



Noni Seed Handling and Seedling Production

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Noni, *Morinda citrifolia* L. (Rubiaceae), is a small, fruit-bearing, evergreen shrub or tree that now grows throughout the tropics. It is a traditional source of medicine, dye, and food for indigenous peoples, and it recently has been marketed internationally as a dietary supplement.

Young, spontaneously germinated noni seedlings may be carefully collected from natural areas and transplanted into pots. For those for whom this approach is not feasible, or who wish to avoid the possibility that seedlings so collected may be infected with plant pathogens, knowledge of clean and efficient propagation techniques is needed. This article describes the anatomy and properties of noni seeds, how to harvest and process them for propagation, and how to produce noni seedlings for outplanting. The information given is derived from published literature on noni and from previously unpublished research on the topic by the author in Hawaii.

Variation in *Morinda citrifolia*

Three varieties of *M. citrifolia* are recognized, each with differing leaf and fruit forms. Although the emphasis of this article is Hawaiian noni, the seed handling and germination methods described apply to any type of *M. citrifolia*.

The most widely grown and culturally and economically important variety is *Morinda citrifolia* var. *citrifolia*, known by the vernacular name noni. This variety is morphologically diverse. Although botanically there are no clear subpopulations that are recognized with significantly unique characteristics, there is some geographic variation worth noting. For example, roughly speaking, there are large-fruited types (e.g., Hawaiian noni) with more ovate leaves, and small-fruited types

(e.g., Micronesian lada) with narrower, more elliptical-elongate leaves.

The variety *Morinda citrifolia* var. *bracteata* is a small-fruited type with conspicuous bracts below the fruit. It occurs in Indonesia and other parts of the region between the Indian Ocean and Pacific Ocean and is cultivated in some areas. This plant can be found in some of Hawaii's botanical gardens.

The third variety is *Morinda citrifolia* var. *potteri*, a comparatively small-fruited type with green-and-white leaf variegation. *Potteri* is distributed throughout the Pacific region and is grown primarily as an ornamental in landscapes.

Fruit and seed

Noni plants produce fruits throughout the year in Hawaii. The fruit, classified as a syncarp, is light green when unripe and yellowish-white when ripe; it is up to about 5½ inches (14 cm) long, 3 inches (8 cm) in diameter, and is soft and fleshy, with a fetid odor.

Hawaiian noni fruits contain up to about 260 seeds each. When air-dried, a noni seed is very light, weighing only about a quarter of a gram. It takes 22 lb (10 kg) of fruit to obtain about 9 oz (250 g) of air-dry seeds. Seed dispersal in native habitats is probably done by water (run-off or flooding), birds, rats, bats, and other mammals.

The seed is brown, about 3/16–3/8 inch (4–9 mm) long, and has a distinct air chamber. The noni seed coat is made up of layers of extremely tough cellulose fibers. The seed has a bulbous, ovoid air chamber and a flattened, bi-layered, tapering paddle. The embryo is located inside the seed coat between the air chamber and the tip of the tapering paddle. The embryo is flattened, oily, and relatively small, about 1/8 inch (a few millimeters) long.

Harvesting noni fruit for seed

Noni fruit is best harvested for seed collection after it falls naturally from the tree. At this completely ripe stage the flesh is very soft. Fruit with any green color should be avoided because the seeds may not be fully developed and may not germinate. Fruit picked from the ground can be processed immediately for planting, whereas fruit picked from the tree is still hard and must be allowed to ripen fully before processing for seed.

An expedient way to propagate noni is simply to break up a ripe fruit and spread the pulp with its seeds over the surface of planting medium in a potting container. Then cover the layer of pulp and seeds with a shallow layer of medium and place the pot in a warm location; water it daily. This method generally results in delayed or reduced germination, which may occur erratically over a period of months.

Most growers want faster, more uniform sprouting with the highest germination rate possible. This can be obtained by using the fruit and seed handling methods described below.

Noni fruit processing and seed scarification

The fruit pulp must be separated from the seeds to get rapid and uniform germination. This process is laborious. The seed-bearing pulp can be rubbed against a screen or colander with a back-and-forth motion while applying a strong spray of water to push the separated pulp through the screen and away from the cleaned seeds. This process may take up to 15 minutes or more per batch of pulp.

After the pulp has been separated from the seeds, place them on a screen to air-dry in the sun for several hours; stir them occasionally. Then, place them in a dry, breezy, shaded location for another few days. Dried seeds may be stored at room temperature for up to 6 months without significant loss of viability, after which viability declines significantly.

Noni seeds require scarification to reduce the time to germination and increase germination percentage and uniformity. To scarify a seed is to cut, scratch, or soften its outer coat to allow ready penetration of water and air. Unscarified noni seeds usually require at least 60 days and usually much longer (up to 6 months or more) for germination. Scarified noni seeds, on the other hand, can germinate in 3–4 weeks, depending on the conditions. Under optimum conditions, at least 60–70% of

scarified noni seeds will germinate, and even higher rates can be achieved. However, given that an entire acre of noni could be planted from the seeds obtained from just two noni fruits, germination percentage may not be a critical factor for most growers.

A simple scarification method is to place ripe fruit pulp in a blender and pulse the blending mechanism a few times to macerate the pulp and cut open the noni seeds. Although effective, this procedure results in a high percentage of seeds with destroyed embryos.

A more reliable but time-consuming method is to use an ordinary fingernail clipper to remove the tip of the tapered part of the noni seed paddle. Just enough of the tip is clipped off (about $\frac{1}{16}$ inch, 1.5–2 mm) to create a tiny, slitted opening in the bi-layered seed coat. Care should be taken not to clip off too much of the paddle and damage the embryo. Seeds scarified in this manner usually germinate in about 4 weeks and have taproots that emerge uniformly and easily through the slit. It is not usually necessary to sterilize the clipper used during scarification.

Some growers prefer to soak the seeds in warm water for several days before clipping, although this is not strictly necessary. The cultural and environmental conditions to which noni seeds are exposed *after* scarification are much more important to successful noni seedling production.

Germination media and conditions

Any well-drained medium will suffice for germination provided it is absolutely free of root-knot nematodes and other pathogens. An inert medium such as vermiculite or a peat-perlite mixture is ideal. Although volcanic cinder is usable, the germination rate is lower than with media with greater moisture-holding capacity; cinder should be amended with peat or compost to increase moisture-holding capacity. Nematode-infested soil or media should be treated with heat (at least 122°F [50°C] for 15 minutes) before use. Mulch (e.g., sawdust, leaf litter, sand) may be placed over the seedbed for weed control and moisture retention.

Fill the propagation container to about 1 inch (2–3 cm) from the top with the desired medium and scatter a handful of noni seeds on the surface. Cover them with a $\frac{1}{2}$ -inch layer of gently compressed medium and place the container in a warm, sunny location; water daily.

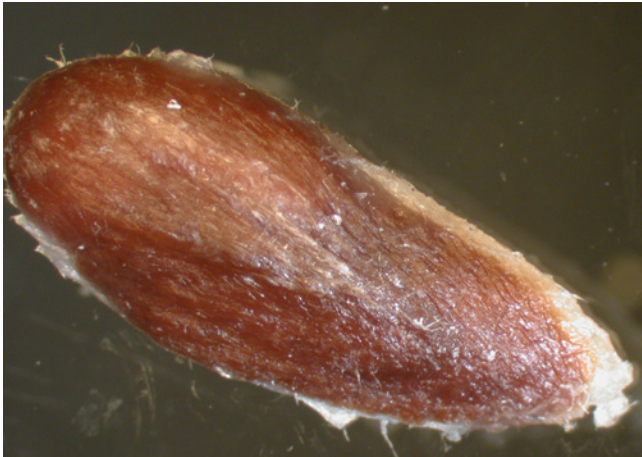
Nursery seedbeds can also be used instead of containers. Seedbeds can use the local soil amended with



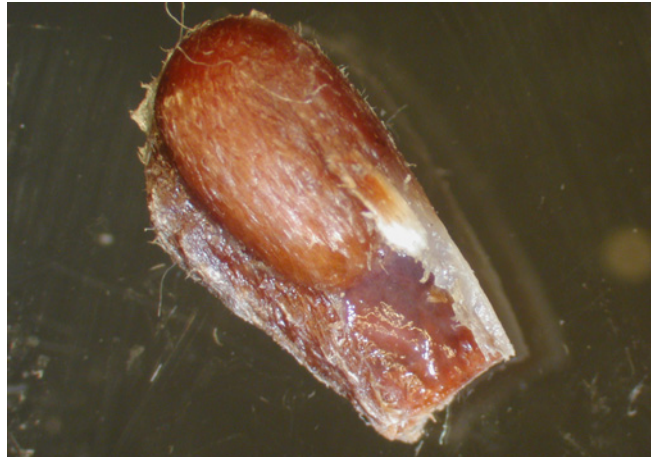
A typical seed of *Morinda citrifolia* var. *citrifolia* (highly magnified), showing the fibrous seed coat, the bulbous air chamber, and the tapering paddle.



Noni seed with bilayered seed coat opened to show the size, shape, color, and position of the flattened embryo.



Typical noni seed, reverse.



Scarified seed ready for planting; tapering seed paddle was removed with a fingernail clipper. Take care not to clip off too much of the paddle and damage the embryo.



Severely galled and misshapen young noni roots infected with root-knot nematodes. These pests must be avoided during noni seed germination and seedling production.



Morinda citrifolia var. *citrifolia* seedling, approximately three months after germination.

compost and raised 6–8 inches (15–20 cm) above the ground surface. Any propagation containers or seedbeds should be protected from wind and heavy rain.

Temperature during germination of noni seeds is perhaps the most critical factor, aside from moisture. Noni germinates most readily at about 100°F (38°C). At lower temperatures, more time is required for germination.

Noni has an extremely wide range of environmental tolerances and is robust enough to germinate in nature under very harsh conditions. Therefore, the media and temperature conditions suggested here are optimal, not strict requirements.

Seedling growth and outplanting

When the taproots of the young seedlings reach the bottom of the germination container, it is time to transplant them to a larger container to grow them to sufficient size before outplanting.

Seedlings in the nursery should be fertilized heavily with a balanced fertilizer containing micronutrients. Seedlings also respond well to foliar applications of liquid fertilizers formulated for the purpose.

When the stems of the young plants become woody (about 9–12 months after germination) they are ready for outplanting, provided they have been “sun hardened” beforehand. Noni seedlings may be planted out after they are 8–12 weeks old and 4–6 inches (10–15 cm) tall, but these young plants require more care and are much more vulnerable to the environment and pest attack than older seedlings. Seedlings grown in full sun in ½–1-gallon

(2–3-liter) pots for at least 24–36 weeks are preferred for outplanting, because they establish rapidly. Plants that are 1 year old may be optimum for some areas. Even 2–3-year-old seedlings may be outplanted. For older seedlings, loosen the root system gently by hand after removing them from the container.

Further reading

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