

Creating Your Own Potting Mixtures



ECHO®

The goal of a nursery?

To produce healthy vegetable transplants or seedling trees that will be successful



Primary goal of a tree nursery

- Quality seedlings (ICRAF 2002)
 - Well-developed root system
 - Anchor in the ground quickly and start growing quickly after planting out
 - Sun-adapted foliage (hardening)
 - Balanced shoot/root ratio (1:1 or 1:2)
 - Adequate carbohydrate reserves
 - Are strengthened by inoculation with *Rhizobium* or mycorrhizae if needed.

Why potting mixtures?

- Why not use soil?
 - Highly variable properties
 - Disease problems
 - Water management
- What are the benefits of *home-made* potting media?
 - Predictable performance
 - Better water retention to media weight ratio
 - Consistent fertility
 - Less disease problems

Potting Mixtures[®]

- Obtaining potting mix or germination mix can be a major challenge for a nursery operation
- Purchasing commercial mix is probably not a viable option.
- A poor quality mix will typically result in poor quality seedlings.
 - Nursery stage is extremely important for long term health and productivity!



What will it take?

- Creating a germination or seed starter mix:
 - Observation
 - Experimentation
 - Resourcefulness
 - Trial and error
 - Planning ahead



Church nursery, Malawi



African Oil Palm Nursery, Congo



Commercial Protea Nursery, Zim



Nursery, Haiti



Japanese NGO, Malawi



Nursery, Haiti



Nursery, Haiti



What makes a good mix?

- Retains adequate moisture
- Is disease free
- Promotes quick and uniform germination
- Promotes excellent root growth
- Provides initial nutritional needs of plants
- Consistent quality and performance
- Based on locally available materials
- Not overly labor intensive to create
- Low cost



Use locally available materials

- Top Soil
- Compost
- Coarse sand or fine gravel
- Composted sugarcane bagasse
- Composted rice hulls
- Charred rice hulls
- Composted Coffee hulls
- Coconut fiber/coir (coir dust)
- Composted manure
- Worm castings



What makes a good mix?

- A balance between 3 major components:
 - A stable, drainage component: Porosity
 - A water-holding component
 - A fertility component



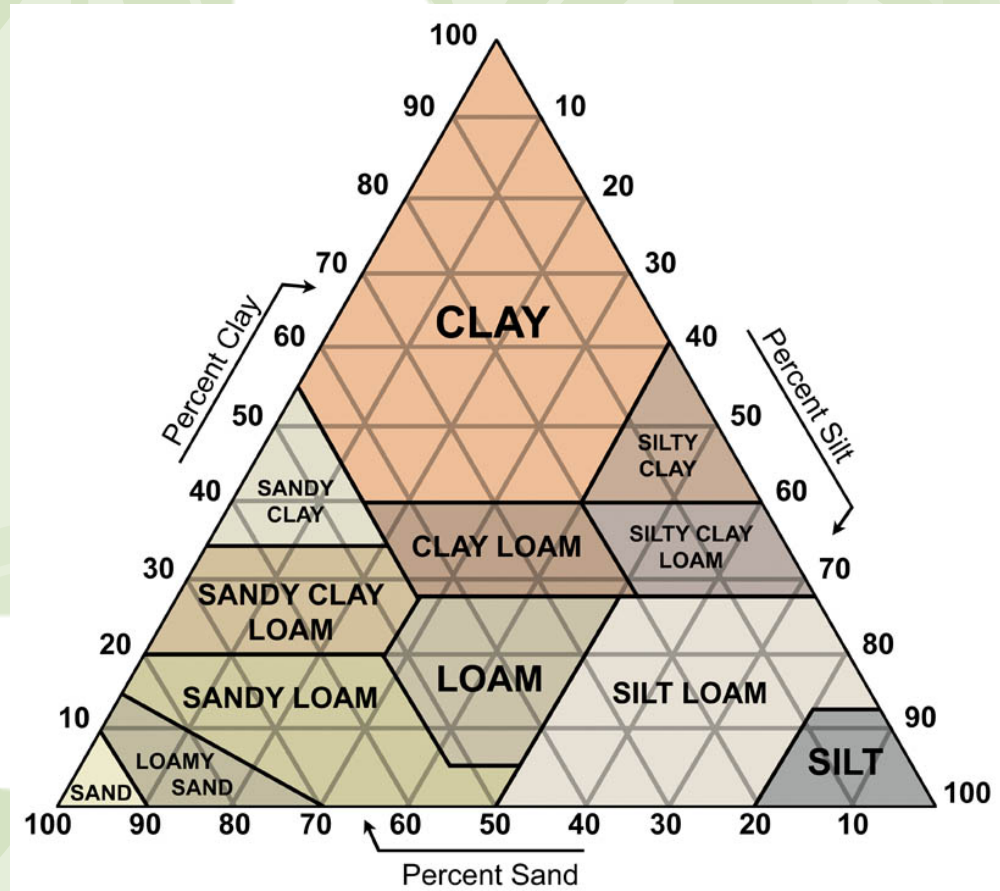
Potting Mixture Recipes

- Depends on crop, soil composition, and climate.
- Example mixes:
 - 3 parts topsoil, 1 part humus-rich soil (compost), 1 part sand (coarse sand)
 - 5 parts topsoil, 2 parts decomposed manure, 1 part coarse sand, 1 part decomposed straw or coir dust, 1 part 3/8" ballast
 - Mix 7 parts soil with 2 parts well-decomposed chicken manure, and 1 part fresh or charred rice hull. (IRRI)

Source: World Agroforestry Center

Potting mix Guidelines

- Learn about your local topsoil!
 - physical characteristics of available soil will determine your potting soil recipe
 - Clay, Silt, Sand, Organic matter



Using soil in your mixture

- Adjust your mixture based on soil type:
 - Ratio of 3 main components

TOPSOIL : FINE GRAVEL : ORGANIC MATTER

- For heavy soil (high clay) 1 : 2 : 2
- For medium soil (loam) 1 : 1 : 1
- For light soils (sandy) 1 : 0 : 1

(World Agroforestry Centre)

Soil ribbon test to assess quality of soil-based mixes

cm	Mix okay?	Likely cause	adjustment
<1.5	No, too much air and not enough water holding capacity	Too much sand	Add clay loam and compost
1.5-2	Yes		
2-4	No, not enough air and water-logged	Too much clay or silt	Add coarse sand
4+	No, very little air space and too much water	Too much clay	Add coarse sand and compost (charred rice hulls)

Organic Matter in Potting Mixes

- Rice hulls
- Compost
- Coconut coir dust
- Bagasse
- Saw dust
- Eucaplytus bark (*E. diversifolia* and *E. calophylla*)..up to 10%, composted and aged 12 months. Up to 30% if milled to particle size of 5mm-uncomposted.
- Kenaf?



Rice Hulls



<http://www.echotech.org/network/modules.php?name=News&file=article&sid=201>



UHDP Experiment

- The goal of the trial was to compare two potting mixtures: one which contained burnt or charred rice hulls and another containing composted rice hulls
- Two treatments:
 - 2:1 soil/burnt rice husks
 - 2:1 soil/rice husks composted in pig manure.
- Seeded with *Zea mays*

13 March 2008 Composted (Left), Burnt (Right)



25 March 2008 Composted (Left), Burnt (Right)



22 April 2008 Composted (Left), Burnt (Right)



Discussion [®]

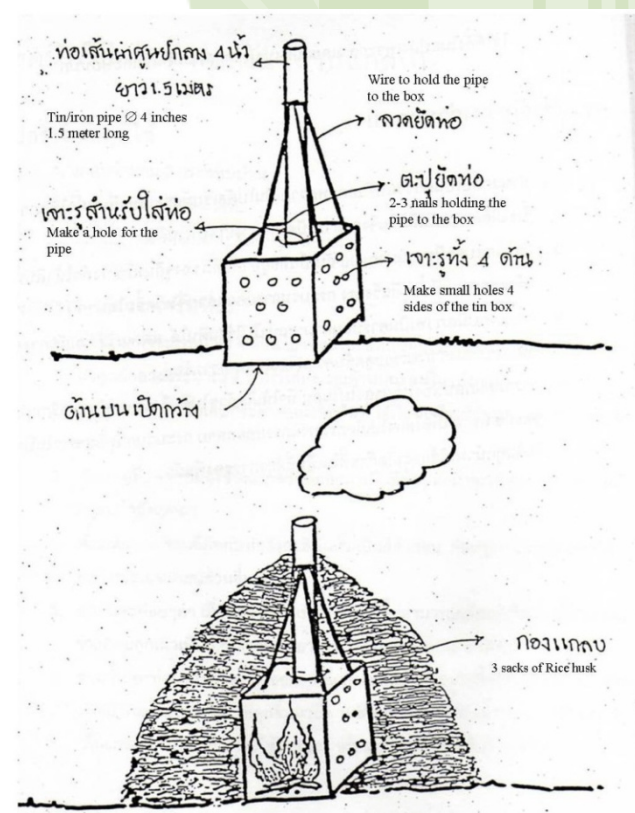
- The treatment with composted rice husks and pig manure showed initial strong growth
- The treatment with burnt rice husks resulted in sustained nutrition
- Burnt rice husk treatment produced more ears and had much darker green foliage
- Composted rice husks probably began to decompose and the microbes were using up all available nitrogen

Test fertility with maize

- Good indicator of fertility
- Many diagnostic keys available for maize
- Other indicator plants?
 - papaya...

Charred Rice Hulls

- “smoked rice hulls” or “rice hull ash”
- Southeast Asia-used extensively in commercial potting mixes
- 38% carbon, 62% silicon
- Properties:
 - Disease-free medium
 - Good water-holding capacity
 - Good drainage
 - Adds soil structure
 - Some essential nutrients (Si)





Compost

- Compost
 - Create humus-rich material
 - Good water retention
 - Biologically rich
 - Good fertility
 - 60°C for ?days?
 - Assessing quality
 - plastic bag test



Zomba, Malawi

Screening your compost

- For fine germination mixture 5mm screen
- For course potting mix us 1/4" screen (?mm)
- Screening:
 - Manual
 - Mechanical (rotary sifting) pictures on flash



Sugar Cane Bagasse





Sugar Cane Bagasse[®]

- Byproduct of processing sugar cane
- Should be finely shredded, then screened
- Best if well composted
 - C:N ratio - Can tie up N initially
- Improves water retention of mix

The Haiti Mix®

- 'Haiti Mix' 5 parts sugarcane bagasse, 1 part rice hulls and 1 part sandy loam soil. (from Amaranth to Zai Holes, Chapter 6)
- Must be well decomposed
- Color of bagasse should be dark red to brown
- Heat finely shredded bagasse by adding 1 pound per cubic meter of urea to mix
- Center of pile should reach 145°F (62°C)
- Turn pile inside out to heat evenly



**Sugar Cane Bagasse
Potting mixture**

Inoculating Potting mixes

- For some species it may be necessary to inoculate with soil microorganisms
- Nitrogen Fixing Bacteria (*actinomycetes*) or mycorrhizae.
- Methods of inoculation:
 - Direct inoculation
 - Nodule drench
 - Stock beds

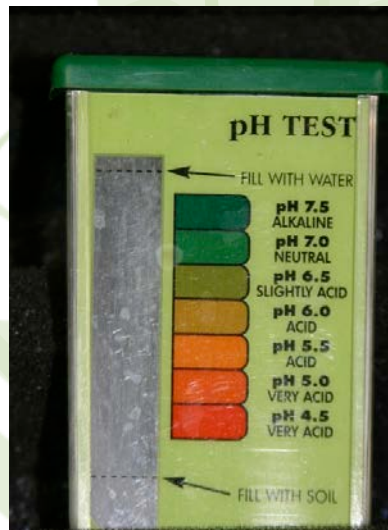
(Tree Nursery Manual for Namibia)



**Forest Soil for Potting Mix,
Ethiopia**

Adjusting pH[®]

- Importance of pH?
- Measuring pH
- Lowering pH: Sulfur
- Raising pH: Lime



Mixing the mix[®]

- Calculate volume needed
- Measure individual components
- Mix light components first
- Mix well until there is uniform consistency



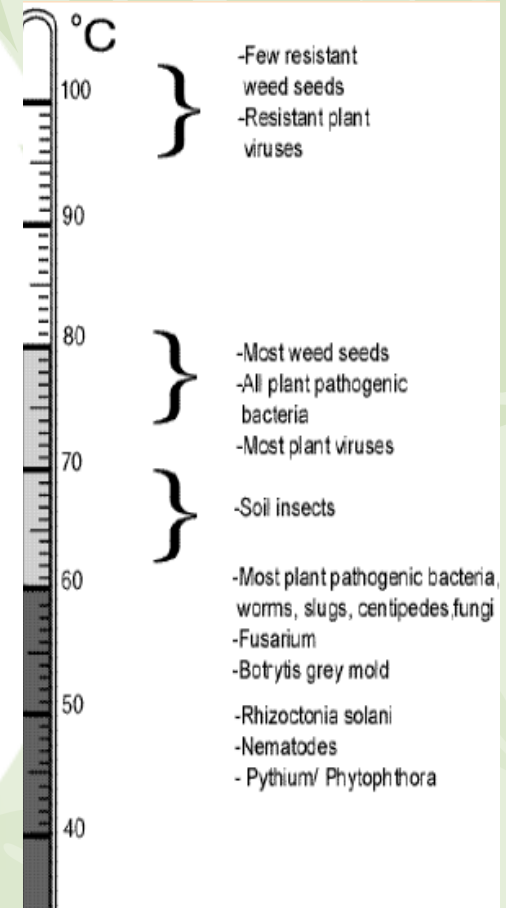
Use a suitable Potting Mix

Measuring Quality

- Assess texture
- Balance of components
- Make adjustments

Keep it Clean!®

- Prevent fungal diseases and kill nematodes with solarization or steam pasteurization
- Do this for germinating seeds that are sensitive to *damping off* or root diseases (*Pythium sp.* or *Phytophthora sp.*)



Solarization [®]

- Spread soil on concrete or plastic.
- Thickness of 10cm
- Cover with clear plastic sheet
- Position in full sun

Temperature °C	Time to kill pathogens
40	2-6 weeks
50	6 hours
60	30 minutes

Pasteurization[®]

- Fire box method
 - Cut a steel drum lengthwise or in half
 - Use stones or bricks to support drum
 - Fill with moist (not wet) potting mix
 - Start fire below drum
 - Heat to 60°C for 30min.
 - Allow to cool

Caution: Over-heating will kill beneficial organisms in soil!



Soil Sterilization

Monitor Temperature!



Resources [®]

- Research for Restoring Tropical Forest Ecosystems: A Practical Guide. 2008. FORRU
- Wightman, Kevyn Elizabeth. Good Nursery Practices: Practical Guidelines for Community Nurseries. World Agroforestry Center.
- Verheij, Ed, and Harry Lovenstein. A Nurseryman and His Trees. Agrospecial 1.

Resources



- Growing Trees and Gardens for Life: Practical tips for healthy tree nurseries and home gardens Edited by H van Houten ICRAF/WOB/SII, 2007. 88 pp. ISBN 9966-956-54-9 <http://www.worldagroforestrycentre.org/downloads/publications/PDFS/B15299.PDF>
- Tropical Trees: Propagation and Planting Manuals. Volume 2. GROWING GOOD TROPICAL TREES FOR PLANTING K.A. Longman. Jan. 1998. Commonwealth Science Council. http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/006/ad228e/ad228e00.htm
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- Good Tree Nursery Practices: Practical Guidelines for community nurseries. K. E. Wightman. 1999 World Agroforestry Centre <http://www.worldagroforestry.org/units/library/books/Book%2031/html/INDEX.htm>
- Vegetative Tree Propagation in Agroforestry: Training guidelines and references. Hannah Jaenicke and Jan Beniest editors. 2002 ICRAF. <http://www.worldagroforestry.org/downloads/publications/PDFs/b14043.pdf>