



**WORLD COFFEE
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GRAFTING ROBUSTA

Nursery training manual and best practices guide



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Glossary of terms

Cambium

A cellular plant tissue from which phloem, xylem, or cork grows by division, resulting in secondary thickening (in woody plants).

Graft

A shoot or twig inserted into the slit on a trunk or stem of a living plant, from which it receives nutrients, used for vegetative propagation.

Rootstock

In grafting, a rootstock is the base element provided by the plant, in the stem, and the root system.

Scion

The upper fragment of a plant used in grafting that provides genetic material. The graft often overlaps the scion.

Objective

This guide intends to instruct coffee producers, nursery operators, and other professionals in the process of grafting robusta plants, including its benefits, risks, requirements, and best practices. In addition, this guide provides an outline of a training procedure to be used in workshops and a step-by-step process that individuals can follow when grafting their own plants. With the assistance of this guide, participants should be able to practice the grafting process, hone their skills, connect the shoots of coffee plants properly, and maintain the health of the new plants generated.

Robusta coffee grafting training procedure

Objective: This is an outline of a training procedure that can be used for training farmers or nurseries in grafting procedures. After practicing this technique, participants will be able to “top graft” coffee plants properly and correctly.

Description and outline of activities for training:

1. Preparation and stretching (10 minutes)
2. Explain training objectives & background (15 minutes)
3. Explain the tools and materials used (10 minutes)
4. Explain the meaning of grafting & the purpose of it (10 minutes)
5. Explain the rootstock splitting technique (10 minutes)
6. Participants practice how to split rootstock (20 minutes)
7. Explain the technique of selecting and preparing/ sharpening the scion (10 minutes)
8. Participants practice how to pick and sharpen the stem (30 minutes)
9. Explain how to graft (10 minutes)
10. Participants practice how to graft (30 minutes)
11. Opportunity for participants to ask questions (10 minutes)
12. Participants practice together (45 minutes)
13. Activity evaluation (15 minutes)
14. Conclusion & closing (5 minutes)

Total training time: 230 minutes

Grafting: what is it and how does it work?

Grafting is one of the vegetative propagation techniques used to support plant growth and health. When grafting is successful, farmers can connect rootstock and scion from different plants, combining the desirable characteristics from each to create a new plant generated from an orthotropic branch.



Rootstock



Scion

Typically, **rootstock**, which forms the root of a grafted plant, is selected for its strength, widespread adaptability, and capacity to survive under the stress of certain biotic and abiotic conditions, and **scions**, which are used as a connection to the rootstock, are selected from parent trees that are in good health and of high yield or high quality.

With this, there are many benefits to be realized through grafting, including the ultimate production of stronger plants that are more resistant to unfavorable soil conditions, rising temperatures, drought stress, or other disturbances, such as root pests like nematodes. In addition, grafting can help accelerate plant production and time to fruiting, which can support farmers in realizing higher yields in shorter periods of time than possible through standard practices.

Benefits and risks of grafting

Before deciding to implement grafting in an on-farm or nursery environment, it is important to understand the various benefits and risks associated with this technique. The benefits and risks of grafting for plant propagation are as follows:

Benefits

- **Improved plant quality and adaptability:** Grafting can produce stronger plants, as rootstock is selected for its ability to survive biotic and abiotic conditions (i.e., being resistant to unfavorable soil conditions, pests, or disease, and temperatures, drought, or climatic shifts, respectively). Therefore, this practice offers farmers the ability to improve upon poor-quality plants and achieve a more desired or superior species or variety.
- **Improved yield and early fruiting:** Grafting can increase coffee tree productivity and yield. It can also accelerate the onset of fruiting in coffee trees. This can be particularly useful for growers who want to start harvesting sooner, those who need to rejuvenate old growth with minimal productivity loss, or those who seek to yield more coffee cherries per tree.
- **Consistency:** Grafting trees can produce more consistent and uniform crops compared to non-grafted trees.

Risks

- **Potential for destabilization:** If scions are large, grafts can be easily damaged by movement from strong winds.
- **Success contingency:** The success rate of grafts is generally low if there is no match between scion and rootstock.
- **Skills requirement:** Making a connection via grafting requires special skills and training, and therefore the margin for error is relatively high.

Getting started

Grafting on robusta plants is typically performed on what are considered “mature” plants (in comparison to arabica plants, which are usually only grafted upon as young, germinated seedlings). Developed robusta seedlings **5-6 months and older are considered mature** and are ready to be used as **rootstock** in grafting. With this age requirement in mind, it is important to note that older robusta plants in the field can also be grafted upon with the intent of rejuvenation. Therefore, the size of rootstock may vary, but should at the very least have a diameter the size of a standard pencil. **The scion** selected should match the rootstock in size, but not necessarily in age.



Tools and materials needed

Materials

- Scion (orthotropic)
- Rootstock
- Plastic tape or wrap
- Plastic bag
- Alcohol or other disinfectant
- Water

Tools

- Grafting knife
- Pruning shears



Various materials & tools needed, from left to right: pruning shears, grafting knife, plastic bags, alcohol (70%), and plastic tie (rope or tape)



Ideal rootstock



Ideal scion

Rootstock and scion requirements

It is recommended that you use rootstock and scion of high quality to increase the likelihood that your graft is successful. The requirements for rootstock and scion are as follows:

Rootstock requirements

- Widespread adaptability, meaning that the plant is compatible with various varieties. You may be able to find this information via local sources, such as national coffee research institutes or non-government organizations.
- Robust roots and resistance to pests and diseases.
- Strong stem.

Scion requirements

- Sourced from a tree that is in good health and free from pests and diseases.
- Straight in shape with a diameter equal to or smaller than the diameter of the rootstock (the largest possible diameter is 1 centimeter).
- Branches sourced from the parent tree for its desirable traits (for example, with high yield and/or high quality).
- Ability to adapt to the rootstock so the connection is successful.

Best practices for grafting

Follow these best practices when performing the grafting process to ensure success:

- The knife and scissors that you utilize for grafting must be disinfected, sharp, and without rust. This will ensure that the graft is not infected by bacteria or other unwanted diseases/pests.
- Grafting should be done as quickly as possible while minimizing repeated incisions.
- Grafting materials and resulting grafts should be kept in a moist state so they do not dry out.
- Grafts should not be exposed to direct sunlight or rain.

How to graft Robusta plants

Here is the step-by-step process to follow when grafting robusta plants:



Step 1

Wash your hands thoroughly using soap and water. Disinfect your tools (pruning shears and grafting knife) using alcohol or another disinfectant.

Step 2

Select a rootstock with at least a diameter the size of a standard pencil.



Step 3

With your grafting knife, make a cut to the rootstock approximately 15–30 centimeters from the soil surface.



Step 4

Split the rootstock down the center at a length of approximately 2–2.5 centimeters with your grafting knife.



Step 5

Select your scion. To prepare it, take the stems along 1 segment, and use your pruning shears to remove the leaves until only 1–2 centimeters remain. Then, use your grafting knife to make a shallow, angled cut (approximately 15–30°) into the stem on either side to expose the cambium (the tissue).



Step 6

Insert the scion into the rootstock carefully.



Step 7

Tightly tie the connection with a plastic tie (rope or tape), using several layers of material to stabilize and protect it.



Step 8

Cover the connection with a transparent plastic bag and tie it securely. Place the plant under the shade. Water the plant frequently in small volumes on a regular basis. Note that plants should never be allowed to completely dry. Once the plant has 2–3 pairs of leaves, you may begin to fertilize accordingly.



Grafting maintenance and indicators of success

Here are some indicators of success to look for and best practices for maintaining your graft over time so the connection will hold and generate a new, healthy plant:



Adhered cambium

Indicators of success

- The scion should be of high quality, fresh, and brownish-green in color.
- The cambium must adhere tightly to each other, at least on one side.

Maintenance practices

- After the scion shoots out with a shoot height of +3 centimeters, the plastic cover should be opened to ensure the newly grown shoots do not overheat.

- Keep the rootstock in moist conditions, and make sure to water if the rootstock begins to look dry.

- When the graft has sprouted and the cambium is united between the rootstock and the scion (this will usually occur within 20–30 days from grafting), remove the bonding tape.

- Remove unwanted shoots that grow on the root stock, as these waste nutrients and burden the plant. Be careful as the rootstock shoots grow faster than that of the upper scion.

- Prop up the grafted plant if it's not strong enough to support itself.

- Maintenance of grafted plants should continue throughout its lifecycle.



Successfully grafted Robusta plant



Examples of failed grafts

L: Scion has died

R: Scion has died, new growth is coming from rootstock



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