USAID Kenya Accelerated Value Chain Development Program

Potato Value Chain

FY 2018 Year 3 Annual Report

1 October 2017–30 September 2018

Award No:

Prepared by:

Root Crops Value Chain

International Potato Center

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ACRONYMS

ADC	Agriculture Development Corporation
ATC	Agricultural trainings center
AVCD	Accelerated Value Chain Development (project)
CHVs	Community health volunteers
CIP	International Potato Center
EGS	Early generation seed
FIPS	Farm Input Promotions Africa
GTIL	Genetic Technologies International Limited
HH	Household(s)
HSMs	Hub-seed multipliers
KALRO	Kenya Agricultural and Livestock Research Organization
KEPHIS	Kenya Plant Health Inspection Service
PPP	Public-private partnerships
SRK	Stokman Rozen Kenya
VPAs	Village-based potato advisors
WAOs	Ward agricultural officers
YGs	Youth groups

1. KEY ACHIEVEMENTS (QUALITATIVE IMPACT)

Over the last three years, the potato value chain within the Accelerated Value Chain Development (AVCD) project, funded by the United States Agency for International Development, supported 46,700 smallholder farmers with technologies to improve farm productivity and engage in market systems. The seed system for potato was scaled out to reach farmers who previously did not have access to quality seed by transforming 181 progressive farmers into active seed multiplier businesses (123 men, 55 women, three associations). To anticipate increased production as a result of improving productivity, potato marketing cooperatives were formed to provide marketing services to beneficiary farmers. Simultaneously, the seed multipliers comprised a majority of the founding cooperative committees and were organized with the intention to support the cooperatives to become seed merchants to produce and market certified seed. AVCD supported five cooperatives (three were newly formed with cooperative certificates) and nine youth agribusinesses to elaborate and implement business plans, resulting in business along the potato value.

1.1 OBJECTIVE 1: DEVELOP AT LEAST 150 PROGRESSIVE SMALLHOLDER FARMERS INTO SEED POTATO BUSINESSES

Addressing the perennial challenge of farmers' limited access to quality seed potato is the key entry point to increasing productivity and incomes of farmers and driving the potato value chain. To contribute to resolving the seed potato crisis in Kenya, the potato component largely concentrated on expanding the seed system to Elgeyo-Marakwet, Nandi, and Uasin Gishu counties of the North Rift, and increasing seed production in Meru. Four seasons of seed production and sales have been completed during the three years of project implementation. Three of these four seasons have faced water shortages due to drought or inconsistent rainfall (Table 1, Annex 1).

TABLE 1. PERIODS OF FIVE PROJECT SEASONS OF AVCD—POTATO COMPONENT

Season Name	Planting Months	Harvesting Months	Seed Sales Months	Seasonal Comment
1. Long rains 2016	Mar.–Apr.	Aug.–Sept.	Sept.–Oct.	Normal rains, good season
2. Short rains 2016	Sept.–Oct.	Feb.–Mar.	Mar.–Apr.	Official drought
3. Long rains 2017	Mar.–Apr.	Aug.–Sept.	Sept.–Oct.	Rains started late and ended early
4. Short rains 2017	Sept.–Oct.	Feb.–Mar.	Mar.–Apr.	Below average rainfall
5. Long rains 2018	Mar.–Apr.	Aug.–Sept.	Sept.–Oct.*	Extraordinary rains

* These sales will be monitored during the no-cost extension phase (November 2018).

Output 1.1 Early generation seed production (minitubers, cuttings, and first/second generation field tubers) increased by at least 200 t annually

Shortage of starter material, minitubers, and basic seed—collectively, early generation seed (EGS)— for certified seed production is a major bottleneck in the potato seed system throughout Kenya. Kenya Agricultural and Livestock Research Organization (KALRO), the national potato program producing basic seed, Agriculture Development Corporation (ADC)–Molo, and private sector Genetic Technologies International Limited (GTIL) produce EGS for seed merchants to produce certified seed.

The apical cuttings technology for starter material is gaining acceptance among stakeholders in Kenya. The Kenya Plant Health Inspection Service (KEPHIS) has officially recognized apical cuttings in certified seed production, having received the first two requests for certifying seed from cuttings in September 2018. With high rates of productivity, cuttings can be profitable after two seasons of multiplication. As a result, farmers access seed equivalent to basic seed, making cuttings compatible with saving seed on farm approaches.

While AVCD supported the initial investments in cuttings, the private sector GTIL and Stokman Rozen Kenya (SRK) invested more than $20,000 combined in screenhouses and nursery operations to produce cuttings, without knowing the future of this technology. Seed companies and major farms are trialing cuttings in their production systems and have privately purchased a combined total of 105,000 cuttings valued at $15,500 without influence from the International Potato Center (CIP). (Explicit metrics of the rapid progress of this technology and its commercial potential considering the initial pilot trial with SRK began 2 years ago.) Kisima Farm, the leader in seed potato production for most of sub-Saharan Africa, trialed the cuttings in March 2018, and ordered a second round for October after the successful pilot in their production system.

To improve access to cuttings and diversify use to include directly used by farmers to produce their own seed and directly into ware production, three decentralized nurseries began to produce cuttings after training in their production. CIP is in discussions to assess how to foster public-private partnerships (PPP) between SRK and the satellite nurseries to produce cuttings under SRK seed merchant license. To comply with regulations recognizing cuttings as seed, they can only be sold by authorized seed merchants or outgrowers under a seed merchant license.

Output 1.2 At least 150 seed multipliers developed to annually produce sufficient seed potato for 2,000 ha and obtain gross margins of $1,500/ha

After 2 years and four seasons of seed production and sales, the 181 active seed multipliers[1] sold 217 t of seed potato in the first year of production, increasing to 323 t in Y2 (Table 2)—sufficient to plant 150 ha. Considering that farmers renew 20–25% of their seed annually, this second year of production actually serves 600–700 ha of farmer land (Annex 2). After an additional 2 years of capacity building in seed production, it is expected that the seed system supported through AVCD will annually inject an additional 2,500 t into the system,[2] an approximate increase of 40% from 2017 production of 6,500 t.[3]

As in Y2, seed multipliers sold seed in standard 50-kg bags. They did not have to sell in smaller quantities to increase market outreach as demand was so great that farmers bought 4 bags a piece (Table 2).

1. Lessons Learned, Section 1.5, defines active seed multiplier.
2. Based on projections from cooperatives, ATC Chebara, ATC Chebororwa. and seed multipliers.
3. TechnoServe. 2018. Kenya Potato ISP.

TABLE 2. SEED POTATO PRODUCTION AND SALES DATA FOR SEED MULTIPLIERS DURING FIRST TWO YEARS OF SEED BUSINESS

	Gender	Y1[a] Summary	Y2 Summary	Meru/Nandi VPA Networks		Elgeyo-Marakwet		Nandi		Uasin Gishu	
				Y1	Y2	Y1	Y2	Y1	Y2	Y1	Y2
# Seed multipliers	Overall	**204**	**135**	**91**	**83**	**22**	**6**	**61**	**31**	**30**	**15**
	Female	63	41	35	26	4	2	18	8	6	5
	Male	136	90	56	57	15	3	42	21	23	9
	Association	5	4	-	-	3	1	1	2	1	1
# Farmer purchases[b]	Overall	**1,477**	**1,301**	**876**	**696**	**122**	**77**	**324**	**366**	**155**	**162**
	Female	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Male	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Association	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Quantity seed harvested (MT)	Overall	**509**	**631**	**345**	**384**	**33**	**37**	**85**	**145**	**46**	**66**
	Female	n/a	n/a	n/a	n/a	4	14	14	32	6	11
	Male	n/a	n/a	n/a	n/a	22	15	70	100	36	45
	Association	12	31			7	8	1	13	4	10
Quantity seed sold (MT)	Overall	**217**	**323**	**106**	**128**	**18**	**24**	**67.1**	**124**	**26**	**47**
	Female	58	n/a	36	n/a	3	8	16	26	3	8
	Male	153	n/a	70	n/a	11	8	51	87	21	33
	Association	6	25	-	-	4	8	0.1	11	2	6
Value of seed sales ($)	Overall	**88,921**	**99,162**	**45,687**	**25,101[c]**	**7,120**	**9,224**	**25,748**	**47,118**	**10,366**	**17,719**
	Female	23,210	26,534	15,848	10,076 [c]	1,249	3,200	4,866	10,282	1,247	2,976
	Male	63,305	63,023	29,839	15,025 [c]	4,323	3,079	20,845	32,336	8,298	12,583
	Association	2,406	9,605	-	-	1,548	2,945	37	4,500	821	2,160
Mean # of 50-kg bags/ farmer	Overall	3	4	2	2	3	6	4	7	3	6
	Female	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Male	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Association	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

a. Years 1 and 2 mean years of production, which occurred during project years 2 and 3, respectively.

b. Farmers purchasing seed each season, inclusive of repeat purchases.

c. Sales data incomplete; Y3 sales still be to reported. VPA: Village-based potato advisors.

Consistent renewal of starter material to multiply seed, usually basic or certified seed, is critical to the seed multiplier model and managing quality control, and is used as a metric of evaluation. Table 3 reveals that (1) Nandi is the leading county investing in seed production, which is remarkable considering that potato was not considered a county crop prior to AVCD. (2) Seed purchases in Y3 were severely reduced after the drought and inconsistent rain of previous seasons. Seed multipliers in North Rift were hesitant to invest in seed, with only 1.5 t purchased for the Oct. 2017 season toward the Y3 total. (3) Although there are more men involved in seed business than women, the unit contributions to investing in starter material totaled $265 and $286 per female and male seed multiplier, respectively.

TABLE 3. SEED MULTIPLIER INVESTMENT IN STARTER MATERIAL FOR ONWARD MULTIPLICATION OF SEED POTATO

County	Quantity Seed Purchased (t)				Value Seed Purchased ($)			
	Y1	Y2	Y3	Total	Y1	Y2	Y3	Total
Elgeyo-Marakwet	4.4	7.3	2.1	13.8	2,057	3,600	1,025	6,682
Female	2	2.9	-	4.9	830	1,450	-	2,280
Male	2.1	2.3	2.1	6.5	1,117	1,100	1,025	3,242
Association	0.3	2.1	-	2.4	110	1,050	-	1,160
Nandi	14.6	19.5	10.9	45	7,213	9,380	5,925	22,518
Female	1.3	5.2	2	8.5	625	2,560	1,000	4,185
Male	13.3	14.3	8.7	36.3	6,588	6,820	4,825	18,233
Association	-	-	0.2	0.2	-	-	100	100
Uasin Gishu	6.2	8.95	3.8	19.0	3,079	4,425	1,875	9,379
Female	1	1.9	1.8	4.7	457	925	875	2,257
Male	5.2	5.65	1.5	12.4	2,622	2,800	750	6,172
Association	-	1.4	0.5	1.9	-	700	250	950
Total North Rift	25.2	35.75	16.8	77.8	12,349	17,405	8,825	38,579
Female	4.3	10	3.8	18.1	1,912	4,935	1,875	8,722
Male	20.6	22.25	12.3	55.2	10,327	10,720	6,600	27,647
Association	0.3	3.5	0.7	4.5	110	1,750	350	2,210
Meru	-	7.0	19.8	26.8	-	3,525	9,900	13,425
Female		2.8	8.9	11.7		1,400	4,450	5,850
Male		4.2	10.9	15.1		2,125	5,450	7,575
Total	25.2	42.75	36.6	104.6	12,349	20,930	18,725	52,004
Female	4.3	12.8	12.7	29.8	1,912	6,335	6,325	14,572
Male	20.6	26.45	23.2	70.3	10,327	12,845	12,050	35,222
Association	0.3	3.5	0.7	4.5	110	1,750	350	2,210

Meru was under Farm Input Promotions Africa, who used the VBA approach to support seed production. Values are cumulative for Y2 (seasons 2 and 3) and Y3 (seasons 4 and 5).

Seed potato business is profitable, with seed potato multipliers in the North Rift counties earning gross margins averaging $2,477/ha over the three seasons of reasonable productivity (seasons 1, 3, and 4, Table 4). Seed potato prices averaged $0.38/kg across the four seasons with little fluctuation. Ware potato averaged $0.20/kg except during the drought, when ware prices averaged $0.31/kg and peaked at $0.43/kg during the drought (data not shown). Note these are all farm-gate prices.

TABLE 4. MEAN GROSS MARGIN OF SEED POTATO MULTIPLIERS OVER FOUR SEASONS OF SEED MULTIPLICATION

County	Gross Margin ($/ha)			
	Season 1 Oct. 2016	Season 2 Apr. 2017	Season 3 Oct. 2017	Season 4 Apr. 2017
Elgeyo–Marakwet	2,002	(126)	1,971	1,823
Female	3,092	(422)	2,678	3,421
Male	1,510	55	1,451	758
Association	3,268	(147)	2,452	—
Nandi	2,133	(860)	3,081	2,873
Female	1,829	(496)	3,059	3,330
Male	2,278	(981)	3,092	2,707
Association	74.3	—	—	—
Uasin Gishu	2,988	(1,501)	2,749	2,670
Female	1,824	(963)	3,164	1,728
Male	3,444	(1,770)	2,369	2,808
Association	3,190	—	2,923	2,923
Overall	2,374	(829)	2,600	2,455
Female	2,248	(627)	2,967	2,826
Male	2,411	(899)	2,304	2,091
Association	2,177	(147)	2,688	2,923

* Total value of sales for seed and ware potato. Gross margin considers total value of sales.

Although profitable, the seed multipliers are not achieving targeted yields of 20 t/ha of which 75% is sold as seed, most notably as a result of inconsistent weather (Annex 3). During seasons of expected rainfall (seasons 1, 3, and 4), seed multiplier yields averaged 15 t/ha (Table 5), of which 65% on average in Y3 of production was sold as seed (data not shown). And though fewer number of women engage in seed business than men, their profitability and productivity are essentially equivalent, with a mean gross margin average of $2,681/ha compared with $2,269/ha for men among the North Rift counties (Table 4). Mean yields of men were 15.1 t/ha, while those of women 14 t/ha (Table 5), not a significant difference.

TABLE 5. MEAN YIELD OF SEED POTATO MULTIPLIERS AFTER THREE SEASONS OF SEED MULTIPLICATION

County	Yield (t/ha)			
	Season 1 Mar.–July 2016	Season 2 Oct. 2016–Feb. 2017	Season 3 Mar.–July 2017	Season 4 Oct. 2017-Feb. 2018
Elgeyo–Marakwet	15.3	3.2	14.7	15.1
Female	16.0 (12.8, 24.0)*	2.6 (0.4, 4.8)	16.7 (12.7, 15.0)	18 (15.0, 22.4)
Male	15.1 (6.3, 36.0)	3.8 (0.4, 8.3)	13.7 (10.0, 18.0)	12.3 (6.5, 18.2)
Association	15.8 (5.9, 26.7)	1.4	11.4	-
Nandi	14	7.9	16.2	15.1
Female	11.4 (6.0, 21.0)	11.7 (1.4, 36.0)	14.3 (8.3, 18.6)	14.4 (8.3, 18.5)
Male	14.9 (2.0, 36.0)	8.5 (2.5, 34.7)	17.1 (7.3, 26.0)	15.3 (8.5, 26.0)
Association	4.7	0.5	-	15.7 (15.3, 16.1)

County	Yield (t/ha)			
	Season 1 Mar.–July 2016	Season 2 Oct. 2016–Feb. 2017	Season 3 Mar.–July 2017	Season 4 Oct. 2017-Feb. 2018
Uasin Gishu	15.6	5.4	14.8	14.1
Female	11.5 (4.5, 18.5)	7.2 (3.6, 18.0)	15.1 (7.2, 26.0)	8.6
Male	17.3 (5.0, 32.0)	4.7 (0.5, 11.0)	14.6 (11.3, 18.7)	15.3 (13.2, 18.7)
Association	14.8 (11.3, 18.4)	0.9	13.6	13.6

*Mean yield (min, max).

Hub-seed multipliers (HSMs). The seven HSMs are progressing into seed businesses, of which four are youth and five HSM have obtained a business license with the goal of becoming a seed merchant. These multipliers contributed 208 t of the Y3 production. The HSMs are growing their businesses to comply with KEPHIS requirements to become a seed merchant by expanding the area they produce seed and investing in seed storage of 10-t capacity. Notably, four HSMs obtained loans totaling $2,230 to expand seed production.

Way forward

The major bottleneck in sustaining the seed multiplier approach is an accessible source of certified seed as starter material for onward multiplication and quality control. To resolve this, a seed unit has been developed within the potato marketing cooperatives. The potato component of the AVCD project is supporting the cooperatives and agricultural trainings centers (ATCs) to become licensed seed merchants with KEPHIS to produce certified seed. Initially though, the cooperatives and ATCs are producing certified seed as outgrowers under the license of a seed merchant. After a few test seasons of producing certified seed, the cooperatives and ATCs will be supported to become seed merchants. To this end, ***CIP is fostering PPP between ADC–Molo***, a parastatal producing EGS and certified seed, **and KALRO**, and ***the potato cooperatives and ATC–Chebara*** in Elgeyo-Marakwet and Uasin Gishu.

1.2 OBJECTIVE 2: INCREASE CAPACITY OF 35,000 SMALLHOLDER POTATO FARMERS TO INCREASE YIELDS BY 30%

Output 2.1 Smallholder potato farmers obtain gross margins of at least $725/ha by using quality seed potato

Output 2.2 Famer capacity built to produce at least 25% of their seed needs by saving quality seed potato on-farm

Results from the Y3 annual survey reveal that median gross margins doubled among smallholder farmers from the baseline of $720 to $1,680/ha, up from $1,327/ha from Y2. There was no difference between gross margin obtained by women compared with men: $1,637 and $1,685/ha, respectively. This could be a result of greater unit prices in Y3 ($0.21/kg vs. $0.19/kg in Y2), along with greater yields. Following the drought in Y2, average yields increased from 6.8 to 11.1 t/ha. The baseline distance to access certified seed was 110 km. In Ys 2 and 3, this distance dropped to 2 and 3 km, respectively, validating that the seed system is improving access to seed. Distances travelled to obtain seed from seed multipliers ranged from 0.5 km to a maximum of 16 km.

Y3 activities to support farmers to improve productivity focused on a training campaign for hilling in Meru. Hilling is an important yield determinant in potato production. A sample of 478 farmers who

applied good hilling averaged yield gains of 22–45% with proper hilling compared with conventional practices. The yield gain is equivalent to an increase of 8.7 t/ha. An additional 8.7 t of ware potato at $0.10/kg would be worth $870. The extra cost of two good hillings incurred by farmers was extrapolated to $120/ha, resulting in additional profits of $750/ha when good hilling is applied.

In the North Rift, 20 ward agricultural officers (WAOs) had a mandate to train 10,000 farmers who received promotional packs of seed potato in a training series of planting, hilling, disease management, and numeracy. The WAOs worked with the farmers to collect tuber yield data so that the farmers would apply the improved practices and value the gains this additional effort brought. This beneficiary and yield gains data are yet to be submitted.

Meru County WAOs-led farmer training. Farm Input Promotions Africa (FIPS) led a training of trainers for six WAOs on FIPS training materials for training of farmers, who subsequently carried out eight farmer trainings each using the materials. The intention was to ***embed the AVCD materials into the county system, leading to increased sustainability***. Three of six WAOs reported on eight trainings each and repeated the exercise, carrying out a total of 72 trainings among them training 700 farmers. The remaining three officers did not report on any trainings. Topics included the following: proper and timely hilling; disease and pest control; dehaulming, harvesting, and sorting; and how to establish a seed nursery plot to save quality seed on farm, which will prepare farmers for managing apical cuttings. The WAOs observed that the structure of the training guides and practice has made them better at interactive practical training, in which they ask questions, listen for answers, and plan the timing of a training. They also reported that they are already seeing a difference in farmers' practices after training them.

Timing between 1-kg pack and purchase of seed. Across the five networks, 22% of 388 farmers interviewed bought seed the same season they received a 1-kg pack. Some 60% bought seed after trying the 1-kg pack and 19% of the farmers bought seed before (or without) receiving a 1-kg pack. This suggests that a 1-kg pack is an effective tool for creating demand for seed since 82% of farmers who bought seed had had contact with the 1-kg pack.

Buying rates of seed potato. The annual survey revealed that 55% of smallholder farmers purchased seed in Y3, an increase from 15% at baseline and 35% in Y2. The 45% who did not purchase seed in Y3 saved seed on-farm or benefited from seed distribution exercise.

In a sample of 338 farmers in Meru County who received a 1-kg promotional pack of seed potato, 84% bought seed once, 14% bought seed twice, and 2% bought seed three times. Farmers expressed that after using clean/certified seed, they routinely multiply it twice more and thus plant from the same source for three seasons. As such, most farmers did not need to return to the VPAs to buy more seed on multiple occasions.

1.3 OBJECTIVE 3: IMPROVE SEED AND WARE POTATO MARKET COORDINATION THROUGH ACCESS TO MARKET INFORMATION AND LINKING VALUE CHAIN ACTORS

Output 3.2 At least 500 farmers linked to formal and informal markets

To respond to demand for better coordinated marketing of potato, the project supported the formation and capacity building of five potato marketing cooperatives to provide marketing and production-

support services to farmer members. This was initiated at the halfway point of the project, along with supporting nine youth agribusinesses: six youth groups (YGs) and three individual youths.

An agribusiness specialist trained five potato-marketing cooperatives and six YGs on entrepreneurship and business skills, followed by supporting the cooperatives to develop business plans. The cooperatives are in the process of implementing their business plans with AVCD support. Membership currently totals 1,091 paid members among the five cooperatives (Table 6).

TABLE 6. POTATO MARKETING COOPERATIVES SUPPORTED BY AVCD

County	County	Date Established	Date Officially Registered	Membership (as of 20 Oct.)
Upendo Potato Farmers' Cooperative Society Ltd	Meru	July 2017*	Sept. 2017	90 paid members
Meru Tamu Potato Farmers' Cooperative Society Ltd	Meru	Feb. 2017*	Aug. 2017	110 paid members
Nandi Potato Growers Farmers' Cooperative Society Ltd	Nandi	July 2017*	Aug. 2017	524 members paid the registration fee of KSH 200 in full or in part
Elgeyo-Marakwet Potato Farmers Marketing Cooperative Society	Elgeyo-Marakwet	May 2015	Nov. 2016	351 members have fully paid the KSH 200 registration fee
Ainabkoi Seed Potato Unit (under Ainabkoi Farmers' Cooperative)	Uasin Gishu	Seed Potato Unit Jan. 2017	Cooperative registered 1963	16 members paid the KSH 500 registration fee

*Directly supported by AVCD potato component since inception of the cooperative.

In Meru, the county government formed five new cooperatives and organized seven others to form a union. AVCD, in partnership with the county government lead by the governor of Meru County, supported the launch of the union. The governor assigned the union the responsibility of sourcing markets where cooperative members can sell their ware potatoes. The county promised to support the union in implementing the planned activities. AVCD will support the union to operationalize in phase 2.

Less than 1 year after receiving official cooperative certification, the potato cooperatives are in the process of securing supply deals. The Nandi Cooperative, for example, supplied approximately 15 t to Norda Industries for Urban Bites potato chips; negotiations are in place for longer term supply agreements. The Upendo Cooperative in Meru County supplied 4.5 t of potato to Sunripe Ltd, a vertically integrated independent grower, processor, exporter, and marketer of fresh vegetables, fruits, and flowers established in Kenya in 1976.

Business training. Forty-three seed multipliers in Meru were trained in farm business simulation module 1. The main topics included theory and simulation games on core aspects of the business cycle such as buying, adding value, selling products, and resource allocation. Selling on credit and managing risk, basic recordkeeping, factors affecting supply and demand, purchasing power, and costs of production are tackled in business simulation module 2.

FIPS, in collaboration with Equity Bank, trained 60 seed multipliers in Meru on savings and credit covering budgeting, saving, debt management, services, and packages offered by Equity Bank, and crop and livestock insurance. The training aimed to enable the seed multipliers make informed and effective decisions with their financial resources. As an outcome of the training, Equity Bank, in collaboration with

the Meru Tamu Cooperative, organized two training/public awareness events in Kiirua ward. The events attracted more than 300 farmers.

1.4 OBJECTIVE 4: MAINSTREAM POTATO AS A COMPONENT OF AGRICULTURAL NUTRITION INTERVENTIONS

A nutrition messaging campaign was launched at the end of Y2 and into Y3. More than 110 individuals—county officers and community health volunteers (CHVs)—received nutrition-related professional training and 1,406 children under 2 years were reached with nutrition messages. Integrating nutrition into potato development work will support households (HH) how to manage the extra income and encourage using this income to purchase nutritious food. The nutrition messaging campaign will continue into phase 2 to bring nutrition knowledge to beneficiary HH to empower them to make sound nutritional decisions when purchasing and preparing food, particularly for children and infants.

Following the community-level HH visits in the four wards in Uasin Gishu County, CHVs in one ward (Tulwet/Chuiyat) reported high levels of malnutrition among children in some of the HH visited. In this regard, the Department of Nutrition and Dietetics, County government of Uasin Gishu, together with the project designed a targeted specific nutrition intervention for this ward. This began with mapping out of identified HH to access the level of malnutrition among the children. The nutrition department managed 30 mid–upper arm circumference measurements and found that:

- Three children with severe acute malnutrition were immediately referred for treatment at the sub-county health facility.
- Eleven children with moderate acute malnutrition were referred for immediate supplementation at the health facility.
- Seven children at risk of acute malnutrition, along with their caretakers, were recommended for nutritional counselling by CHVs with follow-ups to be made later.
- Nine children were well nourished.

This collaboration, though small, showed that such small interventions, if well organized and facilitated, can identify areas of intense intervention to have quick nutritional gains amongst the most affected, especially considering that the rate of acute malnutrition was 66% among these tested HH. However, this activity was costly for the limited scope of intervention and beyond the scope of the nutrition objectives of AVCD.

1.5 LESSONS LEARNED

The seed multiplier approach evolved during the AVCD project as it became evident that the original approach of the model CIP proposed is ineffective to ensure quality control. The seed multiplier model relies on seed multipliers being at the forefront of managing quality control. Consistent renewal of starter material to multiply seed—usually basic or certified—is critical to the seed multiplier model and managing quality control. This is a major bottleneck in the seed multiplier approach. Of the 158 seed multipliers in the North Rift counties who bought starter material during the project, 98 purchased starter seed in two to five of the five project seasons (Table 7) and are considered as seed multipliers. Seed multipliers under the FIPS approach total 83, bringing to 181 active seed multipliers (123 men, 55 women, three associations) during AVCD. The 60 multipliers who purchased starter material only once

are not considered as seed multipliers, as these purchases (one to two 50-kg bags) are insufficient for seed multiplication business. The number of sustaining seed multipliers will be assessed during phase 2.

TABLE 7. NUMBER OF SEASONS THAT SEED MULTIPLIERS IN NORTH RIFT PURCHASED STARTER MATERIAL FOR ONWARD SEED POTATO MULTIPLICATION OVER FIVE PROJECT SEASONS

	Purchased				
Gender	**1 season**	**2 seasons**	**3 seasons**	**4 seasons**	**5 seasons**
Male	46	36	15	10	5
Female	11	14	8	4	3
Association	3	1	0	1	1
Total	**60**	**51**	**23**	**15**	**9**

Forming the potato-marketing cooperatives to absorb the additional production as a result of increased yields also had the benefit of organizing the seed multipliers. These multipliers formed the majority of the founding committees of these cooperatives and a seed unit to manage seed production. With the cooperatives and seed unit in place, the cooperatives can better manage seed production and quality control. The cooperative structure also provides opportunity for the cooperatives to progress to produce certified seed thus comply with national seed regulations.

Taking the seed multipliers a step further to develop into seed merchants or outgrowers to produce certified seed under their respective cooperative or as a private seed entrepreneur will ensure sustainability of seed system interventions across the four counties. Certified seed production requires a business approach to production and marketing, thus will transform seed multipliers, cooperatives, and private seed entrepreneurs into professional businesses. Figure 1 shows the progression steps as seed multipliers transform into seed business to produce certified seed.

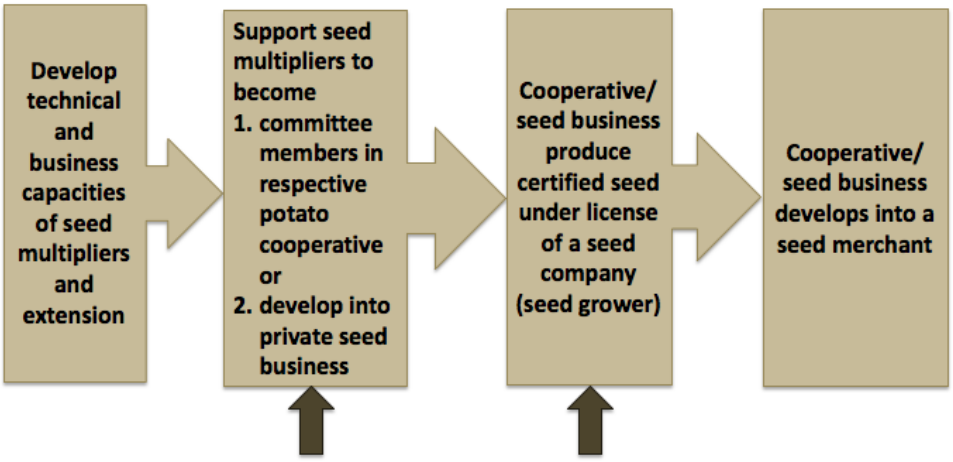

Figure 1. Progression steps as seed multipliers transform into seed business to produce certified seed. Vertical arrows indicate where in the process AVCD potato component is as at end of Y3.

2. ACTIVITY PROGRESS (QUANTITATIVE IMPACT)

Top-line indicator achievements:

- Overall, the potato value chain reached 40,385 HH and 46,411 smallholder farmers with technologies to improve farm productivity and engage in market systems, surpassing the targets of 35,000 and 40,000, respectively.
- A total of 46,425 farmers applied at least one of the technologies promoted by the project to improve productivity (EG.3.2-17), with 8,518 ha under improved technologies (EG.3.2-18). Of significant interest is the approximately equal number of women and men who applied the technologies (Table 8).

TABLE 8. NUMBER OF SMALLHOLDER FARMERS APPLYING TECHNOLOGIES TO IMPROVE PRODUCTIVITY OF POTATO FARMING OVER 3 YEARS OF THE AVCD PROJECT

County	Women	Men	Total
Elgeyo-Marakwet	3,212	3,826	**7,038**
Meru	13,228	10,285	**23,513**
Nandi	4,616	5,617	**10,233**
Uasin Gishu	2,923	3,005	**5,928**
Total	**23,979**	**22,733**	**46,712**

A nutrition messaging campaign was launched at the end of Y2 and into Y3. During that time, 111 individuals received nutrition-related professional training **(HL.9-4)** and 1,406 children under 2 (0–23 months) were reached with community-level nutrition interventions **(HL.9-2).**

One strength of the potato component is business development, particularly higher up the value chain, where capacities and investments are a bit more intensive, but are the pathway to reaching significant numbers of partners. As noted above, the potato component has supported $152,525 in investments of new private sector capital investment into seed and potato value chain businesses over 3 years against a 3-year cumulative target of $90,000 **(EG.3.2-22).** This is remarkable, considering that 87% of this investment is by smallholder farmers and youth who are turning into commercial farmers. Main investment areas are starter material for multiplication, leasing land, seed storage, and irrigation. Private sector investment in cuttings production and use also contributed to the indicator. Table 9 reveals that women are not investing at the same level as their male counterparts.

TABLE 9. INVESTMENTS INTO SEED BUSINESSES BY SEED MULTIPLIERS AND FIRMS

Type of Investment	Year 1 ($)	Year 2 ($)	Year 3 ($)	Total ($)
Starter material	12,349 (25.2 t)	20,930 (42.8 t)	18,725 (36.6 t)	52,004 (104.6 t)
Female	1,912 (4.3 t)	6,335 (12.8 t)	6,325 (12.7 t)	14,572 (29.8 t)
Male	10,327 (20.6 t)	12,845 (26.5 t)	12,050 (23.2 t)	35,222 (70.3 t)
Association	110 (0.3 t)	1,750 (3.5 t)	350 (0.7 t)	2,210 (4.5 t)
Land lease (ha)	259	13,900 (25 ha)	27,000 (39 ha)	
Female	0	5,224 (8 ha)	Data not available	
Male	116	8,546 (15.7 ha)		
Association	143	130 (1.1 ha)		

Type of Investment	Year 1 ($)	Year 2 ($)	Year 3 ($)	Total ($)
Seed storage (t)	3,838 (56 t)	9,520 (97 t)	19,220 (213 t)	32,578 (366 t)
Female	630 (7 t)	3,255 (31 t)	4,610 (47 t)	8,495 (85 t)
Male	3,208 (49 t)	6,265 (66 t)	14,610 (166 t)	24,083 (281 t)
Loans	0	0	2,230	2,230
Female			0	0
Male			2,230	2,230
Investment by youth businesses	0	0	4,624	4,624
Investments by firms	5,583	5,378	8,969	19,930
Total	22,029	49,728	80,768	152,525
Female	2,542			
Male	13,651			
Association/Firm	5,836			

3. PERFORMANCE DATA TABLES

Table 10 summarizes achievements for the potato value chain for years 1–3.

TABLE 10. SUMMARY OF POTATO VALUE CHAIN ACHIEVEMENTS AGAINST TARGETS FOR FTF INDICATORS FOR YEARS 1–3

Indicator	Potato			
	Achieved/ Target Y1	Achieved/ Target Y2	Achieved/ Target Y3	Achieved/Target Total 3 years
EG. 11-6: Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance	N/A	N/A	4,589/1,650	4,589/1,650
HL.9-2: Number of children under two (0–23 months) reached with community-level nutrition interventions through USG-supported programs (RAA)	0	123/425	1,283/200	1,406/625
HL.9-4 Number of individuals receiving nutrition-related professional training thru USG-supported programs		51/48	60/18	111/66
EG.3.2-18: Number of hectares under improved technologies or management practices with USG assistance (RAA) (WOG)	206	4,625/534	8,518.4/6,989	13,349/7,523
EG.3.2-17: Number of farmers and others who have applied improved technologies or management practices with USG assistance (RAA) (WOG)		22,022/19,570	46,425/32,917	46,425/32,917
EG.3.2-1: Number of individuals who have received USG-supported short-term agricultural sector productivity or food security training (RAA) (WOG)		5,863/1,800	6,013/854	11,876/2,654

Indicator	Potato			
	Achieved/ Target Y1	Achieved/ Target Y2	Achieved/ Target Y3	Achieved/Target Total 3 years
EG.3.2-5: Number of PPP formed as a result of USG assistance (RAA)		1/2	5/3	6/5
EG.3-1: Number of HH benefiting directly from USG interventions (RAA)	4,506	21,285/18,700	40,855/35,200	40,855/35,200
EG.3.1-12: Number of agricultural and nutritional enabling environment policies analyzed, consulted on, drafted or revised, approved and implemented with USG assistance (RAA). Enabling environment for private sector investment Process/Step Stage 3: Drafting or revision		1		
EG.3.2-22: Value of new private sector capital investment in the agriculture sector or food chain leveraged by Feed the Future implementation (RAA)	22,029/20,000	49,728/25,000	80,768/45,000	152,525/90,000
EG.3.2-7: Number of technologies or management practices in one of the following phases of development		3/2	4/1	4/3
EG.3.2-20: Number of for-profit private enterprises, producers organizations, water users associations, women's groups, trade and business associations and community-based organizations that applied improved organization-level technologies or management practices with USD assistance (RAA) (WOG)	156	264/156	264/268	264/268
EG.5.2-1: Number of firms receiving USG-funded technical assistance for improving business performance (O)	N/A	6/10	19/20	25/30

4. PERFORMANCE MONITORING

During the 3-year period, county government played a critical role in implementation of monitoring and evaluation activities for the potato value component. This involved their contribution in the preparation of data collection templates and using the same templates for data collection. Previously, they were trained on the use of refined templates, which facilitated efficient collection of data from activities. It is important to note participation of county government agriculture officers, particularly the WAOs in monitoring of project activities. This was mainly through the provision of real-time updates of the progress in the field with regards to the activities being implemented.

The WAOs, through the county governments, were also instrumental in collection of yield data and HH information from the beneficiaries. This provided beneficiary data for continuous monitoring over the 3-year period. WAOs actively helped implement continuous monitoring of activities, including the monitoring of the records of seed multipliers businesses. The county officials also played an important role in coordinating monitoring field visits in various wards with an objective of checking the progress of

the farmers who benefitted from project activities. During the midterm and the recently concluded annual survey, WAOs served as guides by identifying the respondents who were drawn from a pool of project beneficiaries. Generally, since the inception of the project, county government officials have played an important role in monitoring beneficiaries' progress as well as giving relaying feedback from the farmers, underscoring the importance of collaborative participatory monitoring and evaluation.

5. CONSTRAINTS AND OPPORTUNITIES

5.1 CONSTRAINTS

Rain-fed conditions. During the five cropping seasons that the project was being implemented starting from 2016 long rains (March–May), the rainfall pattern varied widely in terms of the amount of rainfall received, onset, and cessation of the season. Only two out of the five seasons could be considered good; the other three seasons either received very low rainfall or experienced delayed onset or early cessation. For example, low and erratic rainfall experienced during the 2017 short rains (Oct.–Dec.) in most parts of the county affected crop performance, leading to low tuber yields during the season. This resulted in low quantities of seed available during the ongoing 2018 long rains and also affected returns on investment for seed multipliers.

During the 2018 long rains, heavy rainfall received between April and June rendered some of the rural roads impassable. Consequently, this delayed some activities in some areas, notably land preparation, harvesting, and seed distribution. The heavy rainfall led to high late blight incidence, which translated to high cost of fungicides due to high frequency of fungicides sprays.

Unmet seed demand and timeliness. Whereas most of the 200 progressive farmers trained to be seed multipliers produced quality seed during the project's duration, the amount of seed is still much below the demand by project beneficiaries. Following the training, seed distribution, and awareness creation campaigns, demand for quality seed has continued to grow. On the other hand, seed multipliers do not always get the required amount and preferred varieties from seed merchants. For example, there was limited quantities of seed for 'Shangi' and 'Unica' varieties for farmers who had planned to plant during the 2018 long rains.

Availability of ready-to-plant seed potatoes from the seed merchants is not fully aligned with the onset of the cropping seasons. For example, seed meant to be planted during the onset of long rains in March/April is often not available until early May and during late October/early November for short rains. Sometimes, seed is available after the onset of the rains and when some farmers have already utilized all the available land. This often delays planting as farmers have to look for alternative land on which to plant or for rains to subside, as was the case during the 2018 long rains.

5.2 Opportunities

Marketing through cooperatives. Formation and capacity building of the five potato-based cooperative societies will provide an opportunity for farmers in each county to get organized and take charge of their produce. With one voice and a stronger bargaining power, farmers will be able to sell their potatoes in a structured manner. The recent bylaws passed by the government to the effect that potatoes will be sold on a per weight basis is also an opportunity that will benefit farmers. The National Potato Council of Kenya, which is a project partner, was involved in the preparation of the bylaws.

Production of certified seed. Following seed certification training by KEPHIS's seed inspectors, seed multipliers, either as an individual or as a cooperative, have shown keen interest in production of certified seed. Production of certified seed by individual seed multipliers or as a cooperative will not only increase production of quality seed, it will also reduce the distance currently covered by farmers when purchasing seed from Kisima Farm, KALRO–Tigoni, or ADC–Molo.

With the support from AVCD, Nandi Potato Farmers' Cooperative and ATC–Chebara registered their seed crop with KEPHIS in August 2018. In Meru, trained seed multipliers have started the process of registering either as a seed grower or seed merchant.

Seed distribution in small packs became a vehicle for introducing potato in nontraditional areas and new varieties. The distribution of certified seed in small packs whereby beneficiaries received 1–4 kg of seed was initially intended to create awareness on importance of using quality seed. However, owing to the high number of farmers who received seed distributed in small packs (more than 12,000 smallholders and wards covered), the activity became a vehicle for introducing potato in nontraditional areas such as Kapseret, Soy and Moiben sub-counties in Uasin Gishu County and Keiyo North in Elgeyo-Marakwet, where potatoes were not planted commercially before the project started. The distribution also provided an opportunity to disseminate new varieties, with 'Unica', a climate-smart variety benefiting most. As a result, many farmers are now aware of 'Unica' based on demand and enquiries for its seed.

Some 67% of seed multipliers will continue to scale up seed multiplication. Moreover, they have the skill to multiply seeds from apical cuttings, especially for preferred varieties whose seed is not easily accessible. The county met with KEPHIS to discuss opportunities for continued support and shared contacts of potential seed multipliers interested in producing certified seed.

6. PROGRESS ON GENDER STRATEGY—YOUTH AND PRIVATE SECTOR

Gender was referred to in previous sections. Although there are more men than women seed multipliers, women and men seed businesses performed at the same level when considering unit investment, gross margin, and yield per woman and per man. At the farmer level, women and men farmers earned essentially the same gross margin from selling market potato.

Private sector engagement through fostering PPP and private-private partnerships were discussed in relation to seed businesses. Private sector and seed multipliers invested $152,525 in their seed businesses.

The potato component supported YGs and individuals in four counties (Uasin Gishu, Nandi, Elgeyo-Marakwet, and Meru) by teaching entrepreneurship and business skills. After identifying agribusiness opportunities of their interest, the YGs developed business plans with support of a specialist. They are in the process of implementing their business plans with AVCD support (Table 11).

TABLE 11. YOUTH AGRIBUSINESSES SUPPORTED BY AVCD

YG	County	Date Established	Date Officially Registered	Business Activity	Business Name	Business License
Kombatich YG	EMC	Oct. 2015	Apr. 2016	Seed multiplication and ware potato production	Kombatich Young Farmers	In progress
Kipyuso Kapmaina YG	EMC	Oct. 2017	Not officially registered	Ware potato production and value addition	Kapmaina Enterprise	In progress
Oldoldol YG	Nandi	Aug. 2010	Aug. 2011	Ware potato production and value addition	Twins Fries Cafe	In progress
Evergreen YG	Nandi	Sept. 2008	Aug. 2009	Ware potato production and value addition	Kaptumo Modern Bytes	Done
Matharu Jikaze YG	Uasin Gishu	May 2013	Nov. 2015	Ware potato production and marketing	Matharu Jikaze Company Ltd	Done
Kapng'etuny Jubilee YG	Uasin Gishu	Dec. 2011	Aug. 2013	Seed multiplication and ware potato production	Kapng'etuny Youths Enterprise	In progress
Erick Bittok	Nandi	Mar. 2017	Aug. 2018	Seed multiplication	Erikibi Enterprise	Done
James Ngugi	Meru	Mar. 2017	Aug. 2018	Seed multiplication	Jungu Farm Enterprise	Done
David Kinoti	Meru	Mar. 2017		Seed multiplication	-	In progress

A needs assessment of the YGs confirmed constraints youths face, ranging from access to capital to limited entrepreneurial and business knowledge. The project invested in youths through training, inputs such as seeds, and equipment for value addition such as potato chippers and peeler. These investments were leveraged by contributions of the YGs from their savings or loans from Sacco's and local banks. Even with limited startup capital, some of the groups have already started to implement various aspects of their business plans, investing $4,624 and generating some revenue totaling $17,000. Others are still struggling with startups from backlashes experienced due to weather and lack of capital (Table 12).

TABLE 12. INVESTMENTS AND REVENUE BY YOUTH AGRIBUSINESSES

Youth Agribusiness	USG Support ($)	YG Investment ($)	Revenue Stream (30 Sept. 2018) ($)
YGs in North Rift	9,340	3,134	2,740
HSMs	6,442	1,490	14,382
Total	**15,782**	**4,624**	**17,122**

Two groups have created employment opportunities for some of its members. Evergreen YG has employed three of its members at a salary of $50 in the first month of operation (August). This will increase to $80/month as the business grows in the coming months. Odoldol YG also employed four of its

members at a daily rate of $3. The group has temporarily closed the business as it intends to relocate to a better location and hopes to get members on monthly wages.

The Evergreen and Oldoldol YGs each opened a chips outlet in Nandi County, with plans for expansion. Each group internally manages its supply of tubers to make the chips, with each member planting on a staggered basis to ensure a consistent supply of raw materials. The YGs have also started to manage internal seed bulking. The Kipyuso Kapmaina Youth Group of Elgeyo-Marakwet is in its second season of seed multiplication using cuttings.

7. PROGRESS ON ENVIRONMENTAL MITIGATION AND MONITORING

Seed of the 'Unica' potato variety is finally available and is being distributed to farmers to experience robustness of this variety. Seed multipliers have also been multiplying 'Unica' from cuttings. Certified seed of the variety, which tolerates abiotic stresses such as heat and water stress, is finally available this current season on a large-scale. This makes 'Unica' a climate-smart variety, providing farmers with more flexible options to cultivate potato. 'Unica' produces reasonable yields in seasons of unreliable rain when many other varieties fail. It can also be grown in warmer agro-ecologies and lower altitudes outside of the traditional cooler, highland areas to where potato is largely restricted, allowing farmers in such regions to diversify crop production. 'Unica' is also becoming appreciated by markets, thus is a variety suiting farmer and market needs.

8. PROGRESS ON LINKS WITH GOVERNMENT OF KENYA AGENCIES

The potato component depends significantly on county governments to lead implementation of activities, monitor project interventions, and interact with project beneficiaries. The counties took leadership for planning and implementing learning farms and in supporting establishment of potato cooperatives. County WAOs led in seed distribution activities to raise awareness of new varieties and benefits of quality seed. County offices are leading nutrition messaging activities, and WAOs are collaborating with CHVs to deliver nutrition messages and train the same HH in improved potato production technologies. WAOs led the intensive farmer-training program, where the same farmers were trained in planting, hilling, disease management, and numeracy.

The potato component collaborated with KEPHIS to integrate cuttings into certified seed protocols to allow seed merchants to produce certified seed along all stages of production (pre-basic, basic, certified 1 and 2) from cuttings.

9. SUSTAINABILITY AND EXIT STRATEGY

Project activities continue to be implemented in close collaboration with county government departments of agriculture and nutrition. This approach is expected to ensure sustainability of project's results. Close engagement with county governments helps to position potato among the objectives of

these departments at county level. County governments also co-invest in project activities under their agricultural support work plans and budgets. It further develops capacities of county governments to enable them to continue autonomously with value chain-related activities. Community nutrition messaging is supervised by sub-county staff from the departments public health and nutrition. Seed potato is closely supervised by the sub-county agriculture extension officers and WAOs.

A major step in the sustainability plan is to certify the seed multipliers under their respective potato cooperative. A seed unit within the supported potato-marketing cooperatives will be established to manage seed production and sales. The cooperatives will be supported to become licensed seed merchants by KEPHIS, and the seed multipliers will access the license to produce certified seed under the cooperative license. Having such systems in place will further reinforce the capacities of the cooperatives. This will also give the cooperatives one of their first operational mandates to provide members with certified seed produced by local progressive farmers. In Meru, individuals were identified to become HSMs and developed seed multiplication business plans. The HSMs are increasing investments and seed production since first season and are in the their third season.

In response to the midterm review sustainability and exit strategy suggestions, and key recommendations, business development and commercialization at diverse levels is the theme for the potato value chain exit strategy. The strategy has already been set in motion to ensure sustainability of the potato seed system, which includes registering seed multipliers as seed merchants to produce certified seed under the umbrella of the potato cooperatives. All value chains were recommended to phase out subsidies. To upstart seed multipliers, the project shared the costs for transport and/or starter seed with seed multipliers. This cost-sharing has been phased out, with seed multipliers purchasing their own seed and organizing transport. However, distributing quality seed to farmers will continue to promote quality seed and develop markets for seed multipliers. Supporting the potato cooperatives to develop business skills and business plans and beginning their execution are key sustainability factors. The potato component has already started to collect outcome data (yield and gross margin) to evaluate the effectiveness of the interventions.

10. SUBSEQUENT QUARTER'S WORK PLAN

Activities for the potato component will concentrate on supporting membership for potato cooperatives and market forums to launch AVCD phase 2 into a market-driven intervention. A postharvest feasibility study evaluating seven types of postharvest storage will be completed to guide cooperative investment in marketing potato. The seed units of the cooperatives will be supported to detail the seed component of the business plans. Nandi Cooperative and ATC–Chebara (Elgeyo-Marakwet) and Chebororwa (Uasin Gishu) are being supported to produce certified seed under ACD– Molo and KALRO seed merchant licenses.

ANNEX 1. KNOWLEDGE MANAGEMENT LIST

The deliverables, success stories, and project briefs were submitted to AVCD knowledge management platform and can be viewed on sharepoint. They will also be permanently available on CGSPACE, an open-access repository for reports, articles, press releases, presentations, videos, policy briefs, and more.

ANNEX 2. IMPROVING FARMER ACCESS TO QUALITY SEED

Reducing the risk of investing in seed entails empowering farmers with the agronomic skills to produce a quality crop and strategies to save seed on-farm, as it is unreasonable to expect farmers to purchase 100% of their seed needs every season. In response to this, CIP has validated several strategies and incorporated different approaches combining sourcing new seed with saving seed on-farm, such as using small seed plot technique and positive selection. Although solely using certified seed results in greatest yields, combining smaller seed purchases with saving seed on-farm is more profitable (Table A2). Farmers will be trained on saving seed on-farm using the learning farms to promote quality seed and new varieties.

TABLE A2. SEED REPLACEMENT OPTIONS FOR FARMERS TO BALANCE SEED PURCHASES AND SAVING SEED ON-FARM WITH YIELD AND PROFITS

	CF	20% CF + PS	20% CF + RSFS	SSPT + PS	SSPT + RSFS	PS	RSFS	Baseline
Seed cost 2 t/ha ($)	1,250	250	250	63	63	0	0	0
Seed transport cost/ha ($)	400	80	80	20	20	0	0	0
SSPT or PS cost/ha ($)		40		150	100	50	0	0
Input cost	800	800	800	800	800	800	800	316
20% interest/risk on investment	490	234	226	207	197	170	160	63
Total cost ($) (without labor)	**2,940**	**1,404**	**1,356**	**1,239**	**1,179**	**1,020**	**960**	**379**
Yield t/ha (mean over 3 seasons)	**49.3**	**44.4**	**41.7**	**44.9**	**35.6**	**34.2**	**11.8**	**8.4**
Yield increase compared to FSS t/ha	37.5	32.6	29.9	33.1	23.8	22.4		
Income—selling price $100/t	4,930	4,440	4,170	4,490	3,560	3,420	1,180	840
Profit ($)/ha (without labor)	**1,990**	**3,036**	**2,814**	**3,251**	**2,381**	**2,400**	**220**	**461**
Profit change ($) to baseline	1,529	2,575	2,353	2,790	1,920	1,939	**-241**	
Min. yield for same profit as baseline (high input)	***34.0***	***18.6***	***18.2***	***17.0***	***16.4***	***14.8***	***14.2***	
Min. yield for same profit as baseline (low input)	***24.9***	***12.1***	***11.7***	***10.7***	***10.2***	***8.9***	***8.4***	

CF = certified seed, PS = positive selection, RSFA = randomly selected farmer seed, SSPT = small seed plot technique.

ANNEX 3. RAINFALL DATA OVER FIVE PROJECT SEASONS

Rainfall data from project sites during the five seasons of project implementation revealing the fluctuations in rainfall that affected productivity are shown in Table A3.

TABLE A3. RAINFALL DATA OVER FIVE CROPPING SEASONS OF THE AVCD PROJECT (POTATO COMPONENT)

County	Rain Meter	Season 1 (Apr.–July 2016)	Season 2 (Oct. 2016–Jan. 2017)	Season 3 (Apr.–July 2017)	Season 4 (Oct.–Jan. 2018)	Season 5 (Apr.–July 2018)
		Rainfall*	Rainfall	Rainfall	Rainfall	Rainfall
Nandi	Nandi Tea Estate, Nandi Hills	785	270	-	-	-
	New KCC Ollessos	330	53	728	247	1,491
	Tindiret Tea Estate	-	-	630	351	951
	Nandi, Chebut Tea Factory	782	230	803	339	1,315
Uasin Gishu	Timborua Forest Station	694	137	386	207	817
	Nabkoi Forest Station	589	181	549	245	904
	Kapseret Forest Station	798	133	-	-	-
EMC	Kapcherop Weather Station	982	119	690	363	795
	Iten	664	148	506	389	1,077

*Rainfall amounts are given in millimeters.