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This publication is an adaptation of a brochure published by the SASHA project led by CIP in Sub-Saharan Africa. We are grateful to our colleagues for making their original material available. The following individuals have made intellectual contributions for adapting this brochure.

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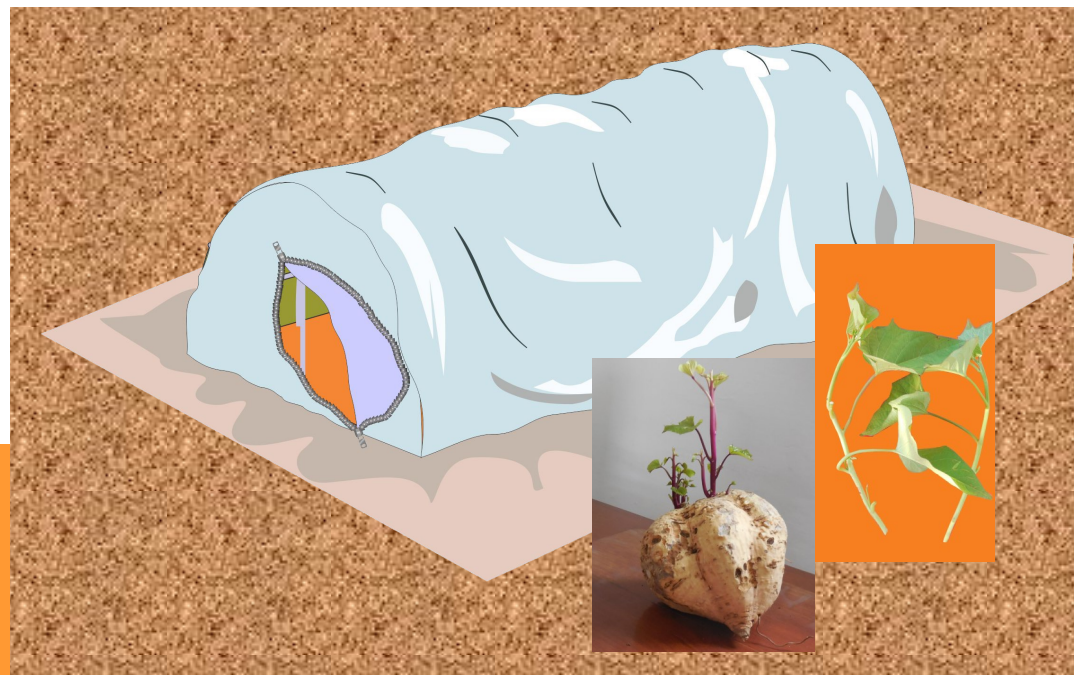
Food Resilience through Root and Tuber Crops in Upland and Coastal Communities of the Asia-Pacific (FoodSTART+) is a three-year project (2015-2018) that builds on and expands the scope of the recently-concluded IFAD-supported Food Security Through Asian Root and Tuber Crops (FoodSTART) project. It is coordinated by the International Potato Center (CIP), in collaboration with the International Center for Tropical Agriculture (CIAT) in Asia. The project is also working closely with the CGIAR Research Program on Roots, Tubers and Bananas (RTB); and the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). It is funded by the International Fund for Agricultural Development (IFAD) and the European Union (EU).

The project aims to enhance food resilience among poor households in upland and coastal communities of the Asia-Pacific region through introducing root and tuber crops (RTC) innovations. To achieve this goal at scale, the project will develop, validate and implement effective partnership strategies with IFAD investment projects to promote RTCs for food security.

FoodSTART+ is being implemented in four primary beneficiary countries; specifically Meghalaya State in India, Maluku Islands in Indonesia, Easter and Central Visayas Regions in the Philippines, Quảng Bình Province in Central Vietnam. Supplementary beneficiary countries are China and Myanmar.



Net Tunnel to Protect Sweetpotato Vine Cuttings from Pest and Disease



With financial support from



High quality sweetpotato planting material production

One of the major yield-limiting factors of sweetpotato production is the poor quality of planting material used by small-scale farmers. Farmers often use vine cuttings from previous sweetpotato crop as source of planting material, particularly in regions where the climate is suitable to year-round growth of vines. This practice results in replanting cuttings infected with pathogens such as viruses, bacteria and fungi, leading to the buildup of diseases in sweetpotato plants over seasons. Low yield and pest problem result in limited marketable storage roots and a stigma for low quality. Positive selection, where good roots from the best plants are obtained and allowed to sprout, can improve the quality of planting material for the subsequent cropping.

The International Potato Center (CIP) has identified the introduction of small net tunnels where cuttings are produced by the sprouting of storage roots as a potential low-cost way to increase farmer access to quality, disease-free (“clean”) planting material of sweetpotato. In fact, regular reverting to storage roots every 2-3 generations will have a regenerative effect on the planting material. This brochure, produced by the CIP-led FoodSTART+ project, provides detailed instructions on how to construct the net tunnel and properly manage storage root sprouts.

Materials required for constructing the net tunnel

The dimensions of the net tunnel are:

Length : 6 meters (m)
Width : 3.5 m
Height : 1.9 m

Material required for the net tunnel:

- White 40-mesh size insect proof netting material: one sheet sized 6.1 m x 6.2 m (for the top and long sides); and three sheets sized 3.7 m x 2 m (one sheet of netting with two zipper sliders for covering the front door, one sheet with one zipper slider for covering

second door, and one piece without zipper for covering the back end). The total amount of netting per net tunnel is 60 m²;

- 22 PVC water pipes (standard 4 m long and 1 inch diameter);
- 2 plastic zippers (1 with one slider, 1 with two sliders for placing a padlock);
- ¼ kg steel binding wire;
- 3 T-type PVC connectors and 9 Shock-Type PVC connectors (1 inch diameter);
- 1 plastic pipe glue;
- 17 bamboo sticks with 0.5 m length for fitting the hoops;
- 2 pieces 6 m wood poles; and
- 2 pieces 3.5 m wood poles.



T PVC Connector
1 inch diameter, 11.5 cm length



Shock PVC Connector
1 inch diameter, 9 cm length

Selecting the site for constructing the net tunnel

The net tunnel should be built on fertile, easy-to-work, well-drained soil, exposed to full sunlight, near an accessible perennial source of water, and safe from animals' destruction. Avoid sites prone to flooding or waterlogging and old sweetpotato fields as these are potential sources of diseases and pests.

Constructing the net tunnel frame and seedbeds

Cut 14 PVC water pipes in 3 m length. Connect them to form 7 pipes (6 m long each) by using 4 Shock connectors and 3 T-type connectors (the latter for accommodating the posts of the two doors and back end). Each connection should be glued (see Figure 1). As shown in the picture, the distance between hoops on the sides should be 1 m. All hoops base are fitted into vertical footing bamboo sticks inserted 20 cm inside the soil to increase stability.

Connect 4 m long pipes with 2 m pipes to form 5 pipes (6 m long each) which will be placed on top and on the sides of the hoops and tied to them using steel wire. Left over pipes will be connected using the pipe glue to form 3 vertical poles of 2.2 m length (for doors and back end).

The net tunnel accommodates two 4 m x 1 m seedbeds spaced out by 0.5 meter from each other to ease planting, weeding, fertilizer application, and harvesting. The seedbed is raised about 20 cm above ground level and surrounded by cement bricks pushed into the ground about 5 cm deep. Apply well-decomposed farmyard manure at a rate of 1-1.5 kilogram per square meter, or NPK (17-17-17) at the rate of 42 grams (g) per square meter – mix these thoroughly with soil before planting.

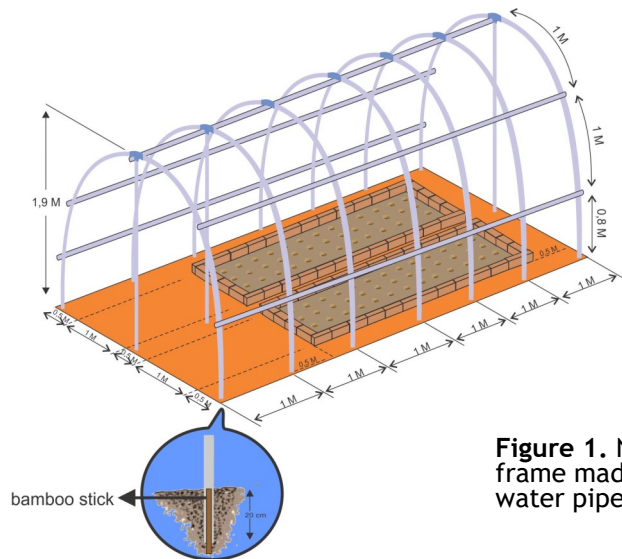


Figure 1. Net tunnel frame made with PVC water pipes.

Covering the net tunnel with the netting

The hoops are covered with the netting along the top and sides (6.1 m x 6.2 m) and fixed with steel wire (Figure 2). Cut the netting to have an extra 20 cm extension which will reach the ground on all sides. A zipper with two sliders is installed on the front end door and other zipper on second door using a sewing machine. Fix the front, second, and back netting sheets to the frame with steel wire. On each side, where the netting touches the ground, place the two 6 m wood poles along the length of each side, and two 3.5 m wood poles for the back and front end then cover it with the soil.

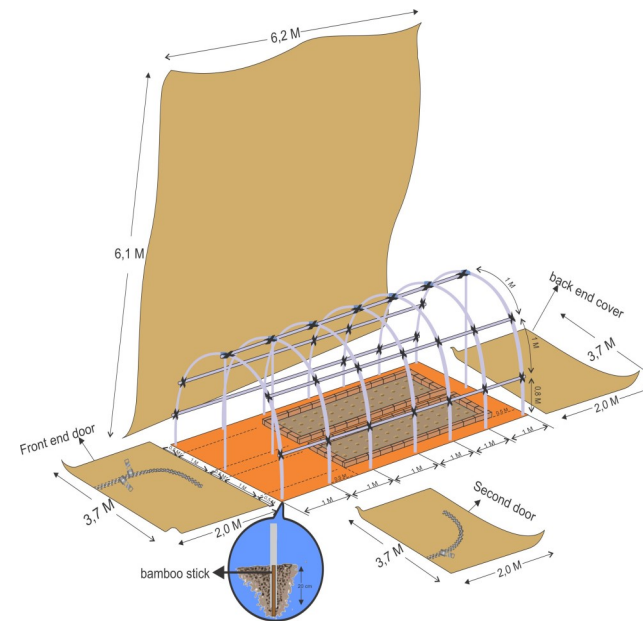


Figure 2. Netting requirement for net tunnel

Sourcing and preparing the storage roots

Storage roots should be selected from healthy, high-yielding plants in the sweetpotato fields. Storage roots should be well-shaped and will not show obvious disease symptoms. It is also important to have uniformity of root shape and size.



Medium-size roots, about 200-300 grams in weight, are preferred over small as they are more likely to be free from weevil damage (Figure 3). The storage roots are gently washed to remove any excess soil then they are left to dry at room temperature prior to planting.

Figure 3. Storage root selected from high-yielding plants

Planting inside the net tunnel

Planting distance between storage roots is 10 centimeters (cm) on the same row (Figure 4). Roots can be arranged either parallel or perpendicular to the direction of the bed. Distance between rows is 20 cm. This should accommodate 5 rows with 10 roots per row in a square meter, resulting to 50 storage roots per square meter. Storage roots should be covered as evenly as possible, with 5-10 cm of soil. Note that more than 10 cm of soil cover may slow down or even prevent the growth of sprouts. Furthermore, it has been observed that there is increased disease incidence in roots buried too deep. Water immediately after planting to moisten the soil. An adequate moisture supply is important to promote rapid and uniform establishment.

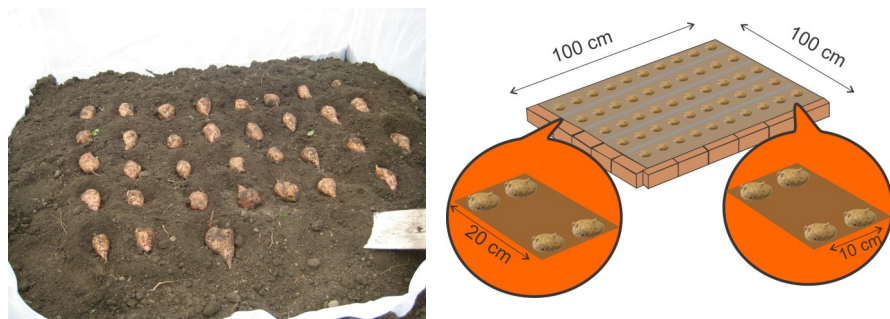


Figure 4. Storage roots are planted in seedbeds under the net tunnel

Cultural management practices of the seedbeds

An integrated control strategy for effective seedbeds management includes:

- Preparing seedbeds where the soil is fine and without lumps.
- Applying and incorporating farmyard manure or compost (2.5 kilogram per square meter) into the seedbed before each planting.
- Removing weeds around the seedbed, since weeds serve as hosts for insects and to avoid competition for water and nutrient.
- Irrigating twice a day (early morning and late afternoon). Note that watering is not necessary when it is raining to avoid waterlogged conditions caused by excessive watering.
- Ensuring that the beds do not become dry, especially during the first five days after planting.
- Labeling each bed with the name of the variety and date of planting.

Harvesting of cuttings from the net tunnel

The vine cuttings obtained depend on the multiplication rates that vary according to the variety, management practices and agro-ecological conditions. Sprouts begin to appear within 4-6 weeks after planting, and harvesting of cuttings is done when the sprouts are 25 cm to 30 cm long. Second harvest can be done 15 days after the first. Each storage root can produce up to 15 sprouts in total (Figure 5).

By planting 400 storage roots in the two seedbeds, 1,200 cuttings can be harvested within 6-8 weeks from the time of planting. This amount is based on the assumption that each root produces at least 3 sprouts.

Suggested period of vine cutting:

- First harvest at 6-8 weeks after planting, cut three longest sprouts.
- Second harvest at 10-15 days after first harvest, cut three longest sprouts.
- Subsequent harvest — cut sprouts every 10-15 days until the last harvest.

- Urea is applied at the rate of 13 grams per square meter after each cutting.
- It is suggested to apply chili insecticide to control aphids, white-flies, caterpillars, ring spot virus as soon as symptoms appear.



Figure 5. Storage roots are planted in seedbeds under the net tunnel

Net tunnel repairs

From time-to-time, the net tunnel will need repair. This can be done as follows:

- Check the net tunnel regularly (at least once per week) to identify any holes and problems. It only takes a small hole for aphids or white flies to enter.
- Use a normal needle and thread used for shoe repair to sew up a damaged net. This can be combined with a small piece of net, cut carefully from the edges of the existing net or sourced from elsewhere.
- Keep the door closed and keep entry to a minimum. Always be careful when opening the netting, so as not to damage it.
- Apply pesticide after repairing the net.

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