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C3P INVENTORY SURVEY FOR CMD-RESISTANT CASSAVA VARIETIES IN DR. CONGO

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 xanthomonas wilt (BXW). 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. Recent research shows that the CMD pandemic in the ECA 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, 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 been exchanging improved cassava germplasm and conducting 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 they 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 selected improved varieties among rural farmers that are facing the CMD problem.

To achieve the above, the project intends to deploy effective CMD control strategies among the farming communities through multiplication and distribution of CMD-resistant varieties and promotion of improved management practices. As such, there is need to have an inventory of available and preferred CMD-resistant varieties and establish the amount of planting materials available prior to dissemination.

2. Materials and Method

2.1 Team Composition

The survey team comprised of researchers from IITA-Uganda, EARRNET, INERA Cassava Program, as well as representatives from CRS, FAO, Caritas (Bukavu & Goma) and the Provincial Agriculture Plant Protection Department. Also extension staff from locations visited were on board to guide the team in their respective areas of jurisdiction. Before and in the course of the survey, the team held meetings to explain the project purpose, discuss ways of collaboration between CRS and FAO on the stems multiplied and review the field performance of the materials multiplied.

2.2 Cassava varieties selected for C3P and targeted establishment area

Three cassava varieties were decided upon for the C3P for multiplication and distribution. They were *Sawasawa* (MM96/3920), *Liyayi* (MM93/0287) and *Mayombe* (MM96/7762). The three are part of the IITA developed improved cassava varieties acquired by INERA through

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germplasm exchange facilitated by EARRNET. These were selected based on farmers' acceptability and yield performance both on-station and on-farm (see yield performance pictures from Tongo, North Kivu province below). Upon evaluation and recommendation of these varieties by INERA for dissemination, FAO went straight into large scale multiplication with selected farmers and farmers groups in the different provinces. The C3P country target for DR. Congo is to establish 125 Ha of the targeted cassava genotypes in all the project areas by the end of the project time. This will require up to 15 ha of planting materials.



The C3P cassava Inventory team in DRC



Admiring the yield of Sawasawa (MM96/3920)



Collecting data in one of the inspected fields



Second best: Liyayi (MM96/0287)

2.3 Area and farmers visited

The inventory survey for CMD-resistant materials in DR. Congo was conducted from 22nd - 31st August 2006 covering 2 provinces i.e. South Kivu and North Kivu (Table 1), where most of the multiplication is taking place. In South Kivu province, Kalehe, Kabare and Uvira territories were visited while in North Kivu province only Rutshuru territory was visited. Due to the fragile security situation in North Kivu, our coverage was restricted to the areas that the United Nations Peace Keeping Force (MONUC) had agreed to give us escorts.

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In all the multiplication sites visited, the materials are co-owned by FAO and individual farmers or CBOs. FAO provides management cost subsidies to the partners who are responsible for ensuring that the materials are well taken care of. At harvest, FAO takes 60%

of the total stem harvest while the 40% of stem harvest and roots belong to the participating partner. Below is a summary of the areas and partners visited.

Table 1. Areas and farmers visited

Province	Territories	Village	Institutions / Farmers
South Kivu	Kabare	Buhegere	FAO/PABU
	Kabare	Buhegere	FAO/PABU Astride
	Kabare	Nyakadaka	FAO/ Mama Della Pace
	Kabare	Kambaga	FAO/INERA
	Kabare	Luhora	FAO/INERA
	Kabare	Mulungu	FAO/Ruzuke FFS
	Kabare	Mulungu	Agro Pro CBO
	Kabare	Mudaka	FAO/ADV
	Kalehe	Ihusi	FAO/Mr. Bashi (Private)
	Uvira	Kiryinye	FAO/Caritas Bukavu
North Kivu	Rutshuru	Tongo	FAO/ Mr. Kasuku (Private)

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2.4 Field Sampling

The team travelled to INERA Mulungu station, FAO and Caritas (main CRS partner in C3P) offices, CBOs and individual farmers to get information on the availability of improved materials. Fields were selected for quantification, disease and pest assessment basing on the following;

- Availability of the targeted improved cassava materials
- Willingness of the owner to sell the materials to the project
- Field size of not less than 200m²
- Age of the planting materials of not less than 7 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 21 fields belonging to the above institutions / farmers were surveyed and sampled for various parameters such number of plants in 50 M² area, plant height and number of stems per stool to estimate number of cuttings per plant and plant population; disease and pest incidence and severity for CMD, CBB, CBSD, CM, and CGM, 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.

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3. Findings

3.1 General information from the multiplication sites and farmers visited

The size of the cassava fields surveyed ranged from 0.1ha to 10.0 ha and crop age 7 – 9 months old. However, fields that were less than 7 months old were scouted for pests and diseases with view of future utilisation by the project in case the mature stems were not enough for this season. About 81% of the fields were first crop stems while 19% of the fields were ratooned stems. Plant population ranges from 4,500-20,000 plants per hectare with an average of 12,019 plants/ha. The high average number of plants per hectare was due to the 1 m x 0.5 m spacing of the materials in most of the fields. On the other hand, the low plant population in Rutshuru was because of wide spacing due to high fertility of the farms (the

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volcanic ash soils) that cause the plants to lodge if planted at the normal 1 m x 1 m spacing. Caritas Bukavu in Uvira was the only place where irrigation was practiced on the multiplication. The number of cuttings per stool was variable and depended on the variety, crop age, soil condition, field management, and status of the crop i.e. first or ratooned crop. It ranged from 6 to 30 cuttings per stool (table 2). All the fields surveyed were planted as sole crops.

Table 2. General Field information

Field No.	Farmer / Institution	Variety	Crop Age (months)	Area (m ²)	Plant Popn/ha	Cuttings/plant
1	FAO/PABU	MM96/0287	11	12519	10400	10
2	FAO/PABU	MM96/3920	11	5194	9000	12
3	FAO/PABU Astride	MM96/0287	11	6000	8800	10
4	FAO/PABU Astride	MM96/3920	11	3400	9400	12
5	FAO/Mama Della Pace	MM96/0287	10	2000	9600	6
6	FAO/INERA	MM96/0287	11	12500	18400	12
7	FAO/INERA	MM96/3920	10	4500	13400	30
8	FAO/INERA	MM96/7762	10	10000	14000	12
9	FAO/INERA	MM96/3920	12	4000	13000	8
10	FAO/INERA	MM96/0287	12	8000	13000	18
11	FAO/INERA	MM96/3920	10	4000	20000	8
12	FAO/Bashi	MM96/0287	8	20000	11000	10
13	FAO/Ruzuke FFS	MM96/3920	10	1000	9800	14
14	Agro Pro(CBO)	MM96/3920	11	10000	18800	12
15	Agro Pro(CBO)	MM96/0287	11	5000	14000	6
16	FAO/ADV	MM96/0287	10	10000	17200	10
17	FAO/Caritas Bukavu	MM96/7762	8	10000	14000	13
18	FAO/Caritas Bukavu	MM96/3920	9	20000	14400	14
19	FAO/Kasuku	MM96/0287	10	70000	5400	24
20	FAO/Kasuku	MM96/7762	8	10000	4200	24
21	FAO/Kasuku	MM96/3920	7	100000	4600	24
Total/Average				328113	12,019	14

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3.2 Quantity and value of improved materials available

More improved materials were found in the South Kivu province with about 2.5 million cuttings than North Kivu province with about 2.1 million cuttings though the margin was not big. This is because there were many multiplication sites in South Kivu compared to North Kivu where only one farmer had multiplied materials meeting the age requirement. Another farmer who had close to 8 Ha of the materials could not be considered for this season as they were only 5 months old at the time of assessment. Looking at territories, Rutshuru had the highest quantity on materials with about 2.1 million cuttings followed by Kabare with 1.6 million cuttings. Kalehe territory had the lowest quantity of materials with about 0.2 million cuttings but good side of it, it borders Kabare District which was second in terms of quantity of available materials.

The estimated amount of cassava planting materials expected from the survey is about 4.6 million cuttings of which 2.0 million cuttings are of MM96/0287, 2.1 million cuttings of MM96/3920, and lastly 0.5 million cuttings of MM96/7762. The quantities were high because the multiplication was still under the support of Government and donors like FAO.

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The multiplication for each variety was fairly good and it shall leave some room for CRS and FAO to share out the materials without much problem. The 2 varieties MM96/3920 and MM96/0287 had more material than MM96/7762 and shall allow choice. The available surveyed materials were more than three times the CRS target of 125 ha requiring about 1.25 million cuttings.

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Table 3: Summary of the Quantified materials by Territory and Variety

Territory	No. Sites	Est. cuttings MM96/0287	Est. cuttings MM96/3920	Est. cuttings MM96/7762	Total
Rutshuru	1	907200	1104000	100800	2112000
Kabare	8	857518	620659	168000	1646177
Kalehe	1	211200	0	0	211200
Uvira	1	0	414720	179200	593920
Total	11	1975918	2139379	448000	456297

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a) **MM96/3920**

The genotype MM96/3920 gave the highest number of cuttings with about 2.0 million cuttings. FAO / Kasuku farm in Rutshuru Tongo, North Kivu had the largest quantity of 1.1 million cuttings while in South Kivu at Uvira, Caritas had 0.4 million cuttings. The two provinces had nearly balanced quantities of the variety.

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b) **MM96/0287**

This variety was the second in terms of availability with 2.0 million cuttings. The largest single source was again at FAO / Kasuku farm with about 0.9 million cuttings. This variety is also yellow fleshed and hence its name Liyayi (Swahili for egg).

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c) **MM96/7762**

This variety was the least multiplied with Caritas in Uvira territory having about 0.18 million cuttings. It was only multiplied in three sites surveyed.

Table 4 below shows the quantity of materials per genotype estimated at the different farms in the two provinces of South and North Kivu.

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

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Farm / Institution	Est. cuttings MM96/0287	Est. cuttings MM96/3920	Est. cuttings MM96/7750	Total
FAO/PABU	124990	56095	0	181085
FAO/PABU Astride	50688	38352	0	89040
FAO/ Mama Della Pace	11520	0	0	11520
FAO/INERA (1)	276000	180900	168000	624900
FAO/INERA (2)	187200	105600	0	292800
FAO/Ruzuke FFS	0	14112	0	14112
Agro Pro CBO	42000	225600	0	267600
FAO/ADV	165120	0	0	165120
FAO/ Mr. Bashi (Private)	211200	0	0	211200
FAO/Caritas Bukavu	0	414720	179200	593920
FAO/ Mr. Kasuku (Private)	907200	1104000	100800	2112000
Total				4563297

The total value of all the improved materials is estimated at 342,247 US dollars. Table 5 below shows s the detailed estimated cost that will be required per variety and on-farm basis. A price of \$3 for every 10 metres of planting material was reported as the prevailing price in the country for the improved genotypes.

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Table 5. Value of planting materials available

Farm / Institution	Est. Value MM96/0287 (US\$)	Est. value MM96/7204 (US\$)	Est. value MM96/7688 (US\$)	Total value (US\$)
FAO/PABU	9374	4207	0	13581
FAO/PABU Astride	3802	2876	0	6678
FAO/ Mama Della Pace	864	0	0	864
FAO/INERA (1)	20700	13568	12600	46868
FAO/INERA (2)	14040	7920	0	21960
FAO/Ruzuke FFS	0	1058	0	1058
Agro Pro CBO	3150	16920	0	20070
FAO/ADV	12384	0	0	12384
FAO/Mr. Bashi (Private)	15840	0	0	15840
FAO/Carita Bukavu	0	31104	13440	44544
FAO/ Kasuku (Private)	68040	82800	7560	158400
Total	148194	160453	33600	342247

3.3 Health status of the improved materials

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During the assessment exercise, the plants 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 cassava mealy bug (CM) were also assessed (Table 6).

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

Variety	CMDi	CMDs	CBSDi	CBBi	CBBs	CMi	CGMi	CGMs
MM96/0287	1%	2	0	68%	2	0	40%	2
MM96/3920	0	1	0	80%	2	0	80%	2
MM96/7762	0	1	0	80%	2	0	40%	2

a) CMD

Generally there was a low incidence of CMD on the varieties quantified with an average incidence of 1% on MM96/0287 with severity score of 2. It was only observed in 14% of the fields surveyed in South Kivu in the territories of Kabare and Kalehe. No CMD was observed in the other two varieties i.e. MM96/3920 and MM96/7762. This shows that the varieties and the materials surveyed were suitable for the C3P for fighting of the CMD pandemic. Those fields where CMD was observed can be cleaned by rouging the diseased plants at cutting time as well as monitoring and rouging out of infected sprouts after planting in the project fields.

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b) CBSD

Cassava brown streak disease was not observed in any of the fields visited although the cassava team was cautioned to be on the alert as the disease has been reported in some parts of DRC.

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c) **CBB**

A few cases of CBB were encountered and all through the severity was low, scoring 2. All the 3 varieties showed the disease symptoms of infection. It was observed in Kabare and Rutshuru territories. Of all the fields planted with MM96/0287 and MM96/7762, 33% had disease symptoms each while 11% of the fields with MM96/3920 showed disease symptoms. The disease did not however affect the quality of the materials.

d) **CGM**

This was highest observed biotic stress in the survey because all the 3 varieties were attacked. MM96/3920 had the highest average incidence of 80% and severity of 2. The other two varieties had similar average incidence (40%) and severity (2). Of all the fields planted with MM96/0287, 66% were attacked by CGM while the rest had lower field incidence of the pest. The relatively high incidence of CGM could be due to the dry weather being experienced in the region to which CGM attack is well associated.

e) **CM**

This was not observed in the fields visited.

f) **Whiteflies**

Though no data was taken on this pest, it was observed in big populations in some fields in Uvira territory in South Kivu where soil fertility was low and the climate dry.

3.4 Sources of varieties and market outlets for stems

All the improved materials surveyed were sourced from INERA Mulungu station where the IITA germplasm introduced from Uganda were evaluated. The FAO was among the first organisations to access ~~the materials from research and went ahead to multiply them on wide~~ scale. As such, most of the secondary multiplication sites are co-owned by FAO. Although improved planting materials have been moving from research through intermediaries like government agencies and NGOs these varieties had not reached the farmers for production.

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Following the meetings during the survey, it became clear that even part of the 60% FAO stake in the materials under multiplication could be accessed to CRS for the C3P. Also the balance of the material that FAO has given to those farmers who multiplied on its behalf was to be sold to the C3P.

3.5 General observations

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Most farmers were still growing local materials which are highly susceptible to CMD. The incidence of CMD on most local materials ranged from 30%-100% with severity score of 3-5. This is because improved varieties were still scarce or the farmers lacked awareness of existence of such improved resistant materials. In addition, some NGOs are still involved in dissemination of local materials in their food security projects due to scarcity of the improved resistant materials. The NGOs also lack the technical knowledge about the cassava genotypes and hence cannot easily distinguish some of the local materials from the improved ones.

4 Conclusions and Recommendations

- Based on the plant health status and availability of improved cassava genotypes in the DRC, genotypes MM96/3920, MM96/0287, and MM96/7762 were selected as targets for the C3P.
- The materials available in the 2 parts of eastern Congo could provide enough planting materials required for the project target of 125 ha. Therefore, the materials for the three varieties selected should be procured for direct distribution to farmers in targeted areas.
- Since the National Program is intending to start up a breeding program, CBD and whitefly resistance should be given first priority. There is also need to take precautionary measures by continuous monitoring of the multiplication sites by technical personnel who know CBD symptoms to report any out break as soon as observed.
- While the CBOs partnering with FAO own 40% of the multiplied materials, they cannot make decisions on the selling of their stake without consulting FAO. As such, the project can use the influence of FAO to ensure that all the materials are secured and not sold to any other players until the target for CRS/Caritas is met.
- To ensure the right varieties and good quality materials are collected from the sites, an experienced technician from INERA should be on site during the cutting and packaging of the materials. He/she should be able to scout the whole field and remove all the off-types and the few CMD infected plants where they appear.
- Proper labelling and record should be done during collection of materials and planting to ensure purity of the materials and easy follow up should there be a problem.

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Appendices

Appendix 1. Farm location

Field No.	Farmer (farm)	Province	Territory	Village	Longitude	Latitude	Elevation (m)
1	FAO/PABU	South Kivu	Kabare	Buhengere	02°12.55S	028°50.35E	1548
2	FAO/PABU	South Kivu	Kabare	Buhengere	02°12.55S	028°50.35E	1548
3	FAO/PABU Astride	South Kivu	Kabare	Buhengere	02°12.55S	028°50.35E	1548
4	FAO/PABU Astride	South Kivu	Kabare	Buhengere	02°12.55S	028°50.35E	1548
5	FAO/Mama Della Pace	South Kivu	Kabare	Nyakadaka / Lwiro	02°15.17S	028°49.48E	1648
6	FAO/INERA	South Kivu	Kabare	Kambogo/INERA	02°19.22S	028°47.26E	1733
7	FAO/INERA	South Kivu	Kabare	Kambogo/INERA	02°19.22S	028°47.26E	1734
8	FAO/INERA	South Kivu	Kabare	Kambogo/INERA	02°19.22S	028°47.26E	1735
9	FAO/INERA	South Kivu	Kabare	Luhora/INERA	02°19.48S	028°47.11E	1746
10	FAO/INERA	South Kivu	Kabare	Luhora/INERA	02°19.48S	028°47.11E	1747
11	FAO/INERA	South Kivu	Kabare	Luhora/INERA	02°19.59S	028°47.26E	1729
12	FAO/Bashi	South Kivu	Kalehe	Ihusi Kapema	02°05.31S	028°54.50E	1560
13	FAO/Ruzuke FFS	South Kivu	Kabare	Mulungu	02°20.08S	028°46.38E	1820
14	Agro Pro(CBO)	South Kivu	Kabare	Mulungu	02°20.07S	028°46.44E	1815
15	Agro Pro(CBO)	South Kivu	Kabare	Mulungu	02°20.07S	028°46.44E	1816
16	FAO/ADV	South Kivu	Kabare	Mudaka	02°24.56S	028°48.85E	1564
17	FAO/Carita Bukavu	South Kivu	Uvira	Kiryinye	02°54.07S	029°00.06E	1139
18	FAO/Carita Bukavu	South Kivu	Uvira	Kiryinye	02°54.07S	029°00.06E	1140
19	FAO/Kasuku	North Kivu	Rutshuru	Tongo	01°11.87S	029°16.82E	1276
20	FAO/Kasuku	North Kivu	Rutshuru	Tongo	01°11.78S	029°16.90E	1272
21	FAO/Kasuku	North Kivu	Rutshuru	Tongo	01°11.78S	029°16.90E	1273

Appendix 2. Improved variety quantification and value

Field No.	Farmer (Farm)	Variety	Crop Age	Area (m ²)	PP/ha	cutting/plant	Available Cuttings	Value (US\$)
1	FAO/PABU	MM96/0287	11	12519	10400	10	124990	9374.25
2	FAO/PABU	MM96/3920	11	5194	9000	12	56095	4207.125
3	FAO/PABU Astride	MM96/0287	11	6000	8800	10	50688	3801.6
4	FAO/PABU Astride	MM96/3920	11	3400	9400	12	38352	2876.4
5	FAO/Mama Della Pace	MM96/0287	10	2000	9600	6	11520	864
6	FAO/INERA	MM96/0287	11	12500	18400	12	276000	20700
7	FAO/INERA	MM96/3920	10	4500	13400	30	180900	13567.5
8	FAO/INERA	MM96/7762	10	10000	14000	12	168000	12600
9	FAO/INERA	MM96/3920	12	4000	13000	8	41600	3120
10	FAO/INERA	MM96/0287	12	8000	13000	18	187200	14040
11	FAO/INERA	MM96/3920	10	4000	20000	8	64000	4800
12	FAO/Bashi	MM96/0287	8	20000	11000	10	211200	15840
13	FAO/Ruzuke FFS	MM96/3920	10	1000	9800	14	14112	1058.4
14	Agro Pro(CBO)	MM96/3920	11	10000	18800	12	225600	16920
15	Agro Pro(CBO)	MM96/0287	11	5000	14000	6	42000	3150
16	FAO/ADV	MM96/0287	10	10000	17200	10	165120	12384
17	FAO/Carita Bukavu	MM96/7762	8	10000	14000	13	179200	13440
18	FAO/Carita Bukavu	MM96/3920	9	20000	14400	14	414720	31104
19	FAO/Kasuku	MM96/0287	10	70000	5400	24	907200	68040
20	FAO/Kasuku	MM96/7762	8	10000	4200	24	100800	7560
21	FAO/Kasuku	MM96/3920	7	100000	4600	24	1104000	82800
Total/Average				328113	12,019	14	4563297	342247

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	FAO/PABU	MM96/0287	0	1	0	0	1	0	0	1
2	FAO/PABU	MM96/3920	0	1	0	0	1	0	0	1
3	FAO/PABU Astride	MM96/0287	1	2	0	0	1	0	0	1
4	FAO/PABU Astride	MM96/3920	0	1	0	0	1	0	0	1
5	FAO/Mama Della Pace	MM96/0287	0	1	0	0	1	0	10	2
6	FAO/INERA	MM96/0287	0	1	0	100	2	0	10	2
7	FAO/INERA	MM96/3920	0	1	0	20	2	0	0	1
8	FAO/INERA	MM96/7762	0	1	0	0	1	0	0	1
9	FAO/INERA	MM96/3920	0	1	0	0	1	0	100	3
10	FAO/INERA	MM96/0287	0	1	0	5	2	0	10	2
11	FAO/INERA	MM96/3920	0	1	0	0	1	0	0	1
12	FAO/Bashi	MM96/0287	1	2	0	0	1	0	100	2
13	FAO/Ruzuke FFS	MM96/3920	0	1	0	0	1	0	0	1
14	Agro Pro(CBO)	MM96/3920	0	1	0	0	1	0	0	1
15	Agro Pro(CBO)	MM96/0287	0	1	0	0	1	0	0	1
16	FAO/ADV	MM96/0287	1	2	0	0	1	0	100	2
17	FAO/Carita Bukavu	MM96/7762	0	1	0	0	1	0	0	1
18	FAO/Carita Bukavu	MM96/3920	0	1	0	0	1	0	0	1
19	FAO/Kasuku	MM96/0287	0	1	0	100	2	0	10	2
20	FAO/Kasuku	MM96/7762	0	1	0	80	2	0	40	2
21	FAO/Kasuku	MM96/3920	0	1	0	80	2	0	60	2