



**C3P INVENTORY SURVEY FOR CMD-RESISTANT CASSAVA  
VARIETIES IN TANZANIA**

**COUNTRY REPORT**

BY

**EARRNET Coordination Office**

**International Institute of Tropical Agriculture**

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## 1. Introduction

Catholic Relief Services (CRS) and International Institute of Tropical Agriculture (IITA) are jointly implementing the Crop Crisis Control Project (C3P) on cassava and bananas production in six East and Central African (ECA) countries. Within the target countries, the implementation is being done in conjunction with country National Research Systems and other local partner organisations. The focus of the project is to fight cassava mosaic virus disease (CMD) and banana bacterial blight (BXW) in Uganda, Tanzania, Rwanda, Kenya, Burundi and DR. Congo. IITA and CRS already have working partners in those countries who will help in the project quick start and implementation.

CMD is one of the greatest threats to cassava production in the above sub region. Research shows that the CMD pandemic affected about 2,600,000 ha of cassava leading to a loss of 22 million metric tons of produce annually (C3P proposal). All the local varieties grown by farmers in this sub region have virtually become susceptible to CMD. As a result of this pandemic, production of cassava has been affected in most areas and food insecurity is on the rise among the rural poor.

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IITA/ EARRNET in collaboration with National Cassava Programs of participating countries have conducted a number of on-farm cassava participatory evaluations that have resulted in the identification of many CMD-resistant varieties in each of the countries. The project would like to increase multiplication and distribution of these improved varieties among her farmers as the percentage growing these improved varieties was still limited. Success of a similar project has been noted in Malawi where most farmers were growing improved varieties and these moved through the farmer to farmer exchange systems.

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To achieve the above objective one of the project activities will involve deployment of effective CMD control measures among the farming communities. This is to be achieved through multiplication and distribution of CMD-resistant varieties and promotion of improved management practices. As such, there is need to have inventory of available CMD-resistant varieties and establish the amount of planting materials available as well as their health status.

## 2. Materials and Method

### 2.1 Area and farmers visited

The inventory survey for CMD-resistant materials in Tanzania was conducted from 14<sup>th</sup> to 20<sup>th</sup> August 2006 covering three regions of Kagera, Mwanza and Mara (Table 1). These are part of the areas where CRS is currently implementing agricultural projects. From Kagera region, the districts of Biharamulo, Muleba and Karagwe were visited, while the district of Geita and Sengerema were visited from Mwanza region. From Mara region only Bunda district was visited.

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The districts visited are parts of the area intended for project implementation. Therefore, they provide good access to available improved cassava varieties. The districts in Kagera region are also popular for banana growing.

Table 1. Area and farmers visited

Region	District	Division	Ward	Village	Farmer	
Kagera	Biharamulo	Nyarubungo	Katoke	Ntungamo	1) Biharamulo Prison Farm	
			Nyarubungo	Nyarubungo	2) Deusdedit Bweze	
			Runazi	Rukara	3) UMOJA FFS	
	Karagwe Bukoba	Misenge	Kitengule	Kihanga	Kitengule	4) Kitengule Prison Farm
				Kianga	Nyabianga	5) Patric D. Mulokozi
				Kyaka	Nyabianga	6) Juma Rajab
				Nyabianga	Nyabianga	7) Abdul Surait
	Muleba	Nshamba	Ngenge	Rwigembe	8) Jackson Nyaitura	
	Mwanza	Geitha	Butundwe	Nyakagomba	Magereza	9) Butundwe Prison Farm
				Chigunga	Chigunga	10) Mikidad Mpina
		Sengerema	Ktunguru	Kasungamile	Kasungamile	11) Kasungamile Prison Farm
				Chifunfu	Lugongo	12) Lugongo Prison Farm
				Nyamazigo	Kijuka	13) Upendo Farmers Group
	Mara	Bunda	Serengeti	Bunda	Nyasura	14) K.M. Siwingwa

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### 2.2 Team Composition

The survey team comprised researchers from IITA (Uganda & Tanzania), Maruku and Ukiriguru Agricultural Research Institute (ARI) who have been in cassava research over years. In addition, extension staffs from district visited were brought on board to guide the team within their areas of jurisdiction.

Due to the vast nature of the area surveyed and time limitation, the team selected only three regions and a few districts with relatively high cassava production. The team was divided into two; one group lead by Vianey (IITA Tanzania) who visited Mwanza and Mara regions and another group lead by Joseph (IITA/EARRNET-Uganda) who visited Kagera region.

### 2.3 Field Sampling

The team travelled to Agricultural/Extension Offices, local NGO (RUDDO) office, Farmer Field Schools (FFS), Farmer groups and individual farmers to get information on the availability of improved materials. Fields were selected for quantification, disease and pest assessment basing on the followings;

- Availability of improved cassava materials
- Willingness of the owner to sell the material to CRS
- Field size of not less than 200m<sup>2</sup>
- Age of the planting materials of not less than 6 months or more than 24 months old.

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Assessment was done using a simplified data sheet designed by IITA-EARRNET to ease quantification and assessment of the health status of the planting materials. A total of 34 fields (plots) belonging to the above farmers were measured (area) and sampled for various variables such as plant height and number of stems per stool to estimate number of cutting per plant, plant population, disease and pest incidence and severity, stem quality and general field management. Additional information such as plant age, sources and outlet for the planting materials were obtained from the owners of the fields.

### 3. Findings

#### 3.1 General information from the multiplication sites and farmers visited

Size of improved cassava fields (plots) visited ranged from 0.035 ha to 4.8 ha with crop age ranging from 7 to 24 months old. About 12% of the fields were ratooned crops. Plant population ranged from 64,000-12,000 plants per hectare with a general average of 8,400 plants/ha. Number of cuttings per stool were highly variable and depended on the variety, crop age, soil condition and management of the ratooned crop. It ranged from 7 to 46 cuttings (Table 2). The majority of the fields were planted in pure stands.

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Table 2. General field (plot) information

Field No.	Farmer (Farm)	Variety	Crop Age	Area (m <sup>2</sup> )	PP/ha	cutting / plant	Available Cuttings	Value shilling
1	Biharamulo Prison Farm	MM96/4684	10	846	12,000	30	30456	
2	Biharamulo Prison Farm	I96 series	10	1,100	14,000	16	24640	
3	Biharamulo Prison Farm	TMS 4(2)1425	12	2,200	8,000	30	52800	
4	Biharamulo Prison Farm	MM96/4684	8	4,725	12,000	15	85050	
5	Biharamulo Prison Farm	TMS 4(2)1425	24	3,900	6,200	19	45942	
6	Deusdedit Bweze	MM96/4684	9	600	6600	14	5544	
7	Deusdedit Bweze	SS4	9	685	6200	7	2973	
8	Deusdedit Bweze	TMS 4(2)1425	9	1,060	7600	15	12084	
9	Deusdedit Bweze	TMS 4(2)1425	9	640	9000	7	4032	
10	UMOJA FFS	TMS 4(2)1425	9	11,975	9000	13	140107.5	
11	UMOJA FFS	MM96/4684	9	3,225	8000	6	15480	
12	Kitengule Prison Farm	MM96/4684	11	19,120	6600	18	227145.6	
13	Kitengule Prison Farm	MM96/4684	9	11,000	7200	20	158400	
14	Kitengule Prison Farm	MM96/4684	9	17,288	7800	14	188785	
15	Jacson Nyaitura	MM96/4684	10	1,824	10600	10	19334.4	
16	Patric D. Mulokozi	I91/0063	8	1,200	7800	9	8424	168480
17	Patric D. Mulokozi	MM96/3075b	8	350	13600	9	4284	85680
18	Patric D. Mulokozi	MM96/4684	8	2,160	8200	12	21254	425088
19	Patric D. Mulokozi	MM96/850	8	3,335	8200	13	35551	711022
20	Juma Rajab	MM96/4619	9	667	6200	12	4962	99250
21	Juma Rajab	TME 14	9	743	6600	12	5885	117691
22	Juma Rajab	SS4	24	30,360	7600	46	1061386	21227712
23	Abdul Surait	MM96/4619	16	3100	6800	36	75888	1517760
24	Abdul Surait	SS4	24	3420	6800	38	88373	1767456
25	Abdul Surait	TMS 4(2)1425	24	3420	6800	38	88373	1767456
26	Butundwe Prison Farm	TMS 4(2)1425	7	52630	12,000	13	821028	16420560
27	Butundwe Prison Farm	Kachaga*	7	8,090	12,000	12	116496	2329920
28	Butundwe Prison Farm	TMS 4(2)1425	7	48,580	12,000	13	757848	15156960
29	Mikidad Mpina	MM Series	8	28340	8800	12	299270	5985408
30	Mikidad Mpina	Kachaga*	8	8,090	7,550	12	73295	1465908
31	Kasungamile Prison Farm	TMS 4(2)1425	9	10,121	6400	19	123071	2461427
32	Lugongo Prison Farm	TMS 4(2)1425	9	12,140	11,300	19	260646	5212916
33	Upendo Farmers Group	TMS 4(2)1425	9	5,000	3000	13	19500	390000
34	K.M. Siwingwa	TMS 4(2)1425	9	20,000	6000	9	108000	2160000
<b>Total/Average</b>				<b>321,934</b>	<b>8,484</b>	<b>17</b>	<b>4,986,308</b>	<b>99,726,161</b>

Comment [P3]: How do we merge table 1 and table 2? You indicated that you visited 14 farmers in table 1 but here I see 34!!!!

There is no need to merge table 1 and 2. Table 1 shows where the different farms are located in the region while table 2 gives individual field information..

Number of farmers visited are not necessarily the same as the number of fields visited. One farmer may have more than one cassava field.

For example, Biharamulo prison farm had five different fields and is recorded as one farmer. Mr. Juma Rajab has three fields but he is just one farmer.

Please note that the farmer I am referring here is someone or institution owning the cassava field(s).

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\*local variety appreciated for its resistance to CMD

### 3.2 Quantity and value of improved planting materials available

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More improved varieties were found in the Kagera region than Mwanza and Mara region. In the Kagera region, Karagwe and Biharamulo districts had the largest concentration of the improved planting materials compared to Muleba district.

The most common improved varieties in areas visited were TMS 4(2)1425 with estimated volume 2.40 million cuttings, SS4 with 1.15 million cuttings and MM96/4684 with 0.75 million cuttings. Other varieties with less than 0.1 million cuttings were; MM96/4619, MM96/8450, MM96/3075b, other MM series, I91/0063, TME 14 (Table 3).

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Other improved planting materials found in smaller quantities with farmers in Karagwe and Muleba but were not quantified were; MM96/8233; MM96/5725; TMS I91/0057 and TMS I91/0067. The TMS I91/0067 which is tolerant to CBSD is available with the farmers visited in Karagwe district in limited quantities.

#### a) TMS 4(2)1425

The largest quantity (1.57 million cuttings) of TMS 4(2)1425 is found at Butundwe prison farm, followed by Logongo Prison farm (0.26 million cuttings), Umoja Farmer Field School (FFS) (0.14 million cuttings), Kasungamile Prison Farm (0.12 million cuttings) and with Mr. K.M. Siwingwa.

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#### b) SS4

SS4 is found in large quantity with Mr. Juma Rajab (1.1million cuttings) and some reasonable quantity with Mr Abdul Surait (0.088 million cuttings) of Nyabianga village, Kyaka ward, Misenge division in Bukoba District.

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#### c) MM96/4684

Fairly good quantity (0.5million cuttings) of MM96/4684 was found at Kitengule Prison Farm (Karagwe district), 0.12 million cuttings at Nyarubungo Prison Farm (Biharamulo district) and about 0.02 million cuttings with Mr. Patrick D Mulokozi of Nyabianga village, Kyaka ward, Misenge division, in Bukoba district.

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#### d) MM96/8450

Quantifiable quantity (0.35million cuttings) of this variety was mainly with Mr. Patrick D Mulokozi of Nyabianga village, Kyaka ward, Misenge division in Bukoba district.

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The total value of all the improved materials is estimated at 99.7 million Tanzanian shillings i.e. about 79,100 US dollars. Table 4 shows detailed amount (Tz shilling) one can spend on the quantified materials per variety and on farm basis.

Table 3. Quantity (cuttings) of improved cassava varieties on different farms

Farmer	TMS 4(2)1425	SS4	MM96/46 84	MM96/4619	MM96/8450	MM Series	I96 Series	I91/0063	TME 14	MM96/ 3075b	Kachaga	Total
Biharamulo Prison Farm	98,742	0	115,506	0	0	0	24,640	0	0	0	0	238,888
Mr. Deusdedit Bweze	16,116	2,971	5,544	0	0	0	0	0	0	0	0	24,631
UMOJA FFS	140,108	0	15,480	0	0	0	0	0	0	0	0	155,588
Kitengule Prison Farm	0	0	574,331	0	0	0	0	0	0	0	0	574,331
Mr. Patric D. Mulokozi	0	0	21,254	0	35,551	0	0	8,424	0	4,284	0	69,513
Mr. Juma Rajab	0	1,061,386	0	4,962	0	0	0	0	5,885	0	0	1,072,233
Mr. Abdul Surait	88,373	88,373	0	75,888	0	0	0	0	0	0	0	252,634
Mr. Jacson Nyaitura	0	0	19,334	0	0	0	0	0	0	0	0	19,334
Butundwe Prison Farm	1,578,876	0	0	0	0	0	0	0	0	0	116,496	1,695,372
Mr. Mikidad Mpina	0	0	0	0	0	299,270	0	0	0	0	73,295	372,565
Kasungamile Prison Farm	123,071	0	0	0	0	0	0	0	0	0	0	123,071
Lugongo Prison Farm	260,646	0	0	0	0	0	0	0	0	0	0	260,646
Upendo Farmers Group	19,500	0	0	0	0	0	0	0	0	0	0	19,500
Mr. K.M. Siwingwa	108,000	0	0	0	0	0	0	0	0	0	0	108,000
<b>Total</b>	2,433,432	1,152,730	751,449	80,850	35,551	299,270	24,640	8,424	5,885	4,284	18,9791	49,863,06

An average price of 20Tz shillings per cutting was quoted by the owners

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Table 4. Value of planting materials available

	TMS 4(2)1425	SS4	MM96/4684	MM96/ 4619	MM96/ 8450	MM Series	I96 Series	I91/0063	TME 14	MM96/3 075b	Kachaga	Total value
Biharamulo Prison Farm	1,974,840	0	2,310,120	0	0	0	492800	0	0	0	0	4,777,760
Mr. Deusdedit Bweze	322,320	59420	110880	0	0	0	0	0	0	0	0	492,620
UMOJA FFS	2,802,160	0	309600	0	0	0	0	0	0	0	0	3,111,760
Kitengule Prison Farm	0	0	11,486,620	0	0	0	0	0	0	0	0	11,486,620
Mr. Patric D. Mulokozi	0	0	425080	0	711020	0	0	168480	0	85680	0	1,390,260
Mr. Juma Rajab	0	21227720	0	99240	0	0	0	0	117700	0	0	21,444,660
Mr. Abdul Surait	1,767,460	1767460	0	1517760	0	0	0	0	0	0	0	5052680
Mr. Jacson Nyaitura	0	0	386,680	0	0	0	0	0	0	0	0	386,680
Butundwe Prison Farm	31,577,520	0	0	0	0	0	0	0	0	0	2329920	33,907,440
Mr. Mkidad Mpina	0	0	0	0	0	5985400	0	0	0	0	1465900	7,451,300
Kasungamile Prison Farm	2461420	0	0	0	0	0	0	0	0	0	0	2,461,420
Lugongo Prison Farm	5212920	0	0	0	0	0	0	0	0	0	0	5,212,920
Upendo Farmers Group	390000	0	0	0	0	0	0	0	0	0	0	390,000
Mr. K.M. Siwingwa	2160000	0	0	0	0	0	0	0	0	0	0	2,160,000
<b>Total</b>	<b>48,668,640</b>	<b>23,054,600</b>	<b>15,028,980</b>	<b>1,617,000</b>	<b>711,020</b>	<b>598,5400</b>	<b>492,800</b>	<b>168,480</b>	<b>117,700</b>	<b>85,680</b>	<b>3,795,820</b>	<b>99,726,120</b>



### 3.4 Health status of the improved materials

During the assessment exercise the plants were assessed for incidence of diseases such as cassava mosaic disease (CMD) cassava brown streak disease (CBSD) and cassava bacterial blight (CBB). Incidence and severity of cassava green mite (CGM) and cassava mealy bug (CM) were also assessed (Table 5).

Table 5. Average percent disease and pest incidence and severity on improved cassava varieties (“i” indicates incidence whereas “s” indicates severity).

Variety	CMDi	CMDs	CBSDi	CBBi	CBBs	CM i	CGMi	CGMs
I91/0063	0	1	0	0	1	0	0	1
I96 series	0	1	0	10	2	0	0	1
Kachaga	0	1	0	0	1	0	0	1
MM96/4619	10	2	0	0	1	0	12	2
MM96/4684	1	1	0	7	2	0	31	2
MM96/8450	0	1	0	0	1	0	43	2
SS4	0	1	0	15	2	0	20	2
TME 14	10	2	0	0	1	0	10	2
TMS 4(2)1425	4	1.2	0	1	1.2	0	36	2.2

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#### a) CMD

Generally there were low incidences of CMD on the varieties quantified with an average incidence of 10% on MM96/4619 with severity score of 2. The other varieties had less the 10% incidence of CMD with severity of not more than 2. However an exceptional case was observed on TMS 4(2)1425 and SS4 at Kitengule Prison Farm where the varieties had succumbed to the disease pressure and incidence of more than 50% and an average severity score of 3. These fields were however excluded from the quantification exercise.

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#### b) CBSD

This was not observed in any of the fields visited although the team suspected it in the district of Bukoba near Uganda. Sometimes farmers at the boarder smuggle planting materials from the neighbouring countries and since it is reported in Uganda we suspect that probably the disease is there.

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#### c) CBB

The highest incidence of the disease was observed on SS4 and MM96/4684 with the other varieties having less than 10% incidence. Generally, the severity score was about 2 on average. The low incidence and severity on CBB observed could have been due to the dry spell being experienced in all the regions visited.

#### d) CGM

This was observed in nearly all the fields visited with incidence ranging from 10-80% and severity score of 2-3. The highest average incidence was recorded on MM96/8450, followed TMS 4(2)1425 and MM96/4684. The relatively high incidence of CGM could be due to the dry weather being experienced in the region.

e) **CM**

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This was not observed in all the field visited.

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**3.4 Sources of varieties and market outlets for stems**

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The original sources of the improved materials are Maruku and Ukiriguru Agricultural Research Institutes (ARIs) in Bukoba and Mwanza, respectively. These materials were supplied by researchers from these stations to Prison farms, NGOs such as Rulenge Diocesan Development Office (RUDDO), Farmer Field schools (FFS) and farmer groups. Individual farmers got materials either through extension agents, NGOs and/or fellow farmers.

Although improved planting materials have been moving from research through intermediaries like Government Prison Farms, NGOs, FFS and farmer groups to individual farmers, these are mostly not on commercial basis. However, the different institutions involved are eager to sell materials to whoever is willing to buy. The majority indicated an average price 20 Tz shillings per cutting with a few mentioning 25 and 30 shillings per cutting. Although the farmers are willing to sell they have never done so. They are even willing to increase acreages under multiplication so long as there is an assured market to sell their cassava planting materials.

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**3.5 General observations**

Most farmers are still growing local materials which are highly susceptible to CMD. The incidence of CMD on most local s ranged from 30-100% with severity score of 3-5. However, two local varieties; Lwakitangasa and Kachaga have shown resistance to CMD. Kachaga is common in Mwanza region while Lwakitangasa is popular with the farmers in the Kagera region.

**4 Conclusions and Recommendations**

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**4.1 Conclusions**

- The most common improved materials available in large quantities are TMS 4(2)1425, SS4 and MM96/4684.
- A wider range of improved materials was found in the Kagera region than Mwanza and Mara regions.
- The district of Muleba still has very limited quantities of improved cassava cuttings in comparison with other districts visited.
- CGM is a threat to the production of CMD resistant varieties available.

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**4.2 Recommendations**

- The three varieties available in large quantities i.e. TMS 4(2)1425, SS4 and MM96/4684 should be used for direct distribution to farmers in targeted areas.
- The varieties which are limited in quantity should be used for setting up mother gardens managed by farmer groups or FFS.
- There is need to supply improved cassava to Muleba either from Biharamulo or Karagwe to reinforce the current low production in the district. The available

materials in Muleba could also be bought and used within the district to set up mother gardens for multiplication.

- Although CBSD was not observed in the region, its threat from Uganda is real. Therefore precautionary measures should be taken to avoid its spilling over from Uganda. The availability of TMS I92/0067 which is tolerant to CBSD is a blessing and CRS and its partners need to explore more and find where it can be found in commercial quantities. The little quantity of this variety with the farmers in Nyabianga village should be collected and used for rapid multiplication.
- Areas such as Ngara and Kigoma that were not visited due to time limitation should be visited to identify and quantify available improved varieties.
- There is need for CRS to secure material which have so far been quantified by issuing vouchers to the above farms/farmers. The vouchers will be some sort of assurance to the farmers.
- To ensure the right varieties and good quality materials are collected from the farmers/farms, an experienced technician should be involved in collection of the materials. He/she should be able to scout the whole field (plot) and remove all the off-types.
- Proper labelling and record should be done during collection of materials and planting to ensure purity of the materials.

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## Appendices

### Appendix 1. Farm location

Field No.	Farmer (farm)	Region	District	Division	Ward	Village	Longitude	Latitude	Elevation (m)
1	Biharamulo Prison Farm	Kagera	Biharamulo	Nyarubungo	Katoke	Ntungamo	02°44.122'	031°19.930'	1,336
2	Biharamulo Prison Farm	Kagera	Biharamulo	Nyarubungo	Katoke	Ntungamo	02°44.122'	031°19.931'	1,336
3	Biharamulo Prison Farm	Kagera	Biharamulo	Nyarubungo	Katoke	Ntungamo	02°44.122'	031°19.932'	1,336
4	Biharamulo Prison Farm	Kagera	Biharamulo	Nyarubungo	Katoke	Ntungamo	02°44.122'	031°19.933'	1,336
5	Biharamulo Prison Farm	Kagera	Biharamulo	Nyarubungo	Katoke	Ntungamo	02°43.97'	031°19.73'	1,347
6	Deusdedit Bweze	Kagera	Biharamulo	Nyarubungo	Nyarubungo	Nyarubungo	02°40.40'	031°20.54'	1,436
7	Deusdedit Bweze	Kagera	Biharamulo	Nyarubungo	Nyarubungo	Nyarubungo	02°40.40'	031°20.54'	1,436
8	Deusdedit Bweze	Kagera	Biharamulo	Nyarubungo	Nyarubungo	Nyarubungo	02°40.40'	031°20.54'	1,436
9	Deusdedit Bweze	Kagera	Biharamulo	Nyarubungo	Nyarubungo	Nyarubungo	02°40.20'	031°20.41'	1,438
10	UMOJA FFS	Kagera	Biharamulo	Nyarubungo	Runazi	Rukara	02°45.60'	031°28.841'	1,392
11	UMOJA FFS	Kagera	Biharamulo	Nyarubungo	Runazi	Rukara	02°45.60'	031°28.841'	1,392
12	Kitengule Prison Farm	Kagera	Karagwe	Tarafa	Kianga	Kitengule	01°16.54'	031°20.621'	1,168
13	Kitengule Prison Farm	Kagera	Karagwe	Tarafa	Kianga	Kitengule	01°16.102'	031°20.453'	1,171
14	Kitengule Prison Farm	Kagera	Karagwe	Tarafa	Kianga	Kitengule	01°16.102'	031°20.453'	1,171
15	Jacson Nyaitura	Kagera	Muleba	Nshamba	Genge	Rwigembe	01°45.589'	031°26.942'	1,218
16	Patric D. Mulokozi	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°14.277'	031°24.622'	1,162
17	Patric D. Mulokozi	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°14.299'	031°24.620'	1,157
18	Patric D. Mulokozi	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°14.299'	031°24.620'	1,157
19	Patric D. Mulokozi	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°14.299'	031°24.620'	1,158
20	Juma Rajab	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°14.281'	031°25.779'	1,156
21	Juma Rajab	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°14.281'	031°25.779'	1,157
22	Juma Rajab	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°15.033'	031°35.961'	1,144
23	Abdul Surait	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°15.586'	031°35.892'	1,159
24	Abdul Surait	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°15.586'	031°35.892'	1,160
25	Abdul Surait	Kagera	Karagwe	Misenge	Kyaka	Nyabianga	01°15.586'	031°35.892'	1,161
26	Butundwe Prison Farm	Mwanza	Geitha	Butundwe	Nyakagomba	Magereza	-	-	1,216
27	Butundwe Prison Farm	Mwanza	Geitha	Butundwe	Nyakagomba	Magereza	-	-	1,216
28	Butundwe Prison Farm	Mwanza	Geitha	Butundwe	Nyakagomba	Magereza	-	-	1,216

Deleted: Province

Deleted: County

Deleted: Parish

29	Mikidad Mpina	Mwanza	Geitha	Butundwe	Chigunga	Chigunga	-	-	1,178
30	Mikidad Mpina	Mwanza	Geitha	Butundwe	Chigunga	Chigunga	-	-	1,178
31	Kasungamile Prison Farm	Mwanza	Sengerema	Ktunguru	Kasungamile	Kasungamile	-	-	1,201
32	Lugongo Prison Farm	Mwanza	Sengerema	Ktunguru	Chifunfu	Lugongo	-	-	1,150
33	Upendo Farmers Group	Mwanza	Sengerema	Ktunguru	Nyamazigo	Kijuka	-	-	1,219
34	K.M. Siwingwa	Mara	Bunda	Serengeti	Bunda	Nyasura	-	-	1,277

#### Appendix 2. Improved variety quantification and value

Field No.	Farmer (Farm)	Variety	Crop Age	Area (m <sup>2</sup> )	PP/ha	cutting/plant	Available Cuttings	Value (Tz shillings)
1	Biharamulo Prison Farm	MM96/4684	10	846	12,000	30	30456	609120
2	Biharamulo Prison Farm	I96 series	10	1,100	14,000	16	24640	492800
3	Biharamulo Prison Farm	TMS 4(2)1425	12	2,200	8,000	30	52800	1056000
4	Biharamulo Prison Farm	MM96/4684	8	4,725	12,000	15	85050	1701000
5	Biharamulo Prison Farm	TMS 4(2)1425	24	3,900	6,200	19	45942	918840
6	Deusdedit Bweze	MM96/4684	9	600	6600	14	5544	110880
7	Deusdedit Bweze	SS4	9	685	6200	7	2973	59458
8	Deusdedit Bweze	TMS 4(2)1425	9	1,060	7600	15	12084	241680
9	Deusdedit Bweze	TMS 4(2)1425	9	640	9000	7	4032	80640
10	UMOJA FFS	TMS 4(2)1425	9	11,975	9000	13	140107.5	2802150
11	UMOJA FFS	MM96/4684	9	3,225	8000	6	15480	309600
12	Kitengule Prison Farm	MM96/4684	11	19,120	6600	18	227145.6	4542912
13	Kitengule Prison Farm	MM96/4684	9	11,000	7200	20	158400	3168000
14	Kitengule Prison Farm	MM96/4684	9	17,288	7800	14	188785	3775699
15	Jacson Nyaitura	MM96/4684	10	1,824	10600	10	19334.4	386688
16	Patric D. Mulokozi	I 91/0063	8	1,200	7800	9	8424	168480
17	Patric D. Mulokozi	MM96/3075b	8	350	13600	9	4284	85680
18	Patric D. Mulokozi	MM96/4684	8	2,160	8200	12	21254	425088
19	Patric D. Mulokozi	MM96/850	8	3,335	8200	13	35551	711022
20	Juma Rajab	MM96/4619	9	667	6200	12	4962	99250
21	Juma Rajab	TME 14	9	743	6600	12	5885	117691
22	Juma Rajab	SS4	24	30,360	7600	46	1061386	21227712

23	Abdul Surait	MM96/4619	16	3100	6800	36	75888	1517760
24	Abdul Surait	SS4	24	3420	6800	38	88373	1767456
25	Abdul Surait	TMS 4(2)1425	24	3420	6800	38	88373	1767456
26	Butundwe Prison Farm	TMS 4(2)1425	7	52630	12,000	13	821028	16420560
27	Butundwe Prison Farm	Kachaga	7	8,090	12,000	12	116496	2329920
28	Butundwe Prison Farm	TMS 4(2)1425	7	48,580	12,000	13	757848	15156960
29	Mikidad Mpina	MM Series	8	28340	8800	12	299270	5985408
30	Mikidad Mpina	Kachaga	8	8,090	7,550	12	73295	1465908
31	Kasungamile Prison Farm	TMS 4(2)1425	9	10,121	6400	19	123071	2461427
32	Lugongo Prison Farm	TMS 4(2)1425	9	12,140	11,300	19	260646	5212916
33	Upendo Farmers Group	TMS 4(2)1425	9	5,000	3000	13	19500	390000
34	K.M. Siwingwa	TMS 4(2)1425	9	20,000	6000	9	108000	2160000
<b>Total/Average</b>				<b>321,934</b>	<b>8,484</b>	<b>17</b>	<b>4,986,308</b>	<b>99,726,161</b>

### Appendix 3. Disease and pest incidences and severities on improved varieties

Field No.	Farmer	Variety	CMDi	CMDs	CBSDi	CBBi	CBBs	CM i	CGMi	CGMs
1	Biharamulo Prison Farm	MM96/4684	0	1	0	5	2	0	40	2
2	Biharamulo Prison Farm	I96 series	0	1	0	10	2	0	0	1
3	Biharamulo Prison Farm	TMS 4(2)1425	0	1	0	0	1	0	30	2
4	Biharamulo Prison Farm	MM96/468	0	1	0	0	1	0	0	1
5	Biharamulo Prison Farm	TMS 4(2)1425	0	1	0	0	1	0	20	2
6	Deusdedit Bweze	MM96/4684	5	2	0	10	2	0	80	3
7	Deusdedit Bweze	SS4	0	1	0	0	1	0	20	2
8	Deusdedit Bweze	TMS 4(2)1425	10	2	0	0	1	0	30	2
9	Deusdedit Bweze	TMS 4(2)1425	0	1	0	0	1	0	20	2
10	UMOJA FFS	TMS 4(2)1425	0	1	0	5	2	0	80	3
11	UMOJA FFS	MM96/4684	5	2	0	10	2	0	10	3
12	Kitengule Prison Farm	MM96/4684	0	1	0	0	1	0	6	2
13	Kitengule Prison Farm	MM96/4684	0	1	0	15	2	0	65	3
14	Kitengule Prison Farm	MM96/4684	0	1	0	20	2	0	35	2
15	Jacson Nyaitura	MM96/4684	0	1	0	0	1	0	28	2

16	Patric D. Mulokozi	I 91/0063	0	1	0	0	1	0	0	1
17	Patric D. Mulokozi	MM96/3075b	0	1	0	0	1	0	0	1
18	Patric D. Mulokozi	MM96/4684	0	1	0	0	1	0	15	3
19	Patric D. Mulokozi	MM96/850	0	1	0	0	1	0	43	2
20	Juma Rajab	MM96/4619	20	2	0	0	1	0	20	2
21	Juma Rajab	TME 14	0	2	0	0	1	0	10	2
22	Juma Rajab	SS4	0	1	0	30	2	0	20	2
23	Abdul Surait	MM96/4619	-	-	-	-	-	-	-	-
24	Abdul Surait	SS4	-	-	-	-	-	-	-	-
25	Abdul Surait	TMS 4(2)1425	-	-	-	-	-	-	-	-
26	Butundwe Prison Farm	TMS 4(2)1425	-	-	-	-	-	-	-	-
27	Butundwe Prison Farm	Kachaga	-	-	-	-	-	-	-	-
28	Butundwe Prison Farm	TMS 4(2)1425	-	-	-	-	-	-	-	-
29	Mikidad Mpina	MM Series	-	-	-	-	-	-	-	-
30	Mikidad Mpina	Kachaga	-	-	-	-	-	-	-	-
31	Kasungamile Prison Farm	TMS 4(2)1425	-	-	-	-	-	-	-	-
32	Lugongo Prison Farm	TMS 4(2)1425	-	-	-	-	-	-	-	-
33	Upendo Farmers Group	TMS 4(2)1425	-	-	-	-	-	-	-	-
34	K.M. Siwingwa	TMS 4(2)1425	-	-	-	-	-	-	-	-