



CIP
INTERNATIONAL
POTATO CENTER



Good agricultural practices for potato production in Rwanda

Demonstration guide

Legal notice

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How to use this guide?



This guide is a **complementary** tool that supports other training materials on ware potato production and seed potato multiplication. Therefore, it is not meant to be used on its own. The objective of this demo guide is to help the trainer to organize and facilitate hands-on demonstration sessions in the field. It contains guidelines for three demos: crop husbandry, positive selection and the small plot technique for seed multiplication. For each demo, the guide tries to answer the following questions:

What?

Why?

When?

For how long?

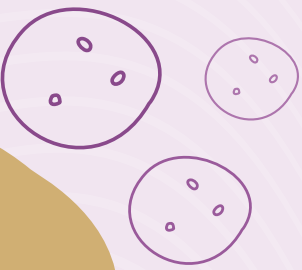
With what?

How?

The How contains both text and images to clearly illustrate each demo session.

For each demo session, the trainer should take into account the following four successive steps:

- (i) an introduction or brief reminder on the subject;
- (ii) the practical demonstration in accordance with this guide;
- (iii) a question-and-answer session; and finally
- (iv) an update for the next training session.

Three stylized seed icons, each represented by a circle with three smaller dots inside, arranged in a triangular pattern.

DEMO 1

CROP HUSBANDRY

Several demos on crop husbandry will be carried out through a field trial with the aim to show farmers the importance of using good quality seeds and train them on techniques for good crop management. To do this, a field trial will be installed with two plots using seeds of two contrasting qualities: good quality seed versus bad quality seed. It is recommended, for fair comparison, to use, as far as possible, the same variety for both plots.

Demo 1.1

Planting techniques

What?

Setting up the field trial.

Why?

Provide hands-on training on potato planting.

When?

At the beginning of the growing season.

For how long?

120 minutes for planting, but the trial spans the entire cropping season.

With what?

- Many small/thin hoes (one per participant),
- 400 seed tubers (28-55 mm diameter) of certified high-quality seed,
- 400 seed tubers from farm-saved seed,
- 600 kg of animal manure or compost,
- Mineral fertilizer (6 kg of NPK 17-17-17),
- Fungicides (see Trainer Guides),
- Insecticides (see Trainer Guides),
- 1 measuring tape, and
- 1 rope for marking the borders of the plots (delimitation).

How?

Prepare two small plots of 8 m x 12 m each. Preferably use a terrain that has not been used for potato or any other crop in the same family for the past three years. Ensure that there is a distance of at least 2 m between the two plots.

For each plot, make 10 furrows with a spacing of 80 cm. If the terrain is steep, make the furrows perpendicular to the slope to minimize the effects of erosion and maintain run-off water within plant rows. In each furrow, place successively the manure or compost, mineral fertilizers and tubers spaced at 30 cm. For each tuber, place 2 handfuls of manure or compost. For the mineral fertilizers, apply the content of 1 plastic water or soda bottle cap of NPK 17-17-17 per two seed tubers. Add the mineral fertilizers on top of the manure. A second dose of 1 plastic water or soda bottle cap of NPK 17-17-17 per two plants is applied as topdressing at the first weeding and hilling-up.

Once the fertilizers have been applied, cover them with little soil to avoid putting the tubers in direct contact with manure and fertilizer. Then carefully place the tubers so as not to break the sprouts. In total, each plot will need 400 tubers which must be well covered with enough soil (10-15 cm above the tuber).

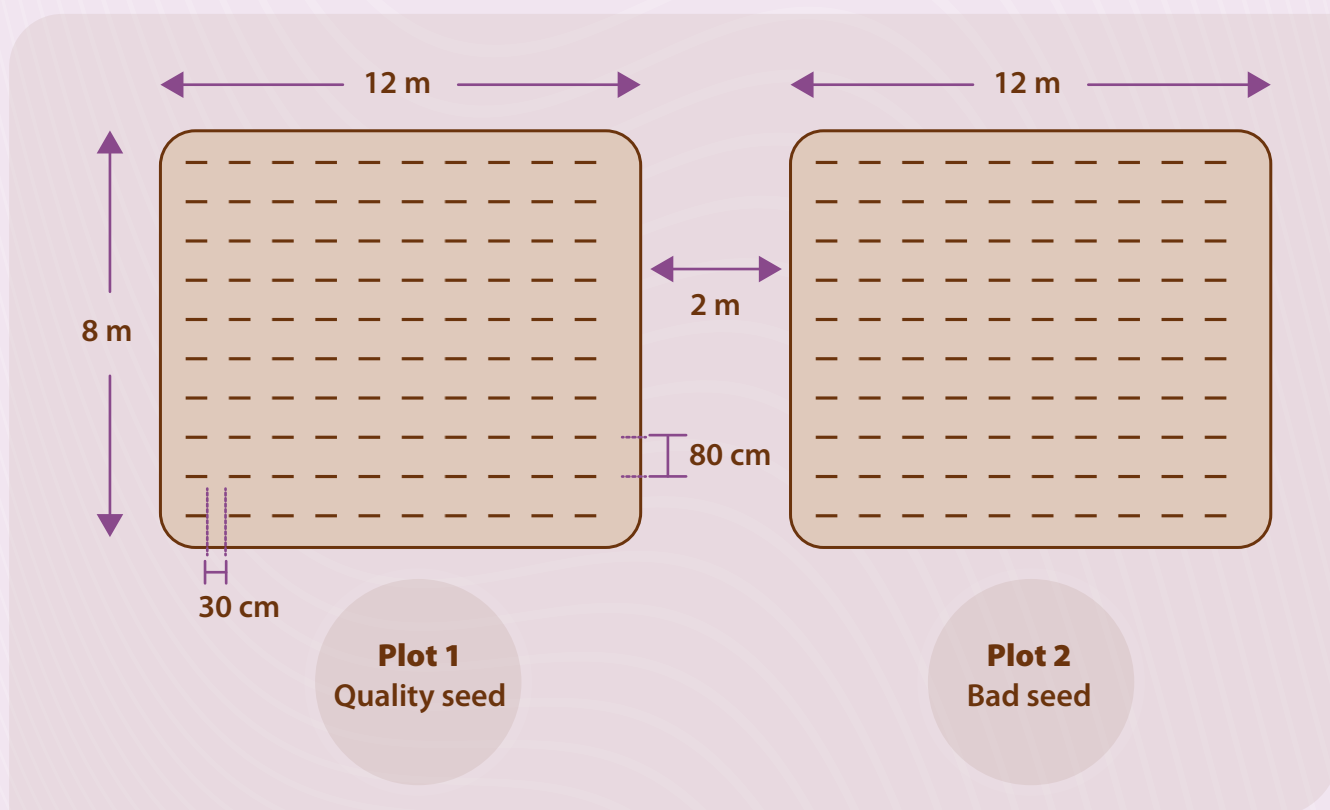


Figure 1. Experimental design.

Demo 1.2

Hilling-up

What?

Hilling-up
potato crop.

Why?

Avoid tuber yield
reduction.

When?

2 - 3 weeks after
plant emergence.

For how long?

60 minutes.

With what?

Small (thin) hoes
(one per participant).

How?

Hiling of the potato crop is done with a small hoe, narrower than a normal hoe, to avoid damage to developing roots or tubers. Stand between two adjacent potato rows. Move backwards as you remove soil from the furrow onto the rows/hills to the two sides. After the demonstration, ask the participants to practice in turn. To avoid risks of contamination, hilling must begin in the plot with good quality seeds and end with the bad seed plot.



Figure 2. Good practice for hilling-up potatoes.

Demo 1.3

Identification of pests and diseases

What?

Field identification of pests and diseases as described in the training manual.

Why?

Pests and diseases reduce yields and spoil the quality of the potatoes.

When?

5 – 6 weeks after plant emergence.

For how long?

60 minutes.

With what?

- Pieces of white paper (one per participant),
- 1 clean glass,
- 1 small sharp knife, and
- Clean water (250 ml).

How?

This demo on identification of pests and diseases is done in the bad seed plot. This is indeed where we expect to find more pests and diseases compared to the plot planted with healthy good quality seeds. Carefully observe and discuss with the participants the identification and management of any pest and disease present in the plots.

Late blight, soft rot and leafroll virus can be identified with the naked eye. Please use the description of symptoms in the Trainer Guide to help identify the different pests and diseases.

For late blight, encourage the participants to look out for leaves or stems with grey/brown/black spots (as if they were burned), yellowing at the edges and white fluffy mycelium strands at the undersides of the leaves.

For identifying the mosaic virus, pass a piece of white paper under a leaf with the suspected symptom. Diseased leaflets will appear translucent and yellowish whereas healthy ones remain opaque and dark green. This test is best done in full sunlight.

To accurately identify bacterial wilt, identify a wilting plant and check if the stems are not cut. If the stems are cut, wilting is not caused by bacterial wilt. In that case, identify another wilting plant. Explain to the participants that a plant infected by bacterial wilt can recover from wilting at early stages of the disease but stops recovering later. Also, a plant that is wilting because of bacterial wilt remains green and doesn't yellow.

An advanced method of detecting bacterial wilt is the glass jar test. Uproot a wilting plant and cut a small piece of the stem base (e.g., 5 cm long) using a sharp knife. Hold the piece of stem base with the hand or the tip of the knife partially immersing it in a glass of clear water. Hold still and wait approximately 2 minutes. If the bacteria ooze out of the end of the stem and move downward like a white smoke it means that the plant is infected by bacterial wilt as there is no other disease known to cause this phenomenon. However, explain to the participants that not all stems infected with bacterial will necessarily ooze.

01

Identify a wilting plant



02

Check that the plant stems are not cut



03

Uproot a stem



04

Cut off a piece of stem base



05

Immerse the stem base into water



06

Hold still and observe if the bacteria ooze out of the end of the stem



Figure 3. Glass test for identification of bacterial wilt.

Demo 1.4

Roguing

What?

Removal of unwanted plants.

Why?

Maintain a high-quality, disease-free crop.

When?

To be combined with the identification of pests and diseases (Demo 1.3).

For how long?

10 minutes.

With what?

- 1 normal hoe,
- 1 bucket/basket or any other container that does not permit soil to leak, and
- 1 peg (1.5 m long).

How?

Discuss with the participants that there are four types of plants to be rogued:

1. plants that didn't recover from wilting after about 8-10 days (bacterial wilt or soft rot), 2. plants having crinkling leaves and/or severe stunting (virus), 3. volunteer plants growing from left-over tubers from past seasons, and 4. off-types caused by varietal mixture at planting. Try to identify plants for each of these types.

Field inspection works well when done early morning, while walking away from the sun for better identification of abnormal plants. It is not recommended to inspect the field in the afternoon as the leaves may naturally appear wilting without any diseases.

When a plant is identified for roguing, uproot the entire plant along with the soil in which it was planted (all foliage, roots, tubers and soil). Take it out of the field and throw it into a deep pit. If possible, burn the plant in the pit. In case there is no pit available for disposal of diseased plants, ensure that the plant and soil are put in a place where there is no risk of contaminating agricultural land, including your neighbours' fields.

01

Identify a wilting plant



02

Uproot the plant and dig out the soil around it



03

Take the foliage, roots, tubers and soil out of the field



Figure 4. Good practices for roguing plants with bacterial wilt.

Demo 1.5

Dehauling

What?

Removing or destroying the potato foliage before its natural death.

Why?

To ensure that high quality seed tubers are harvested and that they maintain quality after storage.

When?

Two weeks before harvest, when the foliage begins to turn yellow in the plot that was established with quality seed.

For how long?

30 minutes.

With what?

➤ 1 sickle or machete.

How?

This demo is done in the plot with good quality seed.

Smallholder farmers may dehaulm using tools such as a sickle. Others pull out the potato plant while stepping around its base to prevent tubers from coming out as well. Tubers remain in the soil while the potato foliage is removed from the field. Since the field trial aims at comparing yields, do the practice on a small corner of the plot. To do this, invite each participant to pull out a plant and then cut a second plant with a sickle. For a fair comparison of yields between the two plots, ask the participants to do the same in the second plot. This means that they must dehaulm the same number of plants in both plots. Discuss the difference between the two dehauling techniques, noting that dehauling with a sickle has the risk of transmitting bacterial wilt and other diseases to the seed tubers.

01

Dehaulming with a sickle (Method 1)



02

Dehaulming by hand (Method 2)



Figure 5. Two methods used by farmers for dehaulming.

Demo 1.6

Harvesting and grading

What?

Harvesting the trial.

Why?

Comparison of yields obtained.

When?

Just after total death of the foliage or two weeks after dehaulming.

For how long?

180 minutes.

With what?

- 50 empty bags, size for 50 kg,
- 1 weighing scale with a capacity of 100 kg,
- 1 potato grading device (hole diameters: 30 and 55 mm),
- 2-3 hoes, and
- 50 small pegs (30 cm long)

How?

Before organizing a demo on harvesting, make sure it is not going to rain. In this session, potato tubers will be harvested in the two trial plots, starting with the one planted with high-quality seeds. Harvest the plants by hand, one by one. If the soil is too hard, use a hoe to loosen it. Be very careful when loosening the soil and lifting the tubers to avoid damaging the potatoes with the hoe.

Once the tubers are dug up, leave them on the ground to dry a bit. Tubers from diseased plants must be harvested last and kept aside. These tubers should be destroyed or used for consumption, but not be used for seed.

To take yield data, collect all tubers from healthy plants and separate them into two main groups according to size: marketable tubers (≥ 30 mm in diameter) and non-marketable tubers (the rest). Then separate the tubers in the first group into two subgroups: a 30-55 mm size and the larger tubers that are normally appreciated for processing. Count and weigh the tubers to determine the total number and total weight of each of the three categories. Use this information from both plots to make a comparative analysis of tuber yields and quality.

Before leaving the field, collect and remove all crop residues, including rotten foliage and tubers. This creates good conditions for planting the following crop by preventing pests and diseases to remain in the field.

01

Harvest manually



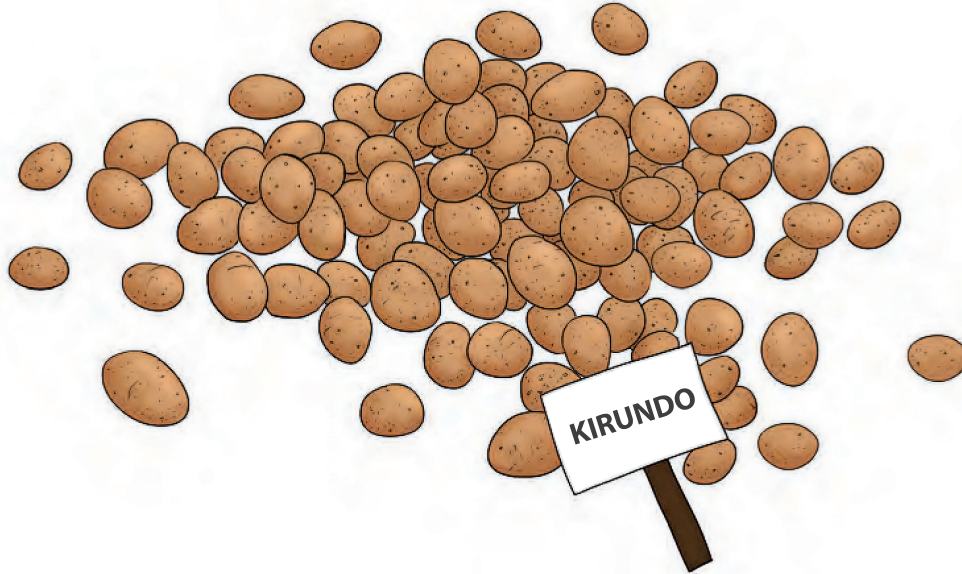
02

Leave the tubers on the ground



03

Gather tubers in piles

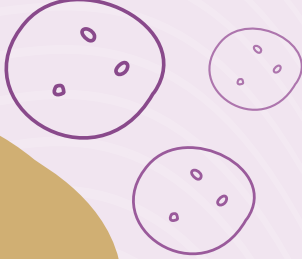


04

Counting and weighing tubers



Figure 6. Harvesting and grading.



DEMO 2

POSITIVE SELECTION

POSITIVE SELECTION

What?

Selecting the best-looking plants for harvesting tubers to be used as seed in the next season.

Why?

Appropriate technique when farmer cannot access high-quality seed and needs to use seeds produced on-farm.

When?

From 6-7 weeks after plant emergence (can be continued until harvest).

For how long?

60 minutes.

With what?

➤ Many pegs (at least one per participant).

How?

Positive selection, also known as “Select the best”, means selecting healthy looking plants as mother plants for seed potatoes. Some potato diseases, like bacterial wilt and viruses, go from the plant to the tubers. If these tubers are planted again, they will produce a sick plant. Often farmers select seed from their own potato crop, mixing sick and healthy tubers. By pegging plants without disease symptoms for seed selection, the number of sick plants in the next crop can be reduced.

Positive selection is normally carried out throughout the season, including harvest and storage. This demo is meant to train participants on how to identify the best plants in the field.

Well before the demo, ask participants to look for a bad looking potato field in their village that is at the stage of 6-7 weeks after plant emergence. Then, use that field for the demo. During the demo, invite participants one after the other to inspect the entire field carefully to identify the best plants. This implies that you remind the participants about the main characteristics of healthy plant, namely the large size (according to the variety), high number of stems with good vigor, dark green leaves as well as the absence of diseases. Ask the participants to mark the best plants using the pegs. The pegs should remain in the field until harvest so that the best plants can be identified at harvest.

If possible, ask the field owner to pay special attention to these plants until harvest. This will allow the owner to harvest better quality seeds compared to what he had planted. At harvest time, the selected plants should be harvested first before harvesting the other potatoes. It is also important to inform the owner to select the best tubers at harvest for seed, which are large tubers that are more likely not to contain diseases.

01

Inspect the field and identify the best-looking plants

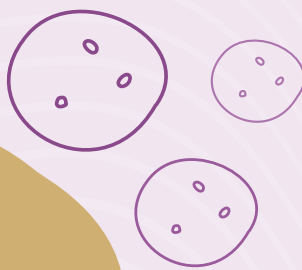


02

Use pegs to mark the best plants



Figure 7. How to select the best plants.



DEMO 3

SMALL SEED PLOT TECHNIQUE

SMALL SEED PLOT TECHNIQUE

What?

Small seed plot technique for on-farm bulking of high-quality seed sourced from trusted seed producers.

Why?

Get a sufficient quantity of good-quality seeds at a lower cost.

When?

Throughout the season.

With what?

For how long?

60 minutes.

- 200 medium sized seed tubers (less than 40 mm in diameter) of high quality, purchased from a trusted seed producer,
- 40 kg of manure or compost,
- Mineral fertilisers (1 kg of NPK 17-17-17),
- Fungicides (see Trainer Guides),
- Insecticides (see Trainer Guides),
- 1 measuring tape,
- 1 rope for delimitation of plots,
- 5 hoes,
- Wooden boards/pieces of timber, and
- 2 shovels.

How?

The small seed plot technique provides an opportunity to increase the farmer's seed stock by purchasing small quantities of high-quality seed and multiplying it in the cleanest part of the land to get a higher quantity of better quality seed for use in the following season.

The small seed plot technique is a triple-clean technology (clean seeds, clean soil and clean agricultural practices) carried out on a small plot of land.

Tools like hoes used to establish and plant the plot should be disinfected before use with fire or disinfectant like Jik.

The size of the seed plot will be determined by the expected area under production in the coming season and/or the amount of quality seed a farmer can afford to purchase. The seed plots should be made on raised beds of 15 cm high and with a width of 1.5 m for easy operations from the side of the bed without entering the plot.

For demonstration, select and prepare a 12 m x 4 m area where potato or another crop from the same family has never been grown or at least not for

the last 5 seasons. Choose a site that is not downstream of other potato fields that could be a source of contamination through runoff water.

After a deep plough, delimit a small plot of land in the middle measuring 9 m x 1.5 m. Clear this plot to a depth of 15 cm by setting the soil aside. Then spread the manure or compost and mineral fertilizers in the plot. Refill the plot with the dug soil cleared from the plot. Then draw planting lines at a regular interval of 30 cm and make small holes about 10-15 cm deep on the lines at a regular spacing of 25 cm. Use small sticks or the end of a hoe handle to dig these holes. In principle, the entire plot will need 180 tubers, corresponding to the number of holes dug. Use the same stick, hoe handles, or hands to cover the tubers with soil.

Since it is not possible to make ridges as it is done in normal fields, hilling-up is done by hand by adding clean soil from the area around the plot. The plot should be raised above the ground surface from the time of planting. This can be aided by wooden boards or pieces of timber. As you hill up with more soil, protect the edges to maintain the top of the plot at a higher level than the ground surface (more than 15 cm).

After the plants have emerged, maintain the plot as you do in a normal field, whether it is for disease and pest control, top dressing or other good agricultural practices. It is extremely important to take precautions to prevent any entry of diseases and pests into the plot, including the use of clean agricultural tools.

Exercise to determine the size of the small seed plot

This additional exercise can be done together with participants after demonstrating the small seed plot technique. The size of the seed plot will depend on the quantity of seeds needed for the area expected to be under production in the coming season.

The seed requirement for a certain land size depends on the preferred spacing and seed size. An average sized seed tuber weighs 50 g/tuber. With a planting distance of 80 x 30 cm and seed tubers of around 50 g (0.05 kg) per tuber, about 4000 tubers are required for 10 are (1000 square meters). Assuming a multiplication rate of 10, 400 tubers need to be planted in the small seed plot to harvest enough seed for 10 are (1000 square meters). If using average sized seed tubers to plant the small seed plot, $(400 \times 0.05 \text{ kg}) = 20 \text{ kg}$ of

seed sourced from a trusted seed producer will be needed.

400 tubers planted in a small seed plot with a spacing of 30 x 25 cm will require $(0.075 \times 400) = 30$ square meters. Hence, the length of the seed plot should be $(30 / 1.5 \text{ m}) = 20 \text{ m}$. Of course, this total length can be achieved by planting several shorter small seed plots of 1.5 m width, for instance 2 small seed plots with a width of 1.5 m and a length of 10 m each.

First, above calculation can be demonstrated in group for a seed plot established to produce seeds for an area of 10 are (1000 square meters) under production the coming season. Then, participants should each get a piece of paper and pen and practice the same calculation for a land size of their choice.

01

Delimit the plot



02

Dig out the plot



03

Weigh manure and fertilizers



04

Spread the manure



05

Spread the fertilizers



06

Refill the plot with soil



07

Mark the planting lines



08

Draw the lines



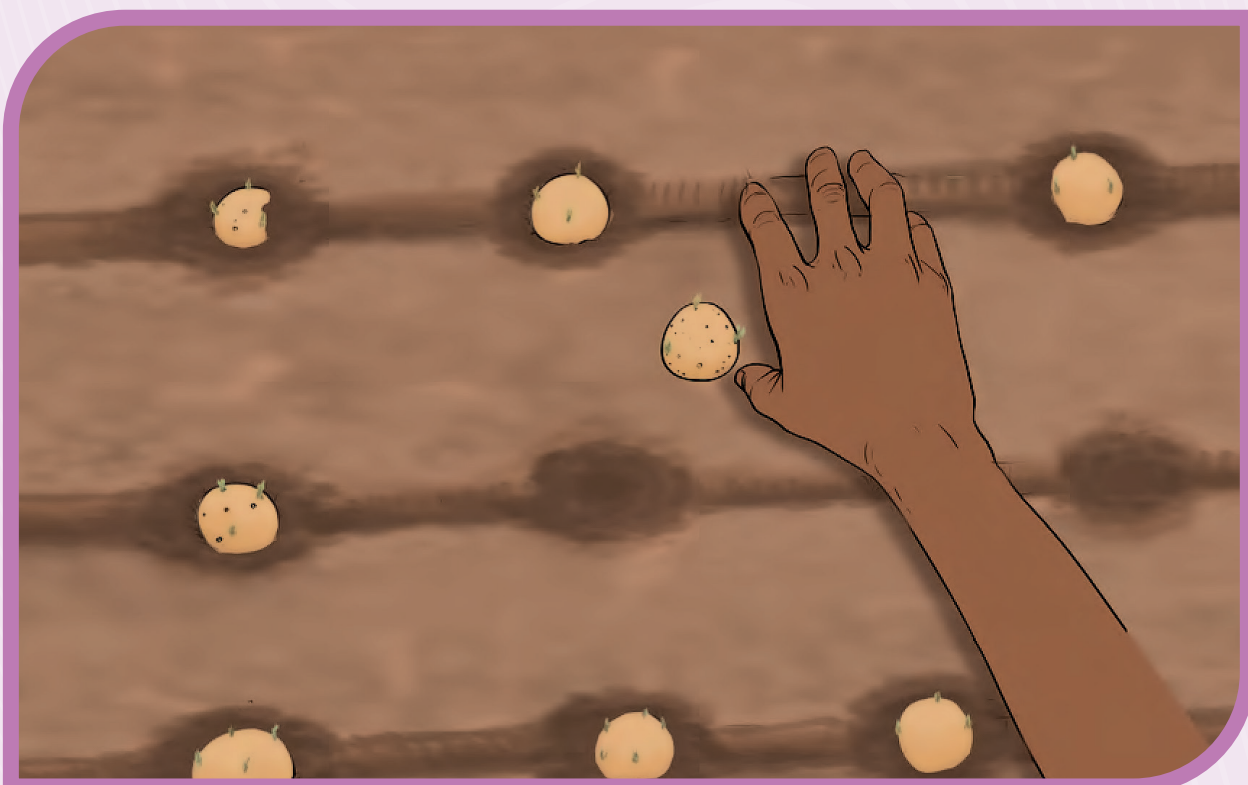
09

Make holes for planting



10

Drop seed tubers into the holes



11

Cover tubers well with soil

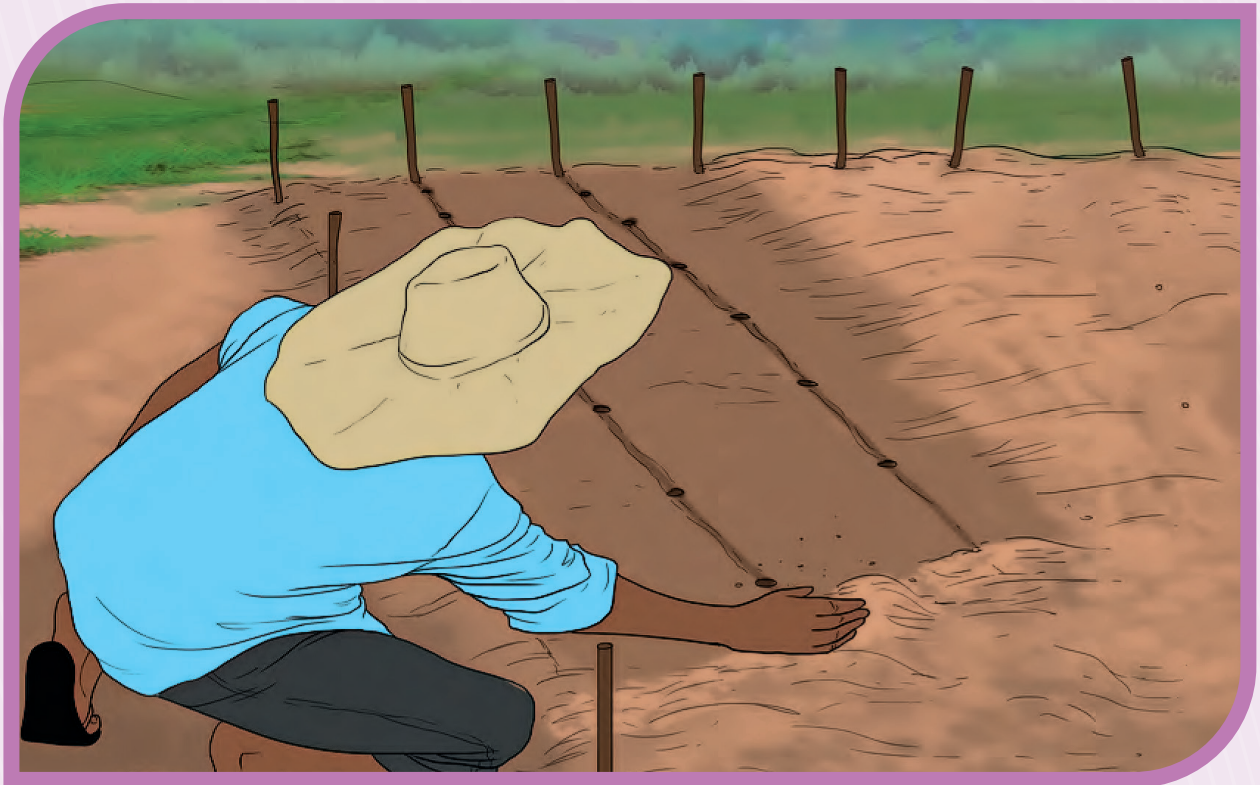


Figure 8. Steps for setting up a small seed plot.

