RTB POTATO SCALING FUND PROJECT COMPLETION REPORT

Increasing Scaling up and Adoption of Potato in Africa through Combining Market-driven, Climate Resilient, Novel Potato Varieties and Seed Systems Innovation

CIP INTERNATIONAL POTATO CENTER
A CGIAR RESEARCH CENTER

CGIAR RESEARCH PROGRAM ON Roots, Tubers and Bananas

FIPS-Africa
FARM INPUT PROMOTIONS AFRICA LTD.

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ACRONYMS

ATC	Agricultural Training Centre
BugiZARDI	Buginyanya Zonal Agricultural Research and Development Institute
CIP	International Potato Center
FIPS	Farm Input Promotions Africa Ltd
GIZ	German Society for International Co-operation
HCDA	Horticultural Crops Development Authority
KALRO	Kenya Agricultural and Livestock Research Organization
Ka-ZARDI	Kachwekano Zonal Agricultural Research and Development Institute
KEPHIS	Kenya Plant Health Inspectorate Services
NGO	Non-Governmental Organization
NPCK	National Potato Council of Kenya
PCPB	Pest Control Products Board
RACs	Rooted apical cuttings
RMTs	Rapid Multiplication Techniques
RTB	Roots, Tubers and Bananas (a CGIAR Research Program)
SFSA	Syngenta Foundation for Sustainable Agriculture
SRK	Stokman Rozen Kenya Ltd
TC	Tissue culture
TOT	Training of Trainers
USD	United States dollar
WAO	Ward Agricultural Officer

EXECUTIVE SUMMARY

The International Potato Center and partner institutions through scaling fund project endorsed the use of rooted apical cuttings (RAC) as a rapid seed multiplication technique to accelerate scaling up and adoption of robust potato varieties in Kenya and Uganda. The project was implemented from the year 2017–2021 and aimed to reach at least 50,000 potato farmers with high quality seed of new varieties. Farmer group training model combining field demonstrations, seed distribution and knowledge exchange was adopted. Awareness creation through field days, national media and agricultural shows formed a major component of RAC/variety dissemination. This was achieved through engagement of existing digital platforms such as use of short messages and the NPCK Viazi soko App, use of televisions and newspaper prints, as well as application of secondary sources of information and promotional campaigns e.g., distributions of variety catalogues, manuals, and information leaflets. The project mainstreamed gender and particularly paid attention to empower women and youths. An endline survey was carried out to determine farmers' preferences and demand for new varieties and seeds.

Collectively, capacity development of 250 trainers of trainees (ToTs), who subsequently trained more than 2,000 farmers (of which 48% were women and 12% youths) was attained. These farmers were reached directly with at least one new potato variety. In total, 142,205 rooted apical cuttings of new varieties were distributed to over 2,000 farmers. Distributions occurred at or after training events. The yields produced on-farm from the cuttings distributed to the farmers is estimated to have generated over 1000 MT basic seeds of new varieties. Farmers reached indirectly through field days, trade fairs, agricultural shows, television and print media is estimated to be over 500,000. Farmers' varietal preference varied according to the agroecology, with farmers in mid-altitudes preferring cultivars which are high yielding and are heat and drought tolerant, and those in the traditional potato-growing highlands preferring varieties which yield high, have ready market, and can tolerate late blight disease.

1. BACKGROUND

Potato sector in Kenya and Uganda is dominated by smallholder farmers whose production efforts are largely constrained by limited access to quality seeds of robust, climate adapted and high yielding varieties. In Kenya, for instance, the informal sector, which is dominated by farmer saved seed, provides >90% of seed for planting, a case which is common in most developing countries. Therefore, strengthening the informal sector through farmer participation, working with farmer groups, researchers and extension agents becomes necessary to undertake local-level seed production and distribution.

Through the project, "*Market-driven scaling up and adoption of potato in Africa through a technology package combining market-driven, climate resilient, novel potato varieties with a seed system innovation*", the International Potato Center and partner institutions adopted a farmer training model that brought together a team of researchers, extensionists and farmers. The aim was to strengthen the linkage between the actors and support the dissemination of climate smart, consumer-demanded potato varieties to 50,000 farmers. A rapid multiplication system based on the use of rooted apical cuttings and novel improved varieties was disseminated to the farmers using this approach.

OUTPUT 1: AT LEAST 50,000 POTATO FARMERS, AMONG WHICH 30% ARE FEMALE FARMERS, WILL BE REACHED IN KENYA AND UGANDA WITH HIGH QUALITY SEED OF NEW VARIETIES

Activity 1.1: Creating awareness and demand for rooted apical cutting and new varieties

Sub-activity 1.1: Training of ToTs

Capacity development formed a major component of the project activities, aiming at strengthening the capacity of farmers and promoting strategic partnerships. Training of ToTs on field production and management of rooted apical cutting was conducted at the county and subcounty levels.

Plate 1: Training event for the ToTs: giving a theoretical background (a); and a practical training (b); and further visit at vegetative phase (c).

The purpose was to build a pool of competent instructors who would then build the capacity of farmers to produce clean seed on-farm. The approach involved both public and private institutions and promoted women and youth engagement. County extension agents constituted majority of the ToTs trained, followed by the village-based advisors. Youths (persons less than 30 years of age) constituted 15% of the ToTs and women 41% (Table 1).

Table 1: Number of persons trained as ToTs on RAC production and management.

Country	Groups trained	Total	Gender disaggregation		Youth	Proportions (%)	
			Men	Women		Women	Youth
Uganda	National research institutions	5	5	-	3	-	60
	Sub county extension agents	73	62	11	11	15	15
	Total	78	67	11	14	14	18
Kenya	County extension agents	129	55	74	18	57	14
	Village-based advisors	10	6	4	-	40	0
	Total	139	61	78	18	56	13
Overall		**217**	**128**	**89**	**32**	**41**	**15**

Sub-activity 1.2. Promotion of rooted apical cuttings and new varieties

1.2.1 Demos during farmer training

Participatory learning was adopted with farmer group model to introduce the apical cutting technology and new varieties to the farmers. With this model, each ToT was tasked to mobilize and train 2 to 5 farmer groups, each group comprising of 5 to 30 farmers. Through this approach, the number of participants trained (in Kenya and Uganda) was 17,151 of which 16,918 (99%) were farmers (Table 2). Women constituted greater percentage of the farmers trained (52%) while youths made up 27% of the total participants trained.

Plate 2: ToTs training farmers on planting and harvesting of apical cuttings in Kenya and Uganda respectively.

Table 2: Farmers and actors reached through training events in Kenya and Uganda.

Country	Groups reached	Total	Gender disaggregation		Youth	Proportions (%)	
			Men	Women		Women	Youth
Uganda	Potato farmers	2,017	841	1,176	428	58	51
	Seed multipliers	56	40	16	7	29	18
	Total	**2,073**	**881**	**1,192**	**435**	58	49
Kenya	Potato farmers	14,901	7,124	7,777	2,218	52	31
	Government officials	59	32	27	7	46	22
	Private seed business	78	36	42	11	54	31
	NGOs	40	21	19	9	48	43
	Total	**15,078**	**7,213**	**7,865**	**2,245**	52	31
Overall		**17,151**	**8,094**	**9,057**	**2,680**	**53**	**33**

1.2.2 Distribution of rooted apical cuttings to farmers

Free promotional packs of rooted apical cuttings and basic seeds of different potato varieties were distributed to the farmers trained. The aim was to introduce farmers to a wide range of robust potato varieties and ultimately promote the rooted apical cutting technology. Each farmer trained (except where low production limited the supply) received 2 to 3 potato varieties, 10

cuttings per variety. Cumulatively, 322,326 cuttings (220,760 in Kenya and 101,566 in Uganda), and about 2 tons of basic seeds were distributed to a total of 10,995 farmers (Table 3). In Uganda, the project leveraged with the GIZ piloting project to support the distribution of cuttings of different varieties. Shangi, Unica, Wanjiku, Chulu, Nyota, and Konjo were the main varieties distributed to the farmers in Kenya. In Uganda, Naropot 1, Victoria, Rwangume, and Naropot 2 were the main varieties distributed.

Table 3: Cuttings distributed to farmers and seed multipliers in Uganda and Kenya.

Country	Variety	#Farmers
Uganda	Kachpot 1	6,502
	Kachpot 2	2,852
	Kinigi	3,543
	Naropot 1	15,507
	Naropot 2	7,306
	Naropot 3	7,938
	Rwangume	12,495
	Victoria	7,812
	Total	63,955
Kenya	Shangi	51,250
	Unica	58,870
	Wanjiku	25,100
	Chulu	7,740
	Nyota	3,860
	Konjo	5,230
	Lenana	670
	Sherekea	140
	Mayan Gold	50
	Dutch Robjn	5,475
	Total	158,385
Overall		**222,340**

Plate 3: A group of ToTs visiting a farmer (a); a farmer attending to her demo plot (b)

1.2.3 Field days, trade fairs and exhibitions

Seventeen (17) field day events organized by public and private partners were held in Kenya with a total of 2,159 participants (1,134 men-53% and 1,025 women-47%), representing various actor types (farmers-1,953; government officials-94; private business-77; and NGOs-35). In Uganda, 389 farmers (280 men-72% and 109 women-28%) were reached through field day events (Table 4). Youths represented 46% of the total participants. Some of these events were aired on national televisions and covered in print media. This platform is estimated to have reached audience of

over 500,000 farmers. The field day and trade fair events were attended by top country officials who in their speech and field observations well, recognized the potential of apical cuttings as a technology to revolutionize seed system and contribute to increased seed supply in the country (see Box 1 for the case of Kenya).

Box 1. Rooted apical cuttings recognized by leaders in Kenya as a technology to revolutionize seed system

The KEPHIS Quality Assurance General Manager, Mr. Simeon Kibet at a KEPHIS Field Day Event held in West Pokot County acknowledged the high yield from apical cuttings. "It is amazing to observe tuber numbers of up to 30 from a single apical cutting compared to 7–10 tubers observed with the basic seeds", he stated. He further reiterated that, "This technology offers a great option to secure clean starter material and can readily go into outgrower scheme to ramp up seed production in remote areas". In the same event, the Minister for Agriculture, West Pokot County Mr. Godfrey Lipale stated that "I am particularly impressed with the high level of late blight disease tolerance shown by these new varieties".

Similarly, the Governor for Kiambu County Hon. James Nyoro in a Farmers' Field Day Event acknowledged the use of rooted apical cuttings as a technology that can rapidly make available high-quality seeds at a cheaper cost. He said, "This technology rapidly multiplies clean seeds at a cheaper cost and has the potential to create jobs to youths and women, thereby raising their rural incomes." He concluded, "I direct the minister for Agriculture to work with CIP in building the capacity of farmers and seed multipliers to adopt this technology".

The Governor for Meru County Hon. Kiraitu Murungi during a Potato Trade Fair Event also stated, "Rooted apical cutting has a tremendous capacity to transform the seed potato system in the country." He called upon the relevant stakeholders and projects to endorse the technology by seeking active participation of grower organizations to ensure sufficient production of RAC starter materials. The Governor urged farmers to form producer organizations and farmer cooperative societies which he described as key to leveraging a competitive advantage, giving farmers opportunity for business registration and higher farmgate prices via direct linkages to buyers of their seed produce.

Plate 1: CEC Agriculture and KEPHIS Officials (a), Governors of Meru (b) and Kiambu (c) Counties visiting the potato apical cutting demos and display booths during Field Day and Trade Fair Events.

The public institutions that partnered with CIP in these events include the County Governments, the national seed regulatory and research institutions (e.g., KEPHIS, HCDA, PCPB, KALRO, Ka-ZARDI, BugiZARDI), and the various national Agricultural Training Centers (e.g., ATC Nakuru, ATC Chebara and ATC Chebororwa). Some of the private partners include the specialized private nursery producers and seed merchants (e.g., Stockman Rozen Kenya Ltd, Grace Rock Farm Ltd,

Agromax Ltd, AGT Laboratories, Fresh Crop Ltd, Agrico East Africa Ltd, Kisima Farm Ltd), as well as the farm-input and knowledge exchange providers (e.g., Corteva Agrisciences, Yara East Africa, Cropnuts, NPCK, FIPS, Self Help Africa).

Table 4: Farmers and actors directly reached through field day events in Kenya and Uganda.

Country	Groups reached	Total	Gender disaggregation		Youth	Proportions (%)	
			Men	Women		Women	Youth
Uganda	Potato farmers	389	280	109	-	28	-
	Total	389	280	109	-	28	-
Kenya	Potato farmers	1,953	1,016	937	498	48	49
	Government officials	94	62	32	18	34	29
	Private business	77	37	40	8	52	22
	NGOs	35	19	16	3	46	16
	Total	2,159	1,134	1,025	527	47	46
Overall		**2,548**	**1,414**	**1,134**	**527**	**42**	**46**

1.2.4. Sales of apical cuttings during field day and training events

Sale of apical cuttings by the seed businesses was monitored at the nursery production units, and at field day and training events. The objective was to test the demand arising from the rooted apical cutting campaigns, especially the sales that occurred at or after training and field day events. From the tracked sales records, the quantity of cuttings sold to a total of 1,122 buyers in Kenya and Uganda was 495,779 with a value of USD 59,992 (Table 5). Of this, a total of 81,841 cuttings was purchased by the project and distributed to the farmers trained. The rest (413,938) was bought by the farmers. Majority of the sales (90%) occurred at the nursery sales units, demonstrating potential capacity and emergence of these nurseries as local seed suppliers. A significant quantity of sales (18,389 cuttings worth USD 184) occurred at the field day and training sites, thus indicating high demand generated by trainings and exhibition campaigns.

Plate 4: Farmers visiting demo plots during a trade fair event (a) and are motivated, thus purchasing cuttings (b).

Table 5: Quantity of cuttings purchased by farmers and project during the project phase.

Country	Business	Buyer	Point/event of sale			Total cuttings sold	Value of sales (USD)	Number of buyers
			Field day	Training	Nursery sales units			
Uganda	Private seed businesses	Farmers	-	-	140,258	140,258	24,370	49
Kenya	Meru satellite nurseries	Farmers	11,655	-	187,997	199,652	19,965	787
		FIPS	-	-	37,871	37,871	3,787	1
	Potato Empire*	Farmers	3,205	2,397	9,456	15,058	1,506	87
		Farmers	589	543	-	1,132	113	47
	Grace Rock Farm Ltd*	Farmers	-	-	57,838	57,838	5,784	150
		CIP	-	-	43,970	43,970	4,397	1
Overall			**15,449**	**2,940**	**477,390**	**495,779**	**59,922**	**1,122**

*The two seed businesses, Potato Empire and Grace Rock Farm Ltd were linked to CIP by World Food Program and KALRO, respectively for technical backstopping and market linkage support.

Sub-activity 1.3. Evaluation of potential demand for new varieties

We evaluated yields and qualitative attributes that could potentially affect farmers' uptake rate of apical cuttings and new varieties. A random sample was drawn from farmers who received, planted, managed, and recorded harvest yields from the apical cuttings of different varieties. A complementary structured survey questionnaire was used to record the qualitative data. A total of 492 respondents drawn from different sub counties in Uganda and Kenya participated in the quantitative survey (187 in Uganda and 305 in Kenya). A further xxx participated in the mobile short code surveys administered by the regional mobile network providers (this plus the qualitative data from Uganda is not reported here).

1.3.1. Survival rate of the apical cuttings distributed to the farmers

Survival rate of field grown apical cuttings was generally higher in Kenya than in Uganda, averaging 91% and 62% respectively (Table 6). Proportion of farmers recording less than 50% survival rate was notably greater in Uganda (20%) than in Kenya (0%). This low survival rate in Uganda was largely attributed to poor handling and packaging of cuttings during long-distance transport, resulting in apical cutting damages and loss of vigor. Nevertheless, more farmers in Uganda (37%) recorded greater proportion of tuber number per plant >20 compared with only 4% of farmers in Kenya. Most of farmers in Kenya faced a period of unusually low rainfall and high temperatures during the production cycle, thus contributing to the low yields.

Table 6: Survival rate of the apical cuttings sampled from farmers in Kenya and Uganda.

Country	Survival rate (%)	Proportion of farmers	#Of tubers per plant	Proportion of farmers (%)
Uganda n=187	95% and above	14.4	≥25	28.9
	90 – 94%	8.6	20-24	8.0
	80 – 89%	22.5	16-19	11.2
	70 – 79%	14.4	12-15	17.1
	60 – 69%	11.2	9-11	11.2
	50 – 59%	9.1	5-8	17.1
	Below 50%	19.8	<5	6.4
Kenya n=305	95% and above	59.3	≥25	2.0
	90 – 94%	13.1	20-24	2.0
	80 – 89%	11.5	16-19	8.5
	70 – 79%	7.5	12-15	40.7
	60 – 69%	4.3	9-11	34.8
	50 – 59%	4.3	5-8	11.8
	Below 50%	0.0	<5	0.3

1.3.2 Tuber numbers per plant

Rwangume, Kachpot1 and Naropot 2 recorded the most tuber number per plant in Uganda and Wanjiku in Kenya (Table 7).

Table 7: Tuber numbers per plant recorded from the cuttings distributed to the farmers.

		Tubers number per plant							%Seed
Country	Cultivar	< 20 mm	20-30 mm	30-45 mm	45-60 mm	> 60 mm	≥ 20 mm	Total	#tubers basis
Uganda	Kachpot 1	5b	6b	8b	2a	0a	17b	23c	79a
	Kachpot 2	1a	1a	2a	1a	0a	4a	5a	80a
	Kinigi	3ab	4ab	4ab	2a	1a	11b	13b	71a
	Naropot 1	4ab	4ab	5ab	2a	0a	12b	16b	76a
	Naropot 2	5ab	6b	6ab	3a	1a	16b	21b	75a
	Naropot 3	4ab	5b	4ab	3a	1a	14b	18bc	79a
	Rwangume	6ab	6b	7b	3a	1a	17b	23c	73a
	Victoria	4ab	5b	6ab	3a	0a	14b	18bc	75a
	Average	4	5	6	3	1	15	19	75
Kenya	Chulu	2ab	3a	3a	2a	0a	9a	11a	79ab
	Konjo	3ab	3a	2a	3a	0a	8a	11a	74ab
	Lenana	5b	4a	2a	2a	0a	8a	13a	64a
	Nyota	2ab	3a	3a	2a	0a	8a	10a	83ab
	Shangi	3ab	3a	3a	2a	0a	9a	12a	75ab
	Unica	1a	3a	3a	3a	1a	9a	10a	86b
	Wanjiku	4ab	3a	4a	3a	0a	10a	14a	75ab
	Average	3	3	3	2	0	9	12	76
Overall		**4**	**4**	**4**	**2**	**0**	**11**	**15**	**76**

Kachpot 2 significantly recorded the lowest number of tubers per plant in Uganda. All the cultivars attained higher percent of seed tuber size fractions, ranging between 71–80% in Uganda and 64–86 in Kenya.

1.3.3. Tuber weight per plant

No significant cultivar effect was found on tuber weight per plant among the varieties, except for Kachpot 2 which recorded significantly low tuber weight per plant in Uganda and cultivar Lenana in Kenya (Table 8). Rwangume and Naropot 2 showed the greatest mean tuber weight per plant and had the greatest tuber yield per hectares. All the cultivars attained greater percent seed size on weight basis, > 80%, both in Kenya and Uganda.

Table 8: Mean tuber weight per plant recorded from the cuttings distributed to the farmers.

		Mean tuber weight per plant (gms)							%Seed	Average
Country	Cultivar	< 20 mm	20-30 mm	30-45 mm	45-60 mm	> 60 mm	≥ 20 mm	Total	Wt. basis	yield tons/ha
Uganda	Kachpot 1	28b	75b	246b	141b	55ab	516b	543b	94a	24b
	Kachpot 2	1a	12a	65a	54a	21a	152a	153a	99a	7a
	Kinigi	20b	79b	151ab	135b	77ab	441b	461b	88a	20b
	Naropot 1	31b	64b	164ab	131b	59ab	418b	449b	90a	20b
	Naropot 2	31b	75b	195ab	175b	142b	587b	618b	92a	27b
	Naropot 3	32b	85b	150ab	175b	156b	566b	599b	94a	27b
	Rwangume	35b	81b	223b	199b	91ab	593b	627b	91a	28b
	Victoria	35b	92b	199ab	181b	48ab	519b	554b	86a	25b
	Average	31	79	192	165	84	520	551	90	24
Kenya	Chulu	21a	56a	68ab	75ab	22a	221a	242ab	91a	11ab
	Konjo	25a	50a	57ab	81ab	8a	196a	221a	88a	10ab
	Lenana	36a	57a	45a	55a	9a	166a	202a	82a	9a
	Nyota	14a	41a	65ab	83ab	26a	214a	228ab	93a	10ab
	Shangi	29a	51a	76ab	84ab	22a	234ab	263ab	89a	12ab
	Unica	13a	45a	69ab	110b	96b	320b	333b	95a	15b
	Wanjiku	34a	59a	87b	94ab	19a	259ab	292b	88a	13ab
	Average	27	53	75	87	27	243	270	89	12
Overall		**28**	**63**	**120**	**117**	**48**	**348**	**377**	**90**	**17**

Plate 5: Farmers guided by a team of ToTs harvesting apical cuttings in Uganda.

1.3.4 Multiplication rates

With the support of the ToTs in Kenya, we tracked yields of rooted apical cuttings multiplied to generation I of seed production. A sample size of 33 farmers who kept proper records were considered.

Table 9: Basic seed produced by farmers with rooted apical cutting as the starter material.

Cultivar	Rooted apical cutting					Generation I			
	#Of cuttings planted	#Of tubers harvested	Wt. of tubers harvested (kg)	Tuber wt. per plant (g)	#Of tubers per plant	Wt. of tubers replanted (kg)	Wt. of tubers harvested (kg)	Tuber wt. per plant (g)	Multiplication rate
Chulu	152	1,414	81	535	9.3	52	432	656	8.3
Konjo	119	1,002	49	411	8.4	29	223	522	7.6
Lenana	19	108	3	140	5.7	1	3	267	5.0
Nyota	79	1,051	63	793	13.3	33	281	847	8.6
Shangi	330	3,659	222	672	11.1	108	896	769	8.3
Unica	143	1,241	124	869	8.7	73	587	1,013	8.0
Wanjiku	219	3,214	217	992	14.7	85	779	867	9.2
Total	**1,060**	**11,690**	**758**	**630**	**10.2**	**381**	**3,201**	**706**	**7.9**

Farmers sampled were 33

From the 1060 cuttings collectively planted by the 33 farmers, 0.8 tons of basic seed reflecting a multiplication rate of 10 was produced (Table 9). About 40% (0.4 tons) of this seed was replanted, of which the harvest yielded 9.6 tons of basic seed, reflecting a multiplication ratio of 1:8. The recovery rate was generally low as more than half of the seeds harvested was not replanted. Averagely, the multiplication rate reduced from 10 with cuttings to 8 with basic seed. Basic seed produced tubers with greater weight per plant (706 g) compared with the apical cuttings (630 g). Differences in varieties were evident with Wanjiku recording the most tuber numbers per plant, and Unica the greatest tuber weight per plant. Lenana produced both the fewest tuber number per plant and the least tuber weight per plant.

1.3.5. Effect of source of cutting and gender on survival rate and tuber yield

We tested the effect of source of cutting, gender and management type on survival rates, tuber numbers per plant, mean tuber weight per plant and average tuber yield per ha of field grown rooted apical cutting. The sources of apical cuttings were the satellite nurseries and highly

specialized commercial cutting producers. The demo plots were managed by individual farmers or farmer groups. No significant cutting-source or gender effect was found on survival rate, tuber numbers per plant, tuber weight per plant or on average tuber yield (Table 10). Thus, the suppliers under consideration produced apical cuttings of similar quality, and both male and female farmers had comparable good knowledge and technique of apical cutting production. However, cuttings managed by group had significantly greater tuber numbers per plant, tuber weight per plant and average tuber yield. As a group, farmers were able to share knowledge, and basic resources such as land, irrigation water, storage facilities etc., leading to greater yields.

Table 10: Effect of source of cutting and gender on survival rate and tuber yield.

				Tuber numbers per plant			Tuber wt per plant (gms)		
Element	Country	Category	Survival rate (%)	< 20 mm	≥ 20 mm	Total	<20 mm	≥ 20 mm	Average yield (tons/ha)
Cutting source	Kenya	Grace Rock	92	2	9	11	21	232	11
		Satellite nursery	96	3	9	12	26	256	13
		SRK	88	4	9	13	33	253	13
	Uganda	Agromax	74	5	17	22	30	544	25
		Satellite nursery	65	4	13	18	31	510	24
	F statistics, p value		0.87	0.97	0.88	0.78	0.87	0.09	0.46
Gender	Kenya	Female	90	3	9	12	26	238	12
		Male	92	3	9	11	23	242	12
	Uganda	Female	0.6	5	16	20	32	512	24
		Male	0.7	4	13	17	29	531	25
	F statistics, p value		0.78	0.94	0.78	0.40	0.34	0.34	0.29
Management type	Uganda	Individual	0.7	4	15	19	31	520	24
	Kenya	Individual	91	3	9	11	23	238	12
		Group	88	7	12	19	64	288	16
	F statistics, p value		0.67	0.04	0.03	0.02	0.02	0.04	0.02

1.3.6. Evaluation of cultivar preferences

A participatory evaluation of different cultivars was conducted in Kenya and Uganda (data reported here is only for Kenya). Farmers' preferences were dependent on the production sites. Most farmers in Kiambu preferred Wanjiku, while farmers in Nakuru preferred Wanjiku and Shangi. Most farmers in Uasin Gishu preferred Unica (Table 11). Overall, the ranking order was Wanjiku> Shangi> Unica> Chulu> Nyota> Konjo.

Table 11: Farmer most preferred potato cultivar by county and overall rank in Kenya.

Cultivar	Kiambu n=92	Nakuru n=66	Uasin Gishu n=15	Overall n=173	Rank
	Percent farmers				
Wanjiku	23.9	43.9	26.7	31.8	1
Shangi	13.0	54.5	26.7	30.1	2
Unica	37.0	0.0	40.0	23.1	3
Chulu	19.6	1.5	6.7	11.6	4
Nyota	4.3	0.0	0.0	2.3	5
Konjo	2.2	0.0	0.0	1.2	6

Higher yields, disease and drought tolerance, ready market, early maturity, and good table qualities were in that order, the most important quality traits preferred by farmers in Kenya (Table 12).

Table 12: Farmers' rating of six cultivars (Wanjiku, Shangi, Unica, Chulu, Nyota, Konjo) based on nine most important traits.

Attributes	Kiambu n=92	Nakuru n=66	Uasin Gishu n=15	Overall n=173	Overall rank	Prob>X*
	Percent (%) of farmers					
Higher yields	27.2	24.4	26	27.2	1	0.001
Disease tolerance	13.3	8.1	19.2	12.1	2	0.012
Drought tolerance	11.8	11.8	9.4	11.6	3	0.031
Easy to sell/has ready market	16.2	5.5	8.8	10.4	4	0.002
Early maturity	13.8	5.5	8.1	11	6	0.038
Good for table	8.8	10.4	9.5	9.8	5	0.042
Vigorous growth	5.5	14.4	6.7	9.2	7	ns
Short dormancy	2.2	14.4	3.3	7.5	8	ns
Long dormancy	1.2	5.5	9	1.2	9	ns

*Kruskal-Wallis rank test, where 1 is most important

1.4. CONCLUDING REMARKS

The high yield obtained by most farmers from rooted apical cuttings provided evidence that on-farm quality seed production using RAC as a rapid multiplication technique at farmer-level is an alternative to the costly certified seeds. Farmers preference for varieties with higher yield and tolerance to diseases was evident, indicating increasing demand and good market potential for improved varieties. However, through stakeholder workshops and farmer feedbacks, higher prices of rooted apical cuttings and non-availability of cuttings of preferred varieties were cited as the possible constraints to effective adoption of rooted apical cuttings. In addition, the low quantity of seeds replanted for second round of multiplication was an indication of poor planning.

Often, planning by most farmers was based on first round multiplication without planning for the land and storage required for the second multiplication. Those well experienced and progressive farmers, who worked as a group, sharing basic resources such as land, irrigation water, storage facilities, prior experience with crop production etc., achieved greater replanting rates and greater yields. Such farmers can easily form producer organizations enabling them to collectively procure land, acquire inputs, lobby for credit, and generally benefit from economies of scale.

Agroecology influenced choices of varieties grown in different areas. For example, Unica, Rwangume and Wanjiku showed a greater potential in terms of adaptability to different regions, indicating their resilience to different environmental conditions. This offers options to farmers in terms of climate-smart consumer-demanded potato varieties in Kenya and Uganda.