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ECHO Development Notes



HARVESTING AND DRYING CONSIDERATIONS FOR QUALITY MORINGA LEAF POWDER

The ability to store moringa powder allows people to benefit from moringa during times such as the dry season when moringa trees are less productive.



OPTIONS FOR SNAIL CONTROL

ECHO's agricultural staff often receive questions about ways to control snails naturally. This article shares some practical, low-resource options for control from OISAT and two ECHO Network Members.



JUTE MALLOW 'THAI'

*Jute mallow (*Corchorus olitorius*) is used for fiber but is also an edible annual leafy green. The 'Thai' variety is shorter, has more branching, and has more tender, smaller leaves compared to varieties used primarily for fiber.*



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Dear Reader,

As editors, we are grateful for your faithful readership of ECHO Development Notes (EDN) over the years. As agricultural technicians, we are grateful for your perspectives, experience, and interests which drive us to deliver you content that will help you in your work with smallholder farmers. As ECHO has gone through recent growth and change, we have made the decision to increase the frequency of EDN releases and incorporate more articles from ECHO's various Regional Impact Centers. You will no longer receive Regional Development Notes (such as ECHO Asia Notes) if you signed up for these, but instead will be receiving EDN every two months. All future issues of EDN starting with this issue will include at least one article contributed directly from ECHO's Regional Impact Centers. Please email publishing@echocommunity.org with any questions or comments.



Harvesting and Drying Considerations for Quality Moringa Leaf Powder

by Tim Motis



Figure 1. Moringa leaf powder.
Source: Tim Motis

What is moringa leaf powder?

Moringa oleifera is a fast-growing, tropical tree known for its nutritious leaves, eaten raw, cooked, or dried and ground into powder (Figure 1). Here we'll focus on moringa leaf ¹ powder, which is easy to store and add to foods. The ability to store moringa powder allows people to benefit from moringa during times such as the dry season when moringa trees are less productive. Added in modest amounts, moringa powder does not appreciably alter the taste of the food and is an excellent way to boost the nutrition of local dishes. Questions arise about how best to process the leaves for quality moringa powder. This article expands on an earlier ECHO publication (Doerr and Cameron, 2005), summarizing factors before and during drying that influence the quality of moringa leaf powder. It also discusses drying methods and practical ways to optimize post-harvest processing for improved nutritional quality.

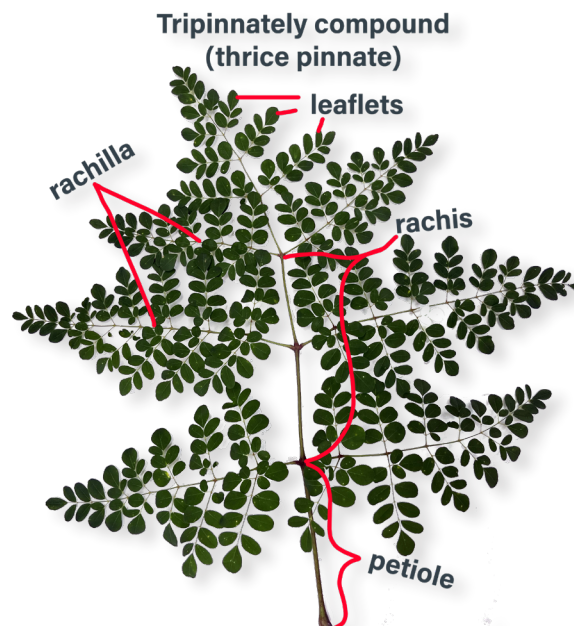






Figure 2. Diagram illustrating parts of a moringa leaf. Source: Tim Motis and Stacy Swartz

¹ A moringa leaf consists of many leaflets attached to branching petiole structures shown in figure 2. For reasons explained later, moringa powder should be comprised mainly of the leaflets, excluding the more fibrous petiole tissue as much as possible. In making moringa powder, we are technically drying the leaflets. For simplicity, in this article we describe moringa powder as "moringa leaf powder" and use the term "leaves" in discussing drying factors and methods.

How are moringa leaves prepared for drying?

Moringa leaves need to be dried before converting them into powder. Wearing gloves while handling leaves is good practice for producing clean moringa powder. Sanitation is especially important if you are

Table 1. Steps in gathering and preparing moringa leaves for drying. Photos by Tim Motis

1		<p>Harvest the leaves using hygienic practices. Wash your hands before harvesting the leaves. Leaf handling during the next steps is easiest if you harvest them in bundles with stem ends all together on one end of each bundle. The stem ends then serve as a handle by which you can grasp each bundle.</p>
2		<p>Wash the leaves. Fill a clean bucket or trough with clean water. Submerge the leaves in the water, swishing them around in the water to wash off dust and debris. Empty the water and wash the leaves once or twice more. If your water is chlorinated, the chlorine will act as a disinfectant to reduce germs. An alternative to chlorine is a 3-to-5-minute dip of the leaves into a 1% salt solution (Sauveur and Broin, 2010).</p>
3		<p>Remove water droplets off the leaves. Grasp a bundle of leaves by the stem ends and shake the water off with a downward swooping motion. You could then spread the leaves out on a cloth or towel to absorb more water. Alternatively, place the leaves in a strainer and allow excess water to drain off the leaves.</p>
4		<p>Strip leaflets from the petiole. Nutrients tend to be more concentrated in the leaflets (Anjorin <i>et al.</i>, 2010; Osumah, 2019) than in the leafstalk (petiole) tissues that leaflets are attached to. It may not be practical to remove individual leaflets but exclude as much leafstalk tissue as you can. Strip the leaves using a grasping and pulling motion. Exclude most of the fibrous leafstalk tissue by stripping leaves off individual “branches” of compound leaves. Leaflets will be easiest to remove if done right away after washing.</p>

producing moringa powder for others. If you are producing moringa powder for a business, be aware of required practices and standards for acceptable quality. Table 1 covers the basic steps to harvest, wash, and prepare moringa leaves for drying.

Here [<http://edn.link/9eh4c4>] is a brief video illustrating how to harvest a moringa leaf from a branch, remove leaflets, and place leaflets on a drying screen.

The rest of this article will focus on drying factors and methods.

What factors should I be aware of in drying moringa leaves?

Air circulation

Air circulation facilitates drying and prevents moist conditions conducive to mold and rotting. Ensure adequate air circulation by spreading the leaves out thinly on your drying surface. Inner layers of thick piles of leaves will stay moist too long. Place leaves in mesh bags/cloth or on screened drying shelves/racks to allow air exposure on all sides. Fans increase air circulation and are often incorporated into cabinet dryers. Gentle air movement is best, to prevent leaves from blowing around in the dryer.

Temperature

The higher the drying temperature, the faster your leaves will dry. Faster drying minimizes the likelihood of mold, but high temperatures reduce vitamin content (Alakali *et al.*, 2015) and other health-promoting compounds like quercetin (Ademilui *et al.*, 2018). ElGamal *et al.* (2023) stated that optimal drying temperatures for retaining vitamin C in vegetables range from 35 to 60°C. Minerals like calcium and iron were well retained at these temperatures in a study in Nigeria by Alakali *et al.* (2015).

Light

Working with cowpea leaves, researchers in Uganda found that drying in the sun reduced vitamins A and C by 58% and 84%, respectively (Ndawula *et al.*, 2004). They attributed the losses to the effects of ultraviolet radiation.

Time

Dry leaves until they become crisp and brittle. Brittle leaflets should break apart easily. Soft leaflets that bend without easily breaking likely have too much moisture. Adjust air circulation and temperature to dry moringa leaves fast enough to prevent mold while retaining vitamins.

Humidity

High humidity increases the time to dry moringa leaves. The longer the leaves remain moist, the greater the risk of mold and rotting. Under high humidity, it is important to have good air circulation and sufficient heat. If you are drying moringa leaves during the rainy season without electricity you may want to:

- Dry the leaves on screens or in mesh bags. Doing so, and spreading the leaves thinly, exposes more leaf surfaces to the air.
- Hang the leaves near the roof² in a well-ventilated room (Figure 3).

²The air about 30 to 60 cm below the roof will most likely be warmer than the air near the floor. This will especially be true of tin roofs.

- Mix/move the leaves around a few times during the drying process to make sure all the leaves are exposed to air.

Contaminants

Dry leaves in ways that minimize contamination of dust, animal droppings, and debris. This is most likely to be an issue with open-air drying in the sun or shade.

What are some methods of drying moringa leaves?

Options for drying moringa leaves include shade-drying, drying in direct sunlight, solar drying, and drying in an oven or cabinet equipped with a heat source and fan(s). An ideal drying method will optimize factors like air movement, temperature, and light to dry moringa leaves with minimal loss of vitamins. Your drying method also needs to be practical. A drying cabinet with a heat source and fan provides high-level control of temperature and air circulation; however, it requires electricity. Shade-drying probably retains more nutrients than sun-drying, but there is the risk of mold under high ambient humidity. Information for choosing and optimizing a drying method is summarized in table 2.



Figure 3. A screened drying rack suspended near the underside of a metal roof. Source: Tim Motis



Figure 4. A solar dryer used at ECHO in Tanzania. Sunlight heats the plastic surface of the heating box (bottom left). Heat then rises up into the drying chamber with screened racks (right). In this way, the leaf biomass is not exposed to ultraviolet light. Source: Stacy Swartz.

Table 2. Strengths, potential problems, and optimization suggestions for moringa drying methods.

Method	Strengths	Drawbacks	Optimization tips*
Sun	Simple	Risk of vitamin loss due to high temperatures and ultraviolet light	Cover leaves with porous cloth to reduce ultraviolet light and protect the leaves from contaminants like dust. May need a barrier around the drying area if animals are present.
	Low cost	Exposure to contaminants	
		Slow drying on cloudy days	Bring leaves indoors at night if cooler night-time temperatures are likely to cause condensation.
Shade	Simple	Slow drying time and risk of mold under humid conditions	When drying indoors, place the leaves in air heated by the roof.
	Low cost	Exposure to contaminants	
	High vitamin retention	Rehydration of leaves not dried sufficiently during the day and left out at night	May need a barrier around the drying area if animals are present.
Solar	Many design options	Materials and construction cost	Maximize vitamin retention by using plastic that blocks ultraviolet light or by using a design in which solar-heated air rises into an enclosed drying space shielded from the sun (Figure 4).
	No moving parts required	Risk of vitamin loss if temperatures get too high and leaves exposed to ultraviolet light	

Table 2. Strengths, potential problems, and optimization suggestions for moringa drying methods.

Oven or cabinet	Ability to control temperature and air movement	Complexity and cost of heat source, thermostat, and/or fan(s)	A low voltage system may be sufficient to dry leaves in a small box for household use.**
	Can dry leaves on cloudy and/or rainy days	Vitamin loss to heat if temperature is not controlled well	If using a household oven, monitor the temperature closely.

*These are in addition to practices that apply to all drying methods, like placing leaves on screens or cloth and spreading the leaves out thinly on drying surfaces.

**A small drying box can be made with inexpensive materials such as 5- or 12-volt mini heating pads, a temperature controller, and computer fans (Figure 5). Experiment with holes added for intake (behind the fans) and venting (at the top) of air.

What if I cannot achieve ideal drying conditions?

Assess unacceptable versus tolerable losses in quality

Rotting, moldy leaves pose an obvious health risk if consumed. This would be an example of unacceptable quality. Other examples would be leaves contaminated or burned (because of overheating) during the drying process.

It would be reasonable, though, to accept the risk of some vitamin loss in using heat to dry the leaves before they become moldy. Even with some reductions in vitamins or antioxidants, moringa leaf powder will still have nutritional benefits. In promoting or marketing moringa leaf powder, avoid overstating its nutritional composition. Reports by those who have studied the effect of drying approaches on moringa powder (e.g., Ademiluyi *et al.*, 2018 and Ahmed and Langthasa, 2022) are useful in gaining a sense of what nutritional values to expect for the method you use. Additionally, an *ECHO Research Note* by Witt (2020) presents nutritional values for a realistic serving size (5 g) of moringa powder.

Learn the nutritional tradeoffs of drying options

This is illustrated by a study in India by Joshi and Mehta (2010). The researchers compared established nutritional values of fresh moringa leaves with those of moringa leaves dried in the following ways:

- Shade drying, which they referred to as shadow drying. Leaves were placed indoors for 6 days on cotton sheets in a well-ventilated space, relying on natural air movement.
- Oven drying, with leaves on trays in a forced-air dehydrator at 60°C for 4 hours.
- Sun drying of leaves placed on cotton sheets and protected from dust and insects by covering with cheesecloth. To avoid rehydration of leaves at night the leaves were brought indoors each night for 4 days.

In their experiment, leaves were dried until they became brittle. Hence, the differences in drying time between methods. Although temperatures were not given for the shade and oven drying treatments, their findings shown in figure 6 are still instructive. Vitamins A and C were best retained by shade drying.

Minerals and protein varied little between methods. With respect to vitamins, the biggest losses compared to shade drying were those of vitamin A with sun drying (9% loss) and vitamin C with oven drying



Figure 5. A temperature-controlled moringa dryer made with a styrofoam cooler (top), equipped on the inside (bottom) with 12-volt computer fans and mini heat pads. Source: Tim Motis.

(60% loss). Even with a 60% loss of vitamin C with oven drying, a 5-g serving of the amount left would provide 19% of the 15-g recommended daily intake for a 1- to 3-year-old child.³

The nutrition of moringa leaves can also vary. Other researchers in India found that sun- and cabinet (shade)-dried moringa leaf powder contained 155 and 135 mg of vitamin C per 100 g of powder, respectively (Ahmed and Langthasa, 2022). In their study, cabinet-drying at 60°C reduced vitamin C by 25% compared to shade drying, quite a bit less than the 60% reduction found by Joshi and Mehta (2010).

Note in figure 6 that drying increased vitamin A while reducing vitamin C. Drying typically concentrates nutrients because it removes moisture in plant material leaves. The fact that drying decreased vitamin C suggests it is more sensitive to heat than vitamin A. ElGamel et al. (2023) mention that vitamin C is more susceptible to heat loss than other vitamins, so if your drying procedure retains vitamin C, other vitamins are probably retained as well. Knowing that vitamin C may be reduced by drying, you could also plan for other sources of vitamins in addition to moringa powder (e.g., fresh moringa leaves and leaves from other leafy greens such as chaya (*Cnidioscolus aconitifolius*)).

Look for ways to work within limitations

Table 1 mentions examples such as coverings to protect the leaves from ultraviolet light for sun and solar drying. Nichols (2008) shared with ECHO a method they used in Burkina Faso, in which leaves are placed on woven plastic mats under pieces of corrugated metal roofing supported by boards (a link to their article is in the References section).

One approach for which there is little information available is the use of desiccant for drying moringa leaves. This concept was explored by Dodson (2012) as part of an undergraduate thesis project. Her work demonstrated the potential of desiccants (e.g., montmorillonite clay, silica gel, and zeolite) to reduce 90% of the moisture in moringa leaves in an enclosed space, without fans or a heat source. More experimentation could be done to find out how much desiccant is required to dry a given quantity of leaves. A desiccant approach could be practical for household use. Please let us know if you would like to experiment further with this or related adaptations and approaches (email publishing@echonet.org).

A word about shelf life

A general guideline for the storage life of moringa is 6 months, since nutrients in moringa powder decline over time (Adejumo and Dan, 2018). Maximize the storage life of your moringa powder by keeping it cool (room temperature or cooler), dry (in airtight containers that

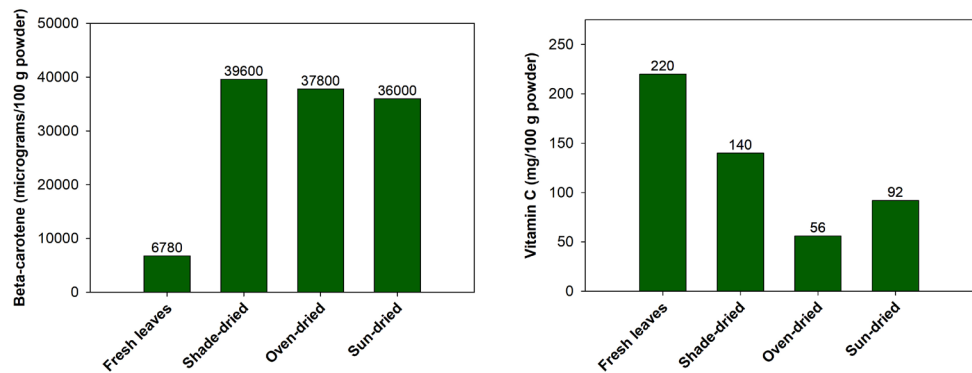


Figure 6. Effect of drying method on concentration of vitamins A (beta-carotene) and C. Adapted from: Joshi and Mehta (2010).

³ Calculate percentage RDA (recommended daily intake) for a 1- to 3-year old child as follows:

1. Find the RDA for vitamin C (VC), which is 15 mg according to the United States Department of Health and Human Services (National Institutes of Health, 2021).

2. Determine the amount of VC per g of leaf powder. The reported amount of VC with oven drying was 56 mg per 100 g of leaf powder. Thus there are 0.56 mg ($56/100 = 0.56$) in 1 g of moringa leaf powder.

3. Determine the number of mg of VC in 5 g of moringa powder consumed over the course of a day. To do this, multiply the amount of VC per g of leaf powder calculated in step 2 by 5 g (the amount of powder consumed). Thus, we find that a day's worth of moringa intake will supply 2.8 mg VC ($0.56 \text{ mg/g of leaf powder} \times 5 \text{ g} = 2.8 \text{ mg of VC}$).

4. Determine the percentage of RDA by dividing the mg VC consumed in a day by the RDA of VC (15 g) and multiply the answer by 100. Thus, we find that a 5-g amount of oven-dried moringa powder supplies 19% of the RDA for a 1- to 3-year-old child ($2.8/15 = 0.19$; $0.19 \times 100 = 19\%$).

exclude humidity, and dark (light causes the powder to fade). Do not consume moringa powder that is molding or smells rotten.

Final thoughts

A good overall indicator of the quality of moringa powder is its color. It should be bright green. Greenness indicates that the harvested moringa trees were healthy, without nutrient deficiencies that lead to yellowing and discoloration. Reduced greenness is also linked to the degradation of chlorophyll caused by high-temperature drying (Ali *et al.*, 2014). Discoloration can also be caused by decomposition/rotting that happens when the leaves stay moist too long.

Aim for a drying method that farmers and gardeners can readily implement with available materials. Look for low-temperature approaches to dry the leaves. Though drying may reduce some nutritional attributes of moringa leaves, moringa leaf powder still offers significant nutritional benefits. Consuming a mix of fresh moringa leaves and moringa leaf powder helps ensure that you get the maximum nutritional value from moringa. Finally, make moringa powder in quantities that can be consumed before it expires.

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ECHO's agricultural staff often receive questions about ways to control snails naturally. Snails and slugs have rasping mouth parts that make their damage to leaves sometimes look like lace (Figure 7). They like moist, shady conditions and typically feed at night or early in the morning.

One of the best methods of controlling slugs or snails is the use of chickens or ducks which eat them. This may not be feasible though, if the fowl would also damage your crop. Other predators of snails include frogs, toads, certain birds, snakes, and certain beetles (OISAT, n.d.). Some cultural control options are to remove alternative shelter for the pests by cleaning out weeds and allowing sunlight into the lower canopy of the crop. If you have an area that is heavily infested with snails, you can try plowing the soil before or after a crop cycle to expose the pests to the sun and predators. Leaving the area without a crop for a short period of time will also remove shelter and food for them and cause them to move on to other areas (OISAT, n.d.). Snails like high organic matter so leaving lots of organic matter in your growing area may encourage snails.

Some curative control options are outlined on OISAT's website here: <http://edn.link/snailcontrol>. If you try any of the ideas on OISAT's website or have your own control ideas, please share your experience on this [ECHO Conversation](#) for others to learn about!

Echoes from our Network: Options for Snail Control

by ECHO Network Members



Figure 7. Snail damage on crops.
Source: Andrei310 ALL RIGHTS RESERVED

Advice from network members

Roger Gietzen in Haiti

Traps can work; malt beverages work well but [this approach] requires some ongoing financial support.

If you use ducks, it's important that someone accompanies them. Otherwise, they can eat the crops. A typical farm is different than a vineyard situation [where the vineyard crop is out of the ducks' reach]. If you use ducks, try local ducks if there are any. Otherwise, Indian Runners are likely a good breed to use for controlling snails.

If you try something like syntropic farming, eventually the system would come into ecological balance and the snails wouldn't be as intense. But... it often gets worse before it gets better [in larger system management].

Jason Weigner in South America

It is a valid concern- leaving old organic material for snails to live and breed in. However, removing the organic material also destroys the habitat of natural snail predators as well and pest species like snails will rebound much faster than their predators. The destruction of habitat and removal of organic material is often what causes pests to reach devastating numbers. I personally leave lots of organic material and brush piles around to encourage predator species. Yes, pests [like snails] may be attracted to this but so are their predators.

I have had success letting ducks and geese range through crops since they generally love to eat snails (although it depends on the size and species of the snail). I found ducks are much better at leaving crops alone than chickens, unless the crops are still very young or produce fruit they eat. Cayuga, Khaki Campbell, Swedish Blue, and Indian Runner ducks have all worked well for me. I would not recommend Muscovy Ducks however as they have a tendency to dig up or mash crops more than other ducks.

Identifying what species of snail you are dealing with might help in control methods and understanding its lifecycle. If it is a native snail, there may be a native predator that could be encouraged to help keep them under control (I know some people hate snakes but small species often eat snails). A lot of small species of snakes like snails. We have a species that specializes in only eating snails! We also have one that only eats slugs.



Figure 8. Pitfall trap made from a plastic water bottle painted yellow to attract insects. Source: Tim Motis

When I lived in Washington State I had success putting pitfall traps (Figure 8) around gardens with a yeast/sugar/water mixture that is usually irresistible to snails and slugs. It needs to be deep enough so they drown when they fall in and changed frequently, so this might not be practical if you are trying to control them over a large area. I have used plastic tubs to catch slugs and snails. I've never seen so many slugs in my life! I would catch them by the hundreds every night. They just have to be deep enough to fall into the yeast mixture and drown. Some people use malt beverages but I find the yeast mixture works best. If they are a large species, going out at night with a flashlight, especially on a wet night, and removing them by hand can help keep populations under control.

How to make a baited pitfall trap for snails or slugs

Yeast solution in a pitfall trap for snail or slug control (OISAT, n.d.):

You will need yeast, water, containers, and a shovel.

1. Dissolve 15 g of yeast per 100 ml of water. *
2. Bury containers in the soil to the rim so that the top of each container is level with the ground (a pitfall trap).
3. Fill the containers with the solution so that it is deep enough for slugs/snail species to drown in the liquid portion.
4. Check the containers frequently, especially after it has rained.
5. Change the solution when needed.

*You can optionally add sugar at a rate of 1.5 g per 100 ml. Make sure the water is warm so that you can dissolve the sugar.

Reference

OISAT. n.d. "Slugs." Online Information Service for Non-Chemical Pest Management in the Tropics. PAN Germany.



This *EDN* issue features the 'Thai' variety of *Corchorus olitorius* or jute mallow. It is in the Malvaceae family which includes diverse species such as cotton (*Gossypium hirsutum*), cacao (*Theobroma cacao*), and okra (*Abelmoschus esculentus*). *C. olitorius* is best known as a fiber crop, commonly called burlap, and increasing in global demand (FAO, 2024). Additionally, people recognize it as a food crop in Africa and Asia.

General description

C. olitorius grows as an erect woody plant, 0.5 to 1.2 m (to 2.5 m under intense cultivation) with leaves up to 15 cm long (UN-EUE, 2001; Figure 9). Leaves are oval to elliptic, with serrated margins, yellow flowers with short, five-part seed capsules holding angular seeds. The 'Thai' variety is shorter, has more branching, and has more tender, smaller leaves compared to varieties used primarily for fiber. Use young and tender shoots and leaves for more palatability in eating.

Growing jute mallow

Agronomic recommendations for production are based on commercial growth of the related species (*Corchorus capsularis*) and, to a lesser extent, from using (*C. olitorius*) for fiber and food.

Jute mallow requires a warm and humid climate 16°C-40°C (24°C- 37°C as optimal), with farmers commercially growing it on alluvial soils during the normal rainy season with at least 500 mm of rainfall (NFSM, 2017). To ensure successful growth, farmers should till the soil well, maintain a pH of 5 to 8 (with 6.0 to 7.6 being optimal), and make sure it is well-aerated, not heavy textured or waterlogged (Pallvi, 2017).

For even distribution, mix seeds for broadcast with loose dry sand or a similar sized material, or plant them at a depth of 3-5 cm with 20

From ECHO's Seed Bank: Jute Mallow 'Thai'

by Robert Walle



Figure 9. 'Thai' jute mallow.
Source: Holly Sobetski

cm between rows and 10 cm between plants, with a seeding rate of 8 kg per ha for commercial production (Pallvi, 2017). Jute mallow is not demanding, responding to compost or low-levels of fertilizer. Commercial rates are 30-60 kg nitrogen ha⁻¹ and 20-40 kg ha⁻¹ for both phosphorus and potassium (Pallvi, 2017). Growing young plants in containers or spacing them wider in the field (opposed to fiber production) produces more palatable leaves for harvesting in as little as 30 days.

Pests

Stem rot (*Macrophomina phaseolina*) (Li *et al.*, 2022) and the jute semi-looper (*Anomis sabulifera*), are economically important pests along with the hairy jute caterpillar (*Spilosoma obliqua*; Maity *et al.*, 2012). Other than these pests, jute mallow is relatively free from pests and diseases while sharing minor pests with its close relative, cotton. These include a flea beetle (*Podagrica* sp.), cotton leaf roller (*Sylepta* sp.), cotton stainers (*Dsysdercus* sp.), and African grasshopper (*Zonocerus* sp.). Please consult your local extension services for pest identification and appropriate ecological control.

Food and nutrition

The 'Thai' variety produces more tender leaves and stems than more fibrous forms of jute mallow (*C. capsularis*). People cook and serve tender leaves and stems, like its relative okra for which jute mallow can serve as a replacement in recipes. Jute mallow has high levels of Beta-carotene, ascorbic acid, and calcium; and is a good source of folic acid, iron, and protein (AVRDC, 2009)

Medicinal

The antioxidant chemicals (e.g. ascorbic acid, thiols, and polyphenols) found in *C. olitorius* contribute to the treatment of a wide list of maladies that practitioners of natural medicine promote jute mallow for treating (Islam, 2013). There are more of these antioxidant chemicals present in the leaves, young stems, and mature roots during the flowering of jute mallow, and these are greater in *C. olitorius* than in *C. capsularis* (Abdel-Razek *et al.*, 2022). Medicinal uses cited in the literature are wide ranging (Islam, 2013; Abdel-Razak *et al.*, 2022; Biswas *et al.*, 2023). Consult your local health professional for additional guidance.

ECHO's Global Seed Bank has trial packets of 'Thai' jute mallow available to development workers (see website for how to request seeds).

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ECHOcommunity Mobile App – Plant Records Tutorial

To keep track of your own plant data, you can create and manage a plant record in the ECHOcommunity mobile app.

Navigate to your plant records page via the menu in the top left corner. When you first download the app, this section will be empty. Tap the plus (+) icon in the top right corner to start your first plant record (Figure 10).

Enter the plant and the variety (Figure 11).

Enter the date you acquired the seeds, the source from which you acquired the seeds, the quality of the seeds when you acquired them, and an ascension number (optional; the number assigned to a batch by a seed bank; Figure 12). You also have the option to upload a photo of the seeds or add your own notes.

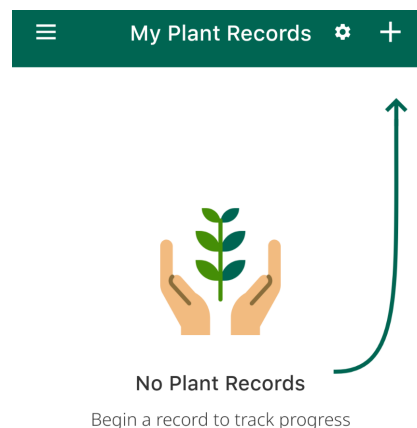


Figure 10. Source: ECHOcommunity mobile app

Books, Websites, and Other Resources

by Abigail Jackson

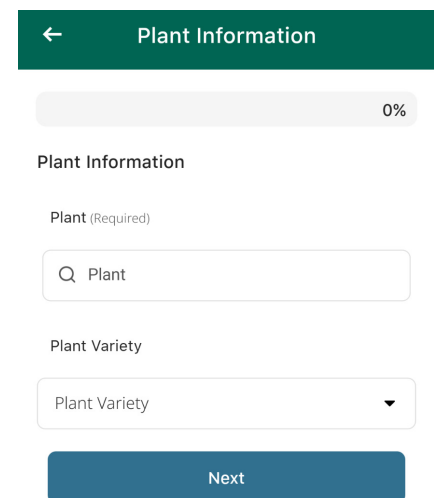


Figure 11. Source: ECHOcommunity mobile app

Figure 12. Source: ECHOcommunity mobile app

Figure 13. Source: ECHOcommunity mobile app

Next, the app will prompt you to enter planting information (Figures 13 and 14). Enter the date of planting and information about your location (Figure 15). Locations can be general or specific. You can identify a garden site or individual field plots where you are planting different crops or varieties. You can even input locations of specific trees or other perennials.

Give your location a name for future reference, and indicate the growing conditions (soil quality, slope degree, and altitude). If you have GPS activated on your device, you can also select use my current location and the app will input your exact GPS coordinates. Tap **Save**.

Navigate back to your ongoing records from the **Plant Records** tab. Keep track of your activities (fertilization, pest management, etc.) and the plant's condition throughout the growth cycle.

Figure 14. Source: ECHOcommunity mobile app

Figure 15. Source: ECHOcommunity mobile app

Add a lifecycle event by tapping **Add Lifecycle Event** (Figure 16).

You can choose from our Lifecycle Event menu or add your own (other).

Add more information to each lifecycle event, such as the date. The app will prompt you to input the correct information based on the lifecycle event you have selected.

You have the option to upload photos of the crop and add your own notes.

Once your growing season is over, tap **Final Evaluation** to finish out the record.

A final evaluation is only used when you have completed all activities for a plant record.

You will be prompted to select the crop success level, whether or not you would recommend this crop, whether you saved seeds and would be willing to share some of them with others, and whether you intend to plant this variety again.

Reviewing Plant Records

When you navigate back to the plant records tab, view all current records, see their progress at a quick glance, and update them with new data as you work.

If you make a mistake and need to start over, you can delete a record by navigating to the record tab, swiping left on the record you wish to delete, and tapping **Delete** (Figure 17).

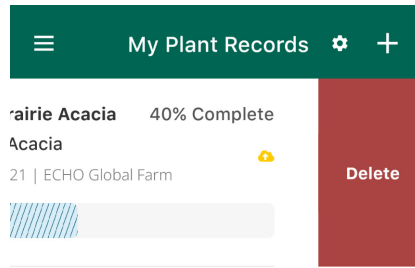


Figure 17. Source: ECHOcommunity mobile app

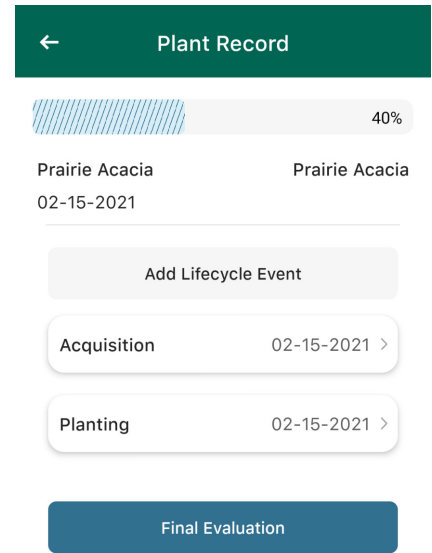


Figure 16. Source: ECHOcommunity mobile app

ECHO Asia

Tropical Agriculture Development

Chiang Mai, Thailand
June 24-29, 2024

ECHO North America

Introduction to Tropical Agriculture Development

North Fort Myers, Florida
April 2-5, 2024

Syntropic Agroforestry (TAD 2)

North Fort Myers, Florida
April 9-12, 2024

ECHO East Africa

Best Practices in Sustainable Agriculture and Appropriate Technologies

Malawi
August 20-22, 2024

Upcoming Events