

Apical Rooted Cuttings of Potatoes Revolutionized How Generation 1 Seed Potatoes are Produced: Example of Kenyan Farmer James Nderui

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Public and Private Partners

Apical Rooted Cutting (ARC) technology was introduced into Kenya by the International Potato Center (CIP) and refined through a partnership with Stokman Rozen Kenya Ltd. The ARC technology was refined and tested in small plots with excellent results. Then, the Potato Council of Kenya (NPCK) provided forums for linkages and networking with the relevant institutions and stakeholders and advertisement platform and market linkage. The Kenya Agricultural and Livestock Research Organization (KALRO) provided RAC and training on seed production while the International Potato Center (CIP) provided training on Apical Cuttings technologies & genetic resources. Kenya Plant Health Inspectorate Services (KEPHIS) provided training on seed quality and certification; NGOs including German Agency for International Cooperation (GIZ) and International Fertilizer Development Center (IFDC) facilitated certification training and registration with a certification body; and Syngenta Foundation provided greenhouses for ARC production in potato farming communities.



Figure 1 - Apical Rooted Cuttings (ARC) showing the juvenile stage of development with simple rounded leaves.

1. Collaboration and Institutional Support for a Young Farmer

James Nderui is a young agripreneur who decided to become a seed potato producer after embracing the ARC technology. After attending a few forums organized by NPCK and being linked to strategic institutions in the subsector, James started creating partnerships and gathering relevant information for seed potato production. He received training on production and postharvest management and potato production from KALRO and CIP. Upon showing a lot of interest in ARC technology, he started attending training organized by Dr. Monica Parker of CIP, who introduced and refined the technology in Kenya and played a key role in its promotion. This training played a big role in knowledge building on ARC management after transplanting to the field. Kenya Plant Health Inspectorate Service (KEPHIS) carried out soil sampling for *Ralstonia solanacearum* and Potato Cyst Nematode. After the soil tests results confirmed all-negative, he received the first ARC from Kenya Agricultural and Livestock Research Organization (KALRO) and transplanted them to a 15m x 10m plot. The resulting harvest was impressive. This led to the decision to go to commercial certified Generation 1 seed production. Currently, he targets to do 20 hectares each of two growing seasons.



Figure 2- A newly transplanted field of ARC (left) and 33 days later (right) with James.

2. Quality and Healthy Planting Material

Quality seed potatoes are in short supply allowing viruses and bacterial wilt (*Ralstonia solanacearum*) to spread through latent infection in the farm sourced non certified “seed” potatoes. James decided to use ARC technology as a way to produce high quality seed potatoes, which would also benefit the major potato production areas in his county. ARC technology allows a seed producer to produce large quantities of seed potato from a relatively small piece of land. The small size of the plots encourages intensive crop management practices that lead to better quality seed potato. This is achieved through strict field hygiene and intensive control of pests and diseases. Watering on a small scale is done to produce

off-season seed potato. Stokman Rozen Kenya is leading in the multiplication of pathogen free tissue culture plants and then growing them in greenhouse beds in a substrate. Apical cuttings are taken to produce more mother plants and when the quantity is sufficient, apical cuttings are taken and rooted in trays and sold to interested parties such as James. Presently, the cost of 100 ARC is about 10USD. The most popular variety demanded, being 90% of James' orders, is the cultivar Shangji. This cultivar with unknown pedigree has likely *S. phureja* (native to Peru) in its background making it well adapted to the 12 hour day length of Kenya. This allows it to be a prolific producer of Apical cuttings while remaining in the physiological juvenile stage with simple rounded leaves. This is paramount to get a normal plant to grow in the field and have a large tuber set. Cultivars Unica, Wanjiki, Dutch Robijn, Chiluba, Leanana and Konjo are also grown on a small scale with ARC.

3. Farm Management and Crop Techniques

As a young new farmer, James, leases land for seed potato production using ARC. In order to avoid the risk of infestation by *Ralstonia solanacearum* and other pests/pathogens, apart from doing soil tests, he ensures the farm has the following characteristics: no history of potato production or other solanaceous plants such as capsicums, tomato and eggplant, preferably for 10 years or more; no runoff water flows onto such land from neighboring higher elevation land; and, no manure/compost, which may be a host residue for pathogens has been applied. James always uses Kenya Plant Health and Inspectorate Service (KEPHIS) for soil testing for bacterial wilt and Potato Cysts Nematode (PCN). From the beginning, land that has been earmarked for seed production is always protected from introduction of the bacteria wilt pathogen and other diseases. This is done by disinfecting all farming tools (hoes, disc ploughs) shoes/feet, and other equipment. Additional protection of seed production sites is achieved by fencing off the farms and limit human crisscrossing. He inspects the seed potato crop frequently to ensure that pests and diseases are controlled promptly. All of the crops are inspected by KEPHIS and provide the seed certification.



Figure 3 - ARC field at 57 days after transplanting of variety Shangji.

4. and 5. Seed Storage and Marketing

At harvest, all seed is placed in Diffused Light storage (DLS) to allow the seed to suberize and once sprouting starts, the seed is packaged in 50kg jute sacks and sold to the customers who ordered the seed. James has partnered with Viazi Soko, a digital platform developed and managed by National Potato Council of Kenya (NPCK) in information dissemination, seed ordering and pre-booking. Farmers are aware of when seeds will be available and planning for the coming seasons becomes easier. James contract sells his Generation 1 seed at USD 27.50/ 50 kg bag of seed. This is the same price as demanded by the Government seed farm. Demand for James' high quality seed is rapidly increasing! He plans to mechanize all farm operations from land preparation, planting, weeding and harvesting. This will not only minimize operations cost but also increase efficiency and in the long run, increase seed.



Figure 4 - James showing interested county agents and farmers the steps in transplanting ARC.

6. Creating added value

James has become a key champion for the ARC technology and has been involved in training youth groups in every sub-county of Nyandarua county with financial support of GIZ. By generously sharing his steps in growing ARC, he is adding great value to the potato sector of his county and the country (Figures 4 and 5). Now James will become a large supplier of ARCs with the financial support of Sygenta Foundation in providing a large new greenhouse. CIP is providing the starting mother plants. In 2021, James plans to establish his own small tissue culture laboratory to maintain and multiply the starting material for his greenhouse mother plants. James is now a licensed seed potato merchant.



Figure 5 - Youthful farmers come to assist in the bountiful harvest of the ARCs in a field of James Nderui (far right).

Quotes

Dr. Monica Parker of CIP: “James Nderui is a model leader driving potato value chain development in Kenya. His youthful energy and skills are leading the way in new ways of quality seed production and beyond.”

Dr. Wachira Kaguongo of NPCK: “Mr. James Nderui, being young and an accountant by profession, is a classic example of how youth and women can work together with a consortium of key and strategic institutions to turn around the ever elusive challenge of seed potato shortage into a thriving and profitable business opportunity in the potato industry. The efforts of this youthful farmer will help many smallholder farmers easily access certified seed potato and

rooted apical cuttings by increasing their availability. National Potato Council of Kenya (NPCK) working with CIP, Syngenta, GIZ and other partners, is working with him to help smallholder farmer's access seeds and other inputs through a digital platform."

Dr. Peter VanderZaag of Sunrise Potato: "The adoption of apical rooted cuttings in East Africa is a dream come true. The pioneering work was done in Dalat, Vietnam in the 1980s (<https://vimeo.com/436509582>) and to see it now start to revolutionize how seed production is done in Kenya where serious problems with soil borne diseases including bacterial wilt exist today".