The role of variety user agreements in access of public potato (*Solanum tuberosum*) varieties in Kenya

January 2016

Consultancy Report

Prepared for:
Centre for Development Innovation

Submitted by:
International Potato Center (CIP)
The role of variety user agreements in access of public potato (Solanum tuberosum) varieties in Kenya

January 2016
Consultancy Report

Prepared by: C. Lung’aho and E. Schulte-Geldermann
Consultancy agreement no. 15/CDI0382
# TABLE OF CONTENTS

ACRONYMS .................................................................................................................. iii

ACKNOWLEDGMENTS .................................................................................................... iv

EXECUTIVE SUMMARY ................................................................................................. v

1. BACKGROUND ........................................................................................................... 1
   1.1 Introduction ........................................................................................................... 1
   1.2 Study Objectives .................................................................................................. 1
   1.3 Research Questions ............................................................................................. 1

2. STUDY APPROACH .................................................................................................... 2

3. OVERVIEW OF THE POTATO SUBSECTOR ............................................................ 2
   3.1 Role in Economy .................................................................................................. 2
   3.2 Varieties in the Public Domain .......................................................................... 2
   3.3 Production Characteristics ................................................................................ 4
   3.4 Production and Yields ....................................................................................... 4
   3.5 Marketing and Trade ......................................................................................... 5
   3.6 Consumption and Utilization ............................................................................ 5
   3.7 Seed-related Policies ......................................................................................... 6
   3.8 Legal and Regulatory Framework Governing the Seed Subsector..................... 6
   3.9 Major Actors and Institutions in the Seed Potato Value Chain.......................... 9

4. PUBLIC VARIETY USER AGREEMENTS/ARRANGEMENTS/ CONTRACTS IN POTATO ........................................ 11
   4.1 Justification for Providing Exclusive Access to Public Varieties........................ 11
   4.2 Potato Variety User Agreements ....................................................................... 11
   4.3 Comparing the Use of Variety Access Agreements in Maize and Potato Subsectors .................................................................................................................. 18
   4.4 Mechanisms for Supply and/or Demand-driven Variety Transfer ..................... 19
   4.5 Contribution of Variety Agreements to Variety Promotion ................................. 19
   4.6 Extent to Which the Agreements Have Improved Women’s Access to Improved Seeds ..................................................................................................................... 19
   4.7 Agreements That Were Instrumental in Getting Potato Varieties from the Public Domain Multiplied and Promoted by Private Seed Multipliers .......................................................... 20
   4.8 Relationship between Agreements That Were Instrumental in Getting Potato Varieties from the Public Domain Multiplied and Promoted by Private Seed Multipliers and the Seed Policy ............................................................................................................. 21
   4.9 Hurdles That Were Overcome to Realize Agreements between Private and SME Seed Producers and Public Sector Research on a Wider and More General Scale .................................................................................................................... 21
   4.10 Direct Agreements between Seed-Producing FOs and Research; and Required Profile and Standards for FOs to Qualify for Such Agreements ........................................................................................................... 21

5. Challenges .................................................................................................................. 22
   5.1 Policy-related Challenges ................................................................................... 22
   5.2 Shortage/Lack of Seed of Preferred Varieties ..................................................... 22
   5.3 High Cost of Seed .............................................................................................. 22
   5.4 Lack of Consistent Seed Demand for Various Seed Categories ......................... 22
   5.5 Pests and Diseases Coupled with Shortage of Land to Allow for Meaningful Rotations .............................................................................................................. 23
   5.6 High Seed Certification Charges ....................................................................... 23
   5.7 No Benefits Accruing to Breeders for Their Intellectual Efforts ....................... 23
   5.8 Sustainably Organizing Seed Producers into Groups ......................................... 24
   5.9 Controlling Tuber Size ...................................................................................... 24
5.10 Getting Reputable Farmers to Serve as Seed Growers ................................................................. 24
5.11 Verbal Agreements .......................................................................................................................... 24

6. Lessons Learned .................................................................................................................................. 24
   6.1 Lessons on the Seed Potato Sector ................................................................................................. 24
   6.2 Lessons on agreements for access to public varieties ..................................................................... 26

7. References .............................................................................................................................................. 27
### ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADC</td>
<td>Agricultural Development Corporation</td>
</tr>
<tr>
<td>ASARECA</td>
<td>Association for Strengthening Agricultural Research in Eastern and Central Africa</td>
</tr>
<tr>
<td>ASDS</td>
<td>Agriculture Sector Development Strategy</td>
</tr>
<tr>
<td>ATC</td>
<td>Agricultural Training Center</td>
</tr>
<tr>
<td>ATIRI</td>
<td>Agricultural Technology and Information Response Initiative</td>
</tr>
<tr>
<td>BW</td>
<td>Bacterial Wilt</td>
</tr>
<tr>
<td>CBO</td>
<td>Community-Based Organization</td>
</tr>
<tr>
<td>CIP</td>
<td>International Potato Center</td>
</tr>
<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
</tr>
<tr>
<td>DUS</td>
<td>Distinctness, Uniformity, and Stability</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation</td>
</tr>
<tr>
<td>FIPS</td>
<td>Farm Input Promotions</td>
</tr>
<tr>
<td>FO</td>
<td>Farmer Organization</td>
</tr>
<tr>
<td>GoK</td>
<td>Government of Kenya</td>
</tr>
<tr>
<td>KALRO</td>
<td>Kenya Agricultural and Livestock Research Organization</td>
</tr>
<tr>
<td>KEPHIS</td>
<td>Kenya Plant Health Inspectorate Service</td>
</tr>
<tr>
<td>MoA</td>
<td>Ministry of Agriculture, Livestock and Fisheries</td>
</tr>
<tr>
<td>NARS</td>
<td>National Agricultural Research System</td>
</tr>
<tr>
<td>NGO</td>
<td>Nongovernmental Organization</td>
</tr>
<tr>
<td>NPT</td>
<td>National Performance Trial</td>
</tr>
<tr>
<td>NPTC</td>
<td>National Performance Trials Committee</td>
</tr>
<tr>
<td>NVRC</td>
<td>National Variety Release Committee PBR</td>
</tr>
<tr>
<td>PGRFAuD</td>
<td>Plant Genetic Resources for Food and Agriculture under Development</td>
</tr>
<tr>
<td>PS</td>
<td>Positive Selection</td>
</tr>
<tr>
<td>PVP</td>
<td>Plant Variety Protection</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium Enterprises</td>
</tr>
<tr>
<td>STAK</td>
<td>Seed Traders Association of Kenya</td>
</tr>
<tr>
<td>TOSCI</td>
<td>Tanzania Official Seed Certification Institute</td>
</tr>
<tr>
<td>UPOV</td>
<td>International Union for the Protection of New Varieties of Plants</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>VCU</td>
<td>Value for Cultivation Use</td>
</tr>
</tbody>
</table>
ACKNOWLEDGMENTS

The study team expresses its appreciation to the following for their assistance in this study: Dr. Monica Parker of CIP, Mr. John Karinga of KALRO Tigon, Dr. Moses Nyongesa of KALRO Tigon, Ms. Nancy Ng’ang’a of KALRO Tigon, Dr. Lusike Wasilwa of KALRO Secretariat, Mr. Raphael Ngige of KALRO Secretariat, David Kipkoech of KALRO Secretariat, Mr. Thomas Kwambai of KALRO Kitale, Mr. Wachira Kaguongo of National Potato Council of Kenya, Mr. Simon Maina of KEPHIS, Mr. Simeon Komen of KEPHIS, Mr. Paul Njuguna of ADC and Ms Miriam Mbiyu of ADC. The constructive comments of participants during the ISSD Africa—Cross case analysis meeting—Thematic working group 2. Access to varieties in the public domain held in December 2015, at Lukenya Getaway, contributed to improvement of the report and are much appreciated. We are also grateful to Willem Heemskerk of KIT and Dr. Ivan Rwomushana of ICIE (previously of ASARECA) for their useful insights and guidance in preparation of this report.
EXECUTIVE SUMMARY

Seed is a key component for reducing the yield gap and allowing the expression of the genetic potential of crop varieties in terms of productivity. However, the quality and availability of planting material of improved potato (Solanum tuberosum) varieties remains a recurrent concern of smallholder farmers in Kenya. Majority of smallholder farmers face challenges in getting reliable access to sufficient quantities of quality seed of superior varieties at the right time and at an affordable price, which affects their agricultural productivity, income, and resilience. Currently, more than 90% of seed potato used by small-scale farmers originates from the farmer’s own field or a neighbor’s field or local markets. The relatively high volume of planting materials needed per unit area, the perishability of seed potatoes, prohibitive cost, distance to seed providers, and/or lack of production of desired varieties are just some of the many challenges to increased use of quality seed potatoes by small, poor, and women farmers, particularly from off-farm sources.

A study aimed at determining the role of variety user agreements/arrangements in access to (public) potato varieties in Kenya was conducted between June and November 2015. The specific objectives were to (1) document and analyze existing variety user agreements/arrangements, and (2) identify the key lessons learned in using the identified variety user agreements/arrangements in seed potato value chains. The main research question addressed by the study was what are effective potato variety use agreements in the seed value chain which improve access to new varieties to farmers and to private and other seed producers? Specifically, the study addressed the following questions:

- What type of user agreements are used for potato in Kenya?
- Why are user agreements less used between public research (CIP and KALRO) and private seed companies for potato and more for other crops such as maize?
- Which type of agreements were instrumental for potatoes in Kenya to get varieties from the public domain multiplied and promoted by private seed multipliers, if any?
- What are the mechanisms for supply and/or demand-driven variety transfer?
- What is the justification of providing exclusive access of public varieties?
- Can the agreements that were instrumental for potatoes in Kenya to get varieties from the public domain multiplied and promoted by private seed multipliers be related to the seed policy in Kenya?
- What were the main hurdles to be overcome to realize these agreements on a wider and more general scale between private and small and medium-scale seed producers and public sector research?
- What is the evidence (even if anecdotal) that the agreements have contributed to a more effective variety promotion?
- How have the agreements improved women’s get access to improved seeds?
- Can seed-producing farmer organizations (FOs) also sign agreements directly with research, or only through seed companies? What profile do these FOs need to have and what standards (indicators) are needed for FOs to qualify for such agreements?
- Have agreements between variety maintainer and private enterprises contributed to variety promotion, in the referred cases? Can it be traced to what the variety promotion actually yielded?

Several techniques were employed to gather information for this study. These included an extensive review of relevant literature from published works and gray literature; semi-structured discussions with key informants and actors in the potato seed sector; and case studies of seed potato initiatives that have been implemented in Kenya.
There are many actors and institutions in the seed value chain. These include public and private organizations, community-based organizations (CBOs), farmers groups, farmer organizations, individual farmers, and various donors. There are no exclusive user agreements for public potato varieties. The agreements/arrangements for potato mainly involve those between public research with other public sector organizations, private sector organizations, CBOs, individual farmers, and amongst multiple value chain actors.

In general, the agreements/arrangements seemed to improve access to quality seed and improved varieties in the formal, semi-formal, and informal seed systems. The specific lessons learned on the seed potato sector were:

- Linking multiple actors proved crucial to the success of farmer seed enterprises. Linking early generation seed growers to seed potato growers; seed potato growers to ware potato growers; and ware potato growers to end markets seemed to catalyze the use of quality seed as it created markets for everyone along the value chain.

- Seed initiatives that offered benefits or services to the seed growers appeared to be more successful. For example, models that invested in development of technical and managerial capacities of individual seed producers’ or organizations as well as their ability to build functional business linkages with service providers appeared to be more successful in increasing the quantities of seed produced and therefore access to seed by farmers. Similarly, technical assistance provided to contract growers/out-growers can also increase out-grower productivity; make a company’s operations more cost effective; and improve farmer profitability—all of which builds mutual trust and loyalty. For example, offering technical backstopping, arranging for transport, and grading services encouraged and motivated growers who participated in seed growing as Agriculture Development Corporation out-growers. This led to increased production of seed and ultimately increased availability and access to seed by farmers.

- Currently, the system of variety evaluation and release has been streamlined and the National Variety Release Committee meets twice a year to recommend varieties that meet the required criteria for release. It requires a minimum of two seasons for the varieties to be released. To date, the public research systems have released over 30 varieties. Using conventional clonal multiplication techniques takes 6–7 generations for sufficient quantities of seed to be bulked and accessed by farmers. In contrast, the use of a variety of rapid multiplication techniques such as aeroponics takes only 3–4 generations before seed reaches the farmer. Thus, the combination of a relatively short variety release process and rapid multiplication techniques seemed to improve access to quality seed of improved varieties.

- Small seed enterprises (e.g., individual farmers and CBOs) in the semi-formal seed system can strengthen themselves and benefit from economies of scale by joining together in associations and protect the market from counterfeiters. They could also source early generation seed jointly, thus minimizing transportation costs. However, equally important for the viability of FOs are business skills, technical skills, and organizational management skills. Most seed growers/seed-growing associations collapsed due to the lack of ownership, group management skills, and inability to link with markets. Despite the advantages that they can offer (including social and technical support), networks of seed growers are largely nonexistent. In cases where they existed, they did not last for long. The chances of networks to be established can be strengthened if due attention is given in the implementation phase of projects to the longer term prospects (e.g., in the processes and criteria used for seed grower selection, site selection, encouragement of farmer-driven network development, and availability of market information to enhance farmers’ access to markets).
• The informal seed system can rapidly diffuse varieties that farmers consider important even in the absence of interventions from the formal seed system. Varieties that have been successfully diffused by the informal seed system include Shangi, Nyayo, Tana Kimande, and Thima Thuti. The principal mechanism for diffusing these varieties are through farmer-to-farmer seed exchanges, purchasing uncertified seed from local markets, or being supplied by brokers/middlemen. The public research system partnered with farmers to improve the quality of the farm-saved seed through training in “positive selection” (PS). In this technology, the best potato plants in a field are marked before crop senescence that obscures disease symptoms. The marked plants serve as mother plants for seed potatoes used for the next season’s potato crop. PS gave an average yield increase in farmer-managed trials of 34%. It would seem that injection of small quantities of high-quality seed in the formal seed systems, coupled with PS, would provide smallholder farmers in the informal seed system with improved access to quality seed. One way of doing this would be through agreements between public research and CBOs.

• The breeding of public varieties is not necessarily market oriented, nor do variety selection/evaluation programs always reflect grower or market needs. This sometimes causes farmers to select different material from those recommended by variety selection/evaluation programs. There are two classic examples to illustrate this fact. Variety Shangi was a farmer-selected variety that spread without official interventions to nearly ‘90%’ of the area under potato in mid-2000s before it was formally registered as a variety. The variety was multiplied by farmers themselves, but later the national potato program would informally multiply small quantities of seed and supply it to interested growers. It is suspected to have been an escape from the formal breeding program and could have been discarded by breeders because it did not meet their selection criteria. In contrast, the variety Purple Gold was formally evaluated and released in 2010. However, following its release, only a handful of farmers grew it; today, hardly anyone does. When a variety has poor attributes or is not liked by the market, it is very likely that no private sector or even other public sector companies or entrepreneurs would be interested in it. This cannot sustain seed enterprises. Agreements between public breeders and farmers/CBOs to evaluate promising varieties may minimize incidence in which “unpopular varieties” are released.

The specific lessons learned on agreements for access to public varieties were:

• Farmers had a lot of confidence in government-related organizations such as ATCs, the research centers, or the Agricultural Development Cooperation (ADC) as providers of good quality seed. In most cases, they would purchase all the seed produced by these organizations regardless of whether it was produced as certified or “quality seed.” The use of ATCs increased the reach of seed production to many farmers and is credited with the increase in seed availability from 1% to 1.5%. Since the ATCs are also located in different parts of the country, many farmers were able to access good quality seed. It would appear that this would be one of the options to exploit to increase the usage of quality seed. Expansion of seed production activities of government organizations such as ADC could also improve access to seed by smallholder farmers. However, no profitability or sustainability studies on the model of seed dissemination have been carried out.

• Demand-side intermediaries have a role in identifying and “procuring” technologies for application and use in business contexts. The use of an intermediary was key to contributing to access of public varieties from Kenya by Tanzania. This arrangement involved the supply of pre-basic seed, basic seed, and variety evaluation data from national performance data of selected varieties from one country to another. The arrangement involved implementing an agreement among East African countries to allow one country to rely on the field test data
of another in approving new seed varieties (only one field test). The Tanzanian government used the process to offer its officials deeper technical training, and the legal and regulatory lessons learned have been spread to other investments and regulators. Syngenta Foundation facilitated the process as an intermediary.

- Arrangements in the semi-formal seed system that promoted the packaging of seed in small packs (5–10 kg) were very effective in improving seed access by smallholder farmers. Small seed packs are much preferred amongst smallholder farmers because they deliver tangible benefits to farmers, including flexibility to purchase the desired quantity coupled with affordability. The small bags encourage farmers to experiment with quality seed potato in an affordable, low-risk way. For example, in the 3G project, FIPS-Africa established a network of promoters to sell seed potato and train farmers in six project districts: Nyandarua, Nyeri, Meru, Kiambu, Molo, and Taita. FIPS-Africa reached out to over 10,000 farmers who bought 60 MT of G3 seed potato packed in 5- and 10-kg bags supplied by Kisima Farm in three seasons. Such small bags could be promoted alongside small fertilizer packs to boost yields.

- Agreements between various actors in the seed value chain need to be better defined, with clear arbitration clauses indicating the penalties of violating the agreements—for example, what are the penalties for late deliveries of (breeder, foundation) seed? Or what are the penalties in case of exclusive agreements of not making the seed available in the market at reasonable prices?

- Direct agreements between breeders of public varieties with CBOs and seed decentralized multipliers seemed to improve access to quality seed of new varieties. Institutionalization of such arrangements will go a long way in improving access of public varieties by farmers.

- Because of the importance of informal seed system in delivering improved varieties to farmers, there is need to engage policymakers to recognize the system and facilitate development of appropriate quality standards for the system.

- Farmers are sourcing/accessing varieties from formal, intermediate, and informal seed systems, although the informal system dominates (over 90%). There are linkages between formal and informal seed systems, but they are weak.

- Partnerships in basic seed production, the introduction of varieties and production technologies (aeroponics and hydroponic systems), and the accelerated diffusion of technologies all increased farmers’ access to new varieties. Agreements between the public and private sector not only increased production of quality seed, but also brought in efficiency, timeliness, mechanization, and improved production and accessibility of seed potato. For example, the private sector contributed over 80% of both minitubers and basic seed produced in 2010 and 2011. Private sector has skills, resources, and knowledge suitable for seed production to extend public sector capacity, and should be an important development partner. The private sector will invest in seed production but may require some initial risk management and ongoing technical backstopping if it is a new enterprise. It may be necessary to give some subsidy (50% initial capital subsidy in one case study); support to get starter seed in the first year of production; free technical backstopping; and assistance with marketing and links to markets. On the basis of the agreement between CIP with Kisima Farm, joint planning workshops could provide good opportunities to identify prospective partnerships that could lead to actual agreements.
1. BACKGROUND

1.1 INTRODUCTION

Seed is a key component for reducing the yield gap and allowing the expression of the genetic potential of newly released varieties in terms of productivity. However, the quality and availability of planting material of improved potato (*Solanum tuberosum*) varieties remain a recurrent concern of smallholder farmers in Kenya. Currently, smallholder farmers face challenges in getting reliable access to sufficient quantities of quality seed of superior varieties at the right time and at an affordable price, which affects their agricultural productivity, income, and resilience. Another related problem is the inappropriateness of some of the varieties since at times they are developed without the involvement or participation of farmers in defining the breeding objectives and determination of priority traits. Organizations dealing with plant health issues are also concerned about planting material because it is often an important carrier of new or existing pests and diseases. The quality of seed depends on several biophysical factors: (1) physiological—rate of sprouting and initial vigor, (2) genetic—heritable traits and purity, and (3) health—presence of pests and diseases.

Currently, more than 90% of seed potato used by small-scale farmers originates from the farmer’s own field, a neighbor’s field, or local markets. The relatively high volume of planting materials needed per unit area, the perishability of seed potatoes, prohibitive cost, distance to seed providers, and lack of production of desired varieties are just some of the many challenges to increased use of quality seed potatoes by small, poor, and women farmers, particularly from off-farm sources. Private sector suppliers have not yet been able to develop a steady market for high-quality seed potatoes. This has resulted in a heavy dependence on public sector initiatives to develop seed improvement initiatives, either based on new cultivars or disease-free planting material.

The need to increase agricultural productivity to enhance food security and reduce poverty in Kenya is well-articulated in various policy documents with improved crop varieties recognized as playing a critical role in these efforts (GoK 2007; GoK 2010a).

1.2 STUDY OBJECTIVES

The study aimed at determining the role of variety user agreements/arrangements in access to (public) potato varieties in Kenya. The specific objectives were to:

- Document and analyze existing variety user agreements/arrangements
- Identify the key lessons learned in using the identified variety user agreements/arrangements in seed potato value chains.

1.3 RESEARCH QUESTIONS

The main research question addressed was what are effective potato variety use agreements in the seed value chain that improve access to new varieties to farmers and to private and other seed producers?

Specifically, the study addressed the following questions:

- What type of user agreements are used for potato in Kenya?
- Why are user agreements less used between public research—for example, the International Potato Center (CIP) and the Kenya Agricultural and Livestock Research Organization (KALRO)—and private seed companies for potato and more for other crops such as maize?
- Which type of agreements (if any) were instrumental in the case of potatoes in Kenya to get varieties from the public domain multiplied and promoted by private seed multipliers?
- What are the mechanisms for supply and/or demand-driven variety transfer?
- What is the justification of providing exclusive access of public varieties?
• Can the agreements that were instrumental in Kenya to get potato varieties from the public domain multiplied and promoted by private seed multipliers be related to the seed policy in Kenya?

• What were the main hurdles to be overcome in order to realize these agreements on a wider and more general scale between private and small and medium-size seed producers and public sector research?

• What is the evidence (even if anecdotal) that the agreements have contributed to a more effective variety promotion?

• To what extent have the agreements improved women’s access to improved seeds?

• Can seed-producing farmer organizations (FOs) also sign agreements directly with research, or only through seed companies? What profile do these FOs need to have and what are the standards (indicators) they need to qualify for such agreements?

• Have agreements between variety maintainers and private enterprises contributed to variety promotion, in the referred cases? Can the promoted variety be traced to its actual yield?

2. STUDY APPROACH

The study was conducted between June and November 2015, and used several techniques to gather information. These included an extensive review of relevant literature from published works and “gray” literature; semi-structured discussions with key informants and actors in the seed potato sector; and case studies of seed potato initiatives that have been implemented in Kenya.

3. OVERVIEW OF THE POTATO SUBSECTOR

3.1 ROLE IN ECONOMY

Potato is Kenya’s most important food crop after maize, and is increasingly becoming an important source of cash for the country’s low-income, small-scale farmers. The crop generates considerable employment in production, marketing, and processing sectors. An estimated 800,000 farmers grow potatoes, and an estimated 2.5 million people are employed in the potato subsector as market agents, transporters, processors, vendors, and exporters.

3.2 VARIETIES IN THE PUBLIC DOMAIN

Table 1 shows that over the last five years (2010–2015), 35 potato varieties have been released, but only 5 are public varieties. Between 2013 and 2015, some 33 varieties were released and only 2 are public varieties. This is largely because of the entry of private sector players in the seed potato industry. The private sector varieties are considered to be suitable for high input management, whereas the public varieties are usually considered to be best suited for conventional management.

Only a few of the many varieties that are grown in Kenya are widely distributed. The availability of markets and yield potential are the key determinants of variety preferences among producers. Farmers frequently change potato varieties (in the past these have mainly been new public varieties or clones that have escaped from public breeding programs), replacing older ones based on yields, susceptibility to disease, and market preferences (Crissman 1989; Lung’aho et al. 2012). Farmers have also abandoned many varieties with long dormancies in favor of varieties with short dormancy periods.

In many cases, availability of seed of locally preferred varieties from the formal seed system has often been a problem. For example, when varieties such as ‘Tana Kimande’, ‘Nyayo’, ‘Thima Thuti’, and ‘Shangi’ (before its release) were popular with farmers, hardly any seed of these varieties could be found within the formal seed system.
## Table 1: Potato varieties officially released

<table>
<thead>
<tr>
<th>Variety</th>
<th>Country of Origin</th>
<th>Year of Release</th>
<th>Owner(s)</th>
<th>Maintainer and Seed Source</th>
<th>Category of Ownership</th>
<th>Type of Management</th>
<th>% Area under Variety&lt;sup&gt;4&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Kears Pink</td>
<td>UK</td>
<td>1931</td>
<td>-</td>
<td>-</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
</tr>
<tr>
<td>2. Dutch Robijn (GK8)</td>
<td>Netherlands</td>
<td>1953</td>
<td>KALRO</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>3. Rodil-Borou (BS3)</td>
<td>UK</td>
<td>1972</td>
<td>KALRO</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>4. Erdfruh Germany</td>
<td>1972</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>5. Marita Germany</td>
<td>1972</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>6. Feldsaloen Germany</td>
<td>1972</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>7. Desiree Netherlands</td>
<td>1972</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>&lt;0.1%</td>
<td></td>
</tr>
<tr>
<td>8. Kenya Akiba</td>
<td>UK</td>
<td>1964&lt;sup&gt;2&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>9. Kenya Baraka</td>
<td>UK</td>
<td>1973</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>10. Roblin Brussels</td>
<td>UK</td>
<td>1974</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>11. Rodil Gucha</td>
<td>UK</td>
<td>1974</td>
<td>-</td>
<td>-</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>12. Rodil Tara</td>
<td>UK</td>
<td>1974</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>13. Rodil Rukia</td>
<td>UK</td>
<td>1974</td>
<td>-</td>
<td>-</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>14. Rodil Karura</td>
<td>UK</td>
<td>1974&lt;sup&gt;4&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>15. Rodil Ashi</td>
<td>UK</td>
<td>1974&lt;sup&gt;4&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>16. Cardinal Netherlands</td>
<td>n/a</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Private</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>17. Rumanio Netherlands</td>
<td>n/a</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Private</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>18. Fisemperil Netherlands</td>
<td>n/a</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Private</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>19. Kenya Chaguo</td>
<td>Kenya</td>
<td>1988</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>20. Kenya Dichtama</td>
<td>CIP</td>
<td>1998</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>21. Tigoni</td>
<td>CIP</td>
<td>1998</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>22. Assante</td>
<td>CIP</td>
<td>1998</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>23. Rodil Kubu</td>
<td>CIP</td>
<td>2002&lt;sup&gt;4&lt;/sup&gt;</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>24. Kenya Fauku</td>
<td>CIP</td>
<td>2002&lt;sup&gt;4&lt;/sup&gt;</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>25. Kenya Siba</td>
<td>Mexico</td>
<td>2003&lt;sup&gt;2&lt;/sup&gt;</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>26. Kenya Musoni</td>
<td>CIP</td>
<td>2004</td>
<td>KALRO</td>
<td>KALRO-Tigoni</td>
<td>Public</td>
<td>CM</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>27. Sheriska</td>
<td>CIP</td>
<td>2010</td>
<td>KALRO/TIGON/PQS</td>
<td>KALRO-TIGON/PQS</td>
<td>Public</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>28. Kenya Mipya</td>
<td>CIP</td>
<td>2010</td>
<td>KALRO/TIGON/PQS</td>
<td>KALRO-TIGON/PQS</td>
<td>Public</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>29. Purple Gold</td>
<td>CIP</td>
<td>2010</td>
<td>KALRO/TIGON/PQS</td>
<td>KALRO-TIGON/PQS</td>
<td>Public</td>
<td>CM</td>
<td>N/A</td>
</tr>
<tr>
<td>30. Alavia Netherlands</td>
<td>Agro U.A.</td>
<td>2013</td>
<td>Agro East Africa Ltd.</td>
<td>Agro East Africa Ltd.</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>31. Arizana Netherlands</td>
<td>2013</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd.</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
<td></td>
</tr>
<tr>
<td>32. Rudolph Netherlands</td>
<td>2013</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd.</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
<td></td>
</tr>
<tr>
<td>33. Conseat Netherlands</td>
<td>2013</td>
<td>Aandappelweek-en selectiebedrijfsselmeer polders BV</td>
<td>Den Hartogh BV</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
<td></td>
</tr>
<tr>
<td>34. Sarpe Mira</td>
<td>Netherlands</td>
<td>2014</td>
<td>Danesipo A/S</td>
<td>Africalla</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>35. Manzou</td>
<td>Netherlands</td>
<td>2014</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>36. Savella</td>
<td>Netherlands</td>
<td>2014</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>37. Toluca (A897-1385)</td>
<td>Netherlands</td>
<td>2014</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>38. Mayan Gold</td>
<td>Scotland</td>
<td>2014</td>
<td>Greenman plc</td>
<td>Agree to not for profit release to Kenyan farmers</td>
<td>MMUST/KARI-Tigoni</td>
<td>Public</td>
<td>CM</td>
</tr>
<tr>
<td>39. Carcza</td>
<td>Netherlands</td>
<td>2014</td>
<td>Saka-Ragis</td>
<td>Den Hartogh</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>40. Brutica</td>
<td>Netherlands</td>
<td>2014</td>
<td>C. Meijer BV</td>
<td>Africalla</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>41. Royal</td>
<td>Netherlands</td>
<td>2014</td>
<td>C. Meijer BV</td>
<td>Africalla</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>42. Jolly</td>
<td>Netherlands</td>
<td>2014</td>
<td>Danesipo A/S</td>
<td>EUROPLANT Pflanzenschutz GmbH</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>43. El Mundo Netherlands</td>
<td>2014</td>
<td>Kartoffelforschung B broker GmbH &amp; Co. KG</td>
<td>Africalla</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
<td></td>
</tr>
<tr>
<td>44. Falaka</td>
<td>Netherlands</td>
<td>2014</td>
<td>SMS Potato B V</td>
<td>Agro East Africa Ltd.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>45. Mabrie</td>
<td>Netherlands</td>
<td>2014</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>46. Sagitta</td>
<td>Netherlands</td>
<td>2014</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V., Field and in-vitro maintenance</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>47. Derby</td>
<td>Netherlands</td>
<td>2014</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V., Field and in-vitro maintenance</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>48. Ambition</td>
<td>Netherlands</td>
<td>2014</td>
<td>Agro U.A.</td>
<td>Agro East Africa Ltd</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>49. Kenjo</td>
<td>CIP</td>
<td>2015</td>
<td>KALRO/TIGON/PQS</td>
<td>KALRO-TIGON/PQS</td>
<td>Public</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>50. Shang</td>
<td>Unknown</td>
<td>2015</td>
<td>KALRO/TIGON/PQS</td>
<td>KALRO-TIGON/PQS</td>
<td>Public</td>
<td>CM</td>
<td>&gt; 80%</td>
</tr>
<tr>
<td>51. Decley (S90-4005)</td>
<td>Netherlands</td>
<td>2015</td>
<td>Agro U.A.</td>
<td>Agro U.A.</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>52. CAROULA</td>
<td>Netherlands</td>
<td>2015</td>
<td>AGROCO U.A</td>
<td>AGROCO U.A</td>
<td>Private</td>
<td>CM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>53. TAOULUS</td>
<td>Netherlands</td>
<td>2015</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>54. EURODA</td>
<td>Netherlands</td>
<td>2015</td>
<td>AGROCO U.A.</td>
<td>AGROCO U.A.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>55. ZARIFA</td>
<td>Netherlands</td>
<td>2015</td>
<td>AGROCO U.A.</td>
<td>AGROCO U.A.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>56. MILVIA</td>
<td>Netherlands</td>
<td>2015</td>
<td>Saatzaucht Bering</td>
<td>Saatzaucht Bering</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>57. CHALLENGER</td>
<td>Netherlands</td>
<td>2015</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>58. PAMANERA</td>
<td>Netherlands</td>
<td>2015</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>59. RODEO</td>
<td>Netherlands</td>
<td>2015</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>60. SIYRA</td>
<td>Netherlands</td>
<td>2015</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
<tr>
<td>61. CHILLER</td>
<td>Netherlands</td>
<td>2015</td>
<td>HZPC Holland B.V.</td>
<td>HZPC Holland B.V.</td>
<td>Private</td>
<td>HM</td>
<td>&lt;0.1%</td>
</tr>
</tbody>
</table>

CM=Conventional Management; HM=High input management; n/a=not released, p=pre-released; n=not released, n=not applicable, 1-<sup>1</sup>-3-<sup>n</sup> indicates date unknown; 2: Withdrawn indicates not officially released as a variety.

4- Estimates are based on expert opinion

---

Only 1–2% of the certified seed potato demand is met. The vast majority (more than 90%) of all potato farmers use their own farm-saved seed tubers and do not rejuvenate their seed stocks on a regular basis (Gildemacher et al. 2009).
Agreements between the public sector and various actors in the seed value chain could possibly increase availability of varieties released by the public sector.

3.3 Production Characteristics

The crop is generally grown on small family farms, where total area planted to potatoes is typically less than 1 ha (Gildemacher et al. 2009; Obare et al. 2010). Although some growing areas exist in the counties, such as Bomet, Nyandarua, and Narok, a small number of large, commercial growers cultivate several hectares or more of potatoes. Most potatoes are grown in monoculture; however, some farmers, especially the very small-scale growers, intercrop potatoes with other food crops such as maize and beans. Owing to small land holdings, most producers practice short crop rotations; while for many others, potatoes are grown without any rotation, leading to build-up of diseases in the soil. The cost of fertilizer remains a big challenge and has contributed to low input use by most smallholder farmers (Barnett et al. 2011; Ng’ang’a et al. 2012).

Nearly all potato production is rain-fed and therefore highly vulnerable to climate variability. Production is characterized by seasonal gluts and waste, punctuated by periods of short supply. Most growers plant the crop twice a year as dictated by rainfall patterns. Where farmers have invested in small-scale irrigation systems such as those that rely on gravity-fed lines tapped from streams (e.g., in Meru), the planting of the crop can be scheduled so that harvesting coincides with lower market supplies and hence command higher prices (Fintrac 2014).

Late blight (Phytophthora infestans), bacterial wilt (BW) (Ralstonia solanacearum), and viral diseases such as potato leaf roll and potato virus Y (Gildemacher et al. 2009; Were et al. 2013) are some of the major diseases. Important pest includes aphids, potato tuber moth, cut worms, and leafminers. A recent report (Mwangi et al. 2015) highlighted the first reported case of the potato cyst nematode (Globodera rostochiensis) in certain parts of the country.

Ware potatoes are usually sold immediately after harvest, and rarely stored for future sale (Kirumba et al. 2004; Muthoni et al. 2009). Liquidity constraints, uncertain returns from storage, technical knowledge gaps, and price unpredictability are some of the factors that contribute to limited storage of ware potato (Fintrac 2014).

On-farm seed storage is generally done in basic stores that employ natural ventilation. Seed tubers may be stored in heaps in the house or outside in pits to enhance sprouting. Few farmers use improved diffused light stores (DLS). Breaking dormancy continues to be a major challenge for small farmers who plant two or three crops a year using varieties with medium or long dormancies. The use of cold stores for seed is not widespread except for a few public organizations and a large private farmer (Kisima Farm). Recent developments indicate that a few cold store facilities are being constructed as part of a recent initiative on potato improvement by Kenya and Netherlands.

Postharvest handling constraints substantially reduce the total volume of potato reaching markets. The losses along the potato value chain are estimated at 19% (Kaguongo et al. 2014).

3.4 Production and Yields

Most of the potato crop is cultivated at 1,500–3,000 masl. Production is currently concentrated in three of Kenya’s eight administrative provinces (GoK 2011): Rift Valley, Central Province, and Eastern Province. The crop is mainly produced in the counties of Bomet, Bungoma, Elgeyo-Marakwet, Kiambu, Laikipia, Meru, Nakuru, Narok, Nyandarua, Nyeri, Taita-Taveta, Trans-Nzoia, Uasin Gishu, and West Pokot. Currently, no significant production of the potato occurs in arid and semi-arid land regions. Statistics provided by the Food and Agriculture Organisation of the United Nations (FAO) (FAOSTAT 2015) show that national average potato yields decreased from 20.4 MT/ha in 2012 to 14.1 MT/ha in 2014. The production in 2012 was 2,915,067 MT, whereas in 2014 it was 1,626,027 MT.
Although these yields are considered relatively high, they vary greatly across potato-growing areas due to climate variation, incidence of pests and disease, and seed quality (Fintrac 2014). Recent projections show that the country will produce 3.57m MT of potatoes in 2017 and 4.2m MT in 2022 (ibid.).

3.5 MARKETING AND TRADE

Small-scale farmers often face difficulties in production and marketing of their produce. They usually sell their produce individually at the farm gate to middlemen or in local markets at given prices. This reduces farmers to price takers irrespective of their production and marketing costs. Furthermore, they must bear the high risk of not being able to market the entire amount of their produce.

The marketing of potato is characterized by presence of middlemen who sometimes form cartels (akin to collusive oligopoly). Cartels distort market information and/or create information asymmetry, leading to exploitation of some players in the value chain, especially producers (Fintrac 2014). Marketing is mainly done through informal value chains that add limited value to the final product. Nevertheless, several marketing studies (e.g., Kirumba et al. 2004; Laititi 2014) have identified a series of well-defined marketing channels linking the major potato-producing areas with rural and urban markets. Three distinct value chains—seed, ware, and processing potato—can be identified, though the processing value chain has few actors.

Although standards for production and marketing have been established, they are largely not enforced and in practice. The traditional extended bag remains the most common form of packing potatoes for transport and sale. Major markets for potatoes are located in large urban areas, such as Nairobi, Mombasa, Nakuru, and Kisumu. Because potatoes are bulky and have a high moisture content, transport costs are high and farmers closer to the major markets benefit more than those in remote areas. Open-air markets, small shops, kiosks, and hawkers are currently the most important sales outlets for fresh tubers. Supermarkets, which are increasingly becoming important outlets for processed potato products, are a highly visible potential partner in efforts to modernize potato marketing and consumption.

Nearly all the crop is for the domestic market. And though there is some informal, cross-border trade with some neighboring countries, the trade is largely opportunistic and typically takes place during short-term, seasonal windows. Small quantities of processed potato products (e.g., crisps, chevra, and chevda) are exported. Some processed potato products are imported from South Africa, and frozen French fries are imported from Europe (e.g., Ireland). No significant export of seed occurs. Small volumes of minitubers have been shipped to neighboring countries, such as Rwanda, Somalia, Uganda, Tanzania, and South Sudan.

3.6 CONSUMPTION AND UTILIZATION

Accurate figures on per-capita consumption are difficult to come by, but some estimates put the figures at 29.6–56.4 kg (Kaguongo et al. 2014; Fintrac 2014). According to a study by Fintrac (ibid.), national per-capita potato consumption is expected to grow at an annual average rate of 5.2% for the next 10 years. Urban residents are the country’s main consumers, the reason for the soaring demand for ware potatoes and processed products, such as chips and crisps in restaurants and bars (Kirumba et al. 2004; Tesfaye et al. 2010).

Processing is currently limited to the production of snack foods, such as crisps, chevra, and chevda. At retail level, potatoes are mainly prepared and consumed as chips in restaurants, bars, and takeaway outlets in major urban centers (Tesfaye et al. 2010). In response to consumer demand for quality processed products, about 40 local processors produce potato crisps and a few large companies produce frozen potato chips for sale in leading supermarkets and some hotels (NPCK 2015). The limited available data, however, suggest that the volumes of raw material handled by these industrial processors are fairly minor compared with the quantities of fresh potatoes peeled.
and fried in bars and restaurants. There are also many emerging small-scale processors, supplying cooled (not frozen) ready-cut chips directly to fast food restaurants and hotels. Processors are often unable to procure the quantity and quality of the product that consumers are looking for (Kaguongo et al. 2013; NPCK 2015).

Packaging of potatoes is poorly developed except for crisps and frozen chips. Small quantities of fresh potatoes are packaged and sold in net bags in some markets and supermarkets.

3.7 Seed-related Policies

The Kenya National Seed Policy (GoK 2010b) is the main policy related to seed issues. It outlines interventions that aim to address constraints in the seed sector with a view to contribute to agricultural productivity. The description of seed systems in the policy follows the formal/informal dichotomy. The description of the informal seed system in the National Seed Policy is not followed by any policy detail on whether the system either requires attention or support.

Although the policy identifies as a problem the use of farm-saved seed, and seed obtained either through farmer-to-farmer exchange or local markets, it does not point out specific problems of these seed systems. Seed certification is presented as the main tool effecting quality control. To enhance certification, the policy proposes registration of all actors in the seed value chain (including relief seed suppliers) and prescription of stiffer penalties for those flouting certification procedures. There is also a call for the continued support of public breeding institutions to maintain varieties and produce seed for those varieties not attractive to the private sector. Targeting informal seed systems is a proposed policy on “provision of advisory services with a view to transform it to the formal sector” (GoK 2010b). While the nature of advisory services is not expounded, the policy calls for strengthening of farmer extension and advisory services in order to make farmers appreciate the benefits of using good quality seed. It is expected that through these services transformation to a formal seed system will occur.

3.8 Legal and Regulatory Framework Governing the Seed Subsector

The seed sector is regulated through several legal instruments, including the Seed and Plant Varieties Act (Seed Act; Cap 326); the Crops Act 2013; the Plant Protection Act (Cap 324); the Agriculture, Fisheries, and Food Authority Act 2013; the Pest Control Products Act (Cap 346); and related regulations such as the Seeds and Plant Varieties Regulations (Seeds Regulations), the Seeds and Plant Varieties Regulations (National Performance Trials Regulations), and the Plant Breeder’s Rights Regulations. In general, the laws provide a broader framework for governance of the seed sector, while regulations contain more specific guidelines for regulatory processes and day-to-day operations.

The Ministry of Agriculture, Livestock and Fisheries (MoA) is mandated to formulate, implement, and monitor agricultural acts, regulations, and policies that support agricultural research, promote technology, ensure quality of seeds and other inputs, and control pests. The MoA also has the final approval on all varieties released to market.

The Kenya Plant Health Inspectorate Service (KEPHIS) is the primary regulatory authority for seed and has a regulatory mandate to protect seed and plant varieties, provide seed certification and laboratory services, and administer sanitary and phytosanitary matters. All crop varieties that fall under Schedule II (including potato) as outlined in the Crops Act 2013 require mandatory inspection.

3.8.1 Variety release and registration

The Seed and Plant Varieties Act, Cap 326 of the Laws of Kenya, guides the regulatory process of seed release, certification, and production. Variety release procedures usually consist of
performance testing through multolocation trials and administrative registration procedures. Two types of trials are run to conduct national performance trials (NPTs):

- Client-managed trials where a client with technical knowledge runs the trials and KEPHIS plays a defined supervisory role on behalf of the National Performance Trials Committee (NPTC)
- KEPHIS-managed trials, where KEPHIS fully manages trials on behalf of the NPTC.

To be officially released and registered in Kenya, a new variety listed under the second schedule of the Seeds and Plant Varieties Act (CAP 326) must:

- Undergo NPTs for at least two seasons and be found to be superior in terms of yield or other special attributes. Where a plant variety has already been officially released in any country within the regional economic blocks to which Kenya is a member and has harmonized performance trial regulations (emphasis added), the variety shall undergo performance trials for at least one season in similar agro-ecological zones, provided that an applicant shall provide the data leading to release of the plant variety in that other country.
- Be proven to be distinct, uniform, and stable (DUS) in the essential characteristics
- Have a valid descriptor for seed certification
- Have been approved and released by the National Variety Release Committee (NVRC) (Sikinyi 2010).

Once a variety has been officially released, it is gazetted and entered into the National Variety List. Commercialization can either be done by the applicant or by another party who is permitted to multiply varieties under license.

The DUS and value-for-cultivation use (VCU) tests are usually carried out for at least two seasons according to International Union for the Protection of New Varieties of Plants (UPOV) protocols. The two tests may be done concurrently. In addition to VCU and DUS data, on-farm data must also be submitted by the breeder, which includes initial field performance evaluations and data. After completion of the DUS and VCU tests by KEPHIS, the data are submitted to the NPTC for assessment. KEPHIS chairs the NPTC meetings, which include various stakeholders from the seed sector, including the Seed Traders Association of Kenya (STAK). At the end of the meeting, the NPTC recommends whether or not the variety should be approved for full release, pre-release, or rejected. The recommendations are forwarded to the NVRC for endorsement and final recommendation and approval by the MoA, which then announces the released varieties before they are entered into the national variety catalogue.

Under regional harmonization, the whole process could be shortened by accepting third-country data if the same varieties have been registered in other countries in the same regional blocs. The precise frameworks and processes surrounding regional variety release will vary, however. For example, within the EAC, Kenya, Tanzania, and Uganda agreed to allow for more open trade of varieties approved in another country through an agreement developed by the Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA). The association provides that only one season of additional NPT testing in the destination market will be required if DUS and VCU data are submitted from the first registration and similar agro-ecological conditions exist.

Similarly, under the Common Market for Eastern and Southern Africa (COMESA), a variety registered in one member state could also be subjected to a streamlined NPT process. According to the COMESA Seed Trade Harmonization Regulations of 2014, a variety registered in one COMESA member country can be entered into the COMESA variety catalogue after one season of NPT/VCU testing in the second member state’s market and submission of relevant DUS and VCU data from the first member state. A variety registered in two COMESA member states can be entered into the catalogue with an application containing the appropriate DUS and VCU data.
3.8.2 Plant breeders’ rights

Plant breeder’s rights (PBR) are proprietary rights exclusively granted by the government, through KEPHIS, to persons or institutions who (1) are involved in discovery, breeding, or developing new varieties of plants and (2) have filed an application for protection of the variety with KEPHIS. They are granted for a specific period of time (20 years) and on complying with internationally recognized standards for DUS tests and novelty requirements.

The KEPHIS Seed and Plant Variety Protection department administers plant breeders’ rights in Kenya. KEPHIS is also the custodian of the plant breeders’ register in Kenya. Once an application for PBR is received, KEPHIS has to examine the variety to confirm whether it is novel (new), distinct, stable, and uniform and hence deserving of recognition and protection under the law. The examination process may be undertaken by KEPHIS itself or in another country under UPOV. The DUS tests are conducted for two years, either by KEPHIS or by the UPOV member state office that has plant variety protection. Where the tests are done in another country, KEPHIS does not conduct the test, relying on the examination report issued by the other UPOV liaison office.

In some cases, it is not necessary to conduct these tests in Kenya because they have been conducted in a different country that is a UPOV member state. Here, KEPHIS relies on test reports from other UPOV members states with which KEPHIS cooperates. This arrangement is done under the provisions of the UPOV Convention, which in recognition of the uniformity of the tests, the costs involved while conducting the tests allow members to share their results and rely on them when granting PBR.

From the date of granting of PBR until it expires (currently 20 years), the holder of rights is granted sole and exclusive rights over the multiplication and commercialization of their variety. This in theory allows the breeder to recover the research and development costs associated with breeding and introducing the variety, thereby providing an incentive for individuals or companies to invest in plant breeding. Once the period of protection expires, the variety passes into public domain.

Currently there are no public potato varieties under PBR. An application for DUS costs US $600; following successful DUS, an application for PBR costs $200.

3.8.3 Seed certification

Kenya maintains a centralized seed certification system. KEPHIS is largely responsible for seed certification according to the standards stipulated in the Seeds Regulations under Cap 326. Seed quality assurance services operate within the guidelines and procedures stipulated in the Seeds Act (Cap 326). Inspections (both in the field and at the seed-processing stage) are undertaken as per these standards, which follow the standards set by the Organization for Economic Cooperation and Development Seed Scheme.

The 2012 Amendment to the Seed Act allows the private sector to participate in conducting inspections. This is yet to be fully operationalized, however, and will require regulatory change as well as an operational process. Kenyan regulation currently provides for eight classes of certified seed: breeder, pre-basic, basic, certified first generation (G1), certified G2, certified G3, certified G4, and standard seed. The Seed and Plant Varieties Act requires that all seed growers be licensed as seed merchants.

Quality declared seed is an alternative system for seed quality assurance developed by FAO in 1993. It is less demanding and expensive than full seed certification systems, and promotes a satisfactory level of seed quality. The system is not yet legalized for any crop in the country.

All seed agents and stockists are expected to be registered with KEPHIS to promote traceability of seed movement and enforce quality standards (inspections, etc.). KEPHIS registers them as outlets and distributors of seed for a fee of $1,600 per agent and $600 per stockist.
3.9 **Major Actors and Institutions in the Seed Potato Value Chain**

Prior to 2012, the subsector was mainly dominated by public actors who controlled industry, policy and regulation, variety development, and seed production and distribution. However, since the signing of an agreement between Kenya and the Dutch government, more players outside the public sector have begun to play a role in the subsector, albeit a small one. This section highlights the main actors and institutions and their roles and relations.

- The MoA is working to revitalize the Kenyan potato sector. The initiatives have included formulation of a National Potato Policy, review of the national framework, and formation of a potato task force to look into factors affecting the industry. The ministry is also responsible for agricultural extension and release of varieties.

- KALRO (formerly Kenya Agricultural Research Institute, or KARI). Seed potato research is dominated by KALRO-Tigoni (National Potato Research Centre). It is the main national research body involved in potato research and variety development in the country and remains a major producer of early generation seed potatoes as part of KALRO seed unit.

- KEPHIS is a regulatory agency for quality assurance on agricultural inputs and produce in Kenya. It carries out plant variety protection, seed certification, and phytosanitary inspection of imports and exports. It has the mandate for both quarantine issues and seed certification. It supervises and carries out DUS tests and NPTs before varieties are officially released and allowed for commercialization.

- Agricultural Development Corporation (ADC) is a governmental parastatal with the mandate for multiplication and bulking of seed potato, with KALRO-Tigoni as its specific seed source for breeder seed. ADC uses the out-grower model to facilitate multiplication.

- Kenya National Farmers Federation (formerly Kenya National Federation of Agricultural Producers) is a nonpolitical, nonprofit-making and democratic member-based umbrella organization of all farmers in Kenya. It represents the interests of about 2m farm families as the legitimate farmers’ voice. Its objective is to articulate issues affecting its members through focused lobby and advocacy, targeted capacity building, and promotion of sector stakeholders’ cohesiveness in dispensing and progressive uptake of agricultural innovations, including seed of improved varieties for enhanced socioeconomic status of the farmers.

- STAK is an association for seed companies registered with KEPHIS, to produce, process, and/or distribute seed. STAK members control 90% of the formal seed sector in Kenya. Members sell only quality seed and adhere to ethical practices at all times. Currently, none of its members grow potatoes.

- National Potato Council of Kenya (NPCK). This is a member-based, nonprofit organization comprising diverse institutions from the public and private sectors. Its mission is to coordinate and regulate potato subsector stakeholders toward development of greater potato industry profitability and improvement of livelihoods. NPCK is responsible for (1) enabling better vertical and horizontal interrelationships among stakeholders; (2) helping develop the subsector into a self-regulating and competitive industry; (3) facilitating policy formulation and review; and (4) encouraging better enforcement of existing regulations and standards.

- Kenya National Potato Farmers Association operates under the umbrella of the Kenya National Farmers Federation. Through its membership of 10,400 farmers growing 3,350 ha of potato, the association is an influential player in the sector. Some of its members have participated in growing seed of public potato varieties.

- Midlands Ltd is a farmer-owned company that deals in fresh-cut potatoes. It sometimes helps ware potato growers to get seed of preferred varieties.
• Processing companies such as Deepa Industries Ltd, Norda, and Chirag provide the market for processing varieties.
• Seed growers dealing in seed potato. Currently, there are six growers registered as seed potato merchants: ADC Potato project, Syngenta EA Ltd, Suera Flowers Ltd, Agrico (EA) Ltd, Kisima Farm, and KALRO—seed unit. Only ADC and KALRO seed unit are public organizations.
• Genetics Technologies International Limited is a private company that produces early generation seed.
• Potato Platform Kenya (www.potatoplatformkenya.com/) Kenya–Netherlands is a collaborative platform in the field of potato production and marketing. It represents seed potato companies such as Agrico East Africa, HPC, Europlant, and Africalla.
• CIP is also a major breeder of public varieties. It is working to improve quality and access to seed of improved potato varieties by integrating rapid multiplication technologies with decentralized seed production and on-farm seed maintenance. A key element of this approach is to partner with the private sector along the seed value chain to create entrepreneurial opportunities for young and female farmers. It provides early generation seed to interested actors to further bulk the seed. It also builds the capacity of early generation seed multipliers.
• Donors with interest in potato. These include:
  — The German Agency for Technical Cooperation is a government agency providing technical assistance with limited capital funding throughout the major regions of the world. It has been involved in the development of the Kenyan potato sector for decades.
  — The United States Agency for International Development (USAID) is the U.S. government’s agency primarily responsible for administering civilian foreign aid. It has shown interest to support the potato sector through a project in seed potato value chains.
• East African Farmers Federation is a nonpolitical, nonprofit, and democratic apex organization of all farmers of East Africa. Through its Support to Farmer Organizations in Africa Program project, member organizations are implementing processes and policies aimed at strengthening their local FOs in their engagement with their respective role players in the potato value chain at the national and regional levels.
• FAO. Achieving food security for all is at the heart of FAO’s efforts, to make sure people have regular access to enough high-quality food to lead active, healthy lives. FAO supported the study “A policymakers’ guide to crop diversification: The case of the potato in Kenya,” which was carried out in 2012.
• Syngenta Foundation for Sustainable Agriculture’s mission is to create value for resource-poor small farmers in developing countries through innovation in sustainable agriculture and the activation of value chains.
• Syngenta Ventures seeks to identify early-stage companies with a strong technology base or new business model. It invests in innovative businesses that help bring plant potential to life.
• ASARECA is affiliated with COMESA and is a lead partner in Pillar 4 of the Comprehensive Africa Agriculture Development Program. ASARECA spearheaded seed policy development and harmonization in member countries, to facilitate regional access to improved varieties.
• Integrated Seed Sector Development in Africa works on the establishment of an African-embedded structure and network of experts, seed programs, and associated organizations in the public and private sectors. It is a pilot project running from 2014 to 2016.
• Farmers and community organizations growing seed. There are many FOs and CBOs growing either quality seed or certified seed.
• Several ATCs of the MoA are involved in seed production.
• Tegemeo Institute of Agricultural Policy and Development, Egerton University, conducts research and analysis on policy in the domain of agriculture, rural development, natural resources, and the environment. The institute aims to address micro- and macroeconomic policy issues bearing on farming, transportation, processing, marketing, and trade of agricultural products and inputs; sustainability of agricultural systems, natural resources, and the environment; and commercialization, income growth, and food security.

4. PUBLIC VARIETY USER AGREEMENTS/ARRANGEMENTS/ CONTRACTS IN POTATO

4.1 Justification for Providing Exclusive Access to Public Varieties

Limited exclusivity agreements are those through which owners of public varieties agree to limited exclusivity for commercialization of their varieties. Although not yet operationalized in potato, such agreements may be permitted under the following conditions:

• The exclusivity is necessary for the further improvement of such intellectual assets or to enhance the scale or scope of impact on target beneficiaries
• The exclusivity is as limited as possible in duration, territory, and/or field of use
• The agreements provide that the varieties remain available in all regions/countries (in case of CIP) for noncommercial research conducted by public sector organizations and, in the event of a national or regional food security emergency, for the duration of the emergency (in case it is bred by CIP).

Example: KALRO or CIP develop a promising crop variety, but lacks the resources to effectively disseminate the variety to farmers. The extension agencies also lack the means to get the variety out to farmers. There are a few small seed companies that are interested in marketing the variety, but none of them is willing to even try unless they are granted an exclusive license to commercialize the variety. In the absence of an exclusive license, the companies fear they will end up undermining each other’s ability to recoup the modest financial gains that might be available through sales in the country. Under such circumstances, CIP or KALRO can grant a time-limited exclusive license with a research exemption to a single company to commercially market the variety, because this would be “necessary to enhance the scale or scope of impact on target beneficiaries.” At the same time, however, KALRO or CIP would still make the variety available to public sector organizations for research (including breeding) purposes. This would facilitate potentially important further uses of the variety in pursuit of developing other improved materials. Other companies could also, “bulk up” seed for sale once the period of exclusivity is over.

4.2 Potato Variety User Agreements

4.2.1 Exclusive license agreements

There are no exclusive user agreements for public potato varieties, probably because no seed potato growers companies have come forth to show interest in getting exclusivity. The consequence of not having these agreements is that commercialization of the variety may not be so widespread and varieties may not reach as many farmers as would be desirable. The public system often does not have the necessary resources (funds and skill) to invest in a marketing and a promotional strategy for a variety. Smallholder farmers may, therefore, not access high-quality seed of improved varieties as much as they would.

CIP has proposed the following arrangement, which is still under discussion:

• CIP is interested in claiming ownership rights and granting limited exclusive rights to national agricultural research systems (NARS). Material being transferred by CIP to NARS under the
Standard Material Transfer Agreement are Plant Genetic Resources for Food and Agriculture under Development ("PGRFAuD") and relate to material purely bred by CIP. Thus, CIP owns this material or PGRFAuD and any related background intellectual property rights.

- NARS should share all information from its trials with CIP, and CIP should grant NARS a limited exclusive right to the material or PGRFAuD and derived products (i.e., the selected promising variety). This allows NARS to (1) register the variety in its country only in CIP’s name and (2) enter into licensing agreements with private seed companies to commercialize the variety in Kenya to ensure open access to any bona fide local seed company. Exclusive rights should be for a limited period, to be agreed on between CIP and NARS.

- NARS may only grant licenses to seed companies that hold a valid seed merchant’s license. NARS must notify CIP once it has (1) successfully registered the variety in Kenya and (2) issued a license to a local seed company. NARS must also pass on the sales data it has received from the seed company to CIP (see further below).

- The licensing terms between NARS and the private seed companies should be based on NARS standard form of license (if they exist or can be developed) and will include the following terms: (1) the license shall be non-exclusive to purchase, produce, and/or sell the variety; (2) the license can be revoked if the seed company has not been granted a renewal of its seeds merchant license; (3) the license is limited to the country where the NARS is based (the license also explicitly prohibits any sublicensing without CIP’s express, written consent); (4) royalty fees charged shall be capped at a percentage to be agreed between CIP and NARS; (5) the private seed company must make an annual payment of 0.77% of the sales of the product to the CGIAR governing body; (6) the private seed company must report to NARS the previous year’s annual sales of the product on January 31 for the duration of the license; (7) NARS, and any subsequent license holder, will take no actions against smallholders for farm-saved seed and no royalties shall be collected; and (8) private seed companies selling the variety shall make it available in pack sizes of 10 kg or less for at least 10% of seed produced by them.

The proposal does not mention the quantities of seed to be provided by the NARS to the private company, nor the quantities of seed the private company is expected to make available.

4.2.2 Contracts

Example 1: Agreement between KALRO and ADC for supply of basic seed, between ADC and out-growers (for growers to grow certified seed and ADC buys back), and between ADC and marketing outlets

Under this arrangement, KALRO sells pre-basic/basic seed to ADC, which in turn produces certified seed. ADC also has agreements with farmers to serve as contract seed growers (out-growers in ADC nomenclature). The use of contract seed growers is meant to provide extra production and to serve as contact points for agricultural extension officers. ADC buys back the certified seed from the contract growers and sells that seed as well as that produced from its own farms through a network of distributors. Seed production is subjected to evaluation on performance criteria, including total yields, percent of seed-sized tubers, percent of damage during harvest, and qualifying for certification.

In a more recent development, ADC plans to contract growers in six counties: Meru, Nyandarua, Kericho, Uasin Gishu, Kieyo, and Bomet. Contract growers will be identified in collaboration with county governments of the respective areas. ADC will provide the growers with basic seed and technical backstopping, and the seed will be inspected using ADC seed merchant’s license. The growers will produce the seed under an agreed contract and ADC will purchase the seed from the farmers, less the cost of inspection. Technical backstopping to help out-growers produce according to ADC’s specifications and realize yields and quality that benefit both the out-grower and the
corporation is provided free. According to recent reports, the varieties produced have been officially released and include ‘Dutch Robjin’, ‘Kenya Karibu’, and ‘Tigoni’.

**Example 2: Agreement/arrangements between KARI (now KALRO) and seed growers (decentralized growers) to use KALRO’s license to act as contract growers for KALRO**

The Agribusiness Development Support project of KALRO between 1999 and 2001 used a contract farming approach to increase seed potato supplies. Under this arrangement, interested growers would buy basic seed from KALRO, and farmers would have their seed certified using KALRO’s license. Following harvest, KALRO would buy the seed from these farmers and the seed would be transported back to KALRO facilities for marketing. KALRO would then pay seed growers after the seed was sold. Later, KALRO feared the risk of introduction of quarantine diseases such as BW on its facilities, and asked the growers to retain the seed on their own farms. KALRO would in turn send interested buyers to these growers, facilitating transportation of seed to its facilities.

**Example 3: Agreement/ arrangement between KALRO/CIP and processors (Deeper, Midlands, etc.) and farmers/farmer groups**

Potato-processing companies may contract farmers to produce raw materials for their operations (crisps or pre-peeled/pre-cut potatoes as the case may be). KALRO/CIP may provide the seed of desired officially released varieties (e.g., ‘Dutch Robjin’ for crisping, ‘Tigoni’ for French fries, ‘Shangi’ for fresh-cut potatoes and French fries). ‘Dutch Robjin’ and ‘Tigoni’ are released varieties; ‘Shangi’ is now a released variety but was not registered when the arrangements began. Two examples illustrate this arrangement:

- **Agreement between Midlands Ltd, a processor, and ware potato growers (fresh-cut potatoes).** Midlands Ltd specializes in making ready-to-cook potato chips (fries) that have a ready market in selected supermarkets and fast food outlets. The factory has contracts with farmers who are sometimes supported with seed, agronomy, and delivery of harvested potatoes to the factory. In some cases, farmers source the seed on their own.

- **Agreement between potato crisping companies (Deepa Industries Ltd, Norda Industries, Chirag Industries) and ware potato growers.** The project “Wealth creation through integrated development of seed production and marketing sectors in Kenya, Uganda, and Ethiopia,” was carried out in September 2008–December 2012. During that time, agreements involving KALRO/CIP/ADC to supply certified seed of processing varieties at cost directly to farmers or through seed growers and farmers to supply the desired varieties to the processing company were made (CIP 2013). Training courses were offered to farmers and seed growers to improve their technical competencies. Sometimes field days were conducted to improve awareness of improved cultivars and illustrate important aspects of seed production (e.g., field selection, planting techniques, weeding, fertilizer rates, plant protection, etc.).

The three processing companies engaged farmers under contract farming arrangements to supply quality potato on a weekly basis: Deepa Industries (45 MT/week), Norda (10 MT/week), and Chirag Industries (5 MT/week). By the end of the project, more than 860 MT of ware potato worth over KES 16 million (KES 84 = US $1) had been purchased by Deepa. Over 140 MT worth KES 4.1 million were delivered to Norda Industries, and about 79 MT worth KES 2.4 million were delivered to Chirag Industries.

Price negotiations between the processors and farmers were done before the beginning of a production season. The farmers and the processors came together and reviewed the prevailing prices at the market at that period. The prices were mainly calculated by the MoA, considering the costs of production. A margin was added to come up with an acceptable price for both the farmers and the producers.
4.2.3 Agreements with CBOs

Example 1: Agreement/arrangement between KARI and CBOs

- **ATRI Initiative.** KALRO in 2000 developed the Agricultural Technology and Information Response Initiative (ATIRI) as a strategy for building local capacities at grass-root levels for farmers to access various technologies on a demand-driven basis. It was conceptualized that through ATIRI the initial beneficiaries would not only adopt the new technologies, but would also transfer the acquired knowledge, skills, and experience to other farmers to help scale up the technical information gained for the benefit of the wider community. The initiative targeted CBOs as beneficiaries or intermediaries (FOs) facilitating member acquisition of appropriate technologies and information. Under ATIRI, KALRO targeted CBOs/FOs rather than individuals in order to reach more beneficiaries. In seed potato, the beneficiary groups included Kirangari Self Help Group, Kikuyu and Young Nyairoko Self-help Group, Oljoro Orrok (KARI-Tigoni 2003). Grants covered acquisition of technologies (e.g., planting material), exchange visits to other farmers who had already adopted the technology; visits by the institute’s staff; and other costs of observing, learning, and adopting technologies. The average grant was about US $3,000. ATIRI promoted only officially released varieties, including ‘Tigoni’ and ‘Asante’.

- **Kirangari Self Help Group, Kikuyu.** The group comprising 35 members (women and men) received KES 79,520 spread over two planting seasons. The money was used to purchase certified seed of officially released varieties ‘Tigoni’ and ‘Asante’, farm inputs, and transportation of the seed. The group aimed to produce seed for farmer-to-farmer distribution. This group did not certify their crop due to the high costs of certification, but was given adequate technical backstopping by staff from KARLO and the MoA. The group also visited KARLO to learn about potato production. The group had small land sizes which made it difficult for them to practice meaningful rotations. Marketing of the seed to local ware potato growers was also a problem because local farmers perceived the seed to be costly. Most of the seed was therefore sold to farmers in other production regions.

- **Young Nyairoko Self-help Group, Oljoro Orrok.** The group had 36 members, but only 18 participated in ATIRI. The group received a total of KES 81,700 to purchase certified seed, transportation of seed, purchase of fungicides and fertilizers, and travel expenses. Similar to Kirangari Self Help Group, the group also produced seed for farmer-to-farmer seed distribution. The group was visited by KEPHIS and given advisory services besides the technical backstopping provided by KALRO. The group planted a variety (‘Asante’) that was not popular in their area but still managed to sell it elsewhere.

- **KARLO–Njoro and farmers giving back seed or seed loans or payback.** In this approach, KALRO–Njoro identified farmers with the assistance of MoA personnel in the early 2000s under an Official Development Assistance-funded project. The farmers were given small quantities of certified seed of two newly released varieties (‘Tigoni’ and ‘Asante’) sourced from KALRO–Tigoni. The seed was given to the farmers on “loan” with the stipulation that the seed given must be repaid with interest (double the initial amount received) back to KALRO–Njoro to then be passed on to another set of farmers. The recipient farmers also followed the same approach.
4.2.4 Partnerships

Example 1: Agreement between CIP/KALRO and private/public seed multipliers and decentralized seed growers

Under these arrangements, CIP and KALRO provide in-vitro plantlets to both public and private seed growers to produce minitubers (G1 seed). These early generation seed multipliers may sell the minitubers directly to seed multipliers, or they may multiply the seed once under field conditions before selling the seed to decentralized seed multipliers. The decentralized seed growers multiply the seed and sell it to ware potato growers at a cost. Under these types of arrangements, CIP/KALRO provide technical backstopping to the seed growers. Seed multipliers are trained in technical aspects of seed production. Through these arrangements, early generation seed growers are linked to decentralized seed multipliers who are in turn linked to ware potato growers. The objective of the agreement is to boost production of quality seed and to disseminate improved varieties. Only officially released varieties have been used in this arrangement (i.e., ‘Kenya Karibu’, ‘Tigoni’, ‘Asante’, ‘Dutch Robijn’, and ‘Kenya Mavuno’).

KALRO/CIP collaborates with agricultural extension officers to identify farmers who have adequate land for rotation (usually 6 ha). Alternatively, farmers who can rent similar land (to allow for a three-season rotation) and are willing to invest in purchase of seed, willing to follow production guidelines for seed potato production, have no recent history of diseases and pests such as BW and nematodes on their farm, willing to renew their seed regularly, and must be enterprising farmers.

Partnerships between CIP and public or private companies

These partnerships were established during implementation of the project ‘Tackling the food price crisis in eastern and central Africa with the humble potato: Enhanced productivity and uptake through the ‘3G’ revolution.’ The USAID-funded project (popularly referred to as ‘3G’) was implemented in Kenya, Rwanda, and Uganda from 1 October 2008 to 30 June 2011. The strategy involved delivering low-cost quality seed to growers in 3 generations of field multiplication, rather than the conventional 5–7 generations seed potato strategy (hence the “3G” system/seed strategy). The 3G seed strategy envisaged producing large numbers of minitubers through 1 generation of a very rapid multiplication technology, thus allowing bulking of sufficient seed in reduced number of field generations. This reduced both the cost of production and prevented the build-up of damaging diseases in the field.

CIP worked with several private companies and public organizations to deliver seed of improved varieties to smallholder farmers. Large-scale private farms were attracted to produce quality seed through a 50:50 cost sharing for the construction of aeroponics facilities (facilities that have very high seed multiplication rates) and by linking them to markets. CIP advertised through the local media for private sector companies interested in participating in pre-basic seed production. CIP supplied in-vitro plantlets to the companies and offered technical support in handling of plantlets to production of minitubers. The private companies produced the minitubers using both the traditional soil-based method and the soilless aeroponic system, which produces more tubers more rapidly and at lower cost than the traditional method. KEPhIS ensured the inspection and detection of potential pests or diseases in the produced seed.

Partnership between KALRO, NGOs, and CBOs

A partnership involving three organizations—KARLO, two NGOs (Plan International and World Vision), the MoA, and CBOs—in the target district was established between 1996 and 1997 (Lung’aho et al. 1998). The main goal of the partnership was to systematically transfer packages involving quality seed and new potato LB-tolerant varieties to growers with NGOs as partners in the process of technology transfer. The target sites were Burgureti and Maua.
The 26 growers who participated in the project were selected on the basis of the following criteria:

- Willingness to allow free access of their farms to other farmers as learning purposes (and as a demonstration plot)
- Willingness to attend training sessions on the utilization of the two technologies
- Willingness to meet input costs related to the technologies
- Willingness to meet certain quality standards and to follow recommended practices in growing seed of improved varieties
- Willingness to take advantage of relatively good quality land (so that they can get the yields necessary to justify the necessary inputs used in seed production)
- Be relatively commercially oriented so that they can afford to buy inputs required for seed production
- Be progressive farmers with the ability to bear risk
- Willingness to grow at least 0.25 acre of seed potato
- Have access to sufficient land (at least 3 acres) to allow for a five-season rotation.

The training of seed growers and provision of basic seed was undertaken by KARLO. NGOs were responsible for monitoring and supervision of seed growers, although the research team offered their time during the numerous field visits. In addition, the NGOs played an important role of mobilizing farmers at grass-roots level. Field days and demonstrations were organized by the NGOs with some input from the research team. NGOs also provided farmer responsibility and obligation training. No formal certification of seed was done, but guidelines for production of quality seed were given to farmers. The group in Burguret built a community DLS from where seed from individual farmers was marketed.

4.2.5 Other types of agreements

Example 1: Agreement/arrangements between KARLO and seed growers (decentralized growers) to use KARLO’s license and grow certified seed or to act as contract growers for KARLO

Under these arrangements, KARLO (also a registered seed merchant in Kenya) allowed interested seed multipliers to use its seed merchant license to grow seed, which is subject to KEPHIS’s certification standards. Usually, most of these growers had previously been trained in seed production by KARLO and were expected to grow the seed as per KARLO’s recommended practices. KEPHIS certified the seed and billed KARLO’s seed unit for the inspection fees. It was the seed growers’ responsibility to market their seed. KARLO usually issued the seed growers a letter (as proof of origin) confirming that they had obtained the basic seed from KARLO. KARLO would visit the growers during the cropping season to provide technical backstopping. Some of the growers sometimes opted not to subject their seed to certification but instead sold the seed as “quality seed.” In such cases, the letter from KARLO was not required as no certification had been done.

KARLO collaborated with agricultural extension officers to identify farmers to multiply the seed using the criteria outlined in section 4.1.4. In these cases, KARLO promoted local seed businesses by promoting production of both quality seed and certified seed.

Individual farmers growing certified seed

These farmers were located in various potato-growing counties: Nakuru, Nyandarua, Meru, Bomet, and Kiambu. The farmers would buy basic seed from KARLO and grow it using seed certification regulations prescribed by KEPHIS. They would use KALRO’s license to grow the seed. KALRO would provide technical assistance, and the MoA would informally help them to market the seed by directing interested buyers to the growers.
Farmers in the North Rift of Kenya growing certified seed
This initiative ran from 2003 to 2013 in the counties of Uasin Gishu, Nandi, Elgeyo, and Trans Nzoia. In total about 30 farmers/groups participated in the program. KEPHIS, KALRO, and the MoA informally participated in the program. Seed production areas ranged from 0.5 to 10 acres. The farmers and/or groups of farmers would purchase basic seed from KALRO and apply for certification. KEPHIS would inspect the crops as per regulations. Once certified, the farmers would sell the seed. In some cases, KALRO would assist with transport and technical backstopping; inspection charges would be billed to KALRO. KALRO has now stopped the use of its license since there is no justification in the seed certification charges being billed to KALRO.

Example 2: Agreement between KALRO and seed growers (decentralized growers) for the growers to grow good quality seed
Under these arrangements, KALRO (a registered seed merchant) sells basic seed to interested seed multipliers to grow quality seed without subjecting the seed to KEPHIS’s certification standards. In most cases, most of these growers have previously been trained in seed production by KALRO and are expected to grow the seed as per KALRO’s recommended practices. It is the seed growers’ responsibility to market their seed, although KALRO and the extension may assist with marketing through informal arrangements. KALRO technical staff normally visit the growers during the growing season to provide technical backstopping.

Example 3: Agreement between KALRO and its sub-centers for provision of basic seed for further multiplication
KALRO has many research centers spread all over the country, some in major growing regions. Some of the centers would produce quality seed or certified seed on their farms for sale to farmers. Under this type of arrangement two seed production models can be identified:

- **Model 1.** In this model KALRO-Tigon, which has facilities for seed production, would produce both basic and certified seed of released varieties on its farms for sale to farmers.
- **Model 2.** Under this model, KALRO-Tigon would sell basic seed of officially released varieties to other KALRO centers interested in seed production on an informal basis. Such centers included KALRO-Oljoro Orok and KALRO-Embu. These centers would either grow certified seed or quality seed, and would then sell seed on their own to interested farmers.

Example 4: Agreement between KALRO and ATCs of the MoA for KALRO to supply certified/quality seed basic seed for further multiplication
Under this arrangement, the ATCs of the MoA were financially supported by the ministry to produce either certified or quality seed for sale to farmers. The ATCs used their large tracts of land, machinery (e.g., tractors), and qualified staff in agriculture to grow the seed. The ATCs bought basic seed from KALRO and multiplied it into certified seed or quality seed. This arrangement is an informal one, with supplies obtained on an as-needed basis. Whenever certification was required, KEPHIS would undertake the certification and either reject or approve the seed as certified seed. KALRO would, in some instances, provide technical support in growing the seed. The support from the MoA ceased in 2013, when devolution of national governments functions to county governments took effect. In total over 10 ATCs participated in the initiative and included Waruihu ATC, Kiambu County; Oljoro orok ATC, Nyandarua County; Njabini ATC, Nyandarua County; Taita ATC, Taita Taveta County; Bomet ATC, Bomet County; and Ngong ATC, Kajiado County. Financial support for seed production for some of the ATCs is now provided by county governments.
Example 5: Agreement between KALRO/CIP and Mtanga Farm (a private company in Tanzania) with Syngenta Foundation as an intermediary

This arrangement involved the supply of pre-basic seed, basic seed, and variety evaluation data from national performance data of selected varieties from one country to another. Mtanga Farm (a large-scale farm in Tanzania) wanted to obtain new seed potato varieties from CIP/KALRO in Kenya. CIP entered into an agreement with Mtanga Farm to provide seed of several officially released varieties, including ‘Tigon’ and ‘Asante’. KALRO consented to KEPHIS sharing performance data from NPTs of the varieties. The arrangement involved implementing an agreement among East African countries to allow one country to rely on the field test data of another in approving new seed varieties (only one field test). The Tanzanian government used the process to offer its officials deeper technical training, and the legal and regulatory lessons learned have been spread to other investments and regulators. Syngenta Foundation facilitated the process as an intermediary. Thereafter, the farm became a successful seed grower. As in 2012, the farm had completed a third cycle of minituber production, reaching 120,000 minitubers. Field multiplication of seed in 2013 reached 1.2 ha of G1/G2, 2 ha of G2/G3, and 5 ha of G4/G5—sufficient to supply approximately 125 MT of certified seed to 500 smallholder farmers (assuming 0.5-acre holdings). The farm also made the first sales of locally grown certified potato seed in 2012, which was the first quality seed produced in Tanzania in perhaps more than 30 years. Syngenta Foundation for Sustainable Agriculture funded training of TOSCI by counterparts at KEPHIS in potato-seed testing and certification. This led to a working protocol for potato seed certification now in place for Tanzania.

4.3 Comparing the Use of Variety Access Agreements in Maize and Potato Subsectors

The use of variety access agreements is more common in crops such as maize than in potato, with more formal arrangements such as licensing observed in maize (unlike in potato). Some of the reasons that may explain this situation are:

- Since potato is bulky and highly perishable, it is considered a risky investment. The private seed sector has shown little interest in seed multiplication for potato due to its high seeding and low multiplication rates. The cost of production, processing, and transportation makes seed potato expensive. Also, farmers tend to save and use their own seed, thus offering little demand for replacement seed and therefore low returns to seed companies.
- Although seed potato crops generate larger returns per hectare than for many other crops, the susceptibility of potato to crops pests, diseases, moisture stress, and extremes makes its yields more variable than those of other crops. The high moisture content and perishability of the tuber make potato expensive to store. Marketing costs for potato are also higher than those of maize.
- Multiplication yield rates are low, making it costly to multiply seed.
- Planting rate is also higher for potato than maize. In potato 1 ha may require 2 MT of seed compared with about 18 kg of maize seed. Seed potato must also be stored before being planted (to break dormancy), and the right amount of light, warmth, and humidity is crucial to ensure good quality seed. Bulky seed potato attracts and transports pests. These include viruses, which are transmitted both in the field and storage by aphids and then vectored from generation to generation in the seed, with significant reductions in yields. Because of the weight, seed potato has high transport costs, especially if seed production sites (as is often the case) are far removed from ware production sites. The same is true if ware potato production sites are far from markets or processors. Unlike maize, planting material for seed potato is often the single most costly input, sometimes accounting for 25% or more of the production costs.
• Hybrid maize is attractive to private seed companies because the yields decline and the crop is no longer uniform if the grains are used as seed. Thus farmers tend to buy new seed every season. There is currently little interest by the seed industry to get involved in potato breeding. However, the processing sector is gradually learning about the need and potential benefits of breeding potato to better fit its needs.

• Potato farmers also can recycle their seed for several seasons without noticeable yield decreases. In contrast, for maize most seed is hybrids and the yield depression of recycled seed is significant after one season. This compels maize farmers to purchase new seed every season and hence create a market for seed maize.

• The number of publicly bred maize varieties is far greater than that of potato. This may give more opportunity for entrepreneurs and seed companies to engage in variety user agreements.

• The market for potato is considered to be smaller than the market for maize. More entrepreneurs are likely to engage in licensing agreements for maize than potato.

4.4 MECHANISMS FOR SUPPLY AND/OR DEMAND-DRIVEN VARIETY TRANSFER

At present, there are no breeding contracts between public agencies, processors, and crop growers. Processors have demanded varieties that suit their needs. Prior to the entry of the private sector into the potato industry, many processors demanded varieties suitable for crisping (‘Dutch Robijn’ was the only variety suitable for crisping). Farmers have also continued to demand varieties with their preferred traits. For example, before the official release of the variety ‘Shangi’, many farmers would ask the research system to give them a variety like it. Likewise, when varieties such as ‘Nyayo’ started to degenerate and became increasingly susceptible to late blight disease, farmers would ask for a variety similar to it but more late blight tolerant. In some cases, farmers have also requested early-maturing potato varieties with short dormancy.

Processors have also participated in on-factory evaluation trials for processing qualities. There are cases where farmers have been involved in participatory variety evaluation. This was one of the main factors in the release of varieties ‘Tigoni’, ‘Kenya Faulu’, and ‘Kenya Karibu’. Similarly, favorable assessment by farmers of near release potato clones in on-station trials was a major reason for release of varieties ‘Tigoni’ and ‘Asante’.

When ‘Kerr’s Pink’ was a popular variety, farmers are on record as stating that the public research system should give them this variety but one that is late blight tolerant/resistant.

4.5 CONTRIBUTION OF VARIETY AGREEMENTS TO VARIETY PROMOTION

Although actual records are lacking, it is estimated that the combined acreage under released varieties (excluding ‘Shangi’*) occupy less than 20% of area under potato production. The reasons for the low uptake are unclear, but may include the limited availability of seed and other agronomic or consumer-driven factors. In the early 2000s, officially released public varieties ‘Tigoni’ and ‘Asante’ were reported to occupy more than 90% of the area cropped to potatoes.

4.6 EXTENT TO WHICH THE AGREEMENTS HAVE IMPROVED WOMEN’S ACCESS TO IMPROVED SEEDS

Although the data are limited on how all the case studies reviewed contributed to women’s access to seed, several of them showed that their access did indeed improve.

4.6.1 Access to seed of improved varieties

In the 3G project, 8,250 farmers in Kenya (57% women) were trained in seed and ware potato production technologies and in best practices following the “Select the Best” positive selection (PS) methodology. At least one female farmer became a seed grower, producing more than 10.3 MT of
seed potato worth over $4,000 (KES 340,300) in one of the production years (CIP 2011a). In the Common Fund for Commodities project (CIP 2013), 137 FGs composed of 3,085 farmers (47% women) were trained on how to use this same PS methodology in Kenya.

4.6.2 Number of varieties specific for women interest uses of potato

Women tend to prefer varieties that are early maturing, easy to cook, suited for home consumption, are disease tolerant, and take a short time to sprout. In this respect a variety that has these traits is most preferred by farmers. For example, ‘Shangi’, thought to be the most widely grown potato variety in the country today, has these attributes. Women also tend to prefer disease-tolerant varieties that have other desirable traits such as high yields. Several LB-tolerant varieties such as ‘Tigoni’, ‘Asante’, and ‘Kenya Mpya’ have been accessed by many farmers including women.

4.6.3 Women seed entrepreneurs and women groups growing seed

Several of the case studies showed that women farmers became seed entrepreneurs and, in some cases, were better seed growers than men (CIP 2011b). Below are some of the women who are currently growing seed potatoes:

- Anne W. Ng’ang’a in Tigoni area of Limuru growing varieties ‘Shangi’ and ‘Dutch Robijn’.
- Ann Mbugua of Molo, currently growing varieties ‘Shangi’, ‘Kenya Mpya’, and ‘Dutch Robijn’. Ann’s decision to start a seed potato business made a world of difference on her farm. Together with her husband, Simon Mbugua, she now grows 30 acres (24 owned and 6 hired) of certified seed potato.
- Mary Wanja of Molo is now growing varieties ‘Dutch Robijn’, ‘Tigoni’, and ‘Kenya Mpya’.
- Alice Gatheka in Nyeri currently grows ‘Shangi’.

4.6.4 Seed-producing groups with women leaders

A number of case studies have shown that women were leaders of some of the seed-producing groups (Ahmed et al. 2014). For example, Beatrice Gikunda of Mworoga in Meru serves as the secretary for Katheri Commercial Village, a 52-member group of farmers who procure and cultivate Kisima Farm potato seed for commercial sale. She also founded and chairs Katheri Capacity Builders, a group of 20 women aiming to improve livelihoods through horticulture. Specifically, she multiplies Kisima Farm potato seed to provide to the group members. Because of the significant transport costs involved in the procurement of Kisima Farm potato seed, multipliers such as Beatrice play a key role in boosting the amount of clean, quality seed available to small farmers in their localities, thereby enhancing the proximity to quality seed.

Another example is that of Florence Aketih, who chairs a self-help group in Mpakoni, in Meru. The group of 52 mothers engages in community-based activities such as health issues, helping orphans, purchasing livestock for the members, and mentoring children. However, low capital limits the group’s ability to sustain its activities and accommodate new members. For this reason, Florence and the group turned to production of certified potato seed from Kisima Farm during the short rains in 2013. Thus, in Mpakone, where few farmers plant potato, the group planted its certified Kisima seed potatoes in one field. The women harvested 53 bags, enough to sell clean seed to 80 potato farmers in the area, and saved seed for multiplication in the following season. The income generated from potato seed helped them to make possible a new “table banking” activity within the group.

4.7 Agreements that were instrumental in getting potato varieties from the public domain multiplied and promoted by private seed multipliers

The agreements that can be referred to as partnerships were crucial in getting varieties from the public domain multiplied and promoted by private seed multipliers. One such example is the agreement between CIP/KALRO and private/seed multipliers and decentralized seed growers (see
section 4.1). Through the 3G strategy, the private sector for the first time played a prominent role in seed potato production and distribution. Out of the 1.2 million minitubers produced in Kenya, more than 80% were produced by the private sector in 2010 and 2011. The minitubers were multiplied under field conditions for one to two seasons to produce quality seed. CIP also worked with partners who packed the seed in small packs for sale to farmers. Newly released varieties ‘Kenya Mpya’, ‘Sherekea’, and ‘Purple Gold’, as well as advanced CIP clones earmarked for research purposes both within and outside of Kenya, were made available in sufficient numbers to farmers within a short period of time. Farmers were able to access certified seed of ‘Kenya Mpya’ within one year. The variety was released in May 2010, and certified seed was available in March 2011. Without the involvement of the public sector, farmers would have accessed the variety ‘Kenya Mpya’ two or more years following its release.

The interventions of the 3G strategy approach can be summarized as the following: (1) increasing the capacity of national programs to produce and multiply minitubers at lower unit cost and reduced number of field generations; (2) encouraging private sector (all interested parties) participation in minituber production and field multiplication; (3) promoting and distributing clean seed to smallholder private seed multipliers and smallholder growers through voucher schemes, seed fairs, and large-scale distribution of small quantities of seed in small packs; (4) promoting the diffusion and adoption of new high-yielding and disease-resistant varieties; (5) securing farm-saved seed supplies at nationally significant scale through PS and farmer awareness campaigns; and (7) promoting use of DLS and raising awareness of the importance of good seed storage.

4.8 Relationship Between Agreements That Were Instrumental in Getting Potato Varieties from the Public Domain Multiplied and Promoted by Private Seed Multipliers and the Seed Policy

The use of agreements between variety suppliers from the public sector with various categories of seed growers was also possible because the seed policy (GoK 2010) has liberalized the seed sector, allowing for many players. In the past, early generation seed could not be sold to anyone else other than one multiplier (i.e., ADC, which was expected to bulk all the basic seed into certified seed).

Similarly, only KALRO was once permitted to produce early generation seed. However, because of liberalization, many organizations, including those in the private sector such as Genetics Technologies International Limited and Kisima Farm, can produce seed without entering into legal problems.

4.9 Hurdles That Were Overcome to Realize Agreements Between Private and SME Seed Producers and Public Sector Research on a Wider and More General Scale

The main hurdles in realizing these agreements on a wider scale include policy barriers (failure to recognize “quality seed” as tradable seed), certification regulations (too stringent for smallholder farmers), poor infrastructure of seed growers, weak technical capacity of seed growers, poor/weak enforcement of agreements, unpredictable market demand for seed (due to on-farm seed saving), high start-up costs for seed growers, and limited access to credit. A lack of trust and communication existed between seed potato value chain actors. There were few opportunities for the different actors along the chain to come together to analyze shared constraints and innovate.

4.10 Direct Agreements Between Seed-Producing FOS and Research; And Required Profile and Standards for FOS to Qualify for Such Agreements

Seed-producing FOS and individual farmers can enter into agreements directly with research to multiply seed. Examples from Section 4.1 show that KALRO entered into agreements with either individual farmers or groups of farmers to grow either certified seed or quality seed. The requirements were that the farmers or FOS must:

- Be registered, known in the county (in the case of FOS)
5. **CHALLENGES**

The main challenges experienced from the various case studies are presented in this section.

5.1 **Policy-related Challenges**

According to the Seed and Plant Varieties Act, only certified seed is recognized as tradable seed—trading in all other types of seed is considered “illegal.” This is an obstacle to various agreements designed to disseminate quality seed of improved varieties. Similarly, the current seed legislation stipulates that only a variety that has undergone NPTs and has been formally registered in the country can be multiplied for seed. This means no matter how popular or well established a variety is, it cannot be officially multiplied as seed. This denies farmers a chance to get “good quality” seed of farmer-selected varieties. A case in point is that of ‘Shangi’. Prior to its registration as a variety, ‘Shangi’ could not be officially grown and traded as seed despite farmers having had a very strong demand for it. Current regulations also stipulate that only registered seed growers or their assignees are permitted to engage in seed production (i.e., pre-basic, basic, and certified seed). Seed growers/merchants are required to pay a certain fee to be registered and an annual fee to renew the license. Variety owners are required to pay a certain fee for a variety to be evaluated in NPTs and for variety protection (if so desired). These charges are considered to be too high and, to some extent, a deterrent to investment in variety development and seed production by small local seed companies and local entrepreneurs. In practice, however, most farmers (>90%) access their preferred varieties through informal channels.

5.2 **Shortage/Lack of Seed of Preferred Varieties**

In many cases there were shortages of seed of varieties preferred by farmers or the markets. This indicates a mismatch between varieties produced by the formal seed system and those preferred by farmers, and/or limited capacity to produce desired varieties. Farmers opted to use informal sources to access their preferred varieties, often times spreading diseases such as viruses, BW, and possibly nematodes. The use of agreements between the formal seed system and informal seed multipliers could have helped to speed farmers’ access to high-quality seed of these varieties.

5.3 **High Cost of Seed**

The cost of seed of all categories remains prohibitive for all players along the seed potato value chain. Average costs are as follows: in-vitro plantlets, $0.30/plant; minitubers, $0.25/minituber; basic seed, KSH 60/kg ($0.60); certified seed size I, KSH 2,200/50 kg ($0.44/kg); and certified seed size II, KSH 1,700/50 kg ($0.34/kg). Thus, for a ware potato grower, seed potatoes account for over 40% of the cost of ware potato production in Kenya.

5.4 **Lack of Consistent Seed Demand for Various Seed Categories**

Once a new variety is released and introduced on the market, farmers’ active participation in the market to buy new seed seemed to be confined to the first few seasons after release/introduction. Thereafter, farmers use their own seed or even that from neighbors to establish subsequent crops. They may use techniques such as PS to maintain the health of their seed. They may, however,
purchase the seed in case of loss of their seed (e.g., through disease, drought, etc.). This pattern for potato is a major disincentive to seed growers/private sector in terms of investing in seed multiplication, quality assurance, promotion, and distribution.

Some of the seed growers closed shop after a few seasons/years as seed multipliers due to lack of markets. Seed growers were not always able to sell their seed, partly because seed renewal rates were low and repeat sales too slow. In some cases, this discouraged growers from continuing in seed production. It is generally recommended that farmers get fresh stocks of seed once every four seasons; but in practice, many farmer renew seed after six to eight seasons or more. Often, farmers confused getting a new variety with getting quality seed. Thus, once farmers obtained a new variety they did not always go back for new seed of the same variety. This affected the market for seed growers. The active life of new varieties depends on the variety itself. Very popular varieties among those released/introduced since the 1980s last an average of 8–10 years or more before they are replaced by farmers. One exception is the variety ‘Dutch Robijn’, which has survived for more than 70 years since it was first introduced into Kenya.

Demand for early generation seed was only certain/predictable from public sector multipliers, perhaps because they had resources to purchase the early generation seed as opposed to individual farmers. This affected the production of early generation seed and, in some cases, resulted in it being unsold. Some of the early generation seed growers opted to recycle their seed and did not practice a flush-through system of seed production. When this is done repeatedly, the quality of early generation seed will ultimately decline due to degeneration.

5.5 Pests and Diseases Coupled with Shortage of Land to Allow for Meaningful Rotations

Successful seed potato production requires long rotations to fend off pests and diseases, and build soil nutrient reserves. In many potato-growing areas, diseases such as BW, viruses, and pests such as nematodes are common. In a few cases where farmer seed multipliers were not vigilant—or deliberately chose to ignore seed production guidelines—the spread of these diseases and pests was promoted. Thus, instead of leading to an increase in yield, such seed resulted in the spread of diseases from infected to non-infected areas. As well, yields were depressed and, in some cases, ware potato growers had a negative impression of seed grown by farmer multipliers from the semi-formal seed system. Such experiences caused the farmers to prefer to use seed from formal sources.

5.6 High Seed Certification Charges

Small and scattered seed fields makes inspection expensive and time consuming. Smallholder seed growers could not, in most cases, afford the cost of complying with seed certification regulations. Failure to certify seed makes smallholder farmers unable to comply with the legal requirement for seed marketing because only certified seed is officially allowed to be traded in Kenya. For this reason, most of the seed produced by smallholder seed growers is “quality seed” because it is not certified.

5.7 No Benefits Accruing to Breeders for Their Intellectual Efforts

In none of the case studies was it possible to collect royalties in whatever form. The public breeding institutions continue to supply varieties for use by seed producers and farmers at no extra cost except for seed. Anyone interested in multiplying the variety would just request it and pay the seed cost. This free sharing of varieties (without payment of royalties) makes it difficult to give recognition, in terms of royalty payments, for the variety improvement work. It does, however, promote access to better seed as anyone interested in the seed is free to purchase it.
5.8 Sustainably Organizing Seed Producers into Groups

Several of the seed initiatives organized farmers into seed-producing groups so that they could have better access to markets, information, agricultural technologies, and related services. Some of these groups, however, collapsed after the projects ended. A possible reason was that the groups were established and used as mechanisms to deliver “seed-related” activities and services (e.g., training, inputs) by projects, rather than allowing/helping to develop as autonomous and sustainable institutions that could engage in seed potato businesses. Additionally, capacity development for direct marketing of varieties (e.g., promotion of varieties through demonstration plots) was not done.

5.9 Controlling Tuber Size

Some of the seed growers were reluctant to control the size of seed tubers, which led to large-sized tubers. The farmers wanted to maximize profits by selling both ware and seed tubers. This in turn led to loss of potential seed tubers onto the ware potato market; in some cases, the loss was as high as 50%. Such seed growers were not sure they would have markets for all their seed.

5.10 Getting Reputable Farmers to Serve as Seed Growers

In periods of high demand, some farmers collude with neighbors and friends to sell poor-quality seed to farmers, purporting it to be good quality seed, especially when there was high demand for it. In some cases, farmers also sold seed rejected by certification authorities, claiming it to be “certified seed” with subsequent poor performance. This brought into disrepute “certified seed” or “quality seed,” and farmers ended up losing trust in such seed growers and quality seed altogether. Farmers who fall victim to fake seed stand to lose not only a whole season of crops but also their trust in improved seed. The sale of fake seed therefore hurts both farmers and genuine seed entrepreneurs.

5.11 Verbal Agreements

Some of the agreements were generally informal and had no arbitration clauses. Thus, there was no way of enforcing them in case any of the parties failed to honor the agreement.

6. Lessons Learned

This section summarizes lessons drawn from the reviews as they relate to the general seed sector lessons and agreements for access to public varieties.

6.1 Lessons on the Seed Potato Sector

In general the agreements seemed to improve access to quality seed and improved varieties in the formal, semi-formal, and informal seed systems. The specific lessons learned are discussed below.

6.1.1 Seed value chain development approaches to promote seed use

Linking multiple actors proved crucial to the success of farmer seed enterprises. Linking early generation seed growers to seed potato growers; seed potato growers to ware potato growers; and ware potato growers to end markets seemed to catalyze the use of quality seed as it created markets for everyone along the value chain.

6.1.2 Benefits/services offered to prospective seed growers

Seed initiatives that offered benefits or services to the seed growers appeared to be more successful. For example, models that invested in development of technical and managerial capacities of individual seed producers or organizations, as well as their ability to build functional business linkages with service providers, appeared to be more successful at increasing the quantities of seed produced and therefore access to seed by farmers.

Consultancy Report: January 2016
Similarly, technical assistance provided to contract growers/out-growers can also increase out-grower productivity; make a company’s operations more cost effective; and improve farmer profitability. All of this builds mutual trust and loyalty. For example, offering technical backstopping, arranging for transport, and grading services encouraged and motivated growers who participated in seed growing as ADC out-growers. This led to increased production of seed and ultimately increased availability and access to seed by farmers.

6.1.3 Registration of new varieties
Registration or approval of new varieties helps to ensure that varieties introduced to the market are useful and distinct from each other. It helps to overcome problems of the same variety being known by different names, or in the opposite case in which many different varieties are known by the same name.

Currently, the system of variety evaluation and release has been streamlined and the NVRC meets twice a year to release varieties that meet the required criteria. It requires a minimum of two seasons for the varieties to be released. To date, the public research systems have released more than 30 varieties. Using conventional clonal multiplication techniques takes 6–7 generations for sufficient quantities of seed to be bulked and accessed by farmers. In contrast, the use of a variety of rapid multiplication techniques, including aeroponics, takes only 3–4 generations before seed reaches the farmer. Thus, the combination of a relatively short variety release process and rapid multiplication techniques seemed to improve access to quality seed of improved varieties.

6.1.4 Seed producers associations and networks
Small seed enterprises (e.g., individual farmers and CBOs) in the semi-formal seed system can strengthen themselves and benefit from economies of scale by joining together in associations and protect the market from counterfeiters. They could also source early generation seed jointly, thus minimizing transportation costs. However, equally important for the viability of FOs are business skills, technical skills, and organizational management skills. Most seed growers/seed-growing associations collapsed from lack of ownership, group management skills, and inability to link with markets.

Despite the advantages that they can offer (including social and technical support), networks of seed growers are largely nonexistent. In cases where they do, they did not last long. The chances of networks to be established can be strengthened if care is given in the implementation phase of projects to the longer term prospects (e.g., in the processes and criteria used for seed grower selection, site selection, encouragement of farmer-driven network development, and availability of market information to enhance farmers’ access to markets).

6.1.5 Rapid spread of farmer-preferred varieties by the informal seed system
The informal seed system can rapidly diffuse varieties that farmers consider important even in the absence of interventions from the formal seed system. Varieties that have been successfully diffused by the informal seed system include ‘Shangi’, ‘Nyayo’, ‘Tana Kimande’, and ‘Thima Thuti’. The principal mechanism for diffusing these varieties is through farmer-to-farmer seed exchanges, purchasing uncertified seed from local markets, or being supplied by brokers/middlemen.

The public research system partnered with farmers to improve the quality of farm-saved seed through training in PS. In this technology, the best potato plants in a field are marked before crop senescence that obscures disease symptoms. The marked plants serve as mother plants for seed potatoes used for the next season’s potato crop. PS gave an average yield increase in farmer-managed trials of 34%.

It would seem that injection of small quantities of high-quality seed in the formal seed systems, coupled with PS, would provide smallholder farmers in the informal seed system with improved
access to quality seed. One way of doing this would be through agreements between public research and CBOs.

6.1.6 The “right” variety

The breeding of public varieties is not necessarily market oriented, and the variety selection/evaluation programs do not always reflect grower or market needs. This sometimes causes farmers to select different material from those recommended by variety selection/evaluation programs. There are two classic examples to illustrate this fact. ‘Shangi’ was a farmer-selected variety that spread without official interventions to nearly 90% of the area under potato in the mid-2000s before it was formally registered as a variety. The variety was multiplied by farmers themselves, but later the National Potato Program would informally multiply small quantities of seed and supply it to interested growers. It is suspected to have “escaped” from the formal breeding program and could have been discarded by breeders because it did not meet their selection criteria. In contrast, the variety ‘Purple Gold’ was formally evaluated and released in 2010. However, following its release, only a handful of farmers grew it; today, few do. When a variety has poor attributes or is not liked by the market, it is very probable that no private sector or even other public sector companies or entrepreneurs would be interested in it. This undermines the sustainability of seed enterprises. Agreements between public breeders and farmers/CBOs to evaluate promising varieties may minimize incidence in which ‘unpopular varieties’ are released.

6.2 Lessons on agreements for access to public varieties

6.2.1 Involvement of government-related entities in seed multiplication

Farmers had a lot of confidence in government-related organizations, such as ATCs, research centers, or the ADC, as providers of good quality seed. And in most cases, they would purchase all the seed produced by these organizations regardless of whether it was produced as certified or ‘quality seed.’ The use of ATCs increased the reach of seed production to many farmers, and is credited with the increase in seed availability from 1% to 1.5%. Since the ATCs are also located in different parts of the country, many farmers were able to access good quality seed. It would appear that this would be one of the options to exploit to increase the use of quality seed. Expansion of seed production activities of government organizations such as ADC could also improve access to seed by smallholder farmers. However, no profitability or sustainability studies on the model of seed dissemination has been carried out.

6.2.2 Role of intermediaries and facilitative legislations in access to varieties

Demand-side intermediaries have a role in identifying and ‘procuring’ technologies for application and use in business contexts. The use of an intermediary was key to contributing to access of public varieties from Kenya by Tanzania.

This arrangement involved the supply of pre-basic seed, basic seed, and variety evaluation data from national performance data of selected varieties from one country to another. The arrangement involved implementing an agreement among East African countries to allow one country to rely on the field test data of another in approving new seed varieties (only one field test). The Tanzanian government used the process to offer its officials deeper technical training, and the legal and regulatory lessons learned have been spread to other investments and regulators. Syngenta Foundation facilitated the process as an intermediary.

6.2.3 Use of small seed packs

Arrangements in the semi-formal seed system that promoted the packaging of seed in small packs (5–10 kg) were very effective in improving seed access by smallholder farmers. Small seed packs are much preferred amongst smallholder farmers because they deliver tangible benefits to farmers, including flexibility to purchase the desired quantity coupled with affordability. The small bags
encourage farmers to experiment with quality seed potato in an affordable, low-risk way. For example, in the 3G project, FIPS-Africa established a network of promoters to sell seed potato and train farmers in six project districts: Nyandarua, Nyeri, Meru, Kiambu, Molo, and Taita. FIPS-Africa reached out to over 10,000 farmers who bought 60 MT of G3 seed potato packed in 5- and 10-kg bags supplied by Kisima Farm in three seasons. Such small bags could be promoted alongside small fertilizer packs to boost yields.

6.2.4 Most agreements are informal and without arbitration clauses

Agreements between various actors in the seed value chain need to be better defined with clear arbitration clauses indicating the penalties of violating the agreements (e.g., what are the penalties for late deliveries of [breeder, foundation] seed? What are the penalties in case of exclusive agreements of not making the seed available in the market at reasonable prices?

6.2.5 Direct agreements between public breeders with CBOs and other decentralized multipliers promote access to seed

Direct agreements between breeders of public varieties with CBOs and decentralized seed multipliers seemed to improve access to quality seed of new varieties. Institutionalization of such arrangements will go a long way in improving access of public varieties by farmers.

6.2.6 Engaging policymakers to recognize informal seed systems

Because of the importance of informal seed system in delivering improved varieties to farmers, policymakers need to recognize the system and facilitate development of appropriate quality standards for the system.

6.2.7 Farmers are accessing varieties from multiple seed systems

Farmers are sourcing/accessing varieties from formal, intermediate, and informal seed systems, although the informal system dominates (more than 90%). There are linkages between formal and informal seed systems, but they are weak.

6.2.8 The role of public-private partnerships

Partnerships in basic seed production, the introduction of varieties and production technologies (aeroponics and hydroponic systems), and the accelerated diffusion of technologies all increased farmers’ access to new varieties. Agreements between the public and private sector not only increased production of quality seed but also brought in efficiency, timeliness, mechanization, and improved production and accessibility of seed potato. For example, the private sector contributed more than 80% of both minitubers and basic seed produced in 2010 and 2011. Private sector has skills, resources, and knowledge suitable for seed production, to extend public sector capacity and should be an important development partner. The private sector will invest in seed production, but may require some initial risk management and ongoing technical backstopping if it is a new enterprise. It may be necessary to give some subsidy (50% initial capital subsidy in one case study); support to get starter seed in the first year of production; free technical backstopping; and assistance with marketing and links to markets. On the basis of the agreement between CIP and Kisima Farm, joint planning workshops could provide good opportunities to identify prospective partnerships that could lead to actual agreements.

7. REFERENCES


smallholder farmer yields in Africa. ALINe People-Centred Performance and Institute of Development Studies.


FINTRAC. 2014. Potato value chain analysis. USAID-KAVES. Washington, DC.


Ng’ang’a, N., Lung’aho, C., Mbiyu, M., and Otieno, S. 2012. Report on potato production practices among small holder farmers in four Counties (Kiambu, Nyandarua, Meru and Nakuru) in Kenya. KARI.


