



Planting and management of potato rooted apical cuttings: A field guide

Objective: Showcase a novel seed system combining use of robust potato varieties

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Site consideration

Protocol:

- Select a site that has not grown solanaceous crops for at least four consecutive seasons (2 years) to avoid the risk of diseases. The solanaceous crops include potato, tobacco, nightshade, eggplant, chilies/pepper, tomato etc.
- Avoid slopes below ware potato or solanaceous crops to minimize spread of diseases by runoff water.
- The soil should be fine, loose and well drained.
- An adequate supply of water suitable for crop irrigation is essential.
- If there is no provision for irrigation water, planting should be done at the onset of rains, and should commence when the soil has adequately moistened.
- The site should not be prone to flooding which will damage the seedlings.
- The site should be accessible to allow movement, transport and regular monitoring.
- Tools must be clean; dip in 10% jik if the tools have been used to work soils on solanaceous crops or soils with unknown levels of hygiene.

Seedbed preparation

Protocol:

- Proper seedbed preparation improves the soil condition, helps in weed control and disease management.
- Demarcate the seedbed with a sisal string; each bed measures 0.9 m width with an inter-bed spacing of 0.7 m.
- The length of the bed will be determined by the number of plants to be planted at an interplant spacing of 25 cm.
- Dig out the demarcated bed to a depth of 20-30 cm below the soil line. Break all the lumps to get a fine tilth.
- Raise the seedbeds to 3-5 cm height above the soil line. See Fig 2.
- Rake the raised seedbeds to a uniform level and firm the soil.

Fertilizer and manure application

Protocol:

- Fertilizer and manure application is best based on soil test results and recommendations.
- A well-decomposed cattle or farmyard manure at a rate of 1 kg per sqm (4 tonnes/acre) is recommended to improve the soil physical condition, soil fertility and soil water holding capacity.
- The manure should be applied at least a week prior to planting and be well mixed with the soil when digging out the beds.
- However, be sure of the source of manure—a contaminated source is an avenue for disease spread.
- Application of basal fertilizer or topdressing is not recommended when the soil is waterlogged.
- NPK 17:17:17 at rates of 50 g per sqm (200 kg per acre) is generally recommended at planting. Alternative complex fertilizers or blends can be used.
- Properly mix the fertilizer with the soil to avoid direct contact with the cutting; if this is not done, scorching may occur.
- A final raking and firming of the soil should be provided prior to sowing.
- Topdressing is done at 2-3 weeks after planting but 2 weeks before flowering; if done when the plant is too young, more vegetative growth and less tuber formation occurs; when the plant is too old, no response to nitrogen application occurs.
- Use CAN or alternative nitrogen fertilizer for topdressing.
- An optimal rate of 25 g CAN per sqm (100 kg per acre) is generally recommended: this activity should be guided by the general condition of the plants, but is best based on the soil test results and recommendations.
- Yellowing and stunted growth are signs of nitrogen deficiency, thus indicate need for topdressing; take note however that some viral disease symptoms, salt accumulation etc. may also express these symptoms.
- Do not topdress only around the plants, but also between the plants and shake the applied fertilizer off the foliage.
- Foliar feed can be applied after emergence and before flowering.

Planting and spacing

Protocol:

- Different spacing give different yields and have varying impact on economics of production.
- Seedbed of 0.9 m width: 2 rows, spacing of 30 cm between rows and 30 cm between plants gives the best economic yields.
- Before planting, demarcate layout using a string and sticks; 30 cm between rows and 30 cm within rows; 2 rows per bed, leaving 30 cm to each edge.
- Leaving 30 cm to each edge is important, as stolons need an allowance for extension; cuttings planted too close to the edge has no soil to cover the stolons. Stolons not covered with the soil form stems instead of tubers.
- Poke planting holes using a stick or hand.
- Transplant the cuttings, burying the collar and leaving only the top foliage above ground.

- Transplant the cuttings in depressions to conserve irrigation water during dry periods.
- Unless the soil moisture is adequate, water the transplants immediately after planting.
- Keep watering each morning and evening until the plants are fully established.
- In cases where the weather is too hot, erect a shade over the plants; use shade net or local natural materials e.g. dry grass, banana leaves, maize stover etc. Take note of pests that could be harbored in the natural materials.
- Keep the shade at 50% and ensure it is completely removed within two weeks after transplanting; this is important to note, as these plants need sunlight to make food.
- Install a placard immediately after planting informing on variety name, number of cuttings planted and date of planting to facilitate monitoring.

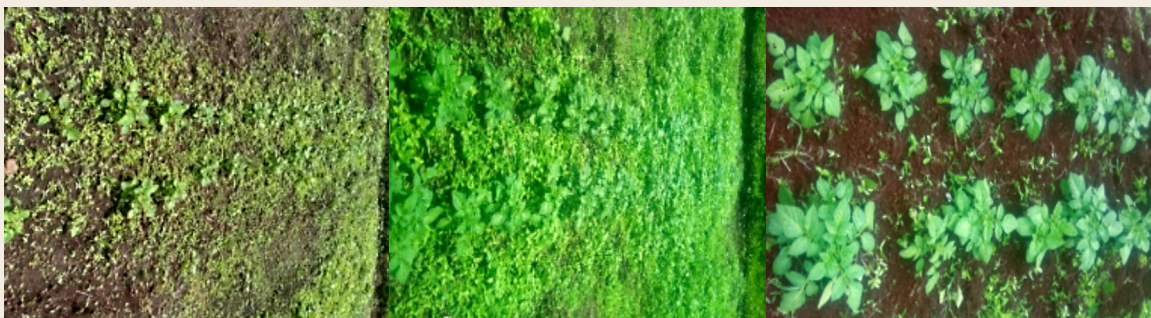


Demarcations (a) and depressions (b) at planting.

Weeding

Protocol:

- Weeds that emerge early, but not injurious to the potato plant should not be bothered within 1-2 weeks after planting. This is because the cuttings are still not well established, and weed removal at this time can lead to crop damage. At this stage, these weeds have little competition for water, nutrients and sunlight, but stabilize the soil.
- If the weeds are noxious (those that come early, are injurious to the crop and persistent), then carefully control as soon as they emerge.



(a) Weeds at 1.5 weeks after planting-if not noxious, these weeds pose little competition.

(b) Weeds after 2.5 weeks of planting-weeds past this stage will damage the cuttings.

(c) The cuttings after the weeds in (b) are removed.

- Weeds emerging closest to potato plants compete most severely. Ensure their complete removal.
- Weeds emerging towards or after canopy senescence will have no effect on tuber yield-do not bother them.
- Avoid the use of herbicides in weed control; applying non-selective, exceeding the recommended application rates, or applying the herbicide at incorrect growth stage can have disastrous consequences, resulting in total crop loss.
- Trace amounts of an herbicide can react with another herbicide or carry-over to the next spraying, causing damage to the cutting.
- Never use the same sprayer for herbicides and for fungicides or insecticides. No cleaning method is 100% foolproof- a very small amount of the herbicide can cause a total damage to the cuttings.



Cuttings damaged by residual herbicide

Hilling

Protocol:

- Hilling is a necessary activity in seed potato production.
- This practice loosens the soil and enhances tuber formation and bulking.
- Hilling also reduces tuber greening and controls potato tuber moth.
- A well-hilled potato cutting produces many tubers of good size and shape.
- Stolons not well covered with the soil develop into stems instead of tubers resulting in reduced yields.
- Perform hilling when the soil is not too wet to avoid soil compaction and clumping.
- Perform first hilling at 2 weeks after planting, when doing first weeding.
- Hill by excavating soil from the 0.7 m paths and mound uniformly around the potato plant; avoid hilling individual plants with hoes/jembes/fork.
- Pile up soil around the plant to about 3-5 cm high at first hilling.
- Repeat hilling at 2-3 weeks after the first hilling.
- The mound that forms after the second hilling should be about 30 cm high.
- When hilling, ensure the plant collar is buried with the soil and take care not to damage the roots and stolons. See Fig 2.

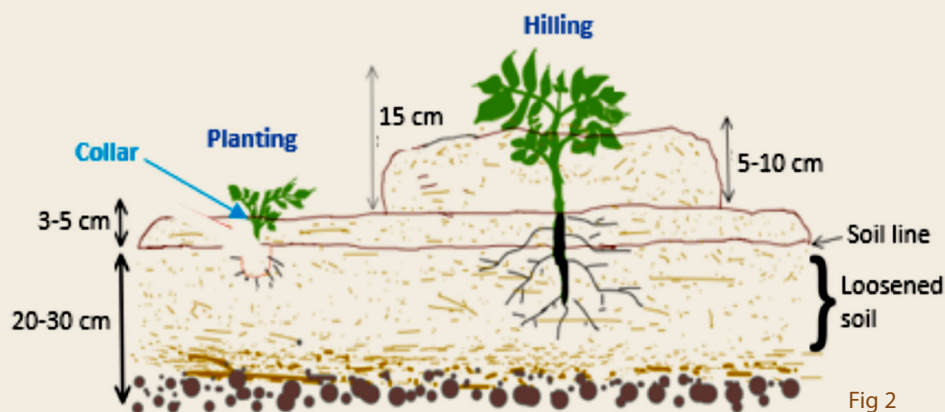


Fig 2

Control of pests

Protocol:

- Only apply pesticides on need basis; keep monitoring to see presence of cut-worms, aphids etc.
- Spot treat the pest to keep the chemical confined to the area requiring treatment.
- Of importance pest are cutworms that are common occurrence in plots of transplanted cuttings.
- Apply insecticides soon after planting to control cutworms (do this at manufacturer's prescribed rates). Some available insecticide products are listed in table 1.
- When applying against cutworms at planting, ensure the insecticides are well drenched in the soil around the plant and on the entire bed.
- Alternate pesticides between sprays to reduce development of pathogen resistance against the product.
- Always wear personal protective gears when applying the chemicals and follow to the latter chemical directions for use, storage and disposal.

Table 1: Some available pesticide products against cutworms.

Trade name	Active ingredient	Formulator/Distributor
Bulldock 25EC	Beta-cyfluthrin 25 g/l	Bayer Science
Tata Alpha 10 EC	Alpha- cypermethrin 10%	Osho Chemical Industries Ltd
Escort 19EC	Emamectin benzoate 19g/l	Greenlife crop protection EA
Voliam Targo 063SC	45 g/l Chlorantraniliprole; 18 g/l Abamectin	Sygenta
Profen 10.8EC	Pyriproxyfen 108g/l	Agrichem Africa Ltd
Radiant 120 SC	Spinetoram 120 g/l	Corteva Agriscience
Runner 240 SC	Methoxyfenozide 240 g/l	Corteva Agriscience

Control of diseases

Protocol:

- Inspection should be done at least once a week during the growing season to monitor diseases such as late blight, bacterial wilt and viruses.
- Symptoms of viral diseases include leaf curl, yellowing of foliage, stunted growth, deformation and even death.
- For late blight disease, leaves and stems turn grey/brown/black and appear burned.
- Remove and destroy viral infected plants and remove all weeds in and around the potatoes during the growing season.
- Use products with active ingredients against late blight and observe manufacturer's prescribed rates. See table 2 for some products available in the market.
- When lots of rain: control late blight at every 7-10 days interval.
- Alternate fungicides between sprays to reduce development of pathogen resistance against the product. Start with the protective chemical ingredients.
- Bacterial wilt infected plants need to be uprooted and destroyed, along with the soil around the roots.

Table 2: Some available fungicide products against late blight disease.

Chemical	Active ingredient	Trade names	Application time
Protective	Mancozeb	Dithane M45, Oshothane	Early in the season
Curative	Metalaxyl	Ridomil, Mistress 72	Middle of the season
Protec-tive/curative	Phosphonate	Agriphite 600	Early and mid-season

Dehauling, harvesting and seed tuber storage

Dehauling:

This activity is conducted at about 2 weeks before harvesting by cutting the stem at soil line to kill the potato plant. Ensure the soil is not disturbed as the tubers must remain covered with the soil to avoid tuber greening.

- Dehauling stops tuber bulking thus helping to obtain desirable seed tuber sizes. It also helps to harden the tuber skin thus reducing bruising during handling and transport.
- Before dehauling, check/scout tuber sizes to ensure that about 70-80% are egg size (after +/- 60-75 days). Do this by gently removing soil away from the plant, taking care not to damage the roots, stolons or detach the tubers.
- If a crop is infected with late blight, dehaulm when 2-25% of foliage is killed with the disease.
- Perform dehauling during dry conditions.

Harvesting:

- Potatoes should be ready for harvesting 2-3 weeks after flowering has ended. However, this activity should be based on regular scouting to ensure that about 70-80% of the tubers are egg size.
- Harvesting should be done in a clear, sunny weather: sunshine helps tubers to harden and dry more quickly. Dig gently when harvesting to avoid wounding the tubers.



Scouting tubers (a) dehauling potato plants (b)

Follow the below procedure at harvest:

1. Count and record the number of plants at harvest. Do this per bed or per line (if each line is a separate potato variety).
2. Dig out the tubers from each plant using a hoe (this is less intensive than harvesting by hand) but can lead to damaged tubers.
3. Take the total tuber weights per bed or per line (if each line is a separate variety).
4. Grade into tuber size above 20 mm and below 20 mm, and count the number of tubers in each grade.



5. Complete the table below and share.

Group name/name of the farmer	Potato variety	Number of plants harvested	Total weight of tubers per bed or per line (if each line is a separate variety)	Number of tubers in each grade		Average number of tubers per plant
				<20 mm	>20 mm	

$$\text{Average number of tubers per plant} = \frac{\text{Total number of tubers (in both <20 mm and >20 mm)}}{\text{Number of plants harvested}}$$

Storage:

- Only store tubers harvested from mature plants.
- Do not take rotten, diseased and damaged seed tubers into the store.
- Store the seed tubers in a well-ventilated cool dry place away from ware potatoes.
- Avoid storing in polythene bags, as they restrict airflow and potatoes will 'sweat' and rot.
- Crates and bulk storage are suitable for long-term storage of 2-3 months.
- Store in crates if possibility of rotten or damaged tubers to limit spread of rot.
- Store in net bags only for short-term storage, maximum of 3 weeks, and only good quality potatoes. The bags should be upright and not on their sides.
- Monitor stored tubers regularly and remove rotten potatoes and any adjacent tubers.

Pictorial steps of rooted apical cutting planting and management

- 1** Demarcate the layout and dig out the soil.
- 2** Raise the bed to 3-5 cm above the soil line and levelize the soil.
- 3** Weigh the fertilizer, spread and properly mix with the soil then firm the soil.
- 4** Mark the planting lines, poke the planting holes and water the bed to moisten it-if the soil is dry.
- 5** Transplant the cuttings, ensuring the collar is buried with the soil.
- 6** Spray the cuttings against cutworm and late blight.
- 7** Install a placard labelled with variety name, number planted and date of planting.
- 8** Erect a shade over the bed-this is only done if the weather is too hot, remove within 2 weeks.
- 9** Replace the dead cuttings, perform weeding, hilling, topdressing (after 2 weeks) and control pests and diseases (based on keen monitoring).
- 10** Control late blight, monitor diseases, check the tuber sizes.
- 11** Are 70-80% of tubers egg size? Yes. Dehaulm.
- 12** Is it 2 weeks after dehauling? Yes. Harvest, sort, grade, take data and store.