C3P INVENTORY SURVEY FOR CMD-RESISTANT CASSAVA VARIETIES IN RWANDA

COUNTRY REPORT

BY

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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 i.e. Uganda, Tanzania, Rwanda, Kenya, Burundi and DR. Congo. Within the target countries, the implementation is being done in conjunction with country National Agricultural Research Systems (NARS) and other local partner organisations. The focus of the project is to fight cassava mosaic virus disease (CMD) and banana bacterial blight (BXW). IITA and CRS already have working partners in those countries who will help in the project implementation.

CMD is one of the greatest threats to cassava production in the above sub region. Recent research shows that the CMD pandemic affects about 2,600,000 ha of cassava leading to a loss of 22 million metric tons of produce annually. 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.

IITA in collaboration with National Cassava Programs of partner countries have held improved cassava germplasm exchange and 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 multiplication and dissemination of these varieties are limited due to the fact that multiplication and distribution require a lot of funds (economic hardships in multiplication and distribution) and poor or inexistent extension service delivery. The project is aiming at increasing multiplication and distribution of the improved varieties among rural farmers that are facing the CMD problem.

To achieve the above objective the project intends to deploy effective CMD control strategies among the farming communities. This is 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 before multiplication and distribution are carried out.

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2. Materials and Method

2.1 Team Composition

The survey team comprised of researchers from IITA (Uganda) and ISAR Rubona Station who have been researching on these varieties over years. In addition was C3P Country Coordinator for Rwanda in the team. Also extension staff from partners visited were brought on board to guide the team within their areas of jurisdiction especially from the NGOs. The ministry of Agriculture was represented by National Seed Services (SNS) person. All the survey was done as one team.

2.2 Area and farmers visited

The inventory survey for CMD-resistant materials in Rwanda was conducted from 2nd to 4th August 2006 covering two provinces of East and South (Table 1). These are main areas

where cassava is a major crop and generally it's a dry area with poor soils. From South province, the districts of Huye and Kamonyi were visited, while from East province it was Bugesera district.

Table 1. Area and farmers visited

Province	District	S/County	Village	Farmer
South	Huye	Rubatira	Gikirambwa	ISAR Rubona Station
		Mamba	Mamba	RAVAC NGO
	Kamonyi	Ruyumba	Nyamiyaga	Semanyenzi Joram (INGABO)
		Mugina	Mugina	a) Byimana Musa (INGABO)
			Mugina	b) Bideri Theogine (INGABO)
			Kiyonza	Nshimiyumukiza (INGABO)
		Kimazi	Rubona	Uwimana Lambert (INGABO)
East	Bugesera	Gashora	Gashora	a) National seed services
			Gashora	b) Gashora Local Administration
			Mwendo	ISAR Karama Station
			Kayovu	ISAR Karama Station

Due to the vast nature of the area surveyed, the team with the guidance of ISAR Cassava Breeding program visited sites where improved cassava multiplication was done significantly. Also before the start of the survey the team had a brief meeting at ISAR Rubona station and here 3 cassava varieties were selected for distribution and multiplication by C3P. So the team focused on these varieties in the course of its survey and they were TMS I92/0067 (although in Rwanda it had been coded as TMS I92/0057), TME 14 and 95/NA-00063. These were all IITA improved varieties that had been evaluated in that country and recommended for production by the cassava program based on their performance and farmers acceptability.

The C3P country target of Rwanda cassava multiplication in the project was 92 Ha.

2.3 Field Sampling

The team travelled to ISAR stations, Local Administration offices, local NGOs (INGABO & RAVAC), Farmer groups and individual farmers to get information on the availability of improved materials. Field 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^2
- Age of the planting materials of not less than 6 months or more than 20 months old.

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 17 fields belonging to the above farmers were surveyed and sampled for various parameters such plant height and number of stems per stool to estimate number of cutting per plant, plant population, disease and pest incidence and severity for CMD CBSD CBB MB CGM, stem

quality and general field management. Additional information such 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

The size of the improved cassava fields (plots) visited ranged from 0.05 Ha to 8.0 Ha with crop age ranging from 6 months to 12 months old. However, the fields that had attained age outside that were inspected for diseases and pests but no other parameters were taken and so that they would be considered for C3P in case of deficits. About 55% of the fields were ratooned crops. Plant population ranged from 5,100-18,700 plants per hectare with a general average of 10,447 plants/ha. The high average plant population per hectare was because in some farms they had been planted at 1M x 0.5 M. The numbers of cuttings per stool were variable and depend on the variety, crop age, soil condition, field management, and first or ratooned crop. It ranged from 4 to 55 cuttings per plant (table 2). All the fields were planted as sole crops of cassava.

Table 2. General Field (plot) information

Field No.	Farmer (farm)	Variety	Crop Age (months)	Area (m^2)	Plant Popn/ha	Cuttings/ plant
1	ISAR Rubona Station	TMS I92/0067	6	2100	8800	4
2	ISAR Rubona Station	TME 14	6	2100	9300	4
3	RAVAC NGO	TMS I92/0067	6	6000	18200	6
4	RAVAC NGO	TMS I92/0067	6	41800	9300	35
5	RAVAC NGO	TMS I92/0067	6	10000	14900	11
6	National Seed services	TME 14	7	80000	6900	10
7	National Seed services	95/NA-00063	7	15000	8600	28
8	National Seed services	TMS I92/0067	12	578	6600	55
9	Gashora Local Admin	TMS I92/0067	8	70000	5100	22
10	Gashora Local Admin	95/NA-00063	7	70000	8400	33
11	ISAR Karama Station	95/NA-00063	6	10000	8400	17
12	ISAR Karama Station	TME 14	7	7500	18700	7
13	Semanyenzi Joram (INGABO)	95/NA-00063	8	35000	12000	14
14	Byimana Musa (INGABO)	95/NA-00063	9	10000	10200	16
15	Bideri Theogine (INGABO)	95/NA-00063	9	10000	13200	15
16	Nshimiyumukiza (INGABO)	TMS I92/0067	7	25000	8800	31
17	Uwimana Lambert (INGABO)	TME 14	8	40000	10200	26
	Total/Average			**435078**	**10447**	**19**

3.2 Quantity and value of improved materials available

More improved varieties were found in the Bugesera District in East province than in the other two provinces of Huye and Kamonyi put together. This is because of the extensive multiplication by the Rwanda National Seed Services and Gashora Local Administration. Rwanda National Seed services provided irrigation facilities and that gave good growth conditions. This was also near ISAR Karama centre where these varieties were evaluated. In the South province Huye slightly had more materials than Kamonyi. If one the big sites in Kamonyi (Nyamigaya) however attains maturity the available materials shall exceed those of Huye.

The estimated amount of cassava planting materials expected from the survey is about 5,445,853 cuttings of which 2,488,114 cuttings are of TMS I92/0067, 1,103753 cuttings are TME 14 and 1,853,986 cuttings are of 95N-0063 (Table 3). More than the currently estimated cuttings were expected because in some sites the stems had not attained maturity. The quantities were high because the multiplication was undertaken by the Government agencies and the NGOs and so had planted big areas and provided good management than if were at farmer level where small areas would have been met.

The multiplication in terms of each variety was good and CRS shall go for distribution based on its preference. The available surveyed materials were five times CRS target of 92 Ha requiring about 920,000 cuttings.

Table 3: Summary of the Quantified materials by District.

District	No. Sites	Estimated cuttings TMS I92/0067	Estimated cuttings TME 14	Estimated cuttings 95N-00063	Total
Huye	3	1071817	13671	0	1085488
Bugesera	3	1145283	823374	1333141	3301798
Kamonyi	4	271014	266708	520845	1058567
Total		**2488114**	**1103753**	**1853986**	**5445853**

a) TMS I92/0067

The highest amount of materials available was from TMS I92/0067 with about 2.5 million cuttings. Gashora Local Administration has the largest quantity (1.14 million cuttings) followed by RAVAC NGO with 1.05 million cuttings. The others had small quantities.

b) 95/NA-00063

This variety was the second in terms of available cuttings with 1.9 million cuttings with again Gashora Local Administration leading with 0.94 million cuttings followed National Seed Services with 0.24 million cuttings, then INGABO farmer 0.19 million cuttings. In some sites the stems had not matured particularly one site in Kamonyi as earlier on cited.

c) TME 14

This variety had about 1.1 million cuttings with SNS having 0.69 million cuttings followed by Uwimana L of INGABO in Kamony with 0.29 million cuttings. Others were ISAR Karama station with 0.13 million cuttings and ISAR Rubona with 0.01 million cuttings. This excludes old multiplication in ISAR Karama with very old stems which are not good for multiplication.

Other improve materials found promoted or yet to be promoted by the cassava program but shall not be used in the C3P project were MH95/0414, MM96/1961, MM96/5280, MM96/0287 and MM96/3920. No data was collected from these varieties because they were not the target varieties.

The total value of all the improved materials is estimated at 54.5 million Rwandan Francs i.e. about 98,123 US dollars. Table 4 show detailed amount (Rwandan Francs) one can spend on the quantified materials per variety and on farm basis.

Table 4. Quantity (cuttings) of improved cassava varieties on different farms

Farmer	TMS I92/0067	95/NA-00063	TME 14	Total
ISAR Rubona	16913	0	13672	***30585***
RAVAC	1054905	0	0	***1054905***
National Seed Services	9909	240594	690530	***941033***
Gashora Local Admin	1135374	948620	0	***2083994***
ISAR Karama	0	143926	132844	***276770***
Semanyenzi Joram (INGABO)	0	166562	0	***166562***
Byimana Musa (INGABO)	0	162535	0	***162535***
Bideri Theogine (INGABO)	0	191748	0	***191748***
Nshimiyumukiza (INGABO)	271014	0	0	***271014***
Uwimana Lambert (INGABO)	0	0	266708	***266708***
Total	**2488114**	**18539856**	**1103753**	**5445853**

An average price of 10 Rwandan Francs per cutting was quoted as prevailing price in the country for the improved cuttings.

Table 5. Value of planting materials available

Farmer	TMS I92/0067	95/NA-00063	TME 14	Total
ISAR Rubona	169,130	0	136,720	***305,850***
RAVAC	10,549,050	0	0	***10,549,050***
National Seed Services	99,090	2,405,940	6,905,300	***9,410,330***
Gashora Local Admin	11,353,740	9,486,200	0	***20,839,940***
ISAR Karama	0	1,439,260	1,328,440	***2,767,700***
Semanyenzi Joram (INGABO)	0	1,665,620	0	***1,665,620***
Byimana Musa (INGABO)	0	1,625,350	0	***1,625,350***
Bideri Theogine (INGABO)	0	1,917,480	0	***1,917,480***
Nshimiyumukiza (INGABO)	2,710,140	0	0	***2,710,140***
Uwimana Lambert (INGABO)	0	0	2,667,080	***2,667,080***
Total	**24,881,140**	**18,539,860**	**11,037,530**	**54,458,530**

3.4 Health status of the improved materials

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

Table 6. Average disease and pest incidence and severity on improved cassava varieties

Variety	CMDi	CMDs	CBSDi	CBBi	CBBs	CM i	CGMi	CGMs
TMS I92/0067	3%	2	0	50%	2	0	89%	2
95/NA-00063	1%	2	0	10%	2	0	53%	3
TME 14	1%	2	0	80%	3	0	98%	3

a) CMD

Generally there was a low incidence of CMD on the varieties quantified with an average incidence of 2% on TMS I92/0067 with severity score of 2 with 28% of the fields (i.e. 2 out of 7 fields) surveyed. The other 2 varieties (95/NA-00063 and TME 14) had 1% incidence of CMD with also severity of 2. In these 2 varieties CMD was only observed in 16% of the fields for 95/NA-00063 (i.e. 1 out of 18 fields) and 25% for TME 14 (i.e 1 out 4 fields). This shows that the varieties and the materials surveyed were suitable for the C3P in fighting the CMD pandemic in the country.

b) CBSD

This was not observed in any of the fields visited although the cassava team was cautioned to be on alert and assess on the possible presence of CBSD as it has been observed in some parts of DRC, Uganda, and Western Kenya when it was thought to be the disease of the low coast land in Eastern Africa. Further more the varieties i.e. TME 14 and 95/NA-00063 were susceptible to the disease.

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c) CBB

The highest incidence and severity of the disease was observed on TME 14 at ISAR Rubona though it was also observed in other 2 varieties as well. CBB was only observed in the South province and in only 11% of the total field surveyed for TMS I92/0067, and 5% of the field surveyed for each of TME 14 and 95/NA-0063. The low incidence may be due to the dry season in the area.

d) CGM

This was highest observed biotic stress in the survey because all the 3 varieties were attacked. TME 14 had the highest average incidence of 98% and severity of 3. It was followed by TMS I92/0067 with average incidence of 89% and severity score 2. It however showed that the varieties had moderate resistance to CGM. The relatively high incidence of CGM could be due to the dry weather being experienced in the region.

e) CM

This was not observed in the field visited.

3.4 Sources of varieties and market outlets for stems

The source of all the improved materials surveyed was ISAR Karama Station in Bugesera East province. These materials were supplied from this station to secondary multiplication sites under government like SNS or NGOs such INGABO, RAVAC, and farmer groups. Individual farmers got materials either through NGOs or fellow farmers.

Although improved planting materials have been moving from research through intermediaries like Government agencies and NGOs to individual farmers the pace has been slow and it's the reason many farmers were still growing the local varieties that were CMD susceptible. Those who have multiplied the improved materials of cassava were ready to sell their stems. The price indicated was 10 Rwanda Francs per cutting and it was regarded as the prevailing price. Some the farmers had never sold any stems since it was the first time to multiply such improved material and thus anxious to expand their multiplication because of the available market opportunities.

3.5 General observations

Most farmers were still growing local materials which are highly susceptible to CMD. The incidence of CMD on most local ranges from 30-100% with severity score of 3-5. This is because improved varieties were still scarce or lack of awareness of existence of such.

4 Conclusions and Recommendations

4.1 Conclusions

- The potential varieties for the C3P project were identified and had enough materials for the project. They were TMS I92/0067, 95/NA-00063 and TME 14
- The materials were available in all the provinces and thus transport costs are reduced when procurement is timely done.
- Proper multiplication be put place with variety purity maintained because there were mixes of the varieties in some sites.
- The cassava program should be on look out in all multiplications for presence of CBSD because two of its varieties are susceptible to CBSD.
- CGM is a challenge to the production of CMD resistant varieties.

4.2 Recommendations

- The materials for three varieties selected should be procured for direct distribution to farmers in targeted areas.
- Although CBSD was not observed in the region, its threat from neighbouring countries is real. Therefore precautionary measures should be taken by inspection of all multiplication and distribution sites. The availability of TMS I92/0067 which is tolerant to CBSD is a blessing.
- 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. This is because in some fields there was variety mix.
- Proper labelling and record should be done during collection of materials and planting to ensure purity of the materials.

Appendices

Appendix 1. Farm location

Field No.	Farmer (farm)	Province	District	S/County	Village	Longitude	Latitude	Elevation (m)
1	ISAR Rubona	South	Huye	Rubatira	Gikirambwa	02°28.99S	029°46.49E	1868
2	ISAR Rubona	South	Huye	Rubatira	Gikirambwa	02°29.10S	029°46.49E	1877
3	RAVAC NGO	South	Huye	Mamba	Mamba	02°28.58S	029°54.73E	1581
4	RAVAC NGO	South	Huye	Mamba	Mamba	02°28.58S	029°54.73E	1581
5	RAVAC NGO	South	Huye	Mamba	Mamba	02°28.62S	029°54.77E	1601
6	SNS Ministry of Agric	East	Bugesera	Gashora	Gashora	02°11.06S	030°15.60E	1453
7	SNS Ministry of Agric	East	Bugesera	Gashora	Gashora	02°11.20S	030°14.61E	1455
8	SNS Ministry of Agric	East	Bugesera	Gashora	Gashora	02°11.42S	030°14.58E	1456
9	Gashora Local Administration	East	Bugesera	Gashora	Gashora	02°11.64S	030°14.38E	1467
10	Gashora Local Administration	East	Bugesera	Gashora	Gashora	02°11.67S	030°14.37E	1468
11	ISAR Karama	East	Bugesera	Gashora	Mwendo	02°17.18S	030°15.49E	1457
12	ISAR Karama	East	Bugesera	Gashora	Kayovu	02°16.29S	030°15.25E	1463
13	INGABO - Semanyenzi Joram	South	Kamonyi	Ruyumba	Nyamiyaga	02°06.44S	029°54.97E	1607
14	INGABO - Byimana Musa	South	Kamonyi	Mugina	Mugina	02°06.73S	029°58.98E	1648
15	INGABO - Bideri Theogine	South	Kamonyi	Mugina	Mugina	02°06.47S	029°59.53E	1613
16	INGABO - Nshimiyumukiza	South	Kamonyi	Mugina	Kiyonza	02°08.56S	029°56.40E	1613
17	INGABO - Uwimana Lambert	South	Kamonyi	Kimazi	Rubona	02°09.68S	029°52.28E	1633

Appendix 2. Improved variety quantification and value

Field No.	Farmer (Farm)	Variety	Crop Age	Area (m^2)	PP/ha	cutting/plant	Available Cuttings	Value (Rwandan Francs)
1	ISAR Rubona	TMS I92/0067	6	2100	8800	4	16913	169,130
2	ISAR Rubona	TME 14	6	2100	9300	4	13672	136,720
3	RAVAC NGO	TMS I92/0067	6	6000	18200	6	93580	935,800
4	RAVAC NGO	TMS I92/0067	6	41800	9300	35	793901	7,939,010
5	RAVAC NGO	TMS I92/0067	6	10000	14900	11	167424	1,674,240
6	SNS Ministry of Agric	TME 14	7	80000	6900	10	690530	6,905,300
7	SNS Ministry of Agric	95/NA-00063	7	15000	8600	28	240594	2,405,940

8	SNS Ministry of Agric	TMS I92/0067	12	578	6600	55	9909	99,090
9	Gashora Local Administration	TMS I92/0067	8	70000	5100	22	1135374	11,353,740
10	Gashora Local Administration	95/NA-00063	7	70000	8400	33	948620	9,486,200
11	ISAR Karama	95/NA-00063	6	10000	8400	17	143926	1,439,260
12	ISAR Karama	TME 14	7	7500	18700	7	132844	1,328,440
13	INGABO - Semanyenzi Joram	95/NA-00063	8	35000	12000	14	166562	1,665,620
14	INGABO - Byimana Musa	95/NA-00063	9	10000	10200	16	162535	1,625,350
15	INGABO - Bideri Theogine	95/NA-00063	9	10000	13200	15	191748	1,917,480
16	INGABO - Nshimiyumukiza	TMS I92/0067	7	25000	8800	31	271014	2,710,140
17	INGABO - Uwimana Lambert	TME 14	8	40000	10200	26	266708	2,667,080
	Total/Average							**54,458,530**

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	ISAR Rubona	TMS I92/0067	0	1	0	50	2	0	100	3
2	ISAR Rubona	TME 14	0	1	0	80	3	0	100	2
3	RAVAC NGO	TMS I92/0067	0	1	0	0	1	0	40	2
4	RAVAC NGO	TMS I92/0067	5	2	0	50	2	0	100	2
5	RAVAC NGO	TMS I92/0067	0	1	0	0	1	0	100	2
6	SNS Ministry of Agric	TME 14	0	1	0	0	1	0	100	5
7	SNS Ministry of Agric	95/NA-00063	0	1	0	0	1	0	100	4
8	SNS Ministry of Agric	TMS I92/0067	0	1	0	0	1	0	100	3
9	Gashora Local Administration	TMS I92/0067	0	1	0	0	1	0	80	2
10	Gashora Local Administration	95/NA-00063	0	1	0	0	1	0	100	4
11	ISAR Karama	95/NA-00063	0	1	0	0	1	0	80	2
12	ISAR Karama	TME 14	1	2	0	0	1	0	100	3
13	INGABO - Semanyenzi Joram	95/NA-00063	1	2	0	0	1	0	10	2
14	INGABO - Byimana Musa	95/NA-00063	0	1	0	0	1	0	10	2
15	INGABO - Bideri Theogine	95/NA-00063	0	1	0	10	2	0	20	2
16	INGABO - Nshimiyumukiza	TMS I92/0067	1	2	0	0	1	0	100	3
17	INGABO - Uwimana Lambert	TME 14	0	1	0	0	1	0	100	2