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Full Length Research Paper

Contributions of farmers' organizations to rural development: Case of North West farmers' organization in Mezam Division, Cameroon

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This works aim to discuss the contribution of farmers' organizations to rural development, particularly the case of North West Farmers' Organization (NOWEFOR). This study was carried out from January to November, 2014 in Mezam Division of the North west Region of Cameroon. 100 farmer's members of NOWEFOR were interviewed using a semi-structured questionnaire and 20 leaders were interviewed using an interview guide. In addition, direct observations were made. The data obtained were analyzed using SPSS. The findings show that, NOWEFOR plays a vital role in the mobilization of resources from the state and external donors. The amount of external aid increased with time from 868.000 to 216.160.428 FCFA. The contribution of NOWEFOR to the support and reinforcement of certain initiatives of farmers was overall positive as 52% of the beneficiaries had increased income and 55% hired labour for farming. According to the t-test analysis used to determine the contribution of NOWEFOR to members, there is a significant difference between the levels of incomes of beneficiary and non-beneficiary farmers. The contribution of NOWEFOR to the provision of inputs to farmers was overall positive as 74% of the beneficiary respondents had agricultural equipment and inputs in their farms. The strengthening of the organisation as a whole was positive, since it permitted NOWEFOR to employ technical staff, boost membership and group marketing, respectively to 9 staff, 2954 members and 950 group sales. The contribution to the development of the community was positive, since 23.53, 19.41, 18.37, 13.02, 12.75 and 12.92% of the respondents, respectively expressed satisfaction of better structuring, improved leaders' capacity, mobilized funds, new strategies in place, improved market access and good governance in the organisation. This study concluded that farmers' organizations are important for famers and their rural communities of farmers.

Key words: Aid, contribution, farmers' organizations, North West Farmers' Organization (NOWEFOR), rural development.

INTRODUCTION

In Cameroon like in many other countries in Sub-Saharan Africa, agriculture is the main-stay of the economy. Agricultural development requires the embracement of external aid to facilitate access to productive resources,

capacity building, marketing, and access to production credit (AfDB, 2010). Aid consisted of food, security, conflict resolution and good governance made life safer and better for the rural population (Koehler et al., 2007). In the past colonial period, external aid has been one of the main vehicles for the rich countries to promote better living conditions in less developed parts of the world, with alleviation of poverty and narrowing income disparities, viewed as its main goals (Calderón et al., 2006).

As the International Monetary Fund (2003) puts it, the incidence of poverty in Cameroon is about 22.1% in the urban and 49.9% in the rural areas. The growth and employment strategy document for Cameroon considers aid as one of the essential pillars used to restart growth. More so, aids as microcredit constitute a form of social intermediation which allows poor and marginalized groups to develop and become autonomous (Fouda, 2002). Peasant organizations play an important role in securing, using and management of aids (Devora, 1997; Mbancele, 2000).

This study will help partners, farmers and NOWEFOR leaders point out the strengths and weaknesses of their projects; it also provides information on the efficiency of the aid assistance to farmers which will help concerned policy makers (SOS Faim Luxembourg and European Union) to take appropriate decisions in formulating aid assistance strategies, that will improve the living conditions of farmers.

In the North West Region of Cameroon, NOWEFOR observed as the strongest farmers' movements with a membership of 2893 farmers has been providing aid to members, to increase their incomes and enhance them to lead in development initiatives in their communities. In pursuing this goal, the beneficiary farmers that NOWEFOR targeted in order to improve their living conditions through capacity building, access to productive resources, micro credit and group marketing, appear not to have been empowered in such a manner that will guarantee the sustainability of the farmer's movement.

Besides, several studies have been carried out on the evaluation of the federation (NOWEFOR-EU project evaluation report, 2010; NOWEFOR Evaluation report, 2012), but it appears that no impact assessment has been carried out to show whether these external aid assistance provided to farmers by NOWEFOR has a positive impact on the farmers. The objective of the study is to analyze the contribution of NOWEFOR to the development of its members and their rural community in Mezam Division of the North West Region of Cameroon; more specifically, to examine the contribution of external aid on the performance of NOWEFOR, and to determine the contribution of NOWEFOR on its beneficiaries and the rural community.

MATERIALS AND METHODS

Study area

The study was carried out in Mezam Division of the North west Region. Mezam Division is located between latitudes 5°40' and 7°50'North and longitudes 9°80' and 11°51' east of the Greenwich Meridian (UNDP, 1999). Mezam has a total surface area of 1,841.45km^2 with a total population of 524,127 in the 2005 census.

The agricultural population is estimated at 258467 representing 43.07% of farm families (Republic of Cameroon, 2015). This population belongs to a large set of ethnic groups, made up of several tribes such as Ngemba (Awings, Mankons, Bafuts, Nkwens, Pignins, Akums, Njongs), Mugahkah (Bali), Bei (Baba IIs, Bafochus), etc. The climate is of the tropical savannah type with two distinct seasons: the rainy and dry seasons. The rainy season starts from mid-March to mid-October. The dry season is characterized by winds and runs from late October to mid-March. Vegetation comprise doted parches, artificial and natural forest, short and thick grasses, hence its name "Grass-field".

As the International Monetary Fund (2003) puts it, the incidence of poverty in Cameroon is about 22.1% in the urban areas and 49.9% in the rural areas. According to the Growth and Employment Strategy Paper for Cameroon (GESP, 2010) the income poverty rate situation of study zone stands at 39.9% in 2007 and the Government strove to reduce the income poverty rate from 39.9 % in 2007 to 28.7% in 2020. This makes a marked difference from the millennium development goal (Figure 1).

Data collection

Two sets of data were collected for the study: primary and secondary. Secondary data were obtained from relevant literature existing in documents and archives of several structures such as the central library of the University of Dschang, British Council library in Bamenda, NOWEFOR annual reports, project reports, evaluation reports and from the internet. Primary data were obtained via observations, interviews (focus group discussions, meetings) and the administration of questionnaires to the beneficiary groups covered by the NOWEFOR aid programme. Also narratives were recorded using a jotter and a recorder.

The before- after design was measured in terms of number of better access to skills and practical knowledge in farm business areas (production, record keeping, backstopping of farmers, and organisation of meetings, group sales and leadership), better market outlet, structuring, governance, funds mobilised and sustainability were obtained.

Sampling

A stratified random sampling method was used. The population of the study is divided into strata (Table 1). Firstly, out of the five Divisions, Mezam Division was chosen because it has the highest

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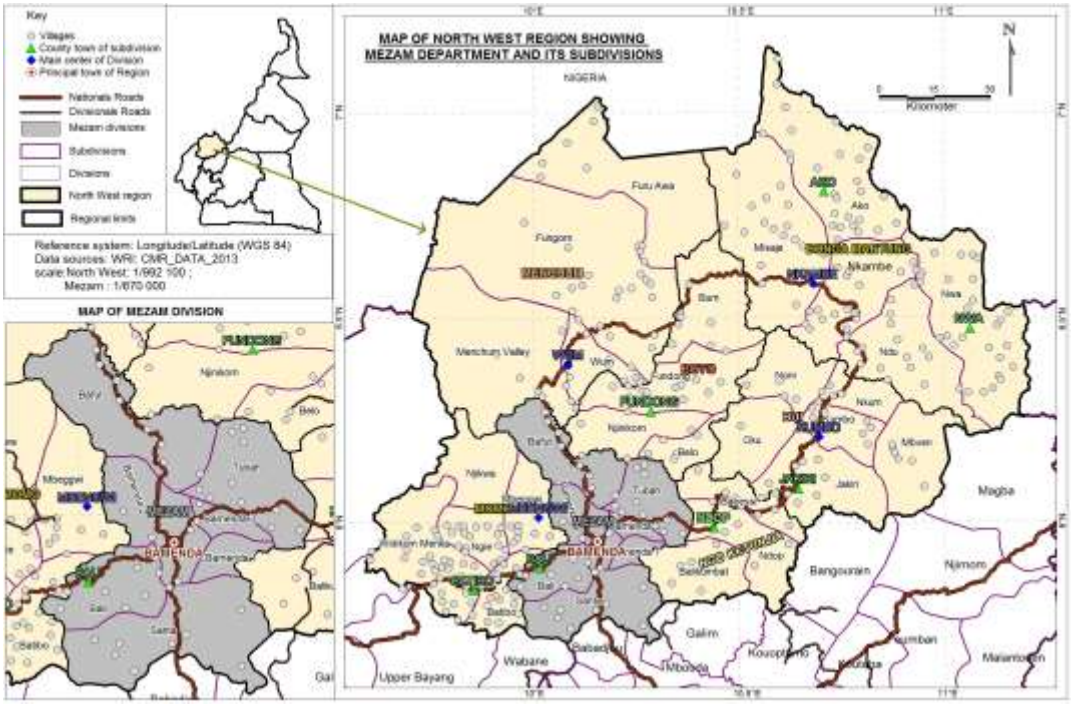

Figure 1: Map of the North West Region Showing Mezam Division. **Source:** WRI: CMR_DATA_2013.

Table 1. Distribution of Sampled Farmers per Unions.

Unions	No. of members per union	Targeted Union members	Non beneficiary members	Total
NDZOFU	195	12	7	19
BASSUG	224	13	8	21
MIFU	224	15	10	25
BUFAG	200	13	10	23
MUFU	157	7	5	12
Total	1000	60	40	100

Nchum Zone Farmers Union (NDZOFU); Bambui Union of Sustainable Self Help Groups (BASSUG); Mforyah Integrated Farmers' Union (MIFU); Bafut Union of Farming Groups (BUFAG); Mundum Farmers' Union (MUFU).

number of beneficiaries constituting 46.25% of the 2162 beneficiaries in the North west Region. Secondly, 10% of the 1000 beneficiary farmers in Mezam Division of the NWR were obtained to constitute the sample size which gave us 100 farmers. Thirdly, for comparison purposes and following external aid intervention, the sample size was also broken down into 60 external aid beneficiary farmers and 40 non beneficiary farmers. Fourthly, all members belonging to the five beneficiary unions of the external aid in Mezam division were interviewed.

These data obtained were analysed using Statistical Package for Social Sciences (SPSS). The non- parametric student (t) test particularly the Mann Whitney test was used to compare the mean annual gross margins of beneficiaries and non-beneficiaries. Descriptive and inferential statistical tools were used to analyze the findings. These findings are presented in form of simple cross-tables, frequencies distributions, percentages, bar chart and student test.

Theoretical framework and concepts

Non-Governmental Organisations (NGOs) play an increasingly prominent role in the development scene and channel a growing share of development assistance to the needy farmers at the grass root level (Masud and Yontcheva, 2005). Cheston et al. (1999) reported that impact is any change positive or negative that results from an intervention. Impact refers to broad economic and social changes, brought about by a project or a programme (Zanoli et al., 2007). Contribution is the part played by a person or something in bringing about a result or helping something to advance (William, 2012).

All impact assessments embody three main elements: a model of the impact chain that the study is to examine; the specification of unit(s) or levels, at which impact is assessed and the specification of the type of impact that is to be assessed. Impact Assessment (IAs) measure the difference in the key variables between the

outcomes on "agents" (individuals, enterprises, household, community, etc.), which have experienced an intervention against the values of those variables that would have occurred, and there had been no intervention aid program (Hulme, 1997). Masud and Yontcheva (2005) measured the impact of external aid on Human Development indicators such as infant mortality and illiteracy using regression and these findings revealed that increased health expenditure per capita reduces infant mortality as those greater NGO aid per capita.

In order to conduct a valid impact assessment, researchers need to define their overall strategy which sets the course for the rest of the research process (Hulme, 1997; Koehler et al., 2007). Another non- experimental methods of impact assessment as agreed upon by the World Bank, is the difference-in-differences and this method relies on key assumptions. For instance difference #1 compared over time, the situation before and after the program and difference #2 compared to the treatment and control groups so as to measure changes between the outcomes on individuals, organizations, communities, etc. He argued that impact assessment is better achieved when the before-after and with-without approaches are combined to an overall treatment effect (Bilal, 2014) as indicated in Table 2.

Alternatively, the study sought the indications on contributions of NOWEFOR to rural development in the North West Region through an impact assessment of the observable and measurable changes between the outcomes on "agent" (individuals, organization and community), that have experienced external aid interventions against the values of those variables that would have occurred and there had been no external aid intervention. In this study, impact assessment is achieved by combining the before-after and with-without approaches to an overall treatment effect.

Table 2. Treatment, control and differences before and after in impact assessment.

Variables	Treatment	Control	Difference
Before	6	8	-2
After	12	10	2
Difference	6	2	4

Source: Bilal (2014).

RESULTS AND DISCUSSION

Socio- economic characteristics of NOWEFOR respondents

It was observed that women generally constituted 48% and men 52% of the total respondents, meanwhile the fraction of women beneficiaries stood at 54%. This 52% agrees with those found in the urban and peri urban zones in Dschang (Defang et al., 2014). Overall, 56% of the respondents are between the age group of 35 to 55 years. The mean age of the respondents was 40 years (±5) indicating that a high proportion of the middle age respondents were involved in production as in agreement with the findings in the locality of Dschang (Defang et al., 2014).

The respondents are almost all married (72%) and among them 61% are aid beneficiaries. Our findings are similar to those found in the locality of Dschang (Defang et al., 2014) and in the West Region of Cameroon (Fotso et al., 2014). The implication of this is that, housewives were still predominantly used as family labour for light farm operations. The farmers have varied levels of education. In the study, 92% of farmers have at least attended formal primary education among which 52% are beneficiaries. These findings are close to those of Defang et al. (2014) and Fotso et al. (2014) in the west region of Cameroon. Education may be of assistance to extension. The fact that 92% of them are literate could facilitate trainings, extension, advice, monitoring and evaluation. The implication is that literate farmers might be more likely to adopt good farming and health-management practices.

It stems from the survey sample that, youths are mostly involved in gardening (16%), adults in poultry (28%) and old (aged) in piggery (565) as their main sources of income. The youths are those found between the age group of 15 to 35 years and could be explained by the fact gardening, which requires much physical efforts and adequate technical know-how. The adults are those found between the age group of 35 to 55 years and this could be explained by the fact that broiler production requires little physical efforts, adequate time, follow up which is very profitable. Also, one of the conditions for farmers to receive aid in poultry was for them to have a poultry house. The observed majority of old people (55+) in piggery could be inferred from the fact that, it requires little technical knowledge and physical efforts though not very profitable compared to poultry (Table 3).

Genesis and growth of NOWEFOR

The Federation today known as North West Farmers' Organization (NOWEFOR) was founded in October 1995. It is a farmers' representation/movement in the North West Region of Cameroon registered under the registry of Common Initiative Groups and Co-operatives and guided by law No. 92/006 of 14 August 1992 and its Decree of Implementation No.92/455/PM of 25 November 1992. It has both internal and external partners including MINADER, MINEPIA, EC, American Peace Corps, VSO with SAILD and SOS Faim as founding partners. The North West Farmers' Organization is a network of 11 unions of Common Initiative Groups with a current membership of 2893 (1454 women and 1439 men) in 140 Common Initiative Groups.

Member unions are located in Bafut, Nchum, Mforyah, Bambui and Mundum I in Mezam Division; Nseh in Bui Division, Babungo and Ibal–Oku in Ngoketungia Division; Kai, Nyen and Batibo in Momo Division; and Mbowiyah in Donga Mantung Division. Its activities were realized mainly with the technical assistance of SAILD. After a series of reflection workshops starting late 2002,

Table 3. Distribution of respondents by sex, age group, marital status, level of education and main income generating activity.

Parameters and characteristics	Category of beneficiaries		
	Beneficiaries (Frequencies)	Non beneficiaries (frequencies)	Total (100)
Sex			
Male	34	18	(52)
Female	26	22	(48)
Age groups			
15-25	2	0	2
25-35	6	6	12
35-45	8	16	24
45-55	16	16	32
55^{+}	28	2	30
Marital status			
Single	4	8	12
Married	44	28	72
Widow(er)	12	4	16
Level of Education			
Illiteracy	8	0	8
Primary	24	16	40
Secondary	20	12	32
2^{nd} cycle secondary	4	8	12
Higher	4	4	8
Main income generating activity			
Gardening	6	10	16
Broilers	12	16	28
Piggery	44	12	56

(): Frequency (Authors surveys).

NOWEFOR and SAILD decided to engage in a process of autonomisation of the producers' organization with the objective to build the economic and institutional capacities of NOWEFOR so that it can assume by itself, its roles and service provision to its members. This objective was reason behind a project that was financed by the EU for SAILD in 2004 to 2005 (NOWEFOR, 2014). Today NOWEFOR is an autonomous federation in the North West Region with board of directors, executive committee and a technical crew of 9 staff.

Resources mobilized by NOWEFOR

Our findings revealed that NOWEFOR mobilized both internal and external resources as follows.

Internal resources

The internal resources of NOWEFOR are mobilized at the beginning of each year as member unions from all the 12 unions affiliated to NOWEFOR pay a minimum annual due of 100,000 FCFA for participation, and strengthening of its associative life. Those unions who do not meet up with their annual contributions are immediately suspended from NOWEFOR services like any field follow up, refinancing projects or any form of support from NOWEFOR (Table 4).

Table 4 reveals that NOWEFOR realizes annually on average as annual dues, the sum of 1,363,000FCFA which is far beyond the targeted amount of 1,200,000FCA making an overall percentage increase of 113.5%.

From our interview with leaders, NOWEFOR usually realize annually 45 000-50 000 FCFA as income from the sales of plantain plantlets. About 200000 to 300000 FCFA is usually realized annually as interest from re-financing of farmers. Our findings showed that the federation is run and managed day to day a team of nine technical staff (1 coordinator, 1 production officer, 1

Table 4. Situation of annual dues contribution in 2010.

Unions	Sectors	Annual dues				
		2010	2011	2012	2013	2014
Mforyah Integrated Farmers' Union	Poultry, pig, yam, ginger Market gardening	159 000	152000	150000	94000	100000
Bafut Union of Farming Groups	Poultry, pig, ginger	143000	121000	124000	85000	100000
Bambui Union of Sustainable Self Help Groups	Poultry, pig, market gardening	172 000	150000	116000	29000	54000
Livestock and Crop Farmers' Union kai	Pig, palms	102 000	136000	96000	100000	100000
Mundum Farmers' Union	Cassava, Pigs , Market gardening	100 000	100000	100000	100000	69000
Nchum Zone Farmers Union	Pigs, ginger	100000	100000	35000	100000	80000
Nseh Group of Farmers' Organisations	Irish potatoes, Pigs	100 000	100000	100000	41000	100000
Babungo Farmers Union	Market gardening, Pigs	100 000	100000	104000	110000	100000
Moghamo Union of Farming groups	Pigs, Market gardening	102 000	100000	100000	105500	100000
Union of Momo Farming Groups	Yam, pig	100 000	100000	100000	100000	100000
IBAL-OKU Union	Tomatoes, pig	150 000	120000	142000	104000	100000
Ngongdzen Farmers Union	Irish potatoes, Pigs	100 000	100000	100000	100000	100000
Din farmers union***	-	-	-	-	372000	256000
Total	-	1,369,500	1, 379,000	1,267,000	1,440,500	1,359,000

*** Newly registered union (Source: Authors survey).

marketing officer,1 microfinance controller, 1 accountant, 1 receptionist, 1 office aide, 3 credit house cashiers) and elected leaders (3 executive bureau members: executive chair person, financial secretary and secretary). The material resources of the organization building is used as office and, 3.5 ton van to facilitate marketing of farmers produce, Toyota Hilux vehicle to facilitate field movement, 2 motor bikes Yamaha AG 125 to facilitate field movement, 6 computers and 3 printers.

External resources

The amount of external resources mobilized by NOWEFOR increases with time as seen in Figure 2.

Overall, from 1998 to 2014 NOWEFOR has received a total of 543, 862, 670 FCFA as external aid mainly from SOS Faim and European Union. In fact, before the support of SOS Faim and European, NOWEFOR farmers live on less than 1 dollar per day (UNDP report, 1999). This is because they are unable to generate adequate income from their farming activities.

Partners of NOWEFOR

Our findings showed that NOWEFOR mobilizes her external resources from a multiplicity of partners. On the level of involvement, we could distinguish three categories of partners: Primary partners that are international organizations or agencies involved actively in the provision of material, financial and technical assistance to NOWEFOR. The main primary partner is Save Our Souls from Hunger (SOS Faim) and the European Commission (EC).

Secondary partners are national and/or international organizations or agencies involved in the provision of both material and financial or material and technical, or financial and technical assistance to NOWEFOR. The secondary partners include: Voluntary Services Overseas (VSO), The American Peace Corps and Support Services to Grassroots Initiatives for

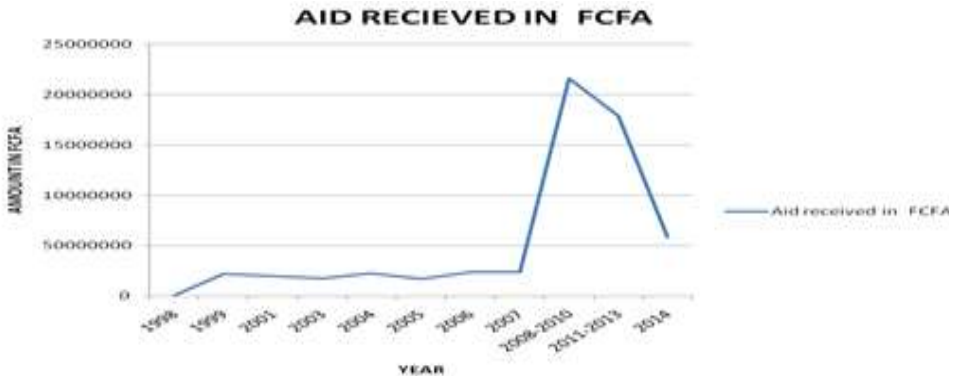

Figure 2. External aid to NOWEFOR (Source: Authors survey).

Development (SAILD). Tertiary partners are national institutions or ministries involved in the provision of technical assistance to NOWEFOR. The tertiary partners include: Ministry of Agriculture and Rural Development (MINADER), and Ministry of Livestock, Fisheries and Animal Industries (MINEPIA).

The analyses of the roles and strategies of each partners involved in the mobilization of NOWEFOR external resources are shown in Table 5. The findings show that, since 1995 till date NOWEFOR had received aid from SAILD, MINADER, MINEPIA, SOS Faim, EC, American Peace Corps and VSO. SOS Faim has been the best aid donor to NOWEFOR since its creation. Also, NOWEFOR has received aid from EC three (3) times.

Contribution of NOWEFOR to the support and reinforcement of certain farmers' initiatives

The contribution of NOWEFOR is in the possession of agricultural equipment. In Table 6, both the beneficiaries and non- beneficiaries have agricultural equipment in their farms. However, the proportion of aid beneficiaries possessing agricultural equipment in their farms outweighs those of the non-beneficiaries. 74% of the respondents who possessed agricultural equipment in their farms got it from the support of SOS Faim/EC, 38% as a result of MINADER support and 17% coming from the farmers' own capital. These findings agree with Hulme (1997) and Fouda (2002) who reported that aid in the form of micro credit contributes to the possession of agricultural equipment by farmers in their farm. The life of respondents on their annual farm incomes from January to December is illustrated in Table 7.

Table 7 indicated that, majority (52%) of the respondents targeted by the aid in Mezam Division have a general increase in farm income with the women beneficiaries constituting 30. These findings agree with Aryeetey (1998); Nshom (2002); Calderón et al. (2006) who reported that external aid helps farmers to have a positive change in their incomes. Testimonies of a farmer from Mforyah help to have a feel of the impact. *"A farmer in Mforyah Bafut has increased his production from about 10 baskets of tomatoes per week to about 20 each week; he has a turnover of at least 150,000FCFA. He has changed the roofing of his house, all his children go to school and he now employs more than two youths in his farms daily. He is an active member of the Mforyah Union".*

The contribution of NOWEFOR to the use of more and more non-family, paid and skilled labour is illustrated in Table 8a.

The findings showed that majority of the respondents employed workers in their farms for farming; however beneficiaries of aid hired 55% of labourers in their farms against 2% for non-beneficiaries. These findings agree with Aryeetey (1998) and Masud and Yontcheva (2005) who reported that aid plays a significant role in reducing household vulnerability to a number of risks such as creation of employment.

The contribution of NOWEFOR to the evolution of the average or means of farm income and gross margins of respondents from the non-parametric t-test is illustrated in Tables 8b, 9 and 10. The findings illustrate that the beneficiaries mean annual farm gross margins for market gardening value chain (206,666) is higher than that of non-beneficiaries (35, 300). The Independent-Samples Mann-Whitney U test showed a statistically significant difference (i.e P=0.000 which is far less than 0.05) at 5% level in the improved annual mean gross margins of beneficiaries for market gardening. This indicates that beneficiary respondents of market gardening have a significantly higher annual gross margins compared to the non-beneficiary respondents. This could be explained by their access to external aid which has improved access to productive resources, training and market outlet.

The findings showed that the beneficiaries mean of annual farm gross margins for broilers value chain (416,833) is higher than that of non-beneficiaries

Table 5. Roles and strategies of partners.

Partner	Analyses of roles and strategies			
	Nature of collaboration (assistance)	**Achievements**	**Lessons learnt**	**Threats**
SOS Faim	Financial, technical	-Creation of NOWEFOR -Sector funds place -Profitable value chains -Multi-purpose shops -New breeds and seed varieties -End of autonomisation -3 –years action plan in production & micro finance	-Farmers interest protected -Improved access to loans -Multipurpose shops failed -Goat value chain failed -potatoes, ginger, poultry and gardening profitable -Increased membership, size of farm and farm income. -NOWEFOR more recognized by donor. Should not depend but rather be independent -Credit funding stopped	-Disaster, -Misappropriation -Leaders manage the organization independently -Inflation &theft, -Decline of funds
SAILD	Technical	-Protocol agreements -Leaders and farmers trained -Credit Houses in place -Autonomization -Tripartite agreements -Leaders and farmers trained -Placement of a microfinance staff at NOWEFOR -information sharing through the farmers voice	-Leaders assumed roles and responsibilities -Money saved for future use -Organization & economic capacities of farmers built -Protocol agreements signed -Recruit of technical staff -Effective & efficient follow up and control of the credit houses -Information sharing through the farmers voice	-theft, -Funds not disbursed on-time -Loss of confidence
EC	Financial	-Multipurpose structures -3 years project financed	-Financed multipurpose structures and shops -Grants mobilization is an opportunity to boost membership and farm income of farmers	Misappropriation
MINEDER/MINEPIA	Technical	-Farmers trained and backstopped -Rapid plantain multiplication techniques	- Involved only in the training and follow up of farmers -NOWEFOR sold plantlets to MINADER and farmers -Internal come increased	political instability
American Peace Corps	Technical (placement of peace corps volunteers)	-Trainings in bee keeping -Placement of peace corps volunteers, -Trainings in cane rat keeping -Provision cane rat to farmers	-3-years agreement signed -Sources of income diversified -Cane rat sector is a source for income diversification -Good governance and accountability is obligatory -Cane rat could fetch more money	-
VSO	Technical	Placement of a short term volunteer	Policies have to be in place for the functioning -Organizational development plans in place	-

(Source: Authors survey).

Table 6. Main equipment possessed by respondents in their farm.

Category	Source of aid	Sprayer	Truck	Engine pump	Wheel barrow	Total
Beneficiaries	SOS Faim/EC	7	9	4	16	36
	MINADER	2	3	0	10	15
	Own capital	1	1	0	4	6
	Total	10	13	4	30	57
Non Beneficiary	MINADER	2	1	0	13	16
	Own capital	0	1	0	7	8
	Total	2	2	0	20	24

(Source: Authors survey).

Table 7. Opinion of respondents on their incomes from January-December.

Category of beneficiary	Sex	Increased (%)	Constant (%)	Decreased (%)
Beneficiary	Male	30	2	2
	Female	22	2	0
	Total	52	4	2
Non beneficiary	Male	2	14	2
	Female	0	14	8
	Total	2	28	10

(Source: Authors survey).

Table 8a. Source of labour.

Category of beneficiary	Hired labour (%)	Family relatives (%)	Alone (%)	Total
Beneficiary	32	22	2	60
Non-beneficiary	2	30	8	40
Total	34	52	14	100

(Source: Authors survey).

Table 8b. Distribution of t-test group statistics for gardening.

Parameter	Category of beneficiary	N	Mean	Std. Deviation	Std. Error Mean
Annual revenue for market Gardening	Beneficiaries	6	400000.00	154919.334	63245.553
	Non Beneficiaries	10	174900.00	106427.022	33655.180
Annual gross margin for gardening	Beneficiaries	6	206666.67	87787.623	35839.147
	Non Beneficiaries	10	35300.00	10942.273	3460.250

(Source: Authors survey).

(100,687). The Independent-Samples Mann-Whitney U test showed a statistically significant difference (that is, P=0.000 which is far less than 0.05) at 5% level in the improved annual mean gross margins of beneficiaries for broiler production. This indicates that beneficiary respondents of broilers value chain have a significantly higher annual gross margins compared to that of non-beneficiary respondents. The contribution of NOWEFOR

Table 9. Distribution of t-test group statistics for broilers.

Parameter	Category of beneficiary	N**	Mean	Std. Deviation	Std. Error Mean
Annual revenue for broilers	Beneficiaries	12	983333.33	500642.012	144522.900
	Non Beneficiaries	16	285937.50	204914.362	51228.591
Annual gross margin for broilers	Beneficiaries	12	416833.33	176202.793	50865.365
	Non Beneficiaries	16	100687.50	106762.333	26690.583

(Source: Authors survey), N**= Sample population.

Table 10. Distribution of t-test group statistics for piggery.

Parameters	Category of beneficiary	N**	Mean	Std. Deviation	Std. Error Mean
Annual revenue for piggery	Beneficiaries	44	554772.73	352797.713	53186.256
	Non Beneficiaries	14	362857.14	245871.404	65711.897
Annual gross margin for piggery	Beneficiaries	44	289681.8182	179790.15840	27104.38620
	Non Beneficiaries	14	94285.7143	51472.81369	13756.68811

(Source: Authors survey), N**=Sampled population.

to the evolution of the average or means of farm income and a gross margin of respondents for piggery is as shown in Table 10.

In Table 10, the beneficiaries' mean of annual farm gross margins for piggery value chain (289,681) is higher than that of non-beneficiaries (94,285). The independent-Samples Mann-Whitney U test showed a statistically significant difference (i.e. P=0.000 which is far less than 0.05) at 5% level in the improved annual mean gross margins of beneficiaries for piggery value chain.

This indicates that beneficiary respondents of piggery value chain have a significantly higher annual gross margins compared to that of non-beneficiary respondents. These findings agree with Aryeetey (1998), Nshom (2002) and Calderón et al. (2006) who reported that external aid helps farmers to have a positive change in their incomes.

In the same light, Calderón et al. (2006) examined the effect of foreign aid on income inequality and poverty reduction for a period 1971 to 2002 using the dynamic panel data techniques and found out external aid is conducive to the improvement of the distribution of income when the quality of the institutions is taken into account. This could be explained by their access to external aid through NOWEFOR which has helped them to improve access to productive resources, training and market outlet. As stipulated by Devora (1997), capital is very important for agricultural production because in its absence, creativity drive and innovations cannot be transformed into practice. The creations of new activities, timely application of fertilizers, good agricultural season, and support from external aid are some of the reasons for the positive change in income.

Contribution of NOWEFOR to inputs supply

Eligibility for inputs/equipment/building materials

For a farmer to be eligible for inputs (insecticides, fungicides, manure, sprayers, animal feed, drugs, piglets, day old chicks and vegetable seeds), equipment (motor pumps) and building materials (Cement, and Zinc) one:

Must have received adequate training
Must have been active in the production sector
Must not be a delinquent member or up to date with his/her financial contributions in union and credit house
Must have been saving at least once a month in the credit house
Must have been in the union for at least 1 year
Must not be on a permanent salary
Must have provided his/her quota of the contribution (labour, local construction materials, financial contribution to the inputs in question)

To crown it all, the commitment and contribution of the farmers were major criteria for assistance and farmers benefited from the project strictly on performance, which no one is like a limitation to small and average farmers. The fact that a farmer must have been in the union for at least one year before benefiting from the grants was a

Table 11. Inputs distributed to farmers from 2008- 2010.

Inputs	Units	Quantity
Cement	Per bag of 50kgs	450
Zinc	Per sheet	2000
Chick	Per chick	27000
Vegetable seeds	Per tin	500
Improved piglets	Per piglet	1000
Grower marsh for pigs	Per bag of 50 kgs	3000
Starter marsh for chicks	Per bag of 50 kgs	810
Finisher marsh for chicks	Per bag of 50 kgs	810
Fungicides	Per packet	6000
Insecticide	Per litre	1000
Manure	Per bag of 50 kgs	2600

(Source: Authors survey).

Table 12. Evolution of human resource strength of NOWEFOR (2007-2010).

Parameters	Before the EU project	After the EU project		
	2007	2008	2009	2010
Membership	923	1450	1820	2162
Trained leaders	25	40	65	100
Technical staff	2	5	6	8

(Source: Authors Survey).

limiting factor for new members to join the unions on one hand, and on the other hand, it was also means to shifter active and non-active members of the group. The inputs distributed to farmers are illustrated in Table 11.

Contribution of NOWEFOR to the development of the rural community

The contribution of NOWEFOR to the development of the human resources of federation is shown in Table 12.

Our findings showed that NOWEFOR membership rose/increased from 923 members in 2007 to 2162 in 2010 giving an overall increase of 42% reason being that the huge sum received by NOWEFOR from the European Commission and SOS Faim during this period boosted the dynamism of existing member unions and improved the general well-being of the farmers at large. The number of trained leaders rose/increased from 25 members in 2007 to 100 members giving an overall increase of 75%. This could be explained by the fact that the EU Project empowered NOWEFOR leaders in terms skills, competencies and abilities that enable them to fully assume their roles and pilot their organization. The same trend holds for the number of technical staff increasing from 2 to 5 permanent staff making an overall increase of 75%. These findings agree with the Community Development Exchange (CDX, 2008) and Horton et al. (2004) who reported that technical skills would enable more people to play an active role in the decision making that affect their organizations. This implies that the impact of external aid on the increased in membership of NOWEFOR, trained leaders and technical personnel is overall positive.

It stems from Table 13 that NOWEFOR membership rose/increased from 2162 members in 2010 to 2954 in 2013 giving an overall increase of 73%. The same trend holds for the number of trained leaders and technical staff. This implies that the external aid from partners facilitated the increased in membership of NOWEFOR, number of trained leaders and the number of technical personnel of the federation. It could be concluded from Table 10 and 13 that, the impact of the external aid is overall positive due to increased membership of NOWEFOR, trained leaders and technical personnel of the federation. These findings are in line with Czuba (1999) who reported that empowerment is a multi-dimensional social process that helps people gain control over their own lives. The contribution of NOWEFOR on the organization of group sales is presented in Table 14.

Our findings showed the number of group's sales or marketing of pigs, assorted gardening crops and broilers

Table 13. Evolution of human resource strength of NOWEFOR (2011-2013).

Parameters	Before the SOS Faim's aid	After the SOS Faim's aid		
	2010	2011	2012	2013
Membership	2162	2493	2560	2954
Trained leaders	100	120	138	150
Technical staff	8	9	9	9

(Source**:** Authors Survey).

Table 14. Group marketing of produce (Gardening, Broilers and Piggery) in NOWEFOR.

Period	Speculation	No. of group sales	Quantities sold	Average prices per unit (in FCFA)
2007	Gardening	40	2010 tons	140 per kilogram
	Broilers		50000 birds	3200 per chicken
	Pigs		800 pigs	65000 per average pig
2008	Gardening	76	2600 tons	150 per Kilogram
	Broilers		70000 birds	3500 per chicken
	Pigs		1000 pigs	72000 per average pig
2009	Gardening	114	3500 tons	175 per Kilogram
	Broilers		95000 birds	3700 per chicken
	Pigs		2000 pigs	76000 per average pig
2010	Gardening	225	4700 tons	200 per kilogram
	Broilers		110000 birds	3800 per chicken
	Pigs		2100 pigs	82000 per average pig
2011-2013	Gardening	950	5500 tons	333 per kilogram
	Broilers		150000 birds	4000 per chicken
	Pigs		4000 pigs	85000 per average pig

(Source: Authors Survey).

rose/increased from 40 in 2007 to 225 in 2010 making an overall increase of 82%. This increment could be explained by the fact there was easier access to information and trainings, harmonization of marketing strategies and the existence of marketing network that strived for better prices for farmers' produce. As a result of this a large number of new producers joined the NOWEFOR unions, based in Bafut, Mforyah, Nchum, Mundum 1 and Bambui. According to the Community Development Exchange (CDX, 2008) an empowered organization is one which is confident, inclusive, organized, co-operative and influential. Testimonies of farmers from Bafut Union on the local mastery of the market and organized group marketing include:

"…With SAILD, we realized that the Bafut market was poorly organized. We invited the traditional authorities in order to put different strategies in place such as: a unique sales place in the market, a rotation of sellers in the market (division by quarters), a market day fixed for each quarter…and the end results was on every day of the weekly market, about 200-250kg of fresh ginger is sold within a few hours at better prices. In this light, 20 new producers joined the NOWEFOR union of BUFAG, based in Bafut…"

According to our survey with members, the opinion of members on the community is seen on the changes brought about by aid within the community at large as shown in Figure 3.

As illustrated in Figure 3, the respondents revealed that aid has brought changes within the community in order of relative importance: better structuring (23.53%), improved leaders' capacities (19.41%), funds mobilized (18.37%),

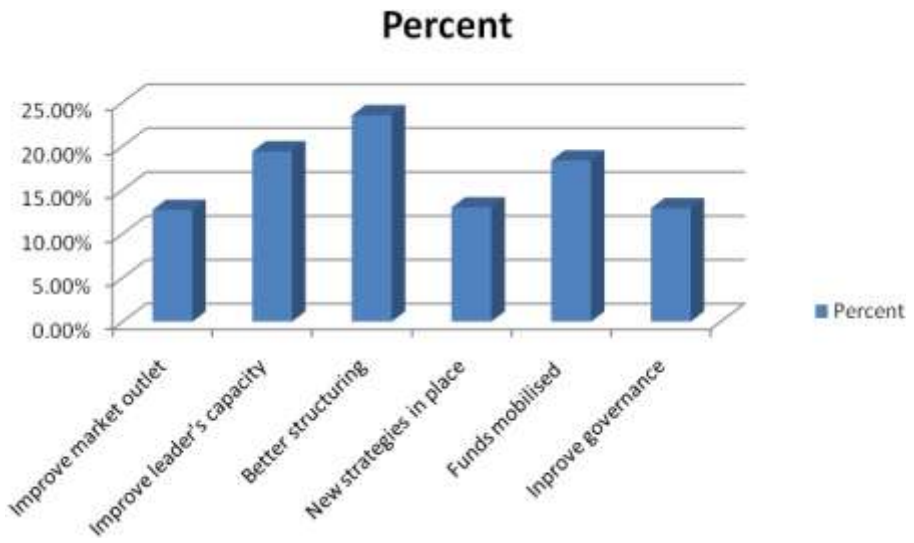

Figure 3. Impact of aid on members' communities.

new strategies in place (13.02), improved market outlet (12.75%) and improved governance (12.88%). Better structuring and improved leaders' skills were achieved through the organization of training workshops on thematic areas such as organization and holding of effective statutory meetings, record keeping, input needs assessments, governance, monitoring and evaluation.

Better market access, new strategies in place to mobilize funds and funds mobilized were achieved through the training of leaders on improved marketing techniques and organization of a unique sales place in the market, a rotation of sellers in the market (division by quarters), and a market day fixed for each quarter in the community. These findings agree with the Community Development Exchange (CDX, 2008) who reported that an empowered and structured organization is one which is confident, inclusive, organized/structured, co-operative and influential. It could be inferred from this that the impact of the external aid on the community of its members is overall positive.

Conclusion

The study carried out in Mezam Division of the North West Region of Cameroon tried to assess the contribution of a farmers' organization to rural development. The findings revealed that since 1995 till date NOWEFOR had received external aid from SAILD, MINADER, MINEPIA, SOS Faim, EC, American Peace Corps and VSO. SOS Faim has been the best aid donor to NOWEFOR since its creation. Also, NOWEFOR had received aid from EC three times. The amount of external aid increased with time. The contribution to the development of the financial capacities of members was overall positive as 74% of the beneficiary respondents had equipment in their farms, 52% of the beneficiaries realised an increased income, and hence 55% of beneficiaries hired labour for farming.

The contribution on the strengthening of the organisation as a whole was overall positive since it had permitted NOWEFOR to employ technical staff, boosted membership and group marketing respectively to 9 staff, 2954 members and 950 group sales. The contribution to the development of the community was positively, since 23.53, 19.41, 18.37, 13.02,12.75 and 12.92% of the respondents expressed satisfaction of better structuring, improved leader's capacity, mobilized funds, new strategies in place, improved market access and good governance respectively in the community of members. Conclusively the contribution of NOWEFOR to the development of the rural community was overall positive in spite of the setback such as untimely available funds.

Following our interview with members in the field, the study recommended that aid donors and NOWEFOR should provide aid on-time and in accordance with farming calendar and income generating activities for the federation. NOWEFOR should put in place an animal feed production unit, a cocoa farm and a multipurpose input shop for sustainability.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Local knowledge of maturity indicators for priority fruits and vegetables in Uganda

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Local knowledge on maturity indicators is important in determining optimal time of harvesting fruits and vegetables. These farm products are increasingly becoming a valuable source of livelihood for many rural families through household consumption and trade. Unfortunately, there is a dearth of literature on the integration of local knowledge and practices in improving maturity assessment techniques with the view of promoting optimal harvesting and consumer acceptability of fruits and vegetables in Uganda. A study was undertaken between April and September 2014 to prioritize viable fruits and vegetables, ascertain socio-economic characteristics influencing maturity assessments, assess local knowledge on maturity indicators and document maturity assessment challenges faced by fruit and vegetable farmers, transporters and traders in Kampala, Rubirizi and Sheema districts. A total of 102 respondents were interviewed as corroborative measure to field visits and focused group discussions involving 27 participants. The findings indicate that passion fruit, watermelon and pineapple were the most preferred fruits while tomato, cabbage and eggplant were highly ranked among vegetables. About 99% of the respondents were knowledgeable about fruit and vegetable maturity indicators. The knowledge of maturity indicators appears to be associated with gender, age, education level, marital status, household size and occupation of the respondents. The maturity indicators used include colour for pineapple (100%, N=102), passion fruit (100%), tomato (90%) and watermelon (11%). Size is used as a maturity indicator for pumpkin, eggplant and cabbage by 100%, 85% and 50% of the respondents, respectively. Respondents felt that the maturity indicators they use are inaccurate (53%) and are influenced by pest and disease infestation (40%), weather (5.8%) and soil (1.4%) conditions. To leverage adoption, participatory design and development of noninvasive maturity assessment tools is, therefore, recommended.

Key words: Farmer, fruit, local knowledge, maturity indicator, trader, Uganda, vegetable.

INTRODUCTION

Local knowledge of maturation periods is essential for optimal harvest, correct handling and packaging, good post-harvest quality and high market prices for fruits and vegetables (Gil et al*.,* 2012; Rajkumar et al., 2012; Okiror

et al., 2017).

Mattheis and Fellman (1999) assert that fruits and vegetables develop their full characteristic flavor, taste and colour during storage if picked during an optimum period. Although fruits and vegetables harvested at an early stage of maturity may have long storage life, they are susceptible to shriveling and mechanical damage. More still, poor flavor and taste is usually attributed to early harvests. To the contrary, delayed harvest produces fruits and vegetables that have good taste and flavor but short shelf life (Dadzie and Orchard, 1997).

There are other key factors that make proper knowledge and use of maturity indicators critical to the fruit and vegetable farmers, transporters and traders. For example, optimal harvest has twin benefits including high economic returns to the producers and quality maintenance for handlers and traders (Kader, 2002; Shewfelt, 2009). Gil et al. (2012) argue that because the physiological response of plants under refrigerated storage conditions has a correlation with time of harvest, it is, therefore, important to harvest fruits and vegetables at the right maturity stage to match the desired market and purpose.

However, research efforts on fruits and vegetables in Uganda have tended to emphasize on vector transmission, emergence of pests and diseases, fruit production challenges and opportunities and post-harvest losses (Kubiriba et al., 2001; Tushemereirwe et al., 2004; Nyombi, 2013). Elsewhere, there have been some attempts (Santulli and Jeronimidis, 2006; Shewfelt, 2009; Wanitchang et al., 2011; Rajkumar et al., 2012) to examine non-destructive techniques for measuring internal quality of fresh fruits. Muchui et al. (2010) assessed the maturity indices for only tissue cultured banana cultivars in Kenya. Much as we acknowledge recent efforts by Okiror et al. (2017) who used on-farm propagation trials and intricate laboratory procedures to determine maturity indices in central Uganda, they focused on one cultivar of tomato (*Solanum lycopersicum*) cv. Ghalia 281.

Further analysis of existing literature shows that, Uganda being one of the tropical countries coupled with high demand for fruits and vegetables in East Africa and world over, has a high potential of generating high foreign revenue and scaling down food insecurity through improved pre-and postharvest handling, processing, value addition to fruit and vegetable products (FAO, 2014; IPC, 2017). Since a majority of the fruit and vegetable farmers, transporters and traders are peasants, deliberate efforts are needed to:

(1) Document their local knowledge of maturity indicators and to

(2) Apply participatory approaches in fabricating and testing customized and low cost maturity assessment tools (Kato, 2011; Muzaale, 2014; Okiror et al., 2017).

Successful development and wide-scale adoption of maturity assessment technologies ought to be premised on local knowledge and practices (Winkler, 2008). Thus, failure to narrow the gaps between local knowledge and new technologies in maturity assessment, harvest and post-harvest handling of fruits and vegetables may reciprocate with increasing post-harvest losses, low income and food insecurity among small scale farmers in Uganda (IPC, 2017). This study was, therefore, aimed at

(1) Participatory prioritization of viable fruits and vegetables
(2) Ascertaining socio-economic characteristics influencing maturity assessments
(3) Assessing local knowledge on maturity indicators and
(4) Documenting maturity assessment challenges faced by fruit and vegetable farmers, transporters and traders in Kampala, Rubirizi and Sheema districts.

MATERIALS AND METHODS

Description of the study area

The study was conducted in six administrative sub-counties in Kampala, Rubirizi, Sheema districts in central and western Uganda (Figure 1). Some respondents were interviewed in one of main fruit and vegetable markets located in Kalerwe, Kawempe division, Kampala district. Kampala is the capital city of Uganda and is situated in the central part of the country. The surface area is 195 km^2. The city lies between latitude 0°19'N and longitude 32º35'E (UDIH, 2005; Agea et al., 2008).

Kampala has a population of 1,557,300 people but the city has a daily transient population of over 2.3 million people (UBOS, 2016). With an average density of 51 inhabitants per hectare, the city population growth rate is at 3.9% per annum (Akankwasah et al., 2012). Kampala receives a bi-modal rainfall regime which peaks from March to May and September to November of the year. The mean annual rainfall is reported to range between 1750 to 2000 mm, respectively. In 2015, Kampala received 122 rain days, resulting in 554 millimeters of rainfall (UBOS, 2016). According to Akankwasah et al. (2012), the temperature is moderately high with a minimum of about 17ºC and a maximum of about 28ºC. The major economic activity in Kampala city is trade. The major fruits and vegetables traded include banana, pineapple, tomato, eggplant, cabbage, watermelon, orange, onion and amaranths (UBOS, 2016).

Geographically, Rubirizi district is located in western Uganda between latitude $00^0$16'S and longitude $30^0$06 E with an elevation of 1,300 m above mean sea level. In 1991, the national population census estimated the district population at 75,361. The national census in 2002 placed the population of Rubirizi at 101,804. In 2014, the population of Rubirizi district was reportedly 129,149 people. The statistical abstract of 2016 presented 133,500 as the number of people in Rubirizi (UBOS, 2016).

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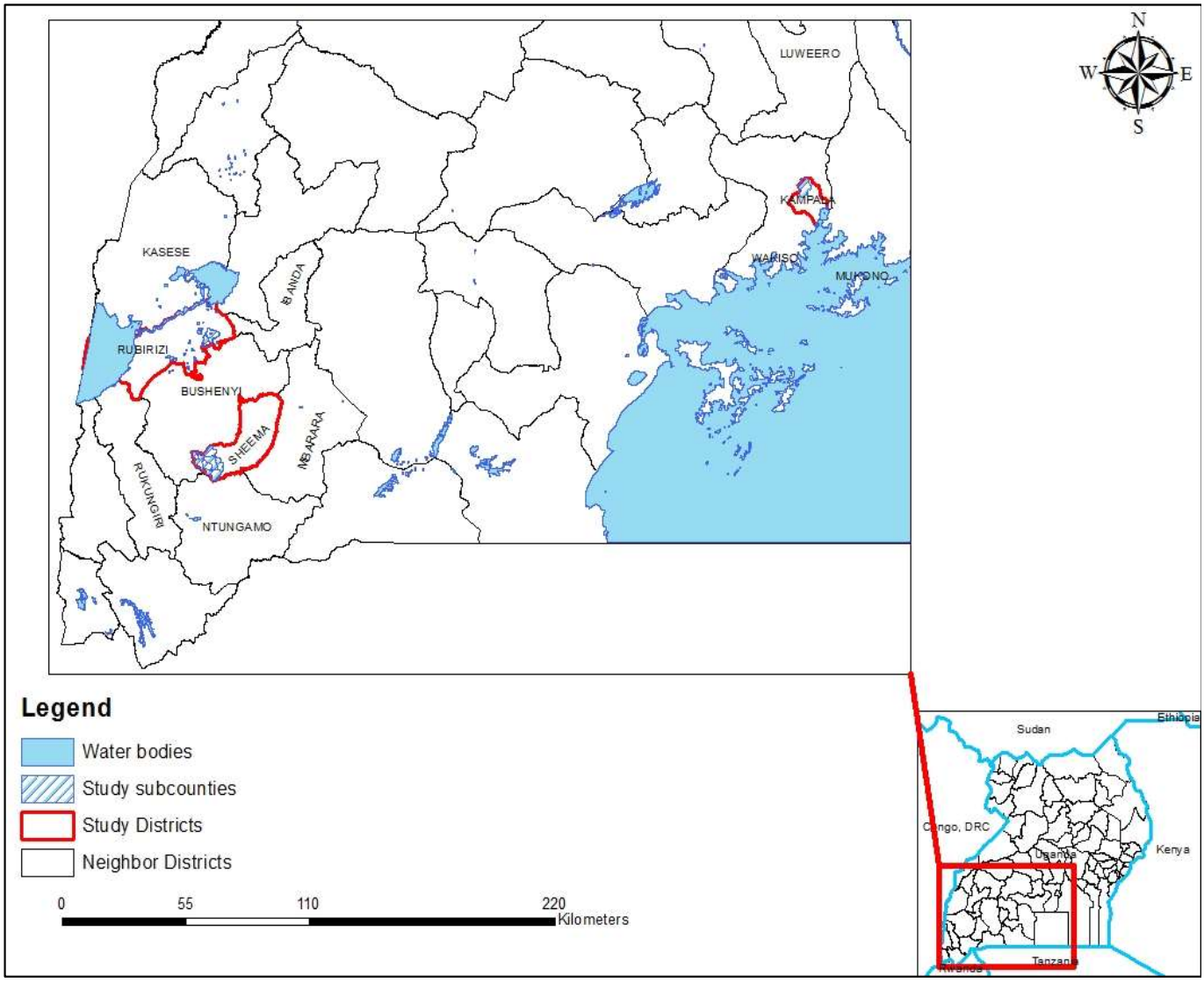

Figure 1. Map of Uganda showing the study area.

On the other hand, Sheema district is located on coordinates 00°32'S, 30°24E and at an altitude of 1,500 m above mean sea level. It covers an area of 699 km^2 in western Uganda. The population of Sheema district has been increasing steadily over the past two decades. In 1991, the national population census indicated the district population at about 153,009. By 2002, the population in Sheema had hit 180,234 people. In 2014, the population of Sheema district was 207,343 people. The statistical abstract of 2016 presented 211,100 as the population of Sheema district (UBOS, 2016).

According to NEMA (2016), Rubirizi and Sheema fall in a tropical climatic zone. The average temperature in the region is 19.3°C in a year and the mean rainfall is 1233 mm. February is the warmest month of the year with an average temperature of 19.7°C. The lowest average temperatures in the year occur in June, when it is around 18.9°C. The hailstorm that occurred in 2009 greatly affected the production of fruits and vegetables especially bananas in the western region leading to a shortage in the staple food and a spike in food prices and other consumer commodities.

Rubirizi and Sheema fall in the South Western Agro-ecological Zone (SWAEZ) characterized by the banana-coffee-cattle farming system. The SWAEZ is further characterized by a rugged terrain and several hills and high population. The average land holding is 1 to 3 hectares per household, though land is heavily fragmented and households cultivate on 5 to 8 tiny plots scattered over several hills (UGADEN, 2005).

Both crops and livestock are raised, primarily on a subsistence level, but several commercial farms are located in the region. The crops grown are; banana plantain, sweet bananas, beans, sweet potatoes, Irish potatoes, millet, cabbage, tomatoes, pineapples, avocado, passion fruit, guava, paw paws and mangoes (NEMA, 2016). Soil degradation, poor marketing and processing systems, and frequent out-breaks of crop and livestock diseases are some of the challenges faced by the farmers in Rubirizi and Sheema districts (NEMA, 2016).

The vegetation in the study region includes natural forests such as Maramagambo and Kasyoha-Kitomi (Rubirizi) and Kalinzu (Sheema) and several *Eucalyptus spp.* and *Pinus spp.* plantations

spread over private estates and licensed central forest reserves (NFA, 2005). However, there is increasing demand for other tree species like temperate fruits (apples and grapes), fodder shrubs and fast growing timber trees (UGADEN, 2005). The variability in the elevation, location in the Pleistocene refugia and proximity to the Albertine rift would have meant high biodiversity but the high population growth, over exploitation of forest resources for firewood and poles and habitat degradation is threatening biodiversity in the sub-region (FAO, 2010). This trend may be worsened if agricultural productivity continues to decline owing to soil degradation, unoptimized harvests and pre- and postharvest losses in the region.

As is the case of other parts of Uganda, the farmers do not have specialized techniques but rely on traditional knowledge for assessing the maturation levels of crops before harvest. The farmers rely on subjective judgment of firmness, colour, size and aroma to harvest fruits and vegetables. The overreliance on indigenous knowledge may lead to low farm productivity and high postharvest losses because the application of traditional knowledge in farm management is usually influenced by several variables such as gender, age, religion, education and socio-demographic factors (Tabuti, 2006).

Research design

This study closely followed research designs described by Akankwasah et al. (2012) and Badri (2016). A cross-sectional survey design was applied to fruit and vegetable growers and traders in the three districts in Uganda representing six administrative sub-counties of Kawempe South, Katanda, Katerera Town Council, Kitagata, Kyabakara and Mwogyera. These sub counties were included in this study because they are among the prominent fruit and vegetable production and trading areas in Uganda. The farmers, transporters and traders usually rely on non-destructive characteristics such as external colour, aroma and size as maturity indicators (Okiror et al., 2017).

Sources of data

The study used both primary and secondary data. The primary data were obtained through questionnaire, interview, on-farm observations and focused group discussion; while secondary data were sourced from books, journals and research publications. Several reports from the Uganda Bureau of Statistics (UBOS) and the National Environment Management Authority (NEMA), National Forestry Authority (NFA) and other published articles were reviewed to ascertain socio-economic activities, human population, state of environment, land use patterns, topography, soils, climatic conditions and fruit and vegetable production and trade patterns and maturity indicators used in the study areas. Amin (2004), Agea et al. (2008) and Okiror et al. (2012) agree that a combination of primary and secondary data approaches is desirable for triangulation of study results.

Sampling techniques and procedures

Data collection took place between April and September 2014. Besides literature review, preliminary discussions were held with the scientists at the Presidential Initiative on Banana Industrial Development (PIBID) and other experts in the National Agricultural Research Organization (NARO), National Agricultural Advisory Services (NAADS) and District Local Governments (DLGs) to map out potential districts for inclusion in the study. The study sites were selected based on their performance in fruit and vegetable production, transportation and trade. Accordingly, three districts including Kampala, Rubirizi and Sheema were selected purposively for the study. Market, Local Council and Farmer Association lists were subsequently used to randomly select 102 household heads for the interview, with the belief that they were representative of the entire population due to the homogeneous characteristics of the population.

Data collection instruments

Secondary data were collected from relevant published and unpublished documents. This process included a desk review of the districts that are renowned for fruit and vegetable production, value chains, postharvest losses, maturity indicators for priority fruits and vegetables.

A peer reviewed semi-structured questionnaire, field observation checklist and a focused group discussion (FGD) guide were developed and used to collect primary data. Leaders of farmer groups were interviewed to ascertain the farmers' skills and capacity to participate on the study. Prior to conducting the interviews, local enumerators were recruited from amongst the community in Kampala, Rubirizi and Sheema districts. Enumerators were trained on how to conduct the survey and how to interpret and translate the questions as done by Ofgeha (2017).

The questionnaire and checklists were pre-tested before administration and some re-arrangement, reframing and correction in accordance with respondent level of understanding were done. Informed consent was sought from respondents before the interview. In addition, respondents were allowed to opt out of the interview at any stage. Some respondents found some questions especially regarding age, land ownership and family size sensitive and preferred not to give responses. Respondents' perceptions on socio-economic variables, maturity indicators and challenges they face in maturity assessment were collected by this technique. A total of 102 household heads were interviewed.

Field visits were held in all selected villages and markets, guided by the respective key informants, who were also asked to give their opinions regarding seasonal fruit and vegetable maturity indicators and challenges they face in maturity assessment. A similar technique was used by Ofgeha (2017).

In addition, two focused group discussions were held with 27 participants drawn from the fruit and vegetable producing association, traders, the National Agricultural Advisory Services (NAADS), and socially respected farmers who were known to have better knowledge on seasonal fruit and vegetable yields and postharvest losses, maturity indicators, social and economic status of the study areas. Species prioritization was conducted by tasking the FGD participants to assign scores of 1-10 to the fruits and vegetables grown and traded in the study areas. A score of 10 meant the fruit or vegetable was highly preferred. Previous studies have used FGDs reportedly because they are useful in corroborating information collected through individual farmer interviews (Agea, 2010; Okiror et al., 2012).

Data analyses

Quantitative data obtained from sample respondents were sorted, coded and subjected to analyses using the Statistical Package for Social Sciences computer software version 16.0 (SPSS Inc., 2005). Descriptive (means and percentages) and inferential statistical procedures were used to analyze the data obtained from fruit and vegetable farmers, transporters and traders, at 5% significance level (Munthali et al., 2016; Hei et al., 2017). Qualitative data gathered from focused group discussions were sorted into three major themes (demographic characteristics, maturity indicators and challenges faced by communities during maturity assessments) that subsequently guided the discussion of results (Krippendorff, 2004).

Table 1. Result of FGDs ranking of fruits and vegetables.

Fruit/Vegetable	Scientific name	Family	Fruit and vegetable prioritization			
			FGD 1	FGD 2	Average Score	Rank
Fruit						
Guava	*Psidium guajava* (L.)	Myrtaceae	7	8	7.5	5th
Passion fruit	*Passiflora edulis* Sims	Passifloraceae	10	9	9.5	1st
Pineapple	*Ananus comosus* (L.) Merr.	Bromeliaceae	8	9	8.5	3rd
Sweet banana	*Musa acumunita* Colla	Musaceae	10	7	8.5	3rd
Watermelon	*Citrullus lanatus* (Thub.)	Cucurbitaceae	9	9	9.0	2nd
Vegetable						
Amaranths	*Amaranthus caudatus* (L.)	Amaranthaceae	8	8	8.0	5th
Cabbage	*Brassica oleracea* L.	Brassicaceae	10	9	9.5	2nd
Eggplant	*Solanum melongena* L.	Cucurbitaceae	9	9	9.0	3rd
Pumpkin	*Cucurbita maxima* Duchesne	Cucurbitaceae	8	9	8.5	4th
Tomato	*Solanum lycopersicum* L.	Solanaceae	10	10	10	1st

RESULTS AND DISCUSSION

Prioritization of fruits and vegetables

A species prioritization exercise that included fruit and vegetable farmers, transporters and traders shows that passion fruit, watermelon, pineapple and sweet banana were the most preferred fruits while tomato, cabbage, eggplant and pumpkin were highly ranked among vegetables by the focused group discussants (Table 1). Akankwasah et al. (2012) argue that Ugandans have been trading in both wild and domesticated plants for several decades. Okiror and Okia (2011) also documented high value Indigenous Fruit Trees and demonstrated the potential of IFTs in ameliorating rural nutritional and income security in Uganda.

The prioritization results from the current study however differ in that short maturing fruits and vegetables (watermelon, passion fruit, pineapple, tomato, cabbage and eggplant) are preferred compared to the perennials such as Shea butter (*Vitellaria paradoxa*), Tamarind (*Tamarindus indica*), Carandus plum (*Carrisa edulis*), Black plum (*Vitex doniana*) and Desert date (*Balanites aegyptiaca*) recorded by Okia (2010) and Okiror and Okia (2011).

The current preference for fast maturing fruits and vegetables can be attributed to increasing incidences of prolonged drought and crop pests and disease, unreliable rainfall and food insecurity that make farmers to propagate tomatoes, eggplant, watermelon, pumpkin and cabbage to generate quick incomes for buying other foods (IPC, 2017). Even then, the preferred fruits and vegetables documented in this study (Table 1) should be harvested at optimal maturity stages to enhance farm productivity and income returns and nutritional security among rural farmers in Uganda.

Demography and knowledge of maturity indicators by respondents

A majority of respondents (81%, N = 102) interviewed were males and 19% were females. In addition, over 87% of the respondents were from male headed households (Table 2). Within Uganda and Africa as a continent, most studies on farming have been dominated by male respondents. Okiror et al. (2012) found 55% male and 45% female farmers in eastern Uganda.

Badri (2016) reported more fathers (80%) than mothers as the key sources of information regarding vegetable production and trade in Sudan. The sample population contained 88% males and 12% females in a study of farmers' production constraints in Ethiopia (Hei et al., 2017). A study of bee farmers in Ethiopia established that 99.4% of the sampled population was male headed and the rest 0.6% were female headed households (Tesfaye et al., 2017). This is mainly because the decisions on whether to grow or plant fruits and vegetables are mainly made by men (Okiror et al., 2012).

In Sierra Leone, women usually comply with men's decisions related to fruit and vegetable propagation, harvest and trade (Leach, 1990), making it critical to consider men's power, influence and decision-making role during the design and dissemination of new technologies on fruit and vegetable maturity assessment in Uganda. More still, Okullo et al. (2003) assert that men are the most influential in families since they are regarded as owners of land the family occupies and in most cases have the discretion to plant, harvest, transport and/or trade in any fruit or vegetable product.

In contrast, Tabuti (2006) reported women to be more knowledgeable about the ecology, use, concoctions, maturation and harvesting regimes of herbal medicinal plants than men. This scenario resonates with the pivotal

Table 2. Socio-economic characteristics of respondents (N=102).

Variable	Sex		Total	Response (%)
	Male	Female		
Gender	83	19	-	-
	81.40	18.60	-	-
Age (years)				
19-35 yrs	47	-	58	56.86
36-55 yrs	29	11	35	34.31
Over 55 yrs	5	6	5	04.90
No response	-	0	4	03.92
Education				
None	9	2	11	10.78
Primary	39	5	44	43.14
Secondary	22	9	31	30.39
Tertiary and above	10	2	12	11.76
No response	-	-	4	3.92
Land ownership				
Yes	73	14	87	85.30
No	8	1	9	08.80
No response	-	-	6	5.88
Land size				
1-2 acres	35	12	47	46.08
3-5 acres	36	4	40	39.22
Over 10 acres	1	0	1	00.98
No response	-	-	14	13.73
Land acquisition				
Inherited	44	-	50	49.02
Bought	30	6	40	39.22
Rent	1	10	1	00.98
No response	-	0	11	10.78
Household head				
Father	82	7	89	87.30
Mother	1	11	12	11.80
No response	-	-	1	01.00
Household size				
1-4 people	20	7	27	26.47
5-10 people	43	11	54	32.94
11-15 people	12	0	12	11.76
Over 15 people	1	9	1	00.98
No response	-	-	8	07.84
Marital status				
Never married	21	3	24	23.53
Married	58	12	70	68.63
Divorced	3	0	3	02.94

Table 2. Contd.

Separated	1	1	2	01.96
Widowed	0	3	3	02.94
Number of children				
None	1	1	2	01.96
1-4	52	10	62	60.78
5-10	22	8	30	29.41
Over 10	3	0	3	02.94
No response	-	-	5	04.90
Occupation				
Farmer	76	13	89	87.25
Employed	3	3	6	05.88
Petty business	3	2	5	04.90
No response	-	-	2	01.96
Knowledge of fruit and vegetable maturity indicators				
Yes	83	18	101	99.02
No response	-	-	1	00.98

role played by women in ensuring the nutritional and health security of their family members especially children in Uganda. A majority of the traders encountered in the study of wild food and medicinal plants were women in Kampala, Uganda's capital city (Akankwasah et al., 2012). De Caluwe (2011) and Agea et al. (2011) also reported that trade in wild food and medicinal plants were generally dominated by women in the West and East Africa. Thus, the findings from the current study coupled with previous reports (e.g. Tabuti, 2006; De Caluwe, 2011; Agea et al., 2011) make a strong justification for scientists and development agencies to involve both men and women in programs aimed at improving the propagation, maturity assessment, postharvest management and trade of fruits and vegetables in Uganda (UBOS, 2016).

The survey further revealed that about 57% of the respondents were aged 19-35 years, while 5% were over 55 years (Table 2). In Uganda, a person below 35 years is considered a youth (UBOS, 2016). According to Kiyemba (2017), there is an increasing surge of youths in the country and 80% of the Ugandans that are 10-24 years old live in rural areas. To harness this demographic dividend, Uganda needs to

(i) Make agriculture more profitable through policy reviews and subsidized agro inputs,
(ii) Improve youth access to land,
(iii) Create platforms for youth to share information on agriculture,
(iv) Increasing access to credit facilities, and
(v) Introducing new technologies and innovations such as maturity assessment tools for fruits and vegetables (Kiyemba, 2017).

The active participation of youth and the elderly in fruit and vegetable production and trade, may make the promotion of new technologies on maturity assessment easily adoptable among rural communities in Uganda and beyond.

About 43% of the study group had attained primary education whereas 11% had never acquired any formal education (Table 2). These results are close to findings by Akankwasah et al. (2012) who noted that 44% of the wild food and medicinal plant traders in Uganda had attained primary education. In a related study, Okiror et al. (2012) established that whereas 39% of respondents had studied up to primary level, 28% had never attained any formal education in eastern Uganda. The low levels of education have implications in the fruit and vegetable propagation, and maturity, yield and postharvest management because farmers, transporters and traders that lack formal education usually find difficulties in accessing, interpreting and sharing farm and market information and undertaking proper agribusiness book keeping (De Caluwe, 2011). They need to be helped. Thus, a deliberate training/farmer extension programme targeting the less educated farmers and traders will be a precursor for the successful design and adoption of improved maturity assessment techniques in the study area.

More than 2 in every 3 (69%) of the respondents were married, 61% had 1-4 children and 33 % of the families consisted of 5-10 people (Table 2). In a related study,

Table 3. Maturity indicators of fruits and vegetables (N=102).

Product	Maturity indicator	Household heads' responses	
Fruit		**No.**	**(%)**
Watermelon	Colour	11	10.50
	Size	27	26.30
	Sound made by a watermelon fruit after hitting with a bare hand	32	31.60
	Drying of stalks	32	31.60
Pineapple	Colour	100	100.00
Passion fruit	Colour	100	100.00
Vegetable			
Tomato	Colour	90	90.00
	Size	7	06.70
	Drying stalks	3	03.30
Cabbage	Size	50	50.00
	Firmness	38	38.90
	Drying of leaves	6	05.60
	Drying of stalks	6	05.60
Pumpkin	Size	100	100.00
Eggplant	Size	85	84.60
	Sound made by an eggplant fruit after hitting with a bare hand	15	15.40

more than half (55%) of the respondents were married (Akankwasah et al., 2012). More still, Okiror et al. (2012) recorded 72.5% couples with 67.5% households having 5-9 persons. According to Okiror et al. (2012), households with 5–9 people tend to be more willing to plant and protect fruits and vegetables because of the commercial and nutritional values. Large families in the rural parts of Uganda usually experience financial and food insecurity. These challenges could be ameliorated through efficient fruit and vegetable propagation, maturity assessment, consumption and trade.

Farming was the mainstay of most (87%) respondents. Overall, 99% of the respondents were familiar with fruits and vegetable propagation and trade (Table 2). These results are in tandem with the national statistics. UBOS (2016) showed that over 80% of Ugandans depend on agriculture for a living. A report by IPC (2017), indicated that there is a general shift among Ugandan farmers from usual crops such as sweet potatoes, maize, banana, Irish potatoes, cassava, millet, coffee and tea to high value quick maturing fruits and vegetables including tomato, eggplant, cabbage and carrots as a way of adapting to climate change, pests and disease, prolonged drought and intermittent rains. This therefore presents a great opportunity for the promotion of fruits and vegetables as key drivers of the local economy and as major exports of Uganda. Currently, the top exports in the country are coffee, raw tobacco, cement, tea and corn.

Fruit and vegetable maturity indicators

The maturity indicators used by farmers, transporters and traders include colour for watermelon (10.5%, N=102), pineapple (100%), passion fruit (100%) and tomato (90%). Size is used as a maturity indicator for pumpkin, eggplant, cabbage and watermelon by 100%, 85%, 50% and 26% of the respondents, respectively. Other maturity indicators include sound made by watermelon (32%) and eggplant (15%) after being hit with bare hands.

Firmness was reported as a maturity indicator for cabbage by 39% of the study group (Table 3). Farmers, transporters and traders could be compelled to devise local means of detecting maturity of fruits and vegetables because of their high perishability. Kader (2002) and Shewfelt (2009) assert that maturity at harvest is one of the main factors influencing quality and the rate of quality changes during postharvest handling and shelf life. Furthermore, it is recommended to harvest fruits and leafy vegetables at optimal maturity stage because of the potentially higher economic benefits for producers and traders. Barg et al. (2008) opined that plants harvested earlier or later than the optimal maturity stage have poor physiological response during refrigerated storage and less optimal quality maintenance.

Elsewhere, colour has been used as a maturity indicator for decades. For example, the United States Department of Agriculture has relied on external colour for classifying fresh tomatoes since 1990s. A colour chart with an ordered six colour sequence notably; green, breaker, turning, pink, light red and red is used to gauge the progress of tomato maturation and ripening (USDA, 1991).

In Ghana, Nigeria and Honduras, farmers, traders and consumers have developed distinct correlations between

colour and the overall quality of specific farm products (Dadzie and Orchard, 1997) through practice and indigenous knowledge accumulated for generations. In Uganda, Okiror et al. (2017), used intricate propagation, laboratory and inferential statistical procedures to prove that colour correlates with physico-chemical and nutritional characteristics of vegetables. The revelation by Okiror et al. (2017) reinforces rural farmers, transporters and traders' perception of colour as one of the most important indicators of fruit and vegetable maturity.

Size is one of the most important indicators of maturity (Table 3). Depending on the country, most producers and consumers of fruits and vegetables usually compare the diameter, length and shape as pre-harvest decision criteria while weight, length, circumference and volume are important post-harvest selection criteria (Dadzie and Orchard, 1997). Muchui et al. (2010) made strong arguments on the relevance of the changes in fruit length and diameter in maturity determination. This study therefore recommends the application of size based indicators in the development of calibrated calipers and diameter tapes for assessing fruit and vegetable maturity on-farms and in markets.

The hitting of fruits and vegetables, with bare hands, to ascertain the level of maturity is a traditional practice among most African farmers, transporters, traders and consumers (Table 3). Fortunately, several scholars have dedicated efforts to study the correlation between sound and maturity of fruits and vegetables. These include Mizrach et al. (1997) who used ultrasound acoustic wave attenuation to determine firmness of mango fruit. There was a strong association between velocity measurement and compression test during ripening of mango fruits (Al-Haq and Sugiyama, 2004). Mizrach et al. (1997), Al-Haq and Sugiyama (2004) and Santulli and Jeronimidis (2006) agree that as the fruits or vegetables mature, sound outputs change in a regular sequence thus providing a basis for the application of acoustics techniques in maturity assessment by farmers in Uganda. However, the current interpretation of sound outputs is subjective and varies from farmer to farmer. It therefore calls for deliberate development of calibrated acoustic tools for assessment of fruit and vegetable maturity on-farm, inspection points and markets.

The drying of flower and fruit stalks reported by the respondents in Table 3 could be attributed to the various physiological changes that occur during fruit and vegetable maturity. It is reported that characterization of the intricate process of maturity and ripening poses a challenge to farmers and scientists (Zhang and McCarthy, 2012). However, incidence of pests and disease, drought and fruit abortion may result in early or delayed drying of stalks. Therefore, drying of stalks should not be used as a single indicator of maturity but rather be complemented with colour, sound and other physico-chemical and nutritional parameters like pH, moisture content, total soluble solids, total titrable acidity and protein content to corroborate results, especially if the fruits and vegetables are destined for foreign markets. However, for local consumption and markets, the farmers can use non-destructive indicators such as drying of stalks, colour and size as maturity indicators.

Shortcomings of the reported maturity indicators

About 53% of the respondents felt the maturity indicators they use are inaccurate, affected by pest and disease infestation (40%, N=102), weather (5.8%) and soil (1.4%) conditions (Figure 2). Indeed there is a debate regarding effectiveness of some of the maturity indicators enlisted by this study. For example Zhang and McCarthy (2012) recognize outer color as an index for maturity of tomato fruit but consider it unreliable for a mixture of cultivars.

External color may vary between cultivars despite the cultivars falling within the same maturity stage (Molyneux et al., 2004). Some farmers and traders with visual impairments may not find colour an appropriate maturity indicator. In addition, there may be dismal variations in some colours for example there a slight difference between breaker and turning tomatoes that many not easily be detected without the aid of colour charts.

However, reports by Dadzie and Orchard (1997), Carvalho et al. (2005) and Caron et al. (2013) strongly support external color as noninvasive and nondestructive indicator that correlates with internal carotenoid synthesis and thus can be used to assess fruit and vegetable maturity in the farms, inspection points and markets. The findings from the current and previous studies, therefore, support farmer- and trader-led design of customized colour charts for assessing the maturation and ripening of fruits and vegetables in Uganda.

As indicated in Figure 2, pest and disease infestation, weather and soil conditions can influence the maturity of a fruit or vegetable. According to Dadzie and Orchard (1997), invasion by pathogens may trigger a breakdown of plant or fruit tissue thus affecting its size, colour, and firmness. This can significantly alter fruit and vegetable maturity trend. Even then, there are physiological disorders that can develop largely in response to an adverse environment especially; unsuitable temperatures or nutritionally deficiency soils during growth and development (Wills et al., 1989). Most physiological disorders affect discrete areas of plant tissue. Some disorders may affect the skin of the fruit but may leave the underlying flesh intact; others affect only certain areas of the flesh or the cortical region (Wills et al., 1989).

According to New and Marriott (1974), immature drying of flower stalks and fruit drop can be associated with rapid ripening precipitated by prolonged drought in the farm or too high temperatures in the ripening room. These scenarios do not only justify the challenges faced by the famers and traders in predicting optimal time of harvest but also provide a basis for fruit and vegetable

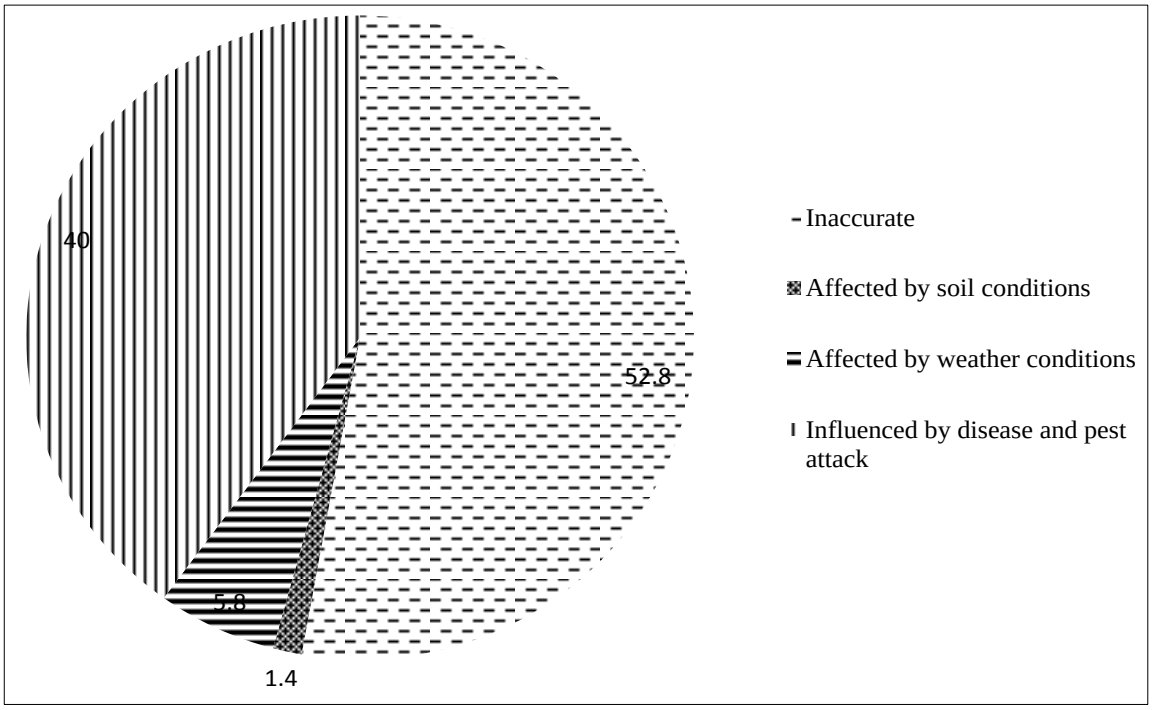

Figure 2. Shortcomings of the maturity indicators used by fruit and vegetable farmers and traders (N=102).

breeders to screen new hybrids for susceptibility to these major physiological disorders prior to dissemination and wide scale adoption by the farmers in Uganda.

CONCLUSION AND RECOMMENDATIONS

This study shows that passion fruit, watermelon, pineapple, sweet banana and guava were the most preferred fruits while tomato, cabbage, eggplant, pumpkin and amaranths were highly ranked among vegetables during the focused group discussions (Table 1). There is, therefore, need to undertake propagation trial in order to develop fast maturing varieties and cultivars of the preferred fruits and vegetables. In addition, horticultural extension programmes, value addition, proper marketing of products and access to proper market information are required to sustain the fruit and vegetable production in Uganda.

In addition 99% of the 102 respondents (farmers, transporters and traders) were knowledgeable about maturity indicators for fruits and vegetables and thus have indigenous practices for assessing maturity. It was also established that respondents' age, gender, education level, marital status and household size influenced the use of indigenous knowledge in fruit and vegetable maturity assessment (Table 2).

The study findings further suggest that farmers, transporters and traders assess fruit and vegetable maturity by largely visual means (color, size, shape) and physical means (firmness, drying of stalks and leaves and sound). In particular, the maturity indicators used include colour for watermelon (10.5%, N=102), pineapple (100%), passion fruit (100%) and tomato (90%). Size is used as a maturity indicator for pumpkin, eggplant, cabbage and watermelon by 100, 85, 50 and 26% of the respondents, respectively (Table 3). These findings have elucidated a need to determine the optimal maturity indices for the priority fruits and vegetables and tools to detect their maturity.

More than half (53%) of the respondents perceived their traditional maturity assessment techniques to be inaccurate. Others thought the maturity indicators are influenced by fruit and vegetable pest and disease infestation (40%) and site weather (5.8%) and soil (1.4%) conditions (Figure 2). This provides an opportunity for the improvement of the maturity assessment techniques through further research and development of low cost maturity assessment tools. Moreover scientists and other rural development experts should build on the traditional knowledge of farmers, transporters and traders when designing maturity assessment tools if meaningful contribution is to be realized towards reduced pre-and postharvest losses and increased incomes from fruit and vegetable farms.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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