

# ASSESSMENT OF CASSAVA DIVERSITY IN UGANDA USING SSR MARKERS

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## **Abstract:**

The genetic diversity and differentiation of 272 cassava landrace accessions collected in Uganda is assessed in this study. In addition to this, 20 Tanzanian material was included from a previous study of diversity in Tanzania, 20 material from the Ghanaian germplasm bank, 20 material from Guatemala and 18 from holdings at CIAT and IITA to represent the core collection from Latin America. All together 9 groups or samples, based on country of origin, were created to study genetic diversity and differentiation within each country and among countries. Using simple sequence repeat (SSR) markers, variation in allele frequency at many unlinked loci was used to estimate the parameters of genetic diversity and differentiation, and to estimate the strengths of various forces shaping them. SSR data was analyzed by GENSURVEY (Vekemans & Lefebvre, 1997), FSTAT 2.9 (Goudet, 1995) and NTSYS-PC (Rohlf, 1993). Results affirm a genetic divergence between African and Latin American accessions. They also show a high genetic diversity and a low differentiation in the Ugandan accession. There is a substantial role played by the cassava mosaic disease (CMD) on cassava genetic constitution in respective districts.

## **Introduction:**

Cassava (*Manihot esculenta*) is an allogamous and vegetatively propagated, neotropical crop that is also widely grown in tropical Africa and south east Asia. Sub Saharan Africa alone produces over 50% of the world's production, predominantly grown by small-scale farmers (Dixon et al, 1998). Cassava is grown mainly for its starchy roots and the leaves and forms a staple by an estimated 14 million people in Uganda (Bua, pers.comm, 2001). Cassava was introduced into Uganda after 1850 by Europeans and Arabs who were pushing into the interior from the coast of East Africa as a valuable safeguard against frequent hungry periods and famines which impeded trade and economic development along the trade routes (Langlands, 1970; Jones, 1959). Because of its excellent adaptability to erratic rainfall and low fertility soils, it became a major dietary staple, a famine reserve crop and a source of cash to many small-scale farming communities.

Cassava is probably thought to have originated in wild *Manihot esculenta* populations growing along the southern rim of the Amazon Basin in Brazil (Olsen & Schaal, 1999), many founder effects should have occurred, with the concomitant result of reduced diversity and increased genetic differentiation. For cassava, being mainly a vegetatively propagated crop, a further reduction in genetic diversity is likely over time due to

accumulation of systemic pathogens and the spread of a few, vigorous, well-adapted landraces. For instance the cassava mosaic disease (CMD) epidemic in Uganda in the late 80's and early 90's. In a survey carried out in 2000 in Mukono, Soroti and Apac districts in Uganda, the impact of the CMD epidemic on cassava diversity composition was clearly seen via the loss of previously well-known varieties.

However, the traditional farming system of slash and burn followed by 3-15 years of fallow practiced by farmers in Tanzania and the allogamous nature of cassava produces a large pool of volunteer seedlings that natural and human selection acts on to produce new varieties which maintains a high diversity (Fregene et al, 2003). In the mentioned survey in 2000, it was also observed that additional genetic variability had arisen from the use of volunteer seedlings by some farmers in Mukono district. In view of the outcrossing and highly heterogeneous nature of cassava differentiating phenotypic distinctiveness of varieties gets more complicated due to gene flow between varieties by hybridisation. Gene flow generates new polymorphism in the populations and increases effective population size thereby opposing random genetic drift, generating new gene combinations on which selection can potentially act (Balloux et al, 2002).

In Uganda identification and collection of cassava germplasm has predominantly relied on vegetative characteristics. The collections are maintained in the field in a continuous vegetative phase by cyclic pruning or periodic renewal of the entire collection every 2-4 years. In traditional farming systems, the concept of a variety can encompass very diverse genetic entities. Traditional naming and classification systems are often based on traits that are perceived subjectively in so doing it is not uncommon to find confusion between varieties or use of different names for the same cultivar (Elias et al.2001).

Determining the relationship between the basic units in a traditional classification system on the one hand and the genetic variability in the traditional farming systems in Uganda on the other hand is thus essential to conservation of genetic resources. Defining the genetic entities is crucial in breeding to identify and/or develop new cassava varieties to

be used as targets for efforts in producing high yielding varieties that meet the demands of farmers and consumers.

Using neutral genetic markers, gene genealogies can be used to assess relationships among alleles in populations. Insights into processes such as selection, fluctuation in population size, and population substructuring that affect the geographical and genealogical relationships among these alleles can be provided. In this study, using SSR markers, variation in allele frequency at many unlinked loci is the preferred way to assess genetic diversity and differentiation, and to estimate the strengths of various forces shaping them. In cassava, SSR markers have been used to search for duplicates in the CIAT core collection (Chavarriaga-Aguirre et al, 1999) and to analyze variation in natural populations of putative progenitors of cassava (Olsen and Schaal, 2001). A study of 67 unlinked loci, microsatellite loci from cassava landraces across three continents of Latin America, Asia and Africa have also been carried out to shed more light on the dynamics of genetic diversity and differentiation (Fregene et al, 2003). We assessed the genetic diversity and differentiation based on SSR markers of landraces from all over Uganda and a small subsection from Latin America and other African countries. The objectives of this study were to: assess the genetic diversity and differentiation of cultivars within and between different agro ecological zones in Uganda; also to determine how the Uganda cassava diversity compares with the total genetic diversity of species within Africa and the cassava collection maintained at CIAT. Genetic diversity is the key to progress in breeding and differentiation can serve as a tool to delineate heterotic pools. High levels of genetic differentiation, potentially representing heterotic pools, have been described for maize (Shull, 1952; Tomes, 1998) and robusta coffee (Leroy et al, 1993). Reliable estimates of population differentiation are crucial to understand the connectivity among populations and represent important tools to develop conservation strategies (Balloux et al, 2002) of cassava in Uganda.

## **Materials and methods**

### **Plant materials:**

The collection started in September through to December 2002 and covered 17 districts that lie between latitudes N02° 12<sup>1</sup> and S 00° 44<sup>1</sup>, longitudes E029° 56<sup>1</sup> and E034° 21<sup>1</sup>, and altitudes of 4451ft and 2177ft above sea level. Cassava is relatively recently introduced in Uganda. It is thought to have spread from Buganda to northwest (Bunyoro) around 1870, to the east in the early 19<sup>th</sup> century and to the north even later (Langlands, 1966). Cassava generally had an extremely limited distribution in Uganda in 1900 (Langlands, 1966). There are many biotic stresses cassava in Uganda has undergone since then the major of which is ACMVD in the late 1920s and later in the 1980s. Hence the forces affecting genetic differentiation in Uganda in the last century since its introduction can be assessed here.

Three of four or five counties in each district were selected at random and mature fields (5 months and above) were selected every 7-10 km along the roads that traversed each of the counties. In each farmer's field the different varieties were identified according to their morphological characteristics as well as by the name given by the farmer. Where no single variety dominated plants of the co-dominant varieties were sampled, labelled to be planted and maintained in NAARI. A total of 221 accessions were collected. A summary of the plant materials and their source can be viewed in appendix 1.

Studies have been done to assess the genetic diversity and differentiation of cassava landraces from primary and African centers of diversity using 67 marker loci (Fregene, 2003). Based on this work 22 Nigerian landraces from both the international collection at the International Institute of Tropical Agriculture (IITA) and improved genotypes from the Institute's cassava breeding programme or the 1950s breeding efforts at the Moor Plantation Experiment Station, Ibadan, Nigeria were included. One genotype 58308, has been used extensively as donor parent for resistance to CMD in the IITA program. In addition to this, 20 Tanzanian material was included from a previous study of diversity in Tanzania, 20 material from the Ghanaian germplasm bank, 20 material from Guatemala and 18 from holdings at CIAT and IITA. 9 groups or samples, based on country of origin,

were created to study genetic diversity and differentiation within each country and among countries. In all, 350 accessions were used with 272 coming from Ugandan farmers.

### **Simple Sequence Marker Analysis**

DNA isolation was carried out from young leaf tissue harvested by CTAB method (Doyle & Doyle, 1987) at Med Biotech Laboratories, Kampala. A subset of 36 SSR markers with high polymorphism information content (PIC) was selected from 67 markers developed at CIAT (Fregene et al, 2003). In that study it was shown that the PIC does not increase appreciatively after 36 markers. The 36 markers were also chosen to represent a wide coverage of the genome. PCR was carried out using 10ng of DNA per reaction. The PCR product was denatured and electrophoresed on 6% polyacrylamide gels using Bio-Rad sequencing apparatus. Silver staining was done as described for these SSR markers (Mba et al, 2002). Allele sizes were then determined using computer software 'quantity One' (Bio-Rad Inc.) based upon an internal gel molecular marker size standard and exported to Microsoft Excel (Microsoft Inc) for further formatting as input files for statistical analysis. A strictly diallelic model of inheritance was adhered to hence markers with three or more alleles were eliminated. Parameters of genetic diversity and differentiation were then calculated from allele data using the computer packages GENSURVEY (Vekemans & Lefebvre,1997),FSTAT 2.9 (Goudet, 1995) and NTSYS-PC(Rohlf, 1993).

### **Results**

Data assessed on 250 accessions of cassava landraces using a total of 35 of 36 SSR loci, one eliminated for being monomorphic, was used to provide estimates for the genetic diversity and differentiation between country and within districts of Uganda.

Between countries, the landraces were grouped into 8 samples according to country of origin, Guatemala having two groups as observed in a previous diversity study (Fregene et al 2003). Within districts there were 18 groups represented. The number of alleles observed at each locus in the data set ranged from 2 to 12 alleles per locus (see fig.1) over the 35 loci. Genetic diversity parameters were calculated from SSR data within and

between country samples (table 1) and within districts in Uganda (table 2) samples. Standard deviations (SD) were estimated by jackknifing over loci (200 replications). The average gene diversity,  $H_e$ , that estimates the probability that two randomly selected alleles in a given accession are different was more than half and comparable for between Uganda districts and for between country at  $0.5320 \pm 0.0445$  and  $0.5649 \pm 0.0698$  respectively. On the whole the least values for average gene diversity were observed in Lira and Luweero districts while Kasese stands out with the highest value of 0.6208. This affirms earlier findings of higher varietal diversity in the western and southwestern districts of Uganda as opposed to those in the eastern districts (Otim-Nape et al, 2001). It is worth noting that these values are lowest for the districts that were worst hit by CMD. The average proportion of observed heterozygous individuals ( $H_o$ ) between countries was  $0.5423 \pm 0.0285$  while Uganda alone had 0.5530. This continues to affirm out crossing and highly heterogeneous nature of cassava. However, only 1% ( $G_{st}=0.0192 \pm 0.0511$ ) of within district in Uganda was due to differentiation. On the other hand, 10% ( $G_{st}=0.1078+0.0502$ ) of the overall heterozygosity ( $H_t=0.6305 \pm 0.1696$ ) in all the country accessions could be attributed to differentiation among the samples from both Africa and Latin America.

Genetic differentiation averaged over all loci estimated by  $F_{st}$  (theta) was  $0.103 \pm 0.009$  (jackknifing) and  $0.082 \pm 0.126$  calculated by bootstrapping at 99% confidence interval (data not shown). This concurs with previous diversity studies in Tanzania hence confirming low differentiation between country samples as observed with  $G_{st}$  (Fregene et al, 2003). Pair wise calculations of  $F_{st}$  (theta) over all loci between pairs of country landraces and Uganda also showed there was lower differentiation between African countries compared with Latin American countries (Fregene et al, 2003), the lowest being with Ghana (0.039) and the highest being with Guatemala group one (0.2475). The dendrogram of landraces for UPGMA of pair wise  $F_{st}$  estimates had an outcome that also separates the African from Neotropical accessions with Guatemala separating in the two groups (Fig.2).

Genetic distance between all pairs of individual Uganda accessions was calculated by the 1- proportion of shared alleles (1-PSA) and presented graphically by a principle coordinate analysis (Fig. 3a). It showed that the Ugandan cassava is least related to the Neotropical. The PC1 and PC2 accounted for about 40% and 10% of the total variance respectively. The PCA for the Ugandan accessions (Fig.3b) showed clustering of the landraces in two groups with no observable difference between districts except Nakasongola. A similar substructure has been reported for earlier studies for Ghana, Tanzania and Nigeria. This feature in the African landrace collections is yet to be explained. The representation of cassava germplasm in the two groups from most of the other districts could probably be due to extensive movement of planting material which started with the mosaic epidemic as collective efforts were made in a bid to avert the shortage of planting material (Otim-Nape 2001, Otim-Nape,1997).

## **Discussion**

The relatively high level of genetic diversity observed on the whole in this study is unexpected considering Uganda has reported two major cassava mosaic disease (CMD) epidemics before (Martin, 1928). The most recent CMD epidemic being in the last 10-15 years, since 1988, affected drastically the cassava varietal composition and saw a decrease in area planted to cassava at its peak between 1990-1994 (Otim-Nape et al, 2001). This finding continues to demonstrate the fact of active involvement of Ugandan farmers in continuous testing and the adaptation of new planting materials to their situations and their need to keep genetic variation. The results notably confirm the role of CMD as one of the major factors in selection force on the Uganda cassava genetic constitution with respect to districts of Uganda. It has been shown that the pattern of genetic divergence of an introduced species is usually non-random and strongly correlated to the environment (Clegg and Allard, 1972). It would be interesting to screen for the introgression of CMD resistance from the wild *Manihot glaziovii* in this cassava collection from earlier efforts in combating the disease in the 1920s and 30s (Jameson, 1964) and lately from Nigerian landraces (Fregene et al, 2003). It would also be

important to find out how much overall spontaneous recombination and farmer selection is going on in Uganda.

The other fundamental finding in this study is the continued clustering of Neotropical and African landraces according to region of origin as has been found in a previous cassava diversity study (Fregene et al, 2003). The African cassava accessions also appear to be structured in response to selection for adaptation to unique aspects of African agroecologies (Fresco, 1986; Nweke, 1994). The underlying factors behind the small differentiation between the Uganda (East Africa) and Ghana (West Africa) accessions however remains to be understood. Uganda being an inland country may have had its founding population from both the East and west coasts of Africa. More insight into this would be obtained from an assessment of cassava diversity in the Democratic Republic of Congo to the west or the Sudan to the north of Uganda.

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**Table 1:** Genetic diversity within groups of cassava landraces classified according to country of origin. Standard deviations (SD) were estimated by jackknifing over loci (200 replications).  $H_t$ ,  $H_s$ ,  $D_{st}$ , and  $G_{st}$ <sup>a</sup> are given over loci and over groups (country populations).

Population	Sample Size	No. of loci	No. of pol. Loci <sup>b</sup>	Percent Of pol <sup>b</sup> . loci	Mean no. Alleles /locus	Mean no. alleles/ pol <sup>b</sup> .locus	$H_o^c$	$H_e^d$	$H_{e-p}^e$
UGANDA	198	35	33	94.3	5.2	5.4	0.5530	0.5454	0.5468
COLOMBIA	5	35	33	94.3	3.3	3.4	0.5081	0.5363	0.5963
BRASIL	3	34	33	97.1	2.8	2.8	0.5735	0.5069	0.6304
PERU	3	35	33	94.3	2.7	2.8	0.5810	0.5218	0.6619
GUATEMALA1	7	35	33	94.3	2.5	2.6	0.5290	0.3908	0.4219
GUATEMALA2	11	35	34	97.1	3.8	3.9	0.5274	0.5640	0.5906
TANZANIA	19	35	32	91.4	3.9	4.1	0.5658	0.5386	0.5536
NIGERIA	20	35	33	94.3	3.9	4.0	0.5002	0.5002	0.5131
GHANA	19	35	33	94.3	4.2	4.4	0.5429	0.5542	0.5694
Mean				94.59	3.59	3.71	0.5423	0.5176	0.5649
Std				1.70	0.86	0.89	0.0285	0.0519	0.0698

	$H_t$	$H_s$	$D_{st}$	$G_{st}$
Mean	0.6305	0.5635	0.0670	0.1078
Std	0.1696	0.1606	0.0332	0.0502
95%CI	0.5713	0.5083	0.0566	0.0916
99%CI	0.6827	0.6135	0.0767	0.1235

<sup>a</sup>  $H_t$ = total heterozygosity in the entire data set;  $H_s$ = heterozygosity within country averaged over the entire data set;  $D_{st}$ = average gene diversity between populations;  $G_{st}$ = coefficient of gene differentiation.

<sup>b</sup> pol. =polymorphic

<sup>c</sup>H<sub>o</sub>= average observed heterozygosity within country

<sup>d</sup>H<sub>e</sub>= average expected heterozygosity within country

<sup>e</sup>H<sub>e-p</sub>= average expected heterozygosity within country corrected for small sample sizes (Nei, 1978)

**Table 2:** Genetic diversity within groups of cassava landraces classified according to district of origin in Uganda. H<sub>t</sub>, H<sub>s</sub>, D<sub>st</sub>, and G<sub>st</sub><sup>a</sup> are given over loci and over groups (district populations).

Population	Sample Size	No.of loci	No.of pol. Loci <sup>c</sup>	Percent Of pol <sup>c</sup> loci	Mean no. Alleles /locus	Mean no. alleles/ pol <sup>c</sup> .locus	H <sub>o</sub> <sup>d</sup>	H <sub>e</sub> <sup>e</sup>	H <sub>e-p</sub> <sup>f</sup>
APAC	6	35	30	85.7	2.8	3.1	0.5267	0.4410	0.4842
LIRA	5	35	28	80.0	2.5	2.8	0.5833	0.4011	0.4483
BUSHENYI	9	35	33	94.3	3.5	3.6	0.5838	0.5306	0.5633
KIBAALE	24	35	31	88.6	4.1	4.4	0.5697	0.5120	0.5235
HOIMA	7	35	33	94.3	3.6	3.8	0.4648	0.5470	0.5867
MPIGI	2	35	27	77.1	2.1	2.4	0.6000	0.3893	0.5476
MUBENDE	18	35	33	94.3	3.7	3.8	0.5423	0.5183	0.5335
MUKONO	23	35	31	88.6	3.7	4.0	0.5271	0.5078	0.5191
LUWEERO	4	35	29	82.9	2.4	2.7	0.4852	0.4219	0.4829
MASAKA	19	35	31	88.6	3.7	3.9	0.5716	0.5169	0.5311
KAMULI	8	35	33	94.3	3.6	3.7	0.5762	0.5084	0.5419
MASINDI	29	35	33	94.3	3.9	4.1	0.5438	0.5318	0.5412
NAKASONGOLA	5	35	30	85.7	2.6	2.9	0.5010	0.4064	0.4522
KASESE	7	35	34	97.1	3.7	3.8	0.6227	0.5740	0.6208
SIRONKO	6	35	31	88.6	3.1	3.4	0.5596	0.5082	0.5522
RAKAI	21	35	33	94.3	4.1	4.2	0.5654	0.5472	0.5606
SOROTI	2	35	27	77.1	2.1	2.4	0.5571	0.4000	0.5714
KABERAMAIDO	1	33	17	51.5	1.5	2.0	0.5152	0.2576	0.5152
mean				86.51	3.14	3.39	0.5498	0.4733	0.5320
std				10.71	0.78	0.71	0.0407	0.0801	0.0445

	H <sub>t</sub>	H <sub>s</sub>	D <sub>st</sub>	G <sub>st</sub>
Mean	0.5589	0.5454	0.0135	0.0192
Std	0.1952	0.1913	0.0220	0.0511
95% CI	0.4951	0.4840	0.0071	0.0010

<sup>a</sup>  $H_t$ = total heterozygosity in the entire data set;  $H_s$ = heterozygosity within country averaged over the entire data set;  $D_{st}$ = average gene diversity between populations;  $G_{st}$ = coefficient of gene differentiation.

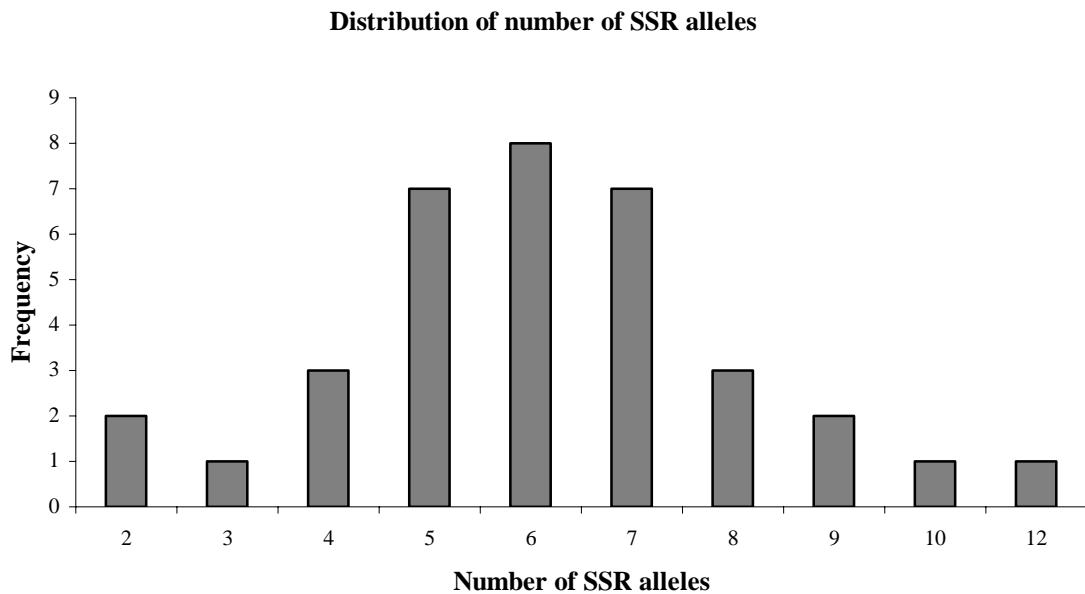
<sup>b</sup> pol. =polymorphic

<sup>c</sup> $H_o$ = average observed heterozygosity within country

<sup>d</sup> $H_e$ = average expected heterozygosity within country

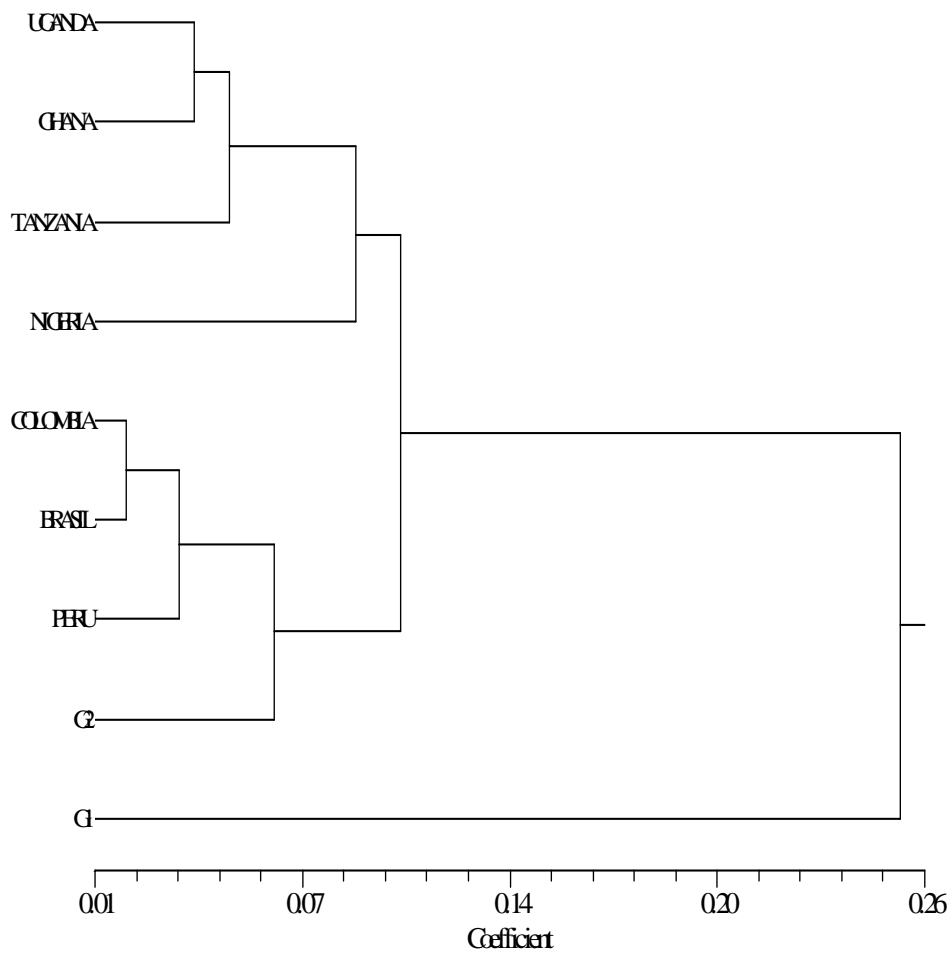
<sup>e</sup> $H_{e-p}$ = average expected heterozygosity within country corrected for small sample sizes (Nei, 1978)

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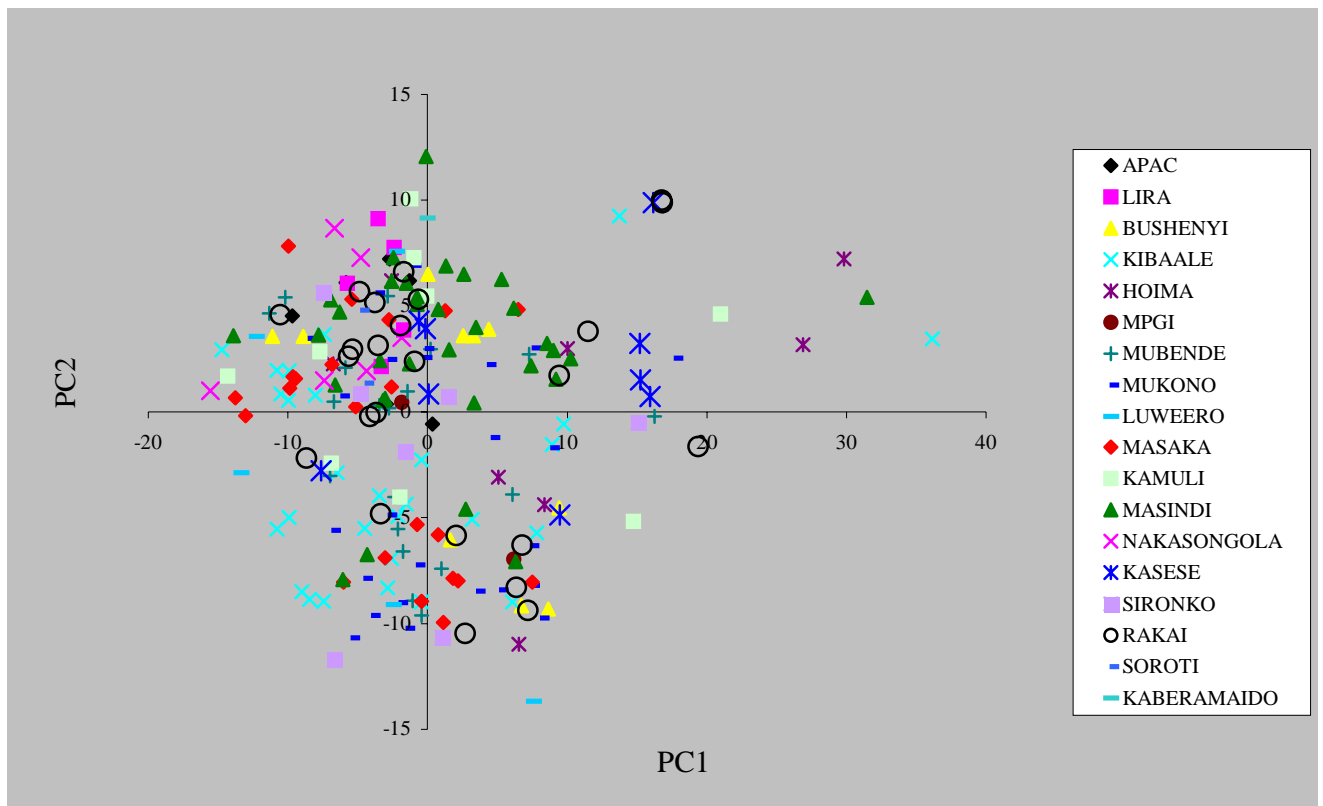


**Figure 1.** Number of simple sequence repeat (SSR) alleles per locus and their frequency in cassava landraces from Uganda, Nigeria, Tanzania, Ghana and selected Latin American countries.

**Figure 2.** Unweighted pair group method with arithmetic averaging (UPGMA) dendrogram of the pairwise fixation index (Fst) between cassava landraces, grouped by country and by source.



**Figure 3.** PCA of Genetic Distance (1-PSA) of landraces within the different districts in Uganda







**APPENDIX 1:** Source data for the Uganda cassava accessions

IDENTITY	DISTRICT	COUNTY	SUBCOUNTY	PARISH	VILLAGE	NAME OF FARMER	LATD	LATM	LATH	LOND	LONM	LONH	ELEVATION(ft)
44. Mukono	Mubende	Mityana	Busimbi	Busimbi	Kikukmambogo LC1	F.5 Nanyonga Noerina	0	23	N	32	4	E	4318
45. Kitenge	Kasese	Bukonjo	Kyondo	Kanyatsi	Kaghorwe	F.4.---	0	1	N	29	56	E	3383
46. kikoola	Mubende	Kassanda	Kassanda		Jjemba	F.8 Mrs. Sharifa Muwonge	0	31	N	31	47	E	4167
47. Kabundaire I	Kasese	Bukonjo East	Lake Katwe	Kabirizi	Rwentutu	F.1 Mr. Johnson	0	1	N	29	56	E	3383
48. Unknown 9	Rakai	Kyotera	Kasaali	Nkenge	Biwerere	F.8:Kitandwe Alamanzan	0	36	S	31	3	E	4524
49. Unknown 30	Kibaale	Muhorro	Kagadi	kagadi	Nyamiti	F.5. Ms. Aino	0	57	N	30	47	E	4494
50. Munyamunyu	Kasese	Bukonjo East	Lake Katwe	Kabirizi	Rwentutu	F.1 Mr. Johnson	0	1	N	29	56	E	3383
51. Njule	Rakai	Kyotera	Kasaali	Nkenge	Biwerere	F.8:Kitandwe Alamanzan	0	36	S	31	3	E	4524
52. Rugogoma	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F.2. Maria Nakabugo	0	54	N	30	45	E	4584
53. Unknown 10	Rakai	Kyotera	Kirumba		Nabigasa LC1	F.9: Charles Nganda	0	34	S	31	29	E	4622
54. Kayinja	Kibaale	Buyanja	Mugarama		Nyamarunda	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
55. Kabuli	Mubende	Kassanda	Kassanda		Jjemba	F10. Alice Namono	0	31	N	31	47	E	4162
57. Unknown 6	Rakai	Kakuuto	Kasasa		Bubango	F.6: Vincencio Ssebugwawo	0	47	S	31	30	E	4278
58. Ngayisihira	Kasese	Bukonjo	Kyarumba	Kabirizi	Kanabusogha	F.3. Muhendo Eunia	0	7	N	29	58	E	3448
59. Unknown 44	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	27	N	31	55	E	3973
60. Nvubu	Rakai	Kakuuto	Kasasa		Bubango	F.6: Vincencio Ssebugwawo	0	47	S	31	3	E	4278
61. Unknown 13	Rakai	Kakuuto	Mukungwe	Bulayi	Mukungwe	F.1. Mrs. Ndawula	0	20	S	31	46	E	4160
62. Unknown 29	Kibaale	Muhorro	Kagadi	Nyamiti	Butumba A LC1	F.4. Mr. Irumba	0	57	N	30	47	E	4494
63. Unknown 15	Masaka	Bukoto East	Mukungwe		Kalagala	F.6. Yiga Misaala	0	20	S	31	52	E	4029
64. Nyakabibi	Kasese	Bukonjo	Munkunyu	Kitsutsu	Kitsutsu II	F.5. Eric Mutsangye	0	3	N	29	50	E	4416
65. Kabundaire II	Kasese	Bukonjo	Kyarumba	Kabirizi	Kanabusogha	F.3. Muhendo Eunia	0	7	N	29	58	E	3448
66. Mafumu	Masaka	Bokoto East	Mukungwe	Katwadde	Luvule	F.3.Ms. Kizza Taatu	0	7	S	31	50	E	4013
67. Mpologoma I	Rakai	Kyotera	Kirumba		Nabigasa LC1	F.9: Charles Nganda	0	34	S	31	29	E	4622
69. Unknown 4	Rakai	Kakuuto	Kifamba	Kabala		F.4: Hosea Sentalo	0	48	S	31	25	E	4308
70. Muva Ssesse	Masaka	Bukoto East	Mukungwe	Bulayi	Mukungwe	F2. Ms. Josephine Nalwoga	0	20	S	31	46	E	4160
71. Bukumbula	Masaka	Bukoto East	Mukungwe	Katwadde	Kayugi	F.5. Ms. Nalubowa	0	19	S	31	52	E	4023
72. Unknown 46	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	27	N	31	55	E	3973
73. Kiboga	Kibaale	Muhorro	Kagadi	Nyamiti	Muhorro	F.3. Mary Nalubega	0	55	N	30	46	E	4498
74. Unknown 8	Rakai	Kyotera	Kasaali	Nkenge	Biwerere	F.8:Kitandwe Alamanzan	0	36	S	31	30	E	4524

75. New Bukalasa	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F1. Josephat Rubani	0	54	N	30	45	E	4583
76. Unknown 11	Rakai	Kyotera	Kirumba		Nabigasa LC1	F.9: Charles Nganda	0	34	S	31	29	E	4622
77. Kanyali	Kibaale	Kagadi	Kagadi		Kiryani	F.12. Hamisi Bikwasiroha	0	5	N	30	50	E	4031
78. Unknown 12	Rakai	Kyotera	Kirumba		Kito	F10. Mukyala Rose	0	30	S	31	30	E	4662
79. Manyi ga balimi	Rakai	Kakuuto	Kifamba		Nyanga	F.5: Masitula Nanyuma	0	47	S	31	27	E	4304
80. Unknown 28	Kasese	Bukonjo	Munkunyu	Kitsutsu	Kitsutsu II	F.5. Eric Mutsangye	0	3	N	29	50	E	4416
81. Nyakeera	Kibaale	Muhorro	Kagadi	Nyamiti	Nyabubaare	F.5. Ms. Aino	0	57	N	30	47	E	4494
82. Nyakunyaku I	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F.2. Maria Nakabugo	0	54	N	30	45	E	4583
83. Sembati	Kasese	Bukonjo East	Lake Katwe	Kabirizi	Rwentutu	F.1 Mr. Johnson	0	1	N	29	56	E	3383
84. Tanzania	Kibaale	Muhorro	Kagadi	Nyamiti	Muhorro	F.3. Mary Nalubega	0	55	N	30	46	E	4498
85. Unknown 14	Masaka	Bukoto East	Mukungwe		Bulayi	F.1.Mrs.Ndawula	0	20	S	31	46	E	4160
86. Matooke	Kibaale	Buyanja	Mugarama	Nyamarunda	Kateete	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
87. Mikidadi Buteeraba	Rakai	Kakuuto	Kifamba		Nyanga	F.5: Masitula Nanyuma	0	47	S	31	27	E	4304
88. Gwaranda	Kibaale	Buyanja	Mugarama	Nyamarunda	Kateete	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
89. Kidimo	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F.2. Maria Nakabugo	0	54	N	30	45	E	4583
90. Bukalasa omukadde	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F1. Josephat Rubani	0	54	N	30	45	E	4583
91. Kakiru	Kasese	Bukonjo	Munkunyu	Kitsutsu	Kitsutsu II	F.5. Eric Mutsangye	0	3	N	29	50	E	4416
92. Unknown 31	Kibaale	Buyanja	Mugarama	Nyamarunda	Kateete	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
93. Unknown 48	Mubende	Kassanda	Kassanda		Jjemba	F.8 Mrs. Sharifa Muwonge	0	31	N	31	47	E	4167
54. Kayinja	Kibaale	Buyanja	Mugarama	Nyamarunda	Kateete	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
95. Kirabba	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F.2. Maria Nakabugo	0	54	N	30	45	E	4583
96. Unknown 109	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	46	E	3886
97. forest Kyampisi	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	46	E	3886
98. Unknown 91	Sironko	Budadiri	Bumasifa	Bulwala	Lulangasa	F.6 Francis Mafabi	1	10	N	34	22	E	4451
99. Unknown 115	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	46	E	3886
100. Kabwa	Mukono	Kyaggwe	Nakisunga	Kyabalogo	Nakisunga	F.6 Rachel Nabawanuka	0	17	N	32	48	E	3955
101. Unknown120	Mukono	Kyampisi	Bulijjo		Kitanda	F.5 Hajji Swaliki	0	29	N	32	45	E	3930
102. Unknown 97	Lira	Kyoga	Muntu	Amolartar	Orimai	F.2 Jonas Epia	1	38	N	32	51	E	3534
103. Njule omweru	Mukono	Kyaggwe	Ntenjeru	Ntanzi	Ntanzi	F.7 Walusimbi George	0	13	N	32	49	E	4050
104. Unknown 114	Mukono	Kyampisi	Bulijjo		Kitanda	F.3 Nsubuga	0	29	N	32	45	E	3947
105. Opio- opio	Apac	Kwania	Abongomola	Abany	Awei	F.3 Richard Atine	2	0	N	32	47	E	3538
106. Nyasenge	Hoima	Kigoroby	Kapapi	Nyanseko	siiba	F.24. Oliver B.Nyansonga						E	

107. Unknown 104	Masindi	Kibanda	Kiryandongo	Kikuube	Kalangala	F.4. Oloya Esther	1	53	N	32	5	E	3570
108. Unknown 63	Hoima	Kitoba	Bugahya	Kiragura	Dwoli	F.22 Yoramu Byeitima	1	31	N	31	21	E	3817
109. Alwaa	Kabera	Kalaki	Kalaki		Kalobo	F.1 Rev. Ewenu	1	51	N	33	24	E	3498
110. Kyankwanzi	Apac	Kwania	Abongomola	Abany	Awei	F.1 Abili James	2	0	N	32	47	E	3538
111. Nyaraboke short	Apac	Maruzi	Ibuje	Aganga	Aganga	F.5 Otim Geoffrey	1	46	N	32	13	E	3530
112. Unknown 99	Masindi	Kibanda	Kiryandongo		Kikuube	F.2. Edison Kisembo	1	52	N	32	3	E	3626
113. Nyadhiang	Apac	Maruzi	Ibuje	Aganga	Aganga	F.5 Otim Geoffrey	1	46	N	32	13	E	3530
114. Njule	Mukono	Kyampisi	Bulijjo		Kitanda	F.2 Mwasanje Kizito	0	29	N	32	45	E	3929
115. Unknown 118	Mukono	Kyampisi	Bulijjo		Kitanda	F.4 Kijambu Ponsiano	0	29	N	32	45	E	3958
116. Elogilog	Soroti	Kasilo	Bugondo	Kamodo	Otimo	F.1 Aswaro Lucy	1	33	N	33	23	E	3595
117. Unknown 121	Mukono	Kyampisi	Bulijjo		Kitanda	F.5 Hajji Swalik	0	29	N	32	45	E	3930
118. Unknown 87	Kamuli	Budiope	Ndolwa	Wesunire	Kalwaala	F.3 Balye Namagaya	1	14	N	33	3	E	3517
119. Kibira	Kamuli	Bugabula	Balawoli	Balawoli	Namayira	F.2. A. V. Kubirima	1	2	N	33	5	E	3737
120. Egabu	Soroti	Kasilo	Bugondo	Kamodo	Otimo	F.1 Aswaro Lucy	1	33	N	33	23	E	3595
121. Nganyi	Lira	Kyoga	Muntu	Amolartar	Orimai	F.2 Jonas Epia	1	39	N	32	51	E	3534
122. Naiboke	Mukono	Kyampisi	Bulijjo		Kitanda	F.3 Nsubuga	0	29	N	32	45	E	3947
123. Okonyo la dak	Masindi	Kibanda	Kiryandongo	Kikuube	Kalangala	F.4. Oloya Esther	1	53	N	32	5	E	3570
124. Socadido	Soroti	Gweri	Dokolo		Abelet	F.2 Ecom Joseph	1	42	N	33	43	E	3578
125. Unknown 88	Kamuli	Budiope	Ndolwa	Wesunire	Kalwaala	F.3 Balye Namagaya	1	14	N	33	3	E	3517
126. Icil icil	Lira	Dokolo	Kangai	Akurolango	Ilong	F.3 Ekwang Jovan	1	46	N	33	5	E	3526
127. Unknown 24	Bushenyi	West Igara	Kyamuhunga		Gongo	F.5. Eva Kyokusimiire	0	25	S	30	7	E	3845
128. kayumba	Mpigi	Mawokota	Muduuma	Muduuma	Buyala	F.1 Kalanzi George	0	19	N	32	24	E	3901
129. Tima-tima	Masindi	Kibanda	Kiryandongo		Kikuube	F.2. Edison Kisembo	1	52	N	32	3	E	3626
130. Njule	Mukono	Kyaggwe	Nakisunga	Kyabalogo	Nakisunga	F.6 Rachel Nabawanuka	0	17	N	32	48	E	3955
131. Unknown 127	Mukono	Kyaggwe	Ntenjeru	Ntanzi	Ntanzi	F.7 Walusimbi George	0	13	N	32	49	E	4053
132. Nyakabiriti	Masindi	Biiso	biiso		Busingiro	F.27 Dolica Kanyinga						E	
133. Matooke	Mukono	Kyaggwe	Ntenjeru	Ntanzi	Ntanzi	F.7 Walusimbi George	0	13	N	32	49	E	4045
134. Unknown 65	Hoima	Kitoba	Bugahya	Kiragura	Dwoli	F.22 Yoramu Byeitima	1	31	N	31	21	E	3817
135. Unknown 60	Kibaale	Buhaguzi	Kabwoya	Gwanjula	Karama	F.16. Dr. Banana Jackson						E	
136. Unknown 113	Mukono	Kyampisi	Bulijjo		Kitanda	F.2 Mwasanje Kizito	0	29	N	32	45	E	3929
137. Unknown 85	Kamuli	Bugabula	Balawoli	Balawoli	Namayira	F.2. A. V. Kubirima	1	2	N	33	5	E	3737
138. Unknown 103	Masindi	Kibanda	Kiryandongo	Kikuube	KikuubePri. Sch.	F.3. Alimundu Nehemia	1	53	N	32	4	E	3584

139. Kakoote	Sironko	Budadiri	Buhugu	Bumatofu	Biwa	F.3 William Kisolo	1	12	N	34	19	E	3966
106. Nyasenge	Hoima	Kigoroby	Kapapi	Nyanseko	siiba	F.24. Oliver B.Nyansonga						E	
141. Mukalasa	Sironko	Budadiri	Busulani	Bugimunye	Namwege	F.5 Nape Ismail	1	9	N	34	21	E	4230
142. Unknown 90	Sironko	Budadiri	Busulani	Bugimunye	Namwege	F.4. Deo Makweta	1	9	N	34	21	E	4225
144. Unknown 107	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	45	E	3902
145. Unknown 116	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	45	E	3902
146. Fumbachai	Kamuli	Budiope	Buyende	Wesunire	kinambugo	F.5. Kinambugo	1	13	N	33	8	E	3582
147. Nakyanzi omumyufu	Mukono	Kyaggwe	Ntenjeru	Ntanz	Ntanz	F.7 Walusimbi George	0	13	N	32	49	E	4053
148. Unknown 125	Mukono	Kyaggwe	Ntenjeru	Ntanz	Ntanz	F.7 Walusimbi George	0	13	N	32	49	E	4050
149. Unknown 5	Rakai	Kakuuto	Kifamba	Kabala	Kabala	F.4: Hosea Sentalo	0	48	S	31	25	E	4308
150. Unknown 2	Rakai	Kooki	Byakabanda		Katerero A	F.3: Bwogi Eriabu	0	45	S	31	25	E	4327
151. Unknown 32	Masaka	Mawokota	Muduuma		Buyala	F.1 Kalanzi George	0	19	S	32	24	E	3901
152. Nyarowic	Masindi	Buliisa	Buliisa	Ngwedo	Kisomero	F.26 Kisomero	2	12	N	31	28	E	2177
153. Unknown 100	Masindi	Kibanda	Kiryandongo		Kikuube	F.2. Edison Kisembo	1	51	N	32	3	E	3626
154. Unknown 106	Masindi	Kibanda	Kiryandongo		Kikuube	F.5. Kabasinguzi Beatrice	1	52	N	32	4	E	3571
156. Unknown 98	Masindi	Kibanda	Masindi port		Kitukuza	F.1 Mzee Ogutu	1	41	N	32	5	E	3460
157. Unknown 96	Lira	Kyoga	Muntu	Amolartar	Orimai	F.2 Jonas Epia	1	37	N	32	51	E	3534
158. Teraka	Mukono	Kyampisi	Bulijjo		Kitanda	F.2 Mwasanje Kizito	0	29	N	32	45	E	3929
159. Nyamaga	Masindi	Kibanda	Kiryandongo		Kikuube Pri Sch.	F.3. Alimundu Nehemia	1	52	N	32	4	E	3584
160. Kenya-kenya	Lira	Kwania	Abongomola	Abany	Awei	F.4 Ocen Joel	2	0	N	32	46	E	3490
161. Unknown 89	Sironko	Budadiri	Butandiga	Nandago	Saralila	F.2 Patrick Nfuya	1	14	N	34	17	E	3787
162. Unknown 92	Sironko	Budadiri	Bumasifa	Bulwala	Lolobi	F.7 Michael Ojele	1	10	N	34	21	E	4391
163. Nyaraboke tall	Masindi	Kibanda	Kiryandongo		Kikuube	F.4. Oloya Esther	1	52	N	32	4	E	3570
164. Unknown 84	Kamuli	Bugabula	Balawoli	Balawoli	Namayira	F.2. A. V. Kubirima	1	1	N	33	5	E	3737
165. Unknown 108	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	45	E	3902
166. Sezalanda	Masindi	Kibanda	Kiryandongo		Kikuube	F.5. Kabasinguzi Beatrice	1	52	N	32	4	E	3571
167. Unknown 112	Mukono	Kyampisi	Bulijjo		Kitanda	F.2 Mwasanje Kizito	0	29	N	32	45	E	3929
168. Unknown 42	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	26	N	31	54	E	3973
169. Unknown 86	Kamuli	Bugabula	Balawoli	Balawoli	Namayira	F.2. A. V. Kubirima	1	1	N	33	5	E	3737
170. Mpologoma II	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	45	E	3902
171. Unknown 94	Soroti	Kasilo	Bugondo	Kamodo	Otimo	F.1 Aswaro Lucy	1	33	N	33	22	E	3595
172. nyakunyaku	Masindi	Budongo	Kabango		Nyamagita III	F.29. Desire Yonah	1	38	N	32	31	E	3630

173. Unknown 101	Masindi	Kibanda	Kiryandongo		Kikuube Pri Sch.	F.3. Alimundu Nehemia	1	52	N	32	4	E	3584
85. Unknown 14	Masaka	Bukoto East	Mukungwe		Bulayi	F.1.Mrs.Ndawula	0	20	S	31	46	E	4160
175. Unknown 71	Masindi	Ihungu	Karujubu	Nyamagisa	Karujubu LC1	F30. Mariko Kaahwa	1	40	N	31	39	E	3611
176. Unknown 68	Masindi	Biiso	Biiso		Busingiro	F.27 Dolica Kanyinga	1	43	N	31	27	E	3586
177. Unknown 39	Mubende	Mityana	Busimbi	Busimbi	Kikumambogo LC1	F.5 Nanyonga Noerina	0	23	N	32	4	E	4318
178. Kinyara	Masindi	Kigoroby	Kigoroby	Kitana	Nyabago	F.23 Miriosi Kaheru	1	36	N	31	18	E	3585
179. Bukalasa 2	Masindi	Budongo	Kabango		Nyamagita III	F.29. Desire Yonah	1	38	N	31	31	E	3630
180. Sukaali	Mubende	Kassanda	Kassanda		Jjemba	F9. Winnie G.Nalubega	0	31	N	31	47	E	4162
181. Unknown 73	Masindi	Ihungu	Karujubu	Nyamagisa	Karujubu LC1	F30. Mariko Kaahwa	1	40	N	31	39	E	3611
182. Unknown 3	Rakai	Kakuuto	Kifamba	Kabala		F.4: Hosea Sentalo	0	48	S	31	25	E	4308
183. Nabubaale	Rakai	Kooki	Byakabanda	Kasiika	Kitaasa	F.1:Agnes Nalumansi	0	44	S	31	22	E	4353
184. Bukalasa	Rakai	Kakuuto	Kifamba	Kabala		F.4 Hosea Sentalo	0	48	S	31	25	E	4308
185. Kagadi 2	Masaka	Mawokota	Muduuma		Buyala	F.2 Disan Iga	0	19	S	32	23	E	3908
186. Unknown 102	Masindi	Kibanda	Kiryandongo	Kikuube	Kikuube Pri Sch.	F.3. Alimundu Nehemia	1	52	N	32	4	E	3584
187. Njule omumyufu	Mukono	Kyaggwe	Ntenjeru	Ntanz	Ntanz	F.7 Walusimbi George	0	12	N	32	48	E	4053
188. Karangwa	Masindi	Biiso	Biiso		Busingiro	F.27 Dolica Kanyinga	1	43	N	31	27	E	3586
189. Unknown 64	Hoima	Kitoba	Bugahya	Kiragura	Dwoli	F.22 Yoramu Byeitima	1	30	N	31	21	E	3817
190. Unknown 110	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	45	E	3902
191. Unknown 111	Mukono	Kyampisi	Bulijjo		Kitanda	F.2 Mwasanje Kizito	0	29	N	32	45	E	3929
192. Abolotong	Lira	Kyoga	Muntu	Muntu	Abarler	F.1. Ekwang Peter	1	38	N	32	53	E	3547
193. Nakyanzi	Mukono	Kyampisi	Bulijjo		Kitanda	F.1 Stephen Ssebowa	0	29	N	32	45	E	3902
194. Karangwa	Kibaale	Buhaguzi	Kabwoya	Gwanjula	Karama	F.21. Dr. Banana Jackson						E	
195. Ngalo za Muteesa	Rakai	Kakuuto	Kifamba	Kabala		F.4: Hosea Sentalo	0	48	S	31	25	E	4308
196. Unknown 38	Masaka	Mawokota	Muduuma		Bulamu	F.4 Namazzi Jesca	0	21	S	32	17	E	4029
197. Tweyambule	Masaka	Bukoto west	Kito	Lwengo	Luti	F.8. Richard Mujumbwa	0	32	S	31	38	E	4481
198. Buziina	Masaka	Bukoto west	Kito	Lwengo	Luti	F.8. Richard Mujumbwa	0	32	S	31	38	E	4481
199. Unknown 17	Masaka	Bukoto west	Kito	Lwengo	Luti	F.8. Richard Mujumbwa	0	32	S	31	38	E	4481
200. Kwatamumpale	Rakai	Kakuuto	Kifamba	Kabala		F.4: Hosea Sentalo	0	48	S	31	25	E	4308
201. Bukalasa 4	Rakai	Kakuuto	Kifamba	Kabala		F.4: Hosea Sentalo	0	48	S	31	25	E	4308
202. Kirimumpale	Masindi	Buliisa	Buliisa	Ngwedo	Kisomero	F.26 Kisomero	2	12	N	31	28	E	2177
203. Unknown 69	Masindi	Biiso	Biiso		Busingiro	F.27 Dolica Kanyinga	1	43	N	31	27	E	3586
204. Unknown 67	Masindi	Buliisa	Buliisa	Ngwedo	Kisomero	F.26 Kisomero						E	

205. Nyarukwii	Masindi	Buliisa	Buliisa	Kigwera	Kirama	F.25 Santino	2	11	N	31	25	E	2177
206. Busuulwa	Rakai	Kooki	Byakabanda	Kasiika	Kitaasa	F.1:Agnes Nalumansi	0	44	S	31	22	E	4353
207. Unknown 76	Nakasongola	Nakitoma	Kigweri		Kimatwe	F.1Sekiganda Alex	1	29	N	32	7	E	3520
208. Unknown 128	Mukono	Kyaggwe	Ntenjeru	Ntanzi	Ntanzi	F.7 Walusimbi George	0	12	N	32	48	E	4053
209. Kitooke	Kibaale	Buyaga	Mabaare		Nyansoro	F17. Katarwa Anatoli	1	3	N	30	30	E	3952
210. Unknown 27	Bushenyi	Bunyaruguru	Kicwamba		Kicwamba H/Q	F.6. Kicwamba s/county HQ	0	14	S	30	5	E	2893
211. Kanabuto	Kibaale	Buyaga	Rugashari	Burora	Nyamigasa	F.19 Habyarema Diyadoni	1	5	N	30	51	E	3760
212. Unknown 52	Kibaale	Kagadi	Kagadi		Kiryani	F.12. Hamisi Bikwasiroha	0	57	N	30	49	E	4031
213. Tanzania	Mukono	Kyaggwe	Ntenjeru	Ntanzi	Ntanzi	F.7 Walusimbi George	0	12	N	32	48	E	4053
214. Yosam	Hoima	Kigorobya	Kigorobya TC	Kitana	Nyabago	F.23 Miriosi Kaheru	1	36	N	31	18	E	3585
215. Kabwa	Mukono	Kyaggwe	Nakisunga	Kyabalogo	Nakisunga	F.6 Rachel Nabawanuka	0	16	N	32	47	E	3955
216. Unknown 19	Masaka	Bukoto west	Kito	Lwengo	Luti	F.8. Richard Mujumbwa	0	32	S	31	38	E	4481
217. Kasimwenge	Masindi	Kigorobya	Kapapi	Nyanseko	siiba	F.24. Oliver B.Nyansonga						E	
218. Bukalasa 5	Kibaale	Buyaga	Mabaare	Kitemuzi	Kitemuzi	F.15. Kairu Vincent						E	
219. Bao	Mukono	Kyaggwe	Ntenjeru	Ntanzi	Ntanzi	F.7 Walusimbi George	0	12	N	32	48	E	4050
220. Kikomoko	Kibaale	Buyanja	Mugarama	Nyamarunda	Kateete	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
221. Kwatamumpale	Masaka	Mawokota	Muduuma	Sabagabo	Namabale	F.3 Elizabeth Zawedde	0	20	S	32	21	E	3958
222. Bukalasa 6	Bushenyi	West Igara	Nyabubaare	Kigoma	Kyomya	F.2. Atukunda Jovinta	0	31	S	30	6	E	4157
223. Nyaruvoya	Masindi	Buliisa	Buliisa	Kigwera	Kirama	F.25 Santino;	2	11	N	31	25	E	2177
224. Njule	Masaka	Mawokota	Muduuma		Bulamu	F.4 Namazzi Jesca	0	21	S	32	17	E	4029
225. Unknown 18	Masaka	Bukoto west	Kito	Lwengo	Luti	F.8. Richard Mujumbwa	0	32	S	31	38	E	4482
226. Unknown 49	Mubende	Mityana	Kassanda		Kyabadde	F.11. Mr. Odaka Mulima	0	29	N	31	44	E	4093
227. Rugogoma	Kibaale	Kibaale	Mabaare		Nyansoro	F17. Katarwa Anatoli	1	3	N	30	30	E	3952
228. Unknown 47	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	26	N	31	54	E	3973
229. Unknown 82	Kamuli	Buzaaya	Nawanyago	Bugobi	Bupadhengo	F.1 Janet Nabirye	0	43	N	33	9	E	3599
230. Obuku-obuku	Apac	Kwania	Abongomola	Abany	Awei	F.3 Richard Atine	2	0	N	32	46	E	3537
231. Mpologoma	Nakasongola	Nakitoma	Bujabe		Bugaramura	F.2. Yorokamu Byarufu	1	31	N	32	0	E	3508
232. Mutamisi	Sironko	Budadiri	Butandiga	Nandago	Saralila	F.1 Nabuluganyo	1	14	N	34	17	E	3805
233. Kyapadilaya	Kibaale	Buyaga	Kyanaisoke		Mugalike	F.14 Mwesige Pascavia	1	0	N	30	52	E	3962
234. Unknown 62	Hoima	Kitoba	Bugahya	Kiragura	Dwoli	F.22 Yoramu Byeitima	1	30	N	31	21	E	3817
235. kanyegamire	Kibaale	Buyaga	Rugashari	Rugashari	Kibuga	F.19. Charity Sofia	1	5	N	30	49	E	3772
236. Bukalasa	Mubende	Mityana			Mityana TC	F.6 Okot Betty	0	23	N	32	4	E	4304

237. Kikoola	Mubende	Kassanda	Kassanda		Jjemba	F.8 Mrs. Sharifa Muwonge	0	31	N	31	47	E	4167	
238. Unknown 56	Kibaale	Buyaga	Mabaare		Nyansoro	F11. Paulo Bakeisa	1	3	N	30	30	E	3952	
239. Unknown 61	Hoima	Kitoba	Bugahya	Kiragura	Dwoli	F.22 Yoramu Byeitima	1	30	N	31	21	E	3817	
240. Nyakaswiga	Kibaale	Buyanja	Mugarama		Nyamarunda	Kateete	F.6. Kiwanuka Tony	0	54	N	30	56	E	4498
241. Unknown 58	Kibaale	Buyaga	Mabaare		Nyansoro	F17. Katarwa Anatoli	1	3	N	30	30	E	3952	
242. Kibatikire	Kibaale	Kagadi	Kagadi		Kiryani	F.12. Hamisi Bikwasiroha	0	57	N	30	49	E	4031	
243. Unknown 79	Rakai	Kakooge	Kyabutaika	Kakooge	Kyabutaika	F.1 Wanyana Florence	1	5	S	32	29	E	3524	
244. Unknown 1	Rakai	Kooki	Byakabanda		Katerero B	F.2:Mukyala Namugerwa	0	45	S	31	25	E	4328	
245. Unknown 55	Kibaale	Buyaga	Kyanaisoke		Mugaliike health Centre	F.14 Mwesige Pascavia	1	0	N	30	52	E	3962	
246. Kanyali	Kibaale	Muhorro	Kagadi	Nyamiti	Nyamanga	F1. Josephat Rubani	0	54	N	30	45	E	4584	
247. Njule	Masaka	Mawokota	Muduuma		Bulamu	F.4 Namazzi Jesca	0	21	S	32	17	E	4029	
248. Kwatamumpale	Masaka	mawokota	Muduuma	Kisoga	Namabale	F.3 Elizabeth Zawedde	0	20	S	32	21	E	3958	
249. Yaadi	Luweero	Bamunanika	Kalagala	Vumba	Vumba	F.5. Mr. Galiwango	0	36	N	32	41	E	3996	
250. Unknown 51	Kibaale	Kagadi	Kagadi		Kiryani	F.12. Hamisi Bikwasirohae	0	57	N	30	49	E	4031	
251. Unknown 57	Kibaale	Buyaga	Mabaare		Nyansoro	F16. Paulo Bakeisa	1	3	N	30	30	E	3952	
252. Unknown 43	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	26	N	31	54	E	3973	
253. Bukalasa bitter	Bushenyi	Igara west	Nyabubaare	Kigoma	Kyomya	F.2. Atukunda Jovinta	0	31	S	30	6	E	4157	
254. Mpologoma	Mubende	Kassanda	Kassanda		Jjemba	F10. Alice Namono	0	31	N	31	47	E	4162	
255. Unknown 25	Bushenyi	Igara west	Kyamuhunga		Gongo	F.5. Eva Kyokusimiire	0	25	S	30	7	E	3845	
257. bombo	Nakasongola	Nakitoma	Kigweri		Kimatwe	F.1Sekiganda Alex	1	29	N	32	7	E	3520	
258. Bukalasa	Bushenyi	Igara west	Kyamuhunga		Gongo	F.4. Eliphaz Kangyenyenka	0	25	S	30	7	E	3845	
259. Unknown 26	Bushenyi	Bunyaruguru	Kicwamba		Kicwamba H/Q	F.6. Kicwamba s/county HQ	0	14	S	30	5	E	2893	
260. Rutuga	Bushenyi	Igara west	Nyabubaare	Kigoma	Kyomya	F.2. Atukunda Jovinta	0	31	S	30	6	E	4157	
261. AMC												E		
262. Kwata akasero	Rakai	Kooki	Byakabanda	Kasiika	Kitaasa	F.1:Agnes Nalumansi	0	44	S	31	22	E	4353	
263. Unknown 58	Kibaale	Buyaga	Mabaare		Nyansoro	F17. Katarwa Anatoli	1	3	N	30	30	E	3952	
264. Real Teraka	Mukono	Kyampisi	Bulijjo		Kitanda	F.2 Mwasanje Kizito	0	29	N	32	45	E	3929	
265. Unknown 72	Masindi	Ihungu	Karujubu	Nyamagisa	Karujubu LC1	F30. Mariko Kaahwa	1	40	N	31	39	E	3611	
266. Unknown 66	Hoima	Kitoba	Bugahya	Kiragura	Dwoli	F.22 Yoramu Byeitima	1	30	N	31	21	E	3817	
267. Rujumba	Kibaale	Buyaga	Mabaare		Nyansoro	F17. Katarwa Anatoli	1	3	N	30	30	E	3952	
268. Unknown 59	Kibaale	Buyaga	Rugashare	Buroro	Kyabasazima	F.18 Simon Kaguru	1	4	N	30	55	E	3573	
269. Unknown 24	Bushenyi	Igara west	Kyamuhunga		Gongo	F.5. Eva Kyokusimiire	0	25	S	30	7	E	3845	

270. Unknown 22	Bushenyi	Igara west	Nyabubaare	Kigoma	Kyomya	F.2. Atukunda Jovinta	0	31	S	30	6	E	4157
271. Unknown 35	Masaka	Muduuma	Sabagabo	Kisoga	Namabale	F.3 Elizabeth Zawedde	0	20	S	32	21	E	3958
272. Unknown 54	Kibaale	Buyaga	Kyanaisoke		Kyenzige hapida	F.13 Juliana Twinonbusingye	0	58	N	30	50	E	4035
273. Komanda	Masaka	Mawokota	Muduuma		Buyala	F.1 Kalanzi George	0	19	S	32	24	E	3901
274. Unknown 1	Rakai	Kooki	Byakabanda		Katerero B	F.2:Mukyala Namugerwa	0	45	S	31	25	E	4328
275. Kalitunsi	Rakai	Kooki	Byakabanda	Kasiika	kitaasa	F.1:Agnes Nalumansi	0	44	S	31	22	E	4353
276. Unknown 123	Mukono	Kyaggwe	Ntenjeru	Ntanz	Ntanz	F.7 Walusimbi George	0	12	N	32	48	E	4050
277. Mureefu	Bushenyi	Igara west	Kyamuhunga		Gongo	F.4. Eliphaz Kangyenyenka	0	25	S	30	7	E	3845
278. Unknown 20	Masaka	Bukoto west	Kito	Lwengo	Luti	F.8. Richard Mujumbwa	0	32	S	31	38	E	4481
279. Unknown 81	Rakai	Kakooge	Kyabutaik	Kakooge	Kyabutaik	F.1 Wanyana Florence	1	5	S	32	29	E	3524
280. Unknown 55	Kibaale	Buyaga	Kyanaisoke		Mugali health Centre	F.14 Mwesige Pascavia	1	0	N	30	52	E	3962
281. Unknown 78	Nakasongola	Nakitoma	Bujabe		Bugaramura	F.2. Yorokamu Byarufu	1	31	N	32	0	E	3508
282. Unknown 74	Nakasongola	Nakitoma	Kigweri		Kimatwe	F.1Sekiganda Alex	1	29	N	32	7	E	3520
283. Ssenyonjo	Nakasongola	Nakitoma	Kigweri		Kimatwe	F.1Sekiganda Alex	1	29	N	32	7	E	3520
284. Kawanda 1	Mubende	Mityana			Mityana TC	F.6 Okot Betty	0	23	N	32	4	E	4304
285. Unknown 77	Nakasongola	Nakitoma	Kigweri		Kimatwe	F.1Sekiganda Alex	1	29	N	32	7	E	3520
286. Unknown 16	Masaka	Bukoto west	Kingo		Kaganda	F.7. Kayira (omusomesa)	0	2	S	31	36	E	4380
287. Kawanda II	Mubende	Mityana			Mityana TC	F.6 Okot Betty	0	23	N	32	4	E	4304
288. Kawulu	Kamuli	buyende	Buyende	Wesunire	kinambugo	F.5. Kinambugo	1	12	N	33	8	E	3582
289. Kagadi 3	Mpigi	Mawokota	Muduuma		Buyala	F.2 Disan Iga	0	19	N	32	23	E	3908
290. kanyaMubende	Kibaale	Buyaga	Rugashari	Burora	Nyamigasa	F.19 Habyarema Diyadoni	1	5	N	30	51	E	3760
291. Lusajja luntamye	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	26	N	31	54	E	3973
292. Wild cassava, F8	Masindi	Buyaga	Kyanaisoke		Kyenzige hapida	F.13 Juliana Twinonbusingye	0	58	N	30	50	E	4035
293. Nakitende	Mukono	Kyaggwe	Ntenjeru	Ntanz	Ntanz	F.7 Walusimbi George	0	12	N	32	48	E	4050
294. Unknown 41	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	26	N	31	54	E	3973
295. kawanda 1	Mubende	Mityana			Mityana TC	F.6 Okot Betty	0	23	N	32	4	E	4304
296. Acek iyito	Apac	Kwania	Abongomola	Abany	Awei	F.2 George Oipo	2	0	N	32	46	E	3537
297. Unknown 23	Bushenyi	West Igara	Nyabubaare		Kigoma	F.3. Mr. Katumwesigye	0	31	S	30	6	E	4157
298. B-8	Kamuli	Budiope	Kidera	Wesunire	kasiira	F.4 Nusula Akiiki	1	12	N	33	8	E	3582
299. Kitakuli	Masindi	Buyaga	Kyanaisoke		Kyenzige hapida	F.13 Juliana Twinonbusingye	0	58	N	30	50	E	4035
300. Unknown 37	MPGI	Mawokota	Sabagabo	Kisoga	Namabale	F.3 Elizabeth Zawedde	0	20	N	32	21	E	3958
301. Unknown 40	Mubende	Kassanda	Myanzi		Myanzi	F.7 Nabukalu Margaret	0	26	N	31	54	E	3973



302. Unknown 117	Mukono	Kyampisi	Bulijjo		Kitanda	F.4 Kijambu Ponsiano	0	29	N	32	45	E	3958
309. Unknown 34	Masaka	Mawokota	Muduuma		Buyala	F.2 Disan Iga; Buyala	0	19	N	32	23	E	3908
310. Wild cassava F8	Bushenyi	Bunyaruguru	Ryeru		Nyakasaru TC	F.8. Nyakasaru restaurant	0	16	S	30	6	E	3093
311. Kagadi 2	Masaka	Mawokota	Muduuma		Buyala	F.2 Disan Iga; Buyala	0	19	S	32	23	E	3908
312. sezalanda	Masindi	Kibanda	Kiryandongo	Kikuube	Kalangala	F.13. Kabasinguzi Beatrice	1	52	N	32	4	E	3571
313. unknown 99	Masindi	Kibanda	Kiryandongo	Kikuube		F.2. Edison Kisembo	1	51	N	32	3	E	3626
314. Apac	Nakasongola	Nakitoma	Bujabe		nongobugalamwa	F.3 Luboyera Christopher	1	31	N	32	0	E	3508
315. Bamunaanika	Luweero	Bamunaanika	Kalagala	Busiika	Nattyole	F.11. Zam Kikabi	0	35	N	32	24	E	3996
316. kikapa	Rakai	Kyotera	Kirumba		Kito	F10. Mukyala Rose	0	3	S	31	3	E	4662
317. Unknown 36	Masaka	Mawokota	Sabagabo	Kisoga	Namabale	F.3 Elizabeth Zawedde	0	20	S	32	21	E	3958
318. Unknown 105	Masindi	Kibanda	Kiryandongo	Kikuube	Kalangala	F.4 Oloya Esther	1	52	N	32	4	E	3570
319. Mbwa	Luweero	Bamunaanika	Kalagala	Busiika	Nattyole	F.11. Zam Kikabi	0	35	N	32	24	E	3996
320. Unknown 50	Kibaale	Kagadi	Kagadi	kagadi	Kiryani	F.12. Hamisi Bikwasiroha	0	57	N	30	49	E	4031
321. Mmuwanvu aduuma	Luweero	Kakooge	Kyabutaik	Kakooge	Kyabutaik	F.1 Wanyana Florence	1	5	N	32	29	E	3524
323. Nyakakwa	Hoima	Bugahya	Kigorobya		Kiganja	F1. Kisembo Margaret			N			E	
324. Unknown 80	Luweero	Kakooge	Kyabutaik	Kakooge	Kyabutaik	F.1 Wanyana Florence	1	5	N	32	29	E	3524
325. Kizungirizi	Rakai	Kyotera	Kirumba		Kito	F10. Mukyala Rose	0	3	S	31	3	E	4662
326. Doodo	Rakai	Kooki	Byakabanda	Katerero A		F.3: Bwogi Eriabu	0	45	S	31	25	E	4327
327. Kitengi	Kasese	Bukonjo	Kyondo	Kanyatsi	Kaghorwe	F.4.--	0	8	N	29	55	E	3973
328. Unknown 70	Masindi	Ihungu	Karujubu	Nyamigisa	Karujubu LC1	F30. Mariko Kaahwa	1	40	N	31	39	E	3611
329. Kangasalya	Kasese	Bukonjo	Kyarumba	Kabirizi	Karujumba	F.2. Muhendo Barbanas	0	5	N	29	56	E	3727

**KEY:** LATD- latitude degrees; LATM- latitude minutes; LATH- latitude hemisphere; LOND- longitude degrees; LONM- longitude minutes; LONH- longitude hemisphere LC1- Local council one; HQ- head quarters; s/county- sub county





