghum for the sample was 0.4ha out of a mean total of land owned of 1.12ha. This means that sampled households use 36% of their land for growing sorghum. A study by Kasozi *et al*. (2005) found that farmers in Kabale allocated on average 31% of their land to sorghum, and that this was the biggest share of cropped land, confirming the importance of sorghum to the people of Kabale. It was also observed that sorghum stays longer in the field, up to 9 months, when compared with other food crops, and it is therefore planted at the expense of other short-term crops (Kasozi *et al*., 2005).

Table 3. Comparison of characteristics between IP and non-IP members

	Mean		
Characteristic	**IP**	**non-IP**	**t-value**
Education level (yrs)	7.63 (n=64)	5.64 (n=77)	1.94*
Parcels accessed (no.)	3.52 (n=64)	2.83 (n=78)	2.35**
Total land owned (ha)	1.31 (n=64)	0.95 (78)	2.26**
Area under sorghum (ha)	0.42 (n=64)	0.39 (n=78)	0.57

Notes: yrs=years; ha=hectare; no.=number; *, **, significant at 10% and 5% levels respectively

Mapping the VC processes, actors and services at the Bubaare IP

The sorghum value chain begins with seed development and distribution (Fig. 9). About 40 varieties of sorghum exist in the area including a local collection of about 15 varieties. The most common local varieties are *Kyatanombe* and *Makune,* among others. However, KAZARDI has worked with the IP to develop new varieties to suit available market, and to reduce maturity period. While the indigenous varieties are mainly low-yielding and take a long time (up to 7 months) to mature, six new varieties, considered very good, early maturing and have good grain quality, will be released soon. Varieties that mature in five months have been produced by KAZARDI. They are given free to farmer Self-Help Groups (SHGs), who multiply them in experimental plots, supervised by KAZARDI, and then sell the seed to other individual farmers. Other new varieties have been produced through research by the International Crop Research for the Semi-Arid Tropics (ICRISAT). The seed is bought by the farmers, from the SHGs at a price ranging between Uganda shillings (UgX)1000-1,400 depending on availability.

For a crop considered as minority, the development of new varieties that are high yielding, and early maturing, is essential for increasing production and developing the value chain. While KAZARDI is committed to developing the new varieties, funding is limited to enable the required interactions with the communities. Experimental plots have to be monitored, and researchers have to visit the community whenever they are needed. KAZARDI lack the financial resources for these activities. In this way, seed production and delivery remains constrained. The first intervention point in this value chain therefore, would be to support KAZARDI and other members of the National Agricultural Research System (NARS) in seed production and its delivery to the farmers.

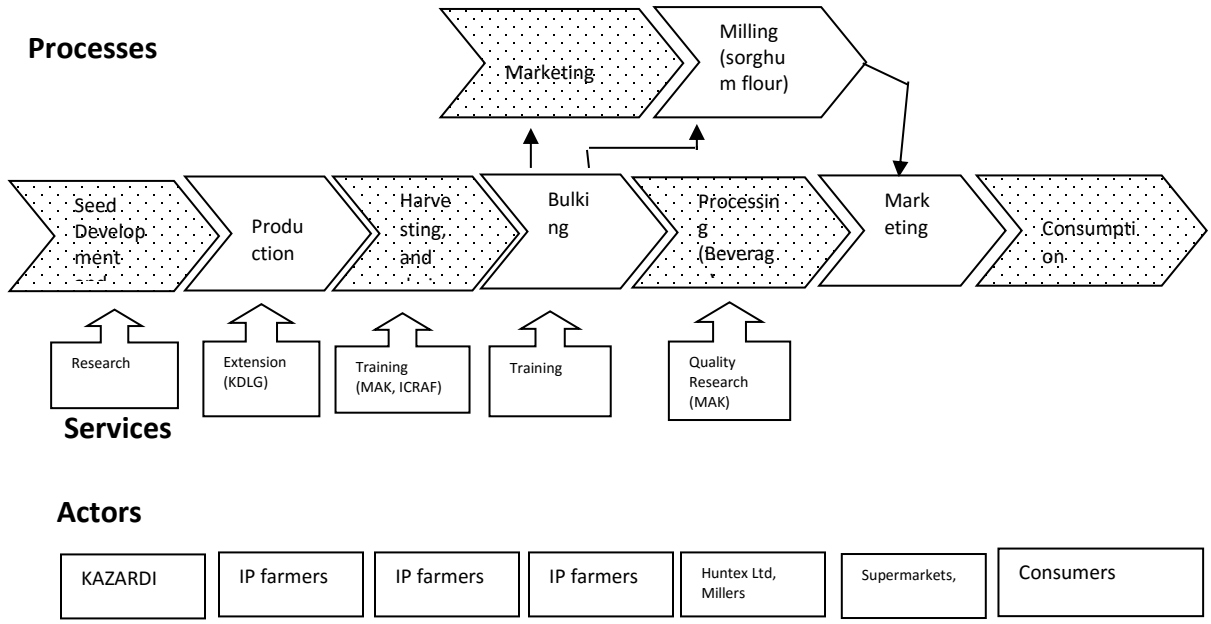

Figure 9. Map of the sorghum value chain processes, services and actors, Bubaare IP

Production is done primarily by the farmers. Sorghum in the Kigezi Highlands was produced traditionally for food, for the production of a local beverage, *Bushera,* and a local brew, *Omuramba*. As a staple food crop, it was mainly managed by women on small household plots. The decision to promote and support the sorghum value chain by the IP was made jointly by the farmers, and other IP partners including Kabale District Local Government (KDLG) and Makerere University Kampala (MUK). The development of the value chain would enable market access for a crop that previously did not have market outside the Kigezi region. Even within the region, the beverage was sold in plastic cups and containers by local kiosks. The main reasons for their choice were raising household incomes particularly incomes of women farmers, and promoting household food security. According to 94% of the respondents in this survey, sorghum was being grown for both income and food.

It was observed during the study period (Aug 2014-July, 2015) that the main sorghum planting season was between December 2014 and July 2015. Sorghum is planted in one long season in a year. The mean yield of sorghum was found to be 1, 072.39kg/ha (Table 4). The mean yield of the IP member households at 1,100.37kg/ha was found not to be significantly different from that of the non-IP households at 1,065kg/ha (Table 5). The mean yield of local varieties of sorghum has been recorded to be as low as 650kg/ha by Ebiyau *et al.* (2005). Although the mean yield of the respondents was found to be significantly above this ($p<0.00$), their yield is much lower than would be expected from improved varieties at 3, 000 kg/ha with good management (Ebinyau *et al*., 2005). Although there was effort to develop and distribute improved sorghum varieties, the use of fertilizer that would greatly complement the use of improved seed is rare. About 59.2% of the respondents were found to have ever used fertilizers, but only 13% of these used inorganic fertilizers, while 34.8% used farm yard manure in the main planting season during the study period (Table 6).

The limited use of fertilizer still constrains household productivity, requiring interventions. Yet improved varieties require the use of these soil fertility enhancement technologies (Macauley, 2015). However there is wide use of other practices that improve productivity and have been introduced in the IP establishment.

Table 4. Yields and Gross Margins of sorghum

Parameters	N	Min.	Max.	Mean	Std. dev
Total cost of production (UgX)	139	0	343,800	78, 239	77,714
Selling price of sorghum (UgX)	122	800	1,800	1,196.7	200
Value of sorghum harvest (UgX)	116	30,000	1,100,000	305,644	227,811.1
Yield of sorghum (kg/ha)	117	0	4,000	1,072.4	879.65
Gross margins (UgX) per ha	90	-82,300	745,357.1	194,290.7	184,832.8

Notes: N=number, UgX=Uganda Shillings, Kg=Kilogram, ha=hectare
Source: Survey Data (2015)

Table 5. Comparison of yields and cost of production between IP and non-IP households

	Mean		
Parameters	IP	non-IP	t-value
Yield of sorghum (kg/ha)	1,100.4 (n=54)	1,065.3 (n=62)	0.214
Value of sorghum harvest (UgX)	330,642.6 (n=54)	283,871 (n=62)	1.104
Cost of production (UgX)	93,334.9 (n=63)	65,725.3 (n=76)	2.11**

Notes: Kg=Kilogram, ha=hectare, UgX=Uganda Shillings, n=number, ** significant at the 5% level
Source: Survey Data (2015)

Table 6. Percentage of respondent households using SWC practices

Practices	Percentage of sample households (%) (n=142)
Mulching	25
Fertilization	59
Agro-forestry	37
Ridges	43
Trenches	47

Source: Survey Data (2015)

The commonly practiced SWC practices in Kabale include the use of trenches on the hilly terrains. It was observed that about 43 and 47 % of the households reported having used ridges and trenches respectively in which up to 95% of these households were the IP households. These practices were introduced to the IP members through extension services by KDLG with KAZARDI and training provided by MUK. Further, agro-forestry was introduced by ICRAF, a partner on the IP. Sixty one percent of the respondents that practiced agro-forestry were IP households, while 73% of the non-IP households did not engage in agro-forestry. Therefore, production can be enhanced by further strengthening the use of such practices, but most especially enabling increased use of inorganic and organic fertilizer.

Sorghum in the Kigezi region is harvested in the months of June and July. After harvest, it is dried by individual farmers and then bulked by collecting it from the individual farmers, to some central place in the community (a community store). It is from there that it is sold to traders. However, in 2013 the IP entered into a contractual arrangement with Huntex Ltd, a processor, to be supplied with an agreed quantity of sorghum, before any excess is sold to traders.

At the Huntex Ltd., the dried sorghum is collected and processed into a beverage, *Mamera*. The beverage has often been packed using different packages depending on their availability in the market. Obtaining packaging materials has been a challenge for Huntex Ltd. At one time, they were obtained from Nairobi, Kenya, but they ran out of stock when the producer stopped production. However, some materials are currently obtained from Kampala, but the need for standard and affordable packaging still exists. Support to entrepreneurs to produce such materials would contribute to promoting the beverage.

The ready product is then sold to supermarkets in Kabale town, and as far as Kampala city as well, located 6 hours away from Kabale town. Huntex Ltd, since being introduced to the IP as a private sector partner, has been the major market outlet for the sorghum produced by IP members. However, Huntex Ltd who originally was into processing mainly dairy products such as cheese and yoghurt, had to expand the premises to accommodate sorghum processing. Huntex is still in need of support for expansion of capacity and automation of the processes, since most machines

are currently operated manually. This would enable faster production and increased output to continue providing the market to the IP.

In order to enable the promotion of the sorghum value chain in Uganda, a strengths, weaknesses, opportunities and threats (SWOT) analysis of this VC is outlined in Table 7.

Table 7. A SWOT Analysis of the sorghum value chain

Strengths	**Weaknesses**
• Sorghum has traditionally been grown in the Kigezi region; farmers are familiar with its agronomy, • Uganda is the second largest producer of sorghum in the EAC region, • Market for the sorghum products exists within the country and the neighboring countries, • Sorghum grain is gluten free and is a good substitute for cereal grains such as wheat (Dial, 2012).	• Limited use of fertilisers • Unaffordability of fertilizer by the farmers, • Underdeveloped market for sorghum grain and products, • Limited funding for the National Agricultural Research System (NARS) to produce and deliver improved seed.
Opportunities	**Threats**
• Rapid population growth is raising the demand for locally grown food, • There is increasing demand for food through local and other commercial markets as more people leave rural to urban areas • The rising temperatures due to climate change are allowing the indigenous varieties to mature earlier than before, • Besides, with climate change, draught-prone crops such as sorghum will be more prevalent when other crops fail to survive, • Economic integration of the EAC provides a wider regional market for sorghum grain and products, • A range of products can be made from sorghum but have not yet been explored.	• If trade agreements among the EAC countries do not materialize, then opportunities to supply sorghum and products to them are diminished.

Summary and Conclusion

Uganda is the second largest producer of sorghum in the EAC region, and it has traditionally been grown in the Kigezi region. While market for the sorghum products exists within the country and the neighboring countries, processors in the country are few, apart from the large brewery companies. In order to tap into this potential market, support to aspiring private sector actors, for processing and other complimentary services, would be essential. Arrangements between the private sector actors and the producers would ensure secure prices for the producers. Further, support to the NARS at the regional level would ensure continued provision of the improved sorghum varieties, and supervision of the field activities.

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