ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 01, pp.15-19, January, 2019

DOI: https://doi.org/10.24941/ijcr.32948.01.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

PRIORITIZING ISSUES OF LOSSES IN AFRICAN INDIGENOUS VEGETABLE: EVIDENCE FROM SOLANUM AETHOPICUMVALUE CHAIN IN UGANDA

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ARTICLE INFO

Article History:
Received 17th October, 2018
Received in revised form
26th November, 2018
Accepted 14th December, 2018
Published online 30th January, 2019

Key Words:

Indigenous Vegetables,
Losses Value Chain, Supply Chain.

ABSTRACT

This presents the results of a study that was conducted in central Uganda to expound on the issues of *Solanum aethopicum* (Nakati) value chain, perception of losses in the supply chain and the consequent solutions to overcome the challenges. The specific objectives of this study in central Uganda were to; (i) identify and map the value chain actors of *S. aethiopicum* (Nakati) vegetable production and marketing and (ii) evaluate farmers' perception on issues of vegetable losses in *S. aethiopicum* supply chain. A PRA was conducted at Namulonge, Kabanyoro, Busukuma and Zirobwe villages on 7th August 2016, 9th August 2016, 10th August 2016 and 12th August 2016, respectively with the farmers to understand the *S. aethiopicum* actors' perception of Nakati vegetable losses and mitigating solutions. A pre-tested semi-structured questionnaire was used to generate the appropriate. The results of value chain actors mapping revealed that there were on average, 60 input suppliers, 41 Nakati farmer groups, 45 wholesale traders, 48 retailers, 3 processors and 63 transporters. On the other hand, during group discussions, members listed a number of vegetables grown in their communities which include Spider plants, Cabbage, Ntuula, Tomatoes, Nakati, Okra, Egg plant, Green pepper, Bugga, and Katunkuma. On an ascending scale where 1 is the most important 10 least important, participants ranked the importance of vegetables. Nakati emerged as the number one vegetable, followed by Ntuula in the second position. The third position is occupied by vegetables Bugga while cabbage are ranked number four. The participants further ranked Katunkuma in a position five and while Aubergine was put in position six. Nakati is a popular vegetable because it grows very fast and is fairly tolerant to water stress situations. Consequently when all other leafy vegetables have dried due to draughts, Nakati fresh leaves are still available for household consumption and sale in local markets. A sizeable number of constraints were highlighted by vegetables producers. The four most highly ranked and reported constraints by farmers include; high inputs costs (34.8%), high post-harvest losses (15.8%) erratic weather (15.6%) and pest and diseases (11.4%). Overall, high post-harvest losses combined with occurrence of pests and diseases are recognized as the major limiting factors in vegetables production. Farmers suggested several solutions to overcome vegetables production constraints. Some are of policy and institutional nature. Worth noting are the four mentioned solutions namely; increase in agro input support system (12.5%), increase availability of improved vegetables varieties (25.3%), subsidy on inputs (10.2%)and request for more training on vegetables husbandry /more extension agents (11.3%).

Citation ***Kasharu, A.K., Kizito, E. B., Masanza, M., Jjagwe, J. and Namutebi, A.,*** **2019.** "Sustaining student's interest in tourism and hospitality business: assessment of student's perspective on campus job fairs: international", *International Journal of Current Research,* 11, (01), 15-19.

INTRODUCTION

Uganda is home to hundreds of African Indigenous Vegetables (AIVs) with high nutritive value. The most preferred AIVs by consumers both in urban and peri-urban markets belong to the Solanacea family (Kasharu *et al.,* 2015). The most traded and produced Solanacea vegetables include *Solananum aethopicum*- shum groupslocally known as Nakati (Musinguzi *et al*., 2006).

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Consumption of *S. aethiopicum* is increasingly becoming the mainstay of traditional diets for millions of Ugandans with the vitamins and minerals needed to maintain health and fight off infections (The Monitor, 2016). Besides being a nutritive food crop, *S. aethiopicum*is now a crop of considerable commercial importance with a very high demand both in the local and regional markets (Rubaihayo *et al* 2003). The crop ranked third in traded commodities in Ugandan markets during 2015 after vegetables and maize (Infotrade 2016). This confirms Ssozi *et al*. (2012) observation that traditional vegetables are increasingly becoming more competitive relative to other non-traditional cash crops. Studies by Jagwe *et al.,* (2015) revealed

that *S. aethiopicum* can earn farmers over USD 1800 per acre compared to maize which earns them USD 80 for the same area. The current government policy is to diversify exports and introduce non-traditional cash crops into the money economy. In this regard AIVs present a great economic potential (The Monitor, 2016). Because of this importance, it is considered a high priority crop in the National Agricultural Research Strategy and Development Plan (MAAIF, 2014). Despite the general consumption appeal of *S. aethiopicum* vegetables, a number of production and post-production constraints limit realization of their potential. Unfortunately large quantities *S. aethiopicum* (Nakati) are lost in the entire vegetable supply value chains. Agona and Muyinza (2008) reported that up to 40% of the food that is grown is never eaten because of damage, rotting, pests, and the consumers' demand for perfect produce. Generally, fresh produce losses are higher than those of processed food. Wakholi *et al*. (2015) registered losses in leafy vegetables in excess of 70%. Search in literature indicate that significant focus and resources have been allocated to increasing food production (Kader 2005; Kader and Roller 2004). Studies show that 95% of the research investments during the past 30 years were reported to have focused on increasing productivity and only 5% directed towards reducing losses (WFLO, 2010). Increasing agricultural productivity is critical for ensuring global food security, but this may not be sufficient. To sustainably achieve the goals of food security, food availability needs to be also increased through reductions in the post-harvest process at farm, retail and consumer levels.
Traditionally, food losses are first measured at the primary production level by estimating losses from farm-to-retail level. The next is losses at the retail level such as supermarkets, convenience sand grocery stores. Consumer level losses such as homes, restaurants and other foodservice outlets are not incorporated. Little is known regarding current levels of *S.aethiopicum* postharvest losses, and the perception supply chain actors in regard to vegetable losses. The specific objectives of this study in central Uganda were to;

- Identify and map the value chain actors of *S. aethiopicum* (Nakati) vegetable production and marketing.
- Evaluate farmers' perception on issues of vegetable losses in *S. aethiopicum* supply chain

MATERIALS AND METHODS

This section presents research design, research area description, research tools, data collection methods and data analysis.

Research Design: This research presents a detailed case study of postharvest losses along a commercial small holder farm-to-market supply chain in Uganda. The study employed several methods to generate different but complementary kinds of data and information. These included primary sources such as participatory rural appraisals (PRA) with key informants and discussions with farmers groups, traders and transporters as well as farmers using standardized structured questionnaire and interview guides.

Research area description: This study isa case study of four commercial smallholder farming communities located in Namulonge, Kabanyoro, Busukumaand Zirobwe villages in Wakiso district. The study was carried out in four villages in two sub counties of Nangabo and Busukuma of central Uganda.This is the main Nakati growing region in Uganda, and is located at about 0^{o} 28' N and 32^{o} 27' E, and northeast of Kampala. The area receives bimodal rainfall, with March-June and October-November as the usual wettest months. The annual rainfall in the area is between 1200-1300 mm. The average maximum and minimum temperatures are about 28.3 and 16.2^{o}C, respectively, and mean relative humidity ranges from 72 to 93% (Ssekabembe *et al*., 2011). Farm and market participatory loss studies were conducted between September and December 2016 in in Namulonge, Kabanyoro, Zirobwe and Zirobwe villages in Wakiso district

Data Collection Methods: A PRA was conducted at Namulonge, Kabanyoro, Busukuma and Zirobwe villages on 7th August 2016, 9thAugust 2016, 10th August 2016 and 12th August 2016, respectively with the farmers to understand the *S. aethiopicum* actors' perception of Nakati vegetable losses and mitigating solutions. The participants through participatory discussions were probed to provide the sources of livelihood in their communities and requested to rank giving number 1 to the most important source of livelihood. A pre-tested semi-structured questionnaire was used to generate the appropriate data. The questions probed included, the constraints encountered in production of *S. Aethiopicum* and the contribution of men and women to overcoming the specific production constraints. The farmers were asked to rank their production constraints with rank 1 being given to the greatest constraint, according to the individual farmers. The percentage of farmers who gave a particular rank to a specific constraint was computed for each constraint, as well as those who did not mention it as a production constraint and, hence, did not attach any rank to it. The interviews were conducted over a period of two months, which coincided with the off-season for rain-fed *S. Aethiopicum* Nakati production. This is the time when the farmers in the area were not too busy with crop production although some of them were involved in production of irrigated *S. aethiopicum*in swamps or involved in seedbed preparation for the following season's crop. Only farmers who were actively involved in *S. aethiopicum* production were considered for this research. This list was provided by the Local Council leaders in the area, and the respondents were randomly selected from that list. All these aspects were made possible by use of a checklist to make sure certain issues of general nature are not left out. Through group dynamic tactics, participants were asked to; identify the major food and cash crops, ranking them by pair wise ranking , cropping and seasonal activity calendars, identify crop production constraints and copping strategies, and what farmers feel should be done by farmers and other players to enable them overcome the constraints. Ranking of vegetable production and marketing issues using mapping problem calendar incidences.

Data analysis: The data obtained were coded and entered into excel computer program which was later exported to SPSS computer statistical package for descriptive statistics analysis. Likewise, qualitative analyses were conducted for some unstructured responses by creating themes and triangulation.

RESULTS AND DISCUSSION

This section presents results of mapping Nakati value chain actors,

Nakati Vegetable value chain actors: The Nakati Vegetable value chain actors comprised of input providers, producers, assemblers, processors and traders, who then sell to consumers.

Table 1 presents the steps involved in different stages of the Nakati vegetable value chain in central Uganda, the agents playing the different roles, their functions at each stage and the outputs at the different stages of the chain. The focus group discussions at Namulonge, Busukuma, Zirobwe and Kabanyoro identified several Nakati value chain actors in central Uganda that are presented in Figure 1.

Input supply node: Suppliers of inputs for S. *Aethiopicum* value chain include: seed companies, urban/ rural agro input dealers mostly registered under UNADA, some government programmes like NAADs and NGOS like World Vision among others. Their sources of inputs are varied and most are imported from Kenya, China, India, and South Africa. Most of the suppliers operate in the main towns across the country and import most of the inputs they sell other than seed with certification from MAAIF. Some agro dealers may choose to be members of UNADA, an umbrella body where they benefit from training.

Nakati production node: Nakati producers are small scale and subsistence in nature tilling an average of 0.25 ha to 1 ha. Their production is characterized by low input use especially seed and pesticides with most of the producers using seed from previous harvest. The small-scale producers carry out production and post-harvest handling such as harvesting, sorting, cleaning and packaging in bundles of 130 kgs. The producers sell their Nakati vegetables to middlemen/village collectors at farm gate who aggregate and eventually transport to major town and Municipal markets in Kampala.

All the interviewed groups were registered with 70% of them being registered as Community Based Organizations (CBOs) and the rest as cooperatives. On average, these groups have been in existence for close to 3 years with membership ranging from 10 to 33 members. Among the activities undertaken by the producer groups are collective production, collective marketing, transport, capacity building trainings, and access to credit and inputs. The least collectively done activity was primary processing of processing. This was carried out by one producer group in Namulonge which was producing vegetable flour and mixing with bean recipes to make infant foods food.
Apart from production of fresh vegetable for the end markets, some producer groups in Busukuma and Namulonge are involved in the production and multiplication of seed seeds for Simlaw Seed Company as well as for other farmers interested in QDS in collaboration with NaCCRI – Horticultural Research Program at Namulonge.

Village assemblers/middlemen: These move around on bicycles and motorcycles collecting beans from the producers. The village assemblers in most cases are traders who buy Nakati and sell them to large scale traders with 5 MT trucks or transport the Nakati vegetables to major towns where big traders are concentrated. On the other hand, village assemblers can act as agents working on behalf of big traders for a commission. They collect and bulk Nakati vegetables from different farmers especially during off season and receive a commission ranging from UGX 50/Kg to UGX 100/Kg. Village collectors' play an important role in the Nakati vegetable value chain, the collectors have strong linkages with the producers and in many times they originate from the producing areas and thus know the sources of vegetables but are also trusted more by the producers. The collectors plays link role between producers and big buyers of vegetables.

In this study it was revealed that producers sell 69% of the of their fresh Nakati vegetables to village collectors and brokers and only 5% is retained for home consumptions, seed and handouts. The remaining 26% is sold directly to processors (Kayebe Sauce Packers,) and institutional buyers such as schools (Figure 2).

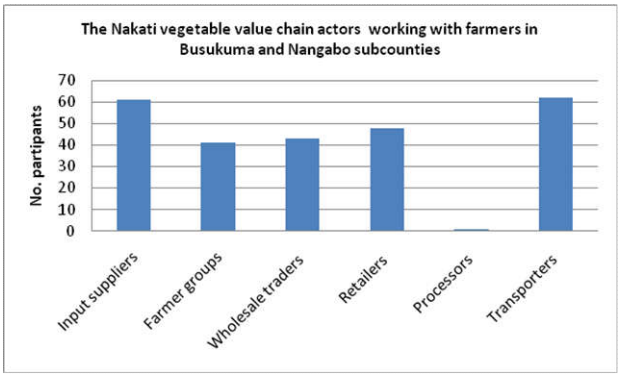


Figure 1. Mapping actors in the Nakati vegetable value Chain

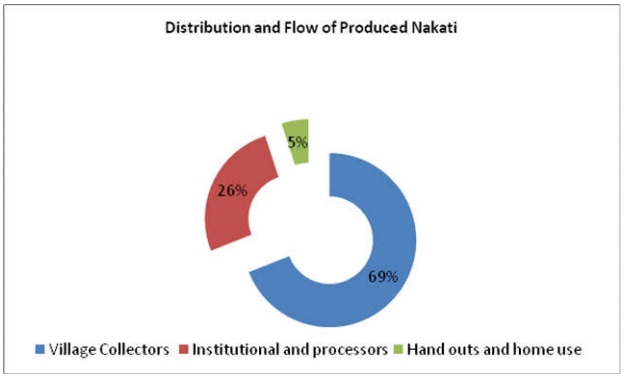
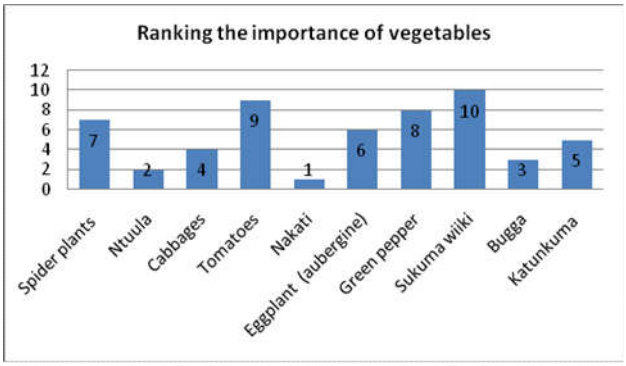


Figure 2. Quantification of Physical flows in the Nakati vegetable value chain



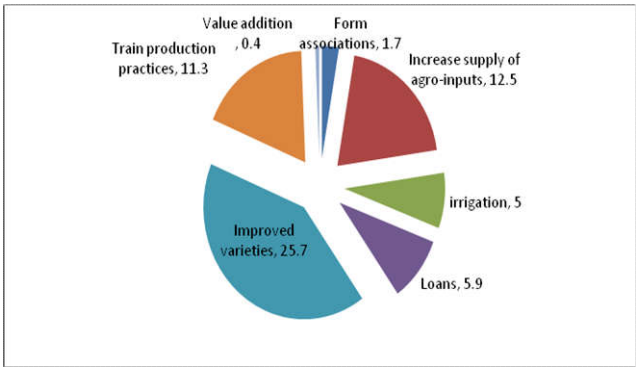


Figure 3. Percentage of producers suggesting solutions to production constraints

Table 1. Mapping the functions of actors in the Nakati vegetable value Chain

Node	In puts	Production	Assembling	Processing	Trading
Actors	• Seed Companies • NGOs	• Individuals • Farmer groups	• Village assemblers • Middlemen	• Food industry • Herbal industry	• Wholesalers • Retailers
Functions	• Farm implements • Farm equipment • Chemicals • fertilizers	• Land preparation • Planting • Weeding • Harvesting, • Threshing, • Packaging	• Bulking • Transporting • Marketing on behalf of producers	• Sorting, Washing • Milling • Quality control • Packaging	• Transporting • Sorting, • Storage • Selling to final consumer

Table 2. Percentage of producers reporting the constraint

Constraint	Ranking	% of respondents ranking
Decrease productivity	9	2.9
Erratic weather	3	15.6
High costs of inputs	1	24.8
Labour shortages		0.2
High post-harvest losses	2	15.8
Land shortage	7	5.3
Limited access to loans	6	5.6
Low prices	8	4.5
Low soil fertility	10	1.7
Pests and diseases	4	11.4
Poor road network		0.3
Storage problems		0.5
Unreliable markets	5	4.1
Theft		0.2

Market Wholesalers: Even though value addition of Nakati vegetables in Uganda is limited, trade in fresh vegetables is expanding due to expanding markets in most urban areas. In this study, a total of 46 wholesale traders were interviewed from markets where Nakati is traded. About 53% of the respondents had legally registered their businesses. Nakati vegetables are generally traded as fresh (98%) and with 2% of the traded Nakati being processed at wholesale level. The main buyers of Nakati vegetables from wholesale traders are fellow wholesale traders, retail traders, schools and hotels.

Retailers: About 9% of retailers interviewed were from Owino market, 22% from Kalerwe and 11%from Nakasero while 15%were from Nakawa market. The Nakati vegetable retailers handled other commodities such as tomatoes, egg plants and cabbages. Most of the respondents had registered their businesses with 60% running them on full time basis while 40% had employed sales people and/or managers to run their businesses. Nakati retailers operate mainly from small shops and open markets as well as supermarkets. Small shops and open markets mainly deal with different vegetables while supermarkets well packaged vegetables though handle small quantities. The retailers are involved in activities such as transportation from wholesalers' premises to their premises and packaging before selling to the final consumers.

Processors: These transform vegetables into different products. An example is Kayebe Sauce Packers (U) Ltd which processes Nakati flour. The process usually involves testing for moisturecontent and drying, sorting, washing, extrusion and milling. Final quality control checks are then done before packaging. The processor (Kayabe Sauce Packers) procures Nakati Vegetables from farmers and open markets and a few selected individual traders. The flour is packaged in 500g packs and sold to supermarkets such as Capital shoppers, Tuskys and NOGAMU.

Production of processed Nakati products is however still low given the low demand and at times the products are produced on demand.

Vegetables Production

The status of vegetable production: During group discussions, members listed a number of vegetables grown in their communities. Farmers in Busukuma and Nangabo sub counties, Wakiso district grow a range of vegetables. Which include Spider plants, Cabbage, Ntuula, Tomatoes, Nakati, Okra, Egg plant, Green pepper, Bugga, and Katunkuma. On an ascending scale where 1 is the most important 10 least important, participants ranked the importance of vegetables (Figure 1) , Nakati emerged as the number one vegetable, followed by Ntuula in the second position (Figure 1), The third position is occupied by vegetables Bugga while cabbage are ranked number four. The participants further ranked Katunkuma in a position five and while Auberginewas put in position six (Figure 1). Nakati is a popular vegetable because it grows very fast and is fairly tolerant to water stress situations. Consequently when all other leafy vegetables have dried due to draughts, Nakati fresh leaves are still available for household consumption and sale in local markets.

Challenges encountered by vegetable producers: A sizeable number of constraints were highlighted by vegetables producers as indicated in table 2. The four most highly ranked and reported constraints by farmers include; high inputs costs (34.8%), high post-harvest losses (15.8%) erratic weather (15.6%) and pest and diseases (11.4%). Overall, high post-harvest losses combined with occurrence of pests and diseases are recognized as the major limiting factors in vegetables production.

Solutions to address vegetables production constraints: Producers suggested several solutions to overcome vegetables production constraints.

Some are of policy and institutional nature (Figure3). Worth noting are the four mentioned solutions namely; increase in agro input support system (12.5%), increase availability of improved vegetables varieties (25.3%), subsidy on inputs (10.2%) and request for more training on vegetables husbandry /more extension agents (11.3%).

Summary and conclusion

This study has identified that there are on average, 60 input suppliers, 41 Nakati farmer groups, 45 wholesale traders, 48 retailers, 3 processors and 63 transporters in nangabo, busukuma and Zirobwesubcounties Wakiso district during 2016. The major grown vegetables grown include Spider plants, Cabbage, Ntuula, Tomatoes, Nakati, Okra, Egg plant, Green pepper, Bugga, and Katunkuma. On an ascending scale where 1 is the most important 10 least important, participants ranked the importance of vegetables. Nakati emerged as the number one vegetable, followed by Ntuula in the second position; the third position is occupied by vegetables Bugga while cabbages are ranked number four. The participants further ranked Katunkuma in a position five and while Aubergine was put in position six. Further farmers highlighted a number of constraints namely; high inputs costs (34.8%), high post-harvest losses (15.8%) erratic weather (15.6%) and pest and diseases (11.4%). Overall, high post-harvest losses combined with occurrence of pests and diseases are recognized as the major limiting factors in vegetables production. Farmers suggested several solutions to overcome vegetables production constraints.

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