

TRAINING AND FIELD DAY REPORT: INTRODUCING APICAL CUTTINGS OF POTATO TO KIAMBU, NAKURU AND USAIN GISHU COUNTIES OF KENYA 2021



1. Stakeholder workshops and awareness creating events

1.1 Training of trainers of trainees (ToTs)

Training of ToTs on production and management of potato rooted apical cutting (RAC) was conducted in Kiambu, Nakuru and Nandi counties. The objective was to build the capacity of farmers to produce clean seed on-farm from potato cuttings and to support market development for both public and private seed businesses (as seed producers alone cannot support the business at scale). A total of 103 ToTs representing both public and private institutions were trained between December 2019 and September 2020 (Table 1). The officers trained to be ToTs comprised of the Ward Agriculture Extension Officers (WAEOs), County Crop Officers, Village Based Advisors (VBAs) and seed business operators. All were drawn from the potential potato producing sub counties and wards.

Table 1: Number of ToTs trained in different counties disaggregated by age, gender and business type.

Value chain actor type	County	ToTs by designation	Male		Female		Total
			< 30 years	>30 years	< 30 years	>30 years	
County Government	Kiambu	Kiambu county WAEOs ¹	1	22	5	19	47
	Nakuru	Nakuru county WAEOs ¹	1	15	4	8	28
Private seed business	Kiambu	Grace Rock Ltd Seed Operators	-	4	1	1	6
	Nakuru	Potato Empire Ltd Seed Operators	1	2	2	1	6
	Nandi	Nandi Cooperative Society Ltd Technical Staff	5	4	3	4	16
Total			8	47	15	33	103

¹WAEOs- Ward Agriculture Extension Officers.



Training event for the Kiambu ToTs: (a) theoretical background; (b) practical training.

1.1.1 The training model

The model adopted for training consisted of starter-meeting-cum-training events which started with the top county/private seed business officials (Fig 1).

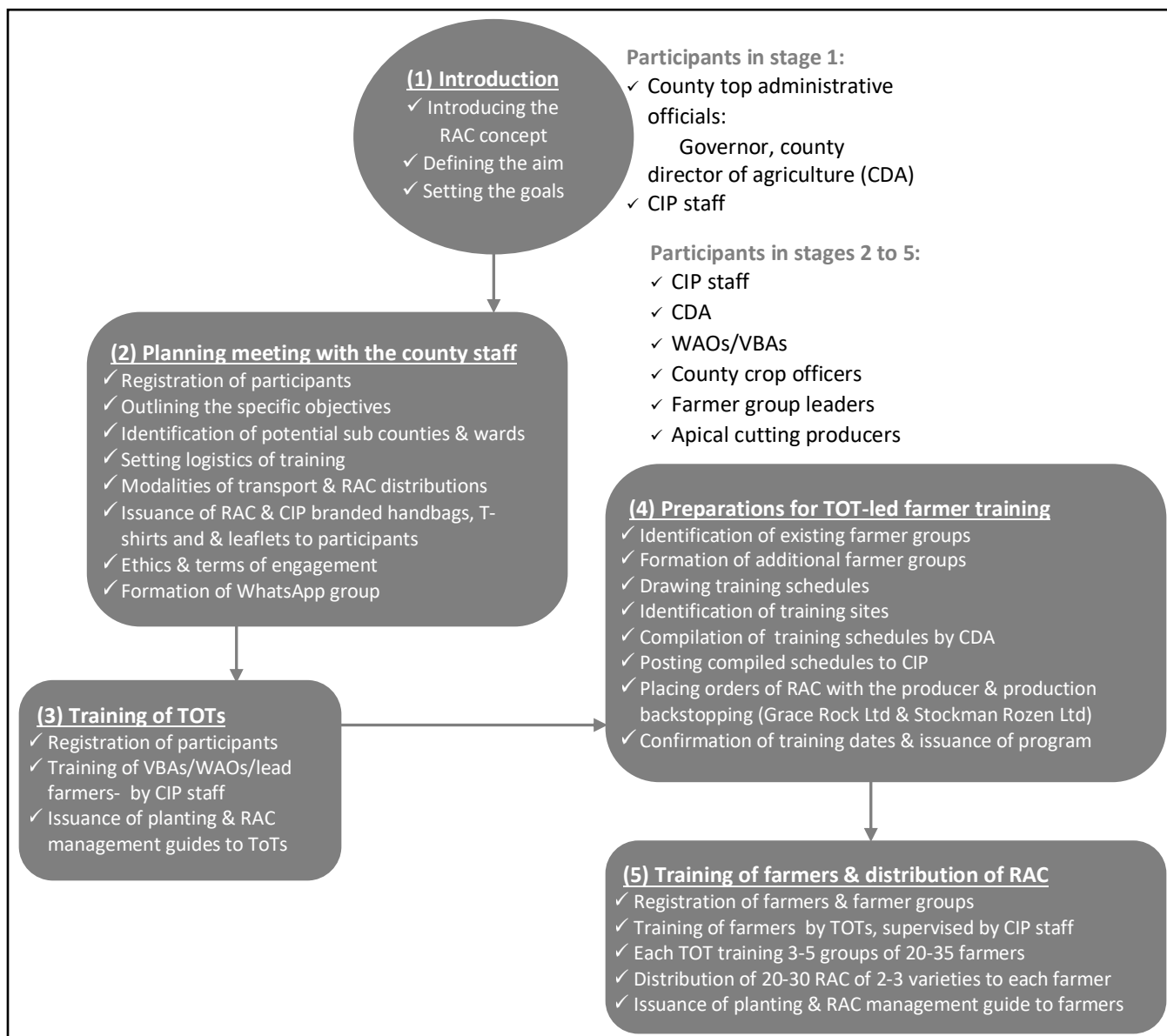


Figure 1: Schematic illustration of training model adopted to scale out potato rooted apical cutting.

The approach cascaded down whereby CIP trained the 103 TOTs that were assigned responsibility of forming and training 2 to 5 groups, each group comprising of 20 to 30 farmers. The model integrated technical backstopping of two private satellite nurseries (Grace Rock Ltd and Stockman Rozen Kenya Ltd) recruited to produce and supply the cuttings. Grace Rock Ltd nursery was trained by the Kenya Agriculture and Livestock Research Organization (KALRO) to invest on cuttings independently. However,

cuttings production in this firm was below the optimal rates and so CIP and Stockman Rozen Kenya Ltd were linked to reinforce the firm's production and market capacity. The model improved networking and fostered learning across the farmer groups, county staff and private seed businesses.

1.2 Capacity building: farmer training and field days

1.2.1 Farmers reached through field days

A total of 4,121 participants were reached through training and field day events for the period between June 2019 and August 2020 (Table 2). Seventeen (17) field day events were held during this period with a total of 1,946 participants (996 men and 950 women). The participants represented various actor types (farmers-1,763; government officials-75; business/farmer groups-74; and NGOs-30) that are potentially interested in the potato rooted apical cutting technology. Disaggregation of the field day participants by age reflected a higher number of adults (75%) than the youths (25%).

Table 2: Farmers and actors reached through field day and training events in different counties.

Event	County	#of events	Total participants	Age (years)		Gender		Value chain actor type			
				< 30 years	> 30 years	Men	Women	Farmers	Government officials	Business/farmer groups	NGO
Field day	EMC	1	209	38	171	138	71	188	8	6	7
	Kiambu	1	169	62	107	85	84	147	14	5	3
	Makueni	2	162	51	111	73	89	130	8	19	5
	Meru	1	174	3	171	91	83	169	4	1	-
	Nakuru	6	628	168	460	308	320	576	13	29	10
	Nyandarua	1	109	19	90	64	45	97	8	-	-
	Uasin Ngishu	1	213	71	142	105	108	186	12	12	3
	Bomet	1	68	6	62	37	31	65	2	1	-
	Nyeri	2	155	12	143	67	88	149	4	1	1
	Narok	1	59	6	53	28	31	56	2	-	1
	Total	17	1,946	436	1,510	996	950	1,763	75	74	30
Training	Kiambu	52	1,548	443	1,105	654	894	1,531	7	8	2
	Makueni	1	43	4	39	23	20	41	-	2	-
	Nakuru	13	538	113	425	310	228	446	18	41	33
	Nandi	1	46	27	19	34	12	30	3	12	1
	Total	67	2,175	587	1,588	1,021	1,154	2,048	28	63	36
Grand Total		84	4,121	1,023	3,098	2,017	2,104	3,811	103	137	66

Multi-partner demo events accounted for 13% (539 farmers) of the farmers reached through field days. The demos were organized in Nyandarua (2 sites), Nyeri (2), Narok (1), Bomet (1), Meru (1) and Uasin Ngishu (1) counties during the 2020 long rains. The CIP partners in these events were the National Potato Council of Kenya (NPCK), Corteva Agrisciences, Yara East Africa, Agrico East Africa and Cropnuts. In this

partnership, CIP supplied the cuttings used for the demos, Yara supported fertilizer inputs, Corteva provided the insecticides and fungicide chemical inputs, Agrico supported certified seed potato seeds that were compared against the produce from the potato rooted apical cuttings, Cropnuts provided the soil test services while the NPCK offered a platform for coordination, event organization and trial management. Heavy floods, cutworms, late blight and dry spell caused significant level of damage to the cuttings planted in the demo sites; replacements were effected with Unica and Shangi varieties.



Makueni (a) and Kiambu (b) County Governors visiting the potato apical cutting display booths during the 2019 World Food Day Events.

1.2.2 Farmers reached through training

Participants reached directly through trainings were 2,175 (1,021 males; 1,154 female; see Table 2). These participants were disaggregated by actor types as follows: farmers-2,048, government officials-28, business/farmer groups-63 and NGOs-36. Youths constituted 27% of the farmers trained across the four counties. During trainings, 11,093 cuttings of 10 different potato varieties were planted in 73 demo sites (Table 3). Nakuru had 3,380 cuttings planted in 12 demo sites, Kiambu 2,395 cuttings in 52 demo sites and the rest was distributed in the remaining eight counties. Shangi, Lenana, Nyota, Unica, Wanjiku, Chulu and Dutch Rojbynson were the main varieties deployed in the training demo sites. The demo sites formed a platform through which the trained farmers met to share experiences. The meetings occurred at critical stages of activity and crop growth (planting, topdressing, hilling and harvesting), and were managed by the group members.

Table 3: Quantity of potato cuttings planted in demo sites in nine counties of participation.

County	#of events	Shangi	Lenana	Nyota	Unica	Wanji ku	Dutch Rojbynson	Konjo	Sherekea	Chulu	Mayan Gold	Asante	Total
Kiambu	52	1,045	-	60	615	30	545	-	20	30	50	-	2,395
Nakuru	12	845	330	360	725	670	20	150	40	240	-	-	3,380
Nandi	1	50	-	-	50	-	50	-	-	-	50	-	200
Makueni	1	10	-	-	10	10	-	-	-	-	-	-	30
Bomet	1	210	125	-	205	100	125	-	-	-	-	-	765
Nyandarua	2	413	250	50	410	250	-	-	-	250	-	-	1,623
Uasin Ngishu	1	125	125	25	125	125	-	-	-	125	-	-	650
Narok	1	225	125	25	225	125	-	-	-	125	-	-	850
Nyeri	1	250	-	-	250	250	-	-	-	-	-	250	1,000
West Pokot	1	100	-	-	100	-	-	-	-	-	-	-	200
Total	73	3,173	955	520	2,615	1,560	740	150	60	770	100	250	11,093



Farmers participating in planting (a) and harvesting of potato apical cutting (b) during training events.

1.3 Trade fairs and exhibitions of potato rooted apical cuttings

The number of potato rooted apical cuttings displayed in trade fair events was 6,478 (Table 4). Nakuru county had six events with 3,078 cuttings representing 48% of the cuttings displayed. Shangji, Unica, Wanjiku and Chulu were the main varieties displayed across the counties.

Table 4: Quantities and varieties of cuttings displayed in trade fair events in different counties.

County	#of events	Shangi	Lenana	Nyota	Unica	Wanjiku	Sherekea	Chulu	Total
Kiambu	1	100	-	-	100	100	-	-	300
Nakuru	6	1,318	120	240	520	640	-	240	3,078
Meru	1	250	-	-	250	250	-	-	750
Makueni	2	200	-	-	200	200	100	-	700
Nyandarua	1	500	-	-	250	250	-	250	1,250
Elgeyo Marakwet	1	100	-	-	100	-	-	-	200
Uasin Ngishu	1	100	-	-	100	-	-	-	200
Total	13	2,568	120	240	1,520	1,440	100	490	6,478



Meru County Governor showing interest in potato cutting technology during a trade fair event.



Farmers purchasing cutting during a trade fair event.

1.4 Sales of cuttings

A total of 48,808 cuttings with a value of USD 4,881 was purchased in the period between June 2019 and August 2020 (Table 5). Of this, 46,113 cuttings worth USD 4,611 was purchased by farmers after training/field day events while 2,695 was purchased during the training and field day events.

Table 5: Quantity of cuttings purchased by farmers during field day and training events in six counties.

County	Event type	Farmer purchases at event	Farmer purchases after event
Kiambu	Training	-	19,793
Meru	Filed day	155	-
Nyandarua	Filed day	154	-
Nakuru	Training	2,386	20,320
West Pokot	Training	-	800
Nyeri	Filed day	-	5,200
Total		2,695	46,113
		48,808	

1.5 Distributions of rooted apical potato cuttings to farmers

The total number of cuttings distributed to the farmers for the period between June 2019 and April 2020 amounted to 41,899 (Table 6). The cuttings were received by 1,768 farmers distributed across 5 counties and 15 sub counties. Of this, 35,991 (86%) was distributed during training events and the rest 5,908 (14%) during field days. Kiambu county constituted 32,144 (77%) of the cuttings distributed; and were received by 1,378 farmers. These cuttings were distributed to 52 farmer groups spread across five sub counties. This was followed by Nakuru-7,720 (18%), Nandi-1,140 (3%), Makueni-650 (2%) and Nyandarua-245 (1%)

counties that had 296, 38, 44 and 12 farmers receiving the cuttings, respectively. The second phase of cutting distributions is underway in Nakuru and Kiambu counties.

Table 6: Cuttings distributed to farmers during field day and training events in different counties.

County	Sub county	Training			Field day		
		#of training events	#of RAC distributed	#of farmers who received RAC	#of field day events	# of RAC distributed	#of farmers who received RAC
Kiambu	Githunguri	13	7,630	355	-	-	-
	Kikuyu	22	13,410	545	-	-	-
	Limuru	10	7,120	288	-	-	-
	Lari	5	2,700	134	-	-	-
	Juja	2	1,000	40	-	-	-
Nandi	Nandi Hills	5	1,140	38	-	-	-
Nakuru	Molo	3	2,991	96	3	705	45
	Njoro	-	-	-	1	500	64
	Kuresoi South	-	-	-	1	120	12
	Nakuru Town	-	-	-	1	3,404	79
Makueni	Wote	-	-	-	1	300	30
	Kibwezi	-	-	-	1	350	14
Nyandarua	Tumaini	-	-	-	1	245	12
Total		60	35,991	1,496	9	5,624	256

1.6 Yields from potato cutting distributed to the farmers

We sampled 100 farmers in Kiambu county from the 1,311 farmers who received cuttings during the training events. From this, 7 potato varieties issued to the farmers across the five sub counties showed an average yield of 12 tubers per plant (a multiplication rate of 1:12) (Table 7). Wanjiku showed the highest multiplication rate of 1:12, followed by Nyota (1:14), Shangi (1:12), Konjo/Chuu (1:11), and Unica (1:9). Dutch Rojbynson showed the lowest multiplication rate partly attributed to the damages suffered during transport.



A farmer group in Nakuru county receives 30 cuttings per farmer trained.

Table 7: Average number of tubers obtained from seven potato varieties sampled from 100 farmers in Kiambu county, 2020 long rains.

Sub county	Average rainfall*	Mean air temperature*	Number of farmers sampled	Number of plants sampled	Potato variety (number of tubers >20 mm)						
					Dutch Rojbynson [#]	Unica	Shangi	Wanjiku	Nyota	Konjo	Chulu
Lari	435	18.4	34	238	7.5	9.8	13.3	19.8	13.2	12.2	11.4
Kikuyu	408	18.9	23	161	6.7	9.3	12.8	18.2	14.5	10.3	11.6
Limuru	423	18.1	20	140	7.4	9.7	14.4	17.6	13.2	9.5	10.5
Githunguri	416	19.1	18	126	4.5	8.4	13.8	17.1	14.6	11.4	9.6
Juja	358	23.3	5	35	-	6.8	3.4	-	-	-	-
Average tuber number					6.5	8.8	11.5	18.2	13.9	10.9	10.8

*Rainfall and air temperature data were obtained from the local meteorological departments. [#]Dutch suffered great damages during transport and was of low vigor at planting. Dash (-) implies the corresponding variety was not distributed in that sub county.

1.7 Capacity development of seed multipliers

1.7.1 Public institutions

Two public agricultural training centers (ATCs) Chebara and Chebororwa were supported to engage in certified seed production with rooted apical cuttings as the starter material, and also to host farmer field day events (Table 8; Annex 1). The project is supporting these institutions to produce certified seed either with their own KEPHIS seed merchant license or as an out grower under another license. Chebara ATC received 10,388 apical cuttings of 7 varieties, which was multiplied to yield 51,853 seed tubers (seeds enough to do 1.25 acres of land). The seeds are in field generation II of multiplication. Chebara ATC is in the process of getting KEPHIS seed out grower license. Initial inspection and soil analysis has been conducted. Chebororwa ATC received 2,610 cuttings of eight potato varieties and produced 17,880 seed tubers of generation I. This seed will be available to farmers after third generation of field multiplication. Prolonged dry spell coupled with human theft and wild animal destruction of the potato tubers were major production setback reported in Chebara ATC. The cuttings in Chebororwa ATC were planted during the short rains and suffered dry spell. Nakuru ATC specifically requested CIP support in a training program in rooted apical cuttings. In response, CIP offered 440 potato rooted apical cutting starter materials of six varieties.

Table 8: Quantity of basic seed produced by three public seed businesses from RAC as starter material.

Name of the Seed Business	Variety	Starter material Rooted apical cutting		Generation of field multiplication			
		#of cuttings planted	#of tubers harvested	Generation I		Generation II	
				#of tubers replanted	Quantity of tubers harvested(kg)	Quantity of tubers replanted (kg)	Quantity of tubers harvested (kg)
Chebara ATC: Elgeyo Marakwet	Shangi	4,200	31936	25411	800		
	Chulu ¹	388	1,876	889			
	Dutch	300	55	49.5	1		
	Lenana	500	1096	986	24		
	Nyota	300	91	82	2		
	Unica	4,200	18208	15028	557		
	Wanjiku	500	467	420	11		
Chebororwa ATC: Uasin Ngishu	Wanjiku	330	1,116	998			
	Unica	330	2,735	2,574			
	Chulu	330	2,491	2,245			
	Shangi	330	3,043	2,587			
	Konjo	330	2,765	2,587			
	Nyota	330	2,206	1,998			
	Lenana	330	1,933	1,821			
	Dutch	300	1,591	1,389			
Nakuru ATC: Nakuru	Shangi	140					
	Unica	140					
	Nyota	40					
	Wanjiku	40					
	Lenana	40					
	Sherekea	40					
Total		13,438	69,733	58,176	1,935		

1.7.2 Private seed businesses

The project is also working with four private seed enterprises in Nakuru and Nandi counties to multiply seeds and disseminate the rooted apical cutting technology (Table 9; Annex 2). The Nandi Cooperative Farmers Society is in generation II of field seed multiplication. The society has produced 1 tonne of seed potato from 5,530 RAC starter material, an equivalent multiplication rate of 1 cutting to 10 tubers. The 1 tonne seed produced is enough to plant 0.5 ha, as this will be small seed resulting in so many tubers. The business is currently in final stage of getting an approval from KEPHIS to be licensed as a seed merchant. Initial soil and water tests against Potato Cyst Nematodes, Erwinia and bacterial wilt has been supported by CIP. CIP has also supported initial cost of inspection. The business has collaborated with Nandi county government and World Bank to intensify seed potato in the county.

Table 9: Quantity of basic seed produced by four private seed businesses from RAC as starter material.

Name of the Seed Business	Variety	Starter material (RAC)		Generation I		Generation II	
		#of cuttings planted	#of tubers harvested	#of tubers replanted	Tubers harvested (kg)	Tubers planted (kg)	Tubers harvested (kg)
Nandi Cooperative (Nandi county)	Wanjiku	1,800	4,901	4,411	220	203	
	Unica	2,240	10,450	9,405	736	733	
	Lenana	270	222	200	9	5	
	Nyota	270	720	648	20	18	
	Mayan Gold	600	2,334	2,101	79	74	
	Shangi	300	790	711	24	19	
	Konjo	50	341	307	2	-	
Jairus Sugut (Nandi county)	Unica	500	565	509	23	20	
	Unica	250	693	624	34	28	
	Mayan Gold	650	3,848	3,463	100	90	
	Wanjiku	1,000	3,435	3,092	150	134	
	Shangi	300	783	705	38	34	
Samuel Sugut (Nandi county)	Shangi	1,000	5,520	5,232	195		
	Unica	2,000	12,06	1,686	720	650	
Potato Empire (Nakuru county)	Shangi	2,000			320	300	
	Unica	1,000			6	5	
	Wanjiku	500			90	80	
Total		14,730	34,602	31,407	2,043	2,393	

From this partnership, Nandi cooperative is targeting 250 acres of land (70 acres already acquired) and 3,000 MT of seed production per year. The Cooperative has currently 2.5 acres of land on apical cutting (44,000 cuttings) to be multiplied 2 to 3 times into certified seed. The whole process has been backstopped by CIP and KEPHIS.



Cuttings on 2.5 acres of land by Nandi Potato Farmers' Cooperative Society.



Kephis conducting inspection of the seed multiplication site by Nandi Potato Cooperative Farmers' Society.

Further, Jairus and Samuel private seed business were supported by CIP to produce seeds from potato apical cuttings. The firms produced 0.34 and 0.88 tonnes of generation I seed tubers from 2,700 and 3,000 cuttings respectively. This quantity reflects a good multiplication rate and is enough to plant an area of 0.1 and 0.4 acres respectively. The seed tubers are currently in generation II of multiplication and is projected to produce tubers enough to plant an area of 0.8 and 1.5 acres respectively. In Nakuru County, Potato Empire Ltd seed business was supported with 1,500 cuttings as starter material, of which only 400 cuttings reached the harvest due to dry spell. This quantity yielded 0.4 tonnes of seed tubers (an average of 1 kg per cutting) which is in generation II of seed multiplication.

Annex 1: Seed potato grades produced from RAC as starter material by three public seed businesses.

Seed business	Harvest date	Variety	# planted	# surviving at 14th day after planting	#surviving at harvest	No<20 mm	Wt<20 mm (kg)	No >20 mm	Wt >20 mm (kg)
Chebara ATC	07-08-19	Unica	3200	2840	2795	3150	75.0	14760	550.0
		Shangi	3200	2895	2759	4210	100.3	23411	750.1
	20-12-19	Lenana	500	458	224	576	6.0	520	20.1
		Unica	1000	983	44	129	1.1	169	6.4
		Dutch Robjn	300	268	21	23	0.2	57	2.5
		Nyota	300	284	8	34	0.3	17	0.7
		Wanjiku	500	484	88	182	0.2	285	10.9
		Shangi	1000	938	704	1329	0.1	2986	114.5
		Chulu	388	315	234	34	0.1	1367	26.1
Cheborow a ATC	19-09-19	Wanjiku	330	303	298	25	0.2	1091	103.5
		Unica	330	317	312	209	1.0	2526	113.7
		Chulu	330	306	304	22	0.1	2469	115.6
		Shangi	330	313	309	138	0.2	2905	73.5
		Konjo	330	318	312	58	0.1	2707	103.2
		Nyota	330	316	311	44	0.1	2162	63.1
		Lenana	330	278	269	88	0.1	1845	52.6
		Dutch	300	266	245	93	0.2	1498	27.7
Nakuru ATC	20-09-19	Shangi	140	138	-	-	-	-	-
		Unica	140	137	-	-	-	-	-
		Nyota	40	39	-	-	-	-	-
		Wanjiku	40	40	-	-	-	-	-
		Lenana	40	37	-	-	-	-	-
		Sherekea	40	38	-	-	-	-	-

Annex 2: Seed potato grades produced from RAC as starter material by three private seed businesses.

Seed business	Harvest date	Variety	# planted	# surviving at day 14 after planting	#cuttings surviving at harvest	Tuber No. <20 mm	Tuber weight <20 mm (g)	Tuber No. >20 mm	Tuber weight >20 mm (g)
Nandi Cooperative	19-09-19	Wanjiku	1,800	1,769	1,742	2,242	66,600	2,659	178,000
		Unica	2,240	2,166	2,114	2,000	61,300	8,450	751,500
		Lenana	270	180	150	135	5,700	87	4,500
		Nyota	270	176	155	305	7,700	415	14,000
		Mayan Gold	600	527	491	1,067	14,000	1,267	74,100
		Shangi	300	262	224	309	6,100	481	20,500
		Konjo	50	45	39	20	1,000	321	1,700
Jairus Sugut	20-09-19	Unica	750	744	703	493	13,700	765	49,500
		Mayan Gold	650	588	532	1,400	27,500	1,498	84,000
		Wanjiku	1,000	977	955	784	12,500	2,651	154,000
		Shangi	300	269	251	298	9,700	487	31,500
Samuel Sugut	26-08-19	Shangi	1,000	1,007	945	2,250	38,000	3,270	167,000
	26-08-19	Unica	2,000	1,890	1,686	1,312	12,000	10,694	720,000
Total			10,600	9,987	12,615	275,800	33,045	2,250,300	10,600