

# MANUAL FOR LOCAL SEED POTATO MULTIPLIERS

Improving access to quality seed by smallholder farmers

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Flower of potato variety Shangi at ATC Njambini in Nyandarua, Kenya

# Introduction

## Seed potato value chain

- Smallholder farmers are experiencing low yields of between 20 to 40 bags (100kg) per acre; this is partly attributed to reusing their own seed over several seasons.
- Availability, accessibility and distribution of quality seed potato is a major challenge for many farmers in rural areas.
- Seed production is a very technical and intensive operation.
- Quality seed needs to be clearly separated from ware potatoes through branding, labeling, and creating a separate seed value chain.

## Local seed multiplication

- Seed potato is bulky and the long distances from producers to farmers make seed potato expensive, hence there is need for making the seed available closer to farmers.
- Local multiplication will encourage the use of quality seed as farmers can see the value of quality seed from their neighbors' fields who are producers and can even buy small quantities more easily.

Social relationships created remove barriers and build trust which is key to developing the local seed business enterprise.

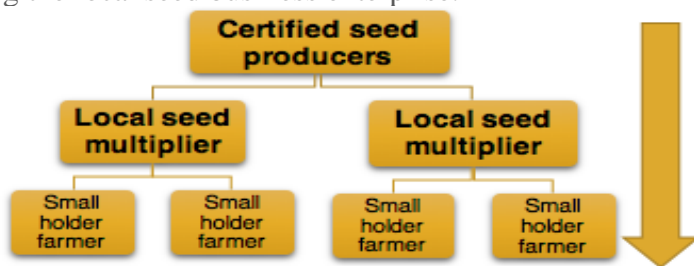


Figure 1. Local seed multiplication approach for accessibility of seed to local small holder farmers.]

# Producing Seed

## Site selection

- Choose sites that have not been planted with potatoes or related crops (tomato, eggplant, African nightshade) for the last 4-5 seasons. Avoid sites with water flowing in from other potato fields into your seed potato plot.
- Select sites with deep, well drained, and loose textured soils with pH ranging from 5.0 to 6.5.
  - Soil analysis is recommended.
  - Avoid black cotton soil and areas with risk of water logging.
- Ensure there is adequate distance (> 20m) between the seed and ware potato crops if possible –otherwise use barrier crops such as Napier grass and maize.
- The site should be easily accessible for regular monitoring of the crop and preferably close to water supply to supplement during low rainfall periods.

## Managing seed tuber dormancy

- It is important to have sprouted seed tubers ready when the seasons starts. Therefore, it is important to understand dormancy periods of different varieties to plan planting and harvesting to ensure seed is ready for timely planting. For example, the variety Shangi has a very short dormancy of less than 1 month as compared to Sherekea with dormancy period of greater than 3 months. This means that the two varieties need be handled differently.

## Seed quality control

- Practice good agronomic practices
- Regularly scout your crop for pests and diseases and take appropriate action

## Reputation, traceability and branding

- Business success of seed multipliers depends on the ability to produce and maintain the supply of quality seed. Seed multipliers should build their reputation through continuously producing quality seed to build trust with the customers.
- Building a strong reputation depends on how the seed grower manages the quality of their seed.
- Traceability and branding of seed are important factors to build a grower's reputation for providing quality seed

## Crop rotation

- Potential seed multipliers have to ensure that they have enough land to allow for proper crop rotation of at least 4-5 seasons with crops not related to potato like cereals, legumes and brassicas. Crop rotation includes good field hygiene and removing volunteers in the following crop.
- Crop rotation is critical to;
  - avoid the accumulation of crop specific pest and diseases in soil and crop.
  - diversify food and fodder supply and reduce risks of single crop failures.
  - maintain and improve soil fertility and soil health.

Without crop rotation you will produce poor quality seed potato!!!

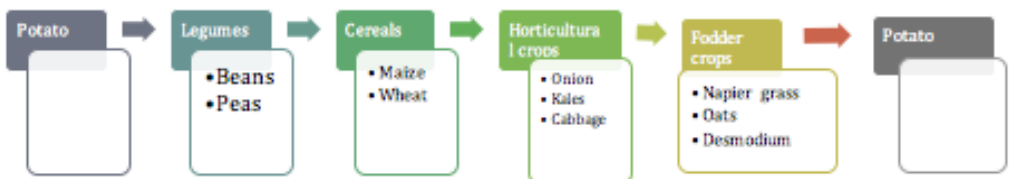


Figure 2. Example of a crop rotation plan

# Land preparation and planting

- Ensure to replace the seed stock after every two seasons. This is to avoid the buildup of diseases in the seed lot every season thus reducing the quality and yield potential of the variety.
- Obtain healthy disease free and true to type seed from a reputable certified seed producer (**Contact National Potato Council of Kenya for producers of certified seed**)

## Seed bed preparation

- Ploughing can be done manually using a jembe, animal drawn ploughs or tractor. Plough land to a depth of around 20-30 cm.
- Proper seed bed preparation will help to improve the condition of the soil, help in weed control and also disease management.

## Manure and fertilizer application

Fertilizer and manure application should be based on soil analysis results and recommendations. The general recommended basal fertilizer rate is about 4 bags of 50kg per acre. Some fertilizers available in the market and can be used in potato production include: NPK 17:17:17; Mavuno Planting and DAP.

- Also consider using top-dressing with CAN or Mavuno Top-Dress with 1 bag per acre which reduces basal application to 3 bags per acre. Top dressing should be done after emergence but before row closure.
- Use of well decomposed farmyard manure is recommended to improve soil physical condition, soil fertility and water holding capacity. Per every 1000 kg per acre applied (15 bags) reduce your basal fertilizer by one bag.

	Option A	Option B	Option C	Option D
Basal fertiliser	3	3	2	4
Top dress	0	1	1	0
Manure/compost	1000 kg	0	1000 kg	0

## **Planting**

- Spacing should be 75 cm between rows and 20-30 cm between tubers within the row depending on seed tuber size.
- Plant tubers 10 to 15 cm deep
- Fertilizer should be applied before planting and must be well mixed with the soil to avoid direct contact with the seed tubers
- The tubers should be placed in the furrows with the sprouts facing upwards
- Ensure that planting is done before the onset of the rains

## **Crop management**

### **Hilling and weeding**

- Weeding and hilling up can be done at the same time. This should be done at least twice in a season; immediately after emergence and when plants are about 10-15cm tall.
- Hilling assists in increasing the number of tubers (more stolons than stems) hence the seed yield.
- It also helps with covering potato tubers forming close to the surface of the soil, hence reducing the risk of damage from potato tuber moths and diseases such as tuber blight.

## Pest and diseases monitoring

- Inspection should be done at least once in a week during the growing season to monitor pest and diseases and assess thresholds that warrant control measures. Late blight, bacterial wilt and viruses are the most common diseases. Others include; blackleg and pests such as nematodes, millipedes, cut worms and tuber moths.

- **Late blight**



- Most common disease in potato production and expensive to manage.
- Effectively managed through resistant varieties and fungicide sprays (timing of first spray is most important).

- **Bacterial wilt**



- Bacterial wilt is transmitted through
  - infected seeds
  - infected soils
  - water runoff and contaminated boots and tools
  - managed through field hygiene and use of clean seed, crop rotation

- **Virus**



- Viruses are mainly transmitted by aphids and accumulate from seed generation to the next.
- Best managed through resistant varieties and regular replacement with clean seed stocks

Note: Refer to the pest and disease management booklet

## Harvest and postharvest management

### Dehaulming

- Varieties have different maturity periods; hence it is important to monitor tuber sizes regularly towards the end of flowering to target recommended seed sized tubers.

- Dehaulming is recommended about 2 weeks before harvesting. During warm weather and when there is risk of potato tuber moth, 1 week should be sufficient.
- This can be done manually by cutting the foliage close to the ground. Re-growth of leaves, if any, should also be cut after a week of dehaulming because the tender and succulent leaves are more attractive to aphids which transmit viruses.
- The purpose of dehaulming in seed production is to:
  - stop tuber bulking to obtain a desirable tuber size. (Check tuber sizes to ensure that about 70- 80% of the tubers are between 30-60 mm).
  - reduce the risk of late season virus transmission by aphids.
  - promote skin set and prevent bruising to improve storability.

## Harvesting

- It is best to harvest in clear, sunny weather, because sunshine will help tubers to harden and dry more quickly, making it easier to remove excess soil from their skins and reduce the risk of tuber infection that cause rots.
- Harvesting methods affect tuber quality. Potatoes can be harvested directly by hand, using a jembe or mechanized lifting. Harvesting by hand takes longer and is more labor intensive, but will produce good quality, undamaged tubers. Using a hoe is less time-consuming and labor-intensive, but some tubers will be damaged in the process. Mechanized harvesting, if available is expensive but cost effective.
- After harvesting, collect and destroy any leftover tubers which could grow as volunteers and harbor disease in the next cropping season.
- Post-harvest field sanitation has to continue in the following crop by removing volunteer plants



## Sorting, grading and packaging

- Sorting and grading is done immediately after harvesting. Sorting involves removing the rotten, diseased, infected and cut tubers before storage.
- Proper size grading of tubers is recommended. There are two categories of seed sizes recommended for sale in Kenya; size 1 seed (30-45mm) and size 2 seed (45-60mm).
- If the seed has not been multiplied more than two times previously and your crop has been healthy, all tuber sizes can be replanted for further seed multiplication.

## Seed storage

- The recommended storage system is diffused light storage (DLS) for seed to be replanted the next season.
  - DLS involves storing the potatoes in thin layers on shelves or trays in natural, diffused (indirect) light with good ventilation.
  - light induces short, stout and colored sprouts, which is ideal for potato production. Potatoes must be arranged in thin layer so that each tuber receives sufficient light.
  - DLS has to be protected with insect proof net to prevent transmission of viruses by winged aphids.
- To store seed for longer than 3 months on relatively low cost ambient cold stores are recommended because:
  - they are suitable for varieties with long dormancy periods.
  - the cold and dark environments delay sprouting and deterioration.
  - bags allowing ventilation are recommended for seed storage\*

In all storage systems, regularly check and remove rotting tubers. Disinfect the infected area with Jik. Check for pests such as aphids and tuber moth in and outside the store



**Plate 1 and 2. Difused light store for up to 5 months of seed storage (varietal differences!!)**

DLS should be well ventilated. Potato tuber requires sufficient air.

Respiration of the tubers produces heat inside the storage area. Heat speeds up the growth of sprouts which means the tuber is rapidly using energy, thus quickly becoming physiologically old. (*For more information contact CIP*).



**Plate 3 and 4. Low cost ambient stores for storage up to 8 months (varietal differences!!)**

Cold storage has its drawbacks. For instance, one rotten potato can spread rot to the whole lot. As a result, cold storage requires a good grading system that eliminates rotting potatoes as well as scratched ones.

# Seed replacement strategy

## Renewal of seed stock with healthy material

It is recommended to regularly renew your seed stock with certified seed to avoid accumulation of diseases in your seed hence always maintaining high quality seed.

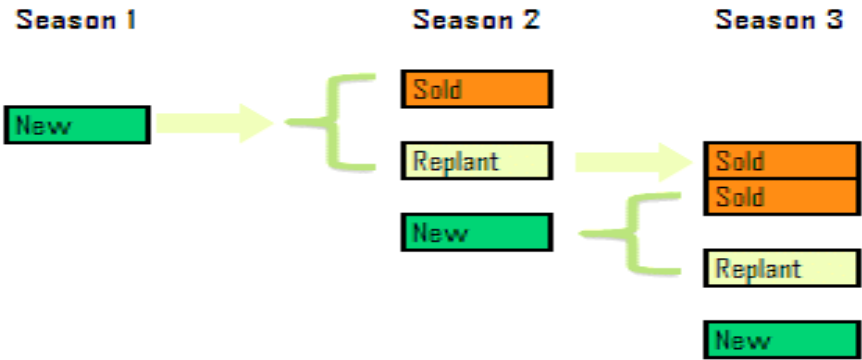


Figure 2. Seed replacement through partial renewal of seed stock every season

Table 1. List of producers of certified seed potato varieties

Certified seed producer	Location	Varieties produced	Contact
Kisima farm	Meru	Tigoni, Asante, Sherekea, Kenya Mpya, Dutch Robijn, Shangi	0716968766
ADC	Molo	Tigoni, Asante, Kenya Mpya, Dutch Robijn, Shangi	0721202565
KALRO Tigoni	Limuru	Tigoni, Asante, Sherekea, Kenya Mpya, Dutch Robijn, Shangi	0733834675

## Seed plot technology from minitubers

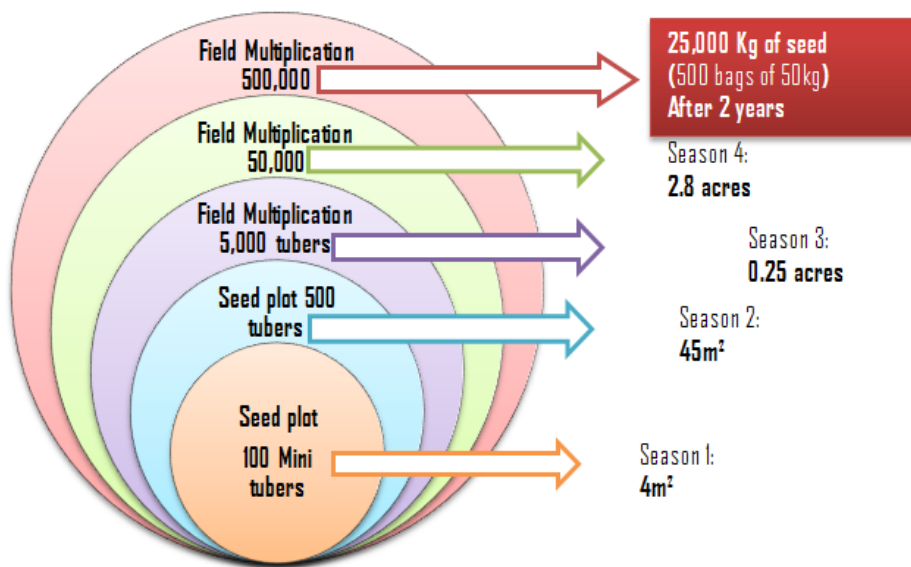


Figure 3. Schematic example of 2 years seed multiplication starting with minitubers



*Seed bed preparation and plant growth on the seed nursery*

Table 2. Sources of minitubers

Mini tubers producer	Location	Varieties	Contact
Kisima farm	Timau, Meru	Tigoni, Asante, Sherekea, Kenya Mpya, Dutch Robijn, Shanghi	0716968766
GTIL	Nairobi		0722662037
Edward Mbugua	Limuru		0722734919

**Note:** Contact CIP, KALRO and NPCK for updated sources of minitubers

## Economic Analysis

- An economic analysis will provide information on profitability of seed production.
- Income from potato farming will come from selling seed potato and ware potato.
- Types of expenditures vary greatly, but generally consist of the following cost items: Seed, organic and inorganic fertilizer, sacks to package harvest produce, fungicides, insecticides etc, labor from land preparation to harvesting, transportation, storage and other seed potato enterprise related costs.

## Record Keeping

- Record income and expenditure every season to help in calculating the profitability.
- Enter all expenditures and income related to the production in record books.

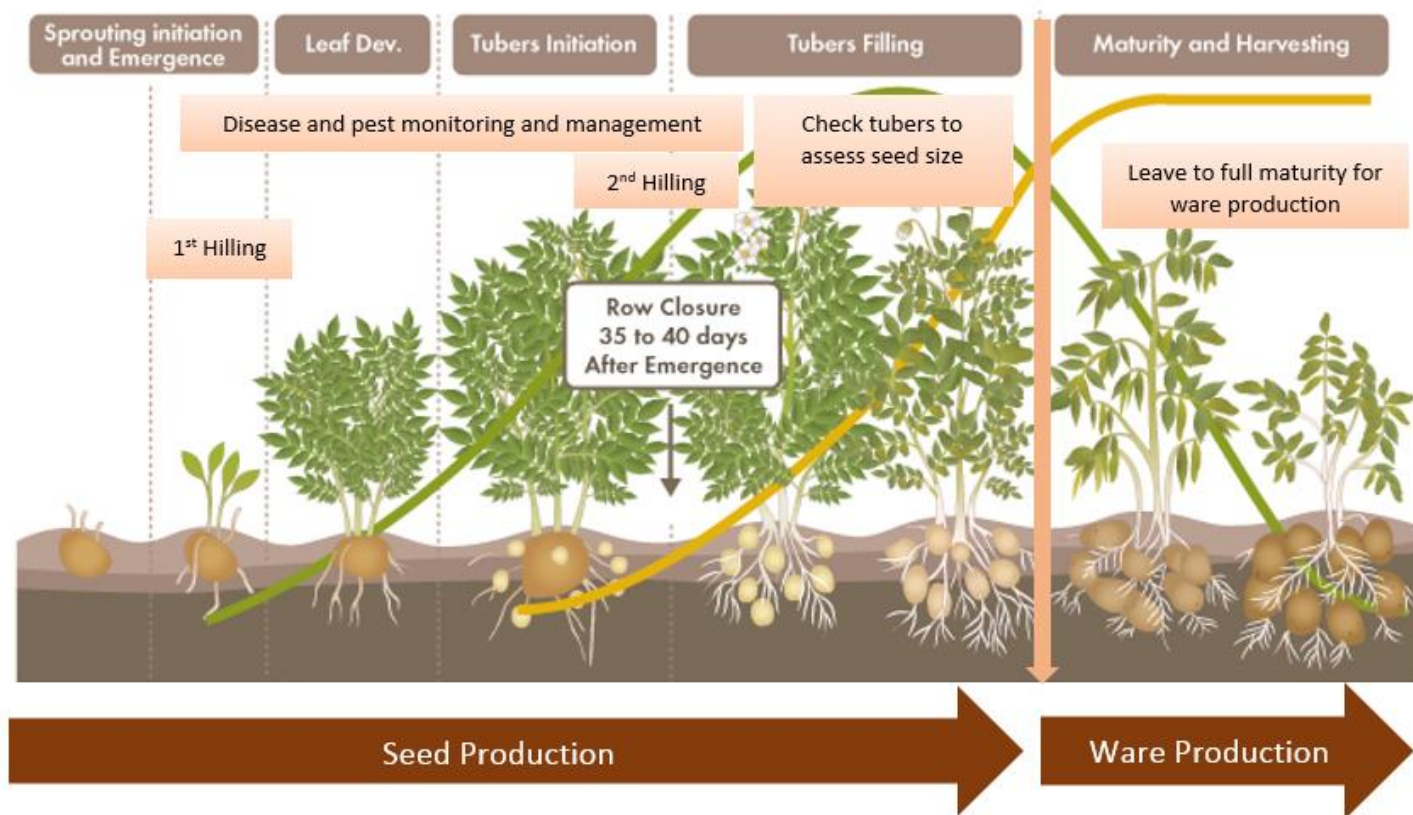
**Table 3. Cost benefit analysis of seed potato production per acre (Kenya Shillings)**

<b>Inputs</b>	<b>Quantity</b>	<b>Unit cost</b>	<b>Cost per acre</b>
<b>A. Materials</b>			
Land Lease	1 acre	3000	3000
Seed	18 bags	2,500	45,000
Fertilizer	4 bags	3,600	14,400
Manure	40 bags(100Kg)	100	4,000
Fungicides and others*	6 sprays	3,000	18'000
Packaging bags**	200	60	12,000
<b>SUB TOTAL</b>			<b>96,400</b>
<b>B. Labor</b>			
Land preparation	17 mandays	400	7,000
Manure application	8 mandays	400	3200
Planting	15 mandays	400	6000
Weeding/ Hilling up 1 and 2	20 mandays	400	8000
Dehauling	4 mandays	400	1600
Harvesting/transport	30 mandays	400	12,000
Storage	20 mandays	400	6000
<b>SUB TOTAL</b>			<b>43,800</b>
<b>Total Production cost</b>			<b>140,200</b>
<b>Contingency, interest rates and opportunity cost (30%)</b>			<b>42,060</b>
<b>Grand Total (Cost of Production)</b>			<b>182,260</b>
<b>Gross Income per acre</b>	<b>120 bags***</b>	<b>2000</b>	<b>240,000</b>
<b>Net income</b>			<b>57,740</b>
<b>Return of investment (%)</b>			<b>31.7</b>

- \* Including cost of application

- \*\*Packaging bags available at NPCK

\*\*\* Assuming 6t/acre (15t/ha) sold as seed



**Figure 4. Activities targeted on different stages of growth in seed production**



Table 4. Some potato varieties and their characteristics

Variety	Tuber dormancy	Growing period (Days)	Use	Characteristics
Kenya Mpya	60-90 days	90- 120 days	Table	Few very big tubers, resistant to late blight, susceptible to viruses' quick degeneration below 2200 m.a.s.l. Early tuber bulking-dehauling for seed sizes critical
Tigoni	60-90 days	90-120 days	Chips and table	High medium sized tuber number. Tubers turn green quickly on exposure to light
Sherekea	90-120 days	More than 120 days	Table	Very high medium sized tuber number, tolerant to late blight
Asante	60-90 days	90 days	Table	Few big tubers, virus resistant, tolerant to drought
Shangi	< 30 days	90 days	Chips and table	Few big tubers, early maturity, Short cooking time, tolerant to viruses
Dutch Robijin	90-120 days	90-120 days	Crisps, chips and table	High medium sized tuber number, good processing qualities
Kenya Karibu	90-120 days	More than 120 days	Table	High medium sized tuber number and tolerant to late blight
Konjo	60-90 days	90-120 days	Table	High medium sized tuber number, Late blight resistant

### Important contacts

KALRO-Tigoni, P. O. Box 338, Limuru, Tel: 020-2022052, Mobile: 0727 031 783

Kenya Plant Health Inspectorate Service, P.O. Box: 49592-00100 Nairobi.  
Tel: 020 661 8000 Cell: 0709 891 000

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Waiyaki Way;  
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