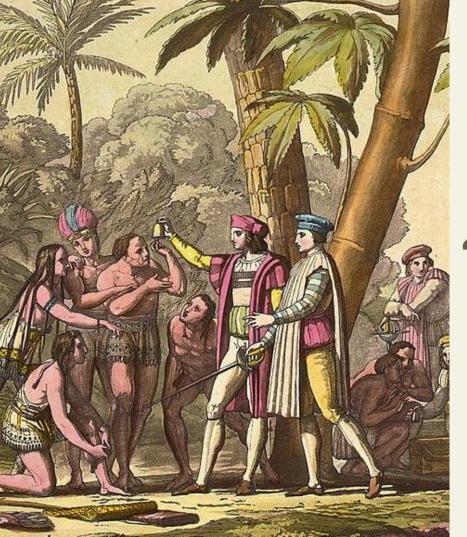
15 Underutilized Crops for Improving the Lives of Smallholder Farm Families



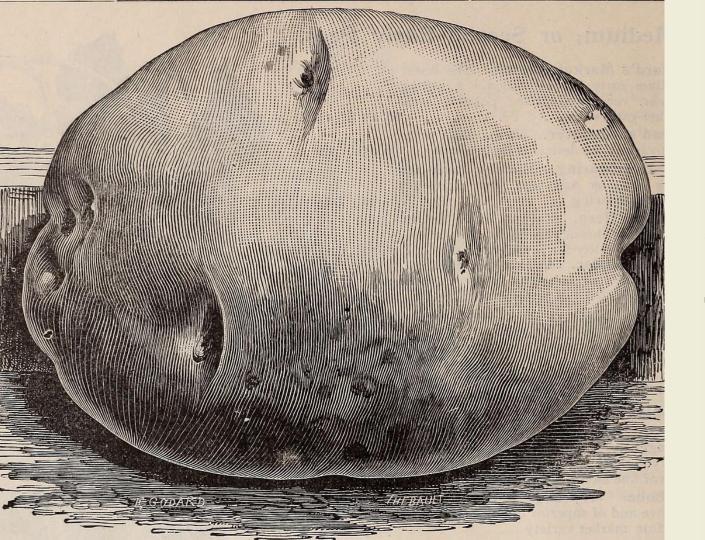
Josh Jamison – h.e.a.r.t. Village



H.e.a.r.t. Village is a training center in Central Florida for students involved in Christian community development work.



1492 – The "Columbian Exchange" begins

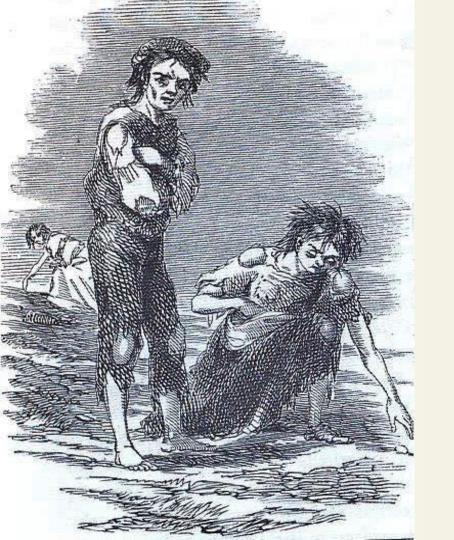


Solanum tuberosum

The "Irish" potato

Lesson #1

The introduction of a new crop can make a dramatic impact on the food security of a society.



1844 – Tragedy strikes as late blight destroys Irish crop.

One million Irish people die in the Irish Potato Famine and one million more flee the country to escape starvation.



Lesson #2

Crop diversity is a crucial tactic for ensuring food security.

Crop Diversity

A vital tool for year round food production



September 15



April 22



An incredibly nutritious perennial leafy green adapted to a diverse range of tropical settings. A great option for home gardens.



High labor annual vegetables vs. reliable chaya

Component	Spinach ¹	Chaya ¹	Moringa ²	Mulberry ³
Water (%)	90.7	85.3	75	74
Protein (%)	3.2	5.7	6.7	7.3
Fat (%)	0.3	0.4	1.7	1.1
Crude Fiber (%)	0.9	1.9	0.9	N/A
Total CHO (%)	3.8	4.2	13.4	10.7
Ash (%)	1.8	2.2	2.3	4.8
Calcium (mg/100g)	101.3	199.4	440	583
Phosphorus (mg/100g)	30	39	70	76 ⁴
Potassium (mg/100g)	146.5	217.2	259	284 ⁵
Iron (mg/100g)	5.7	11.4	7	7.5
Ascorbic Acid (mg/100g)	48.1	164.7	220	220
Carotenoids (mg/100g)	0.014	0.085		
Beta-carotene (mg/100g)			6.8	12.3

¹ECHO Chaya Technical Note, 2006.

Exceptional nutrition - significantly higher than spinach in protein, calcium, potassium, iron, vitamin C, and vitamin A

²ECHO Moringa Technical Note, Revised 2000.

³International Journal of Food Science. Nutritional quality of leaves of some genotypes of mulberry (Morus alba), 2006.

⁴Manuel D. Sanchez, FAO. Mulberry: an exceptional forage available almost worldwide!

⁵N. Kitahara, S. Shibata & T. Nishida, FAO. Management and utilisation of mulberry for forage in Japan.



Chaya – an excellent edible hedge

Why Chaya?

- Highly nutritious
- Available year-round
- Widely adaptable
- Good tasting greens
- Drought tolerant
- Easy to propagate
- Creates nice barrier/hedge
- Minimal pest and disease issues



A nutritious perennial leafy green shrub for humid tropical lowlands



Temperate crops often succumb to pests in the tropics.



Katuk hedges can provide year-round leafy green production.

Why Katuk?

- Thrives in hot, humid conditions
- Tolerates moderate to heavy shade
- Highly nutritious
- Available year-round (if rainfall permits)
- Great taste
- Easy and fast to prepare for meals
- Creates good barrier/hedge



A multi-purpose tree for almost all habitable climates; yielding marketable berries, edible leaves, animal forage and much more.



Large, improved forms of mulberry are not well known. These cultivars may have high market potential.



"Taiwan Long" Cultivar



Intensive fruit production in Korea



A very precocious tree

Immediate fruit production may boost excitement about fruit tree planting.



Mulberry greens – Moringa for cold climates?

Component	Spinach ¹	Chaya ¹	Moringa ²	Mulberry ³
Water (%)	90.7	85.3	75	74
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¹ECHO Chaya Technical Note, 2006.

Mulberry greens exceed moringa in protein, calcium, potassium, iron, and vitamin A. They taste good too!

²ECHO Moringa Technical Note, Revised 2000.

³International Journal of Food Science. *Nutritional quality of leaves of some genotypes of mulberry (Morus alba)*, 2006.

⁴Manuel D. Sanchez, FAO. Mulberry: an exceptional forage available almost worldwide!

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Mulberry greens production in highland Mexico



Dense planting for leafy green production can double as a fence or hedge.



Mulberry is an excellent animal forage.



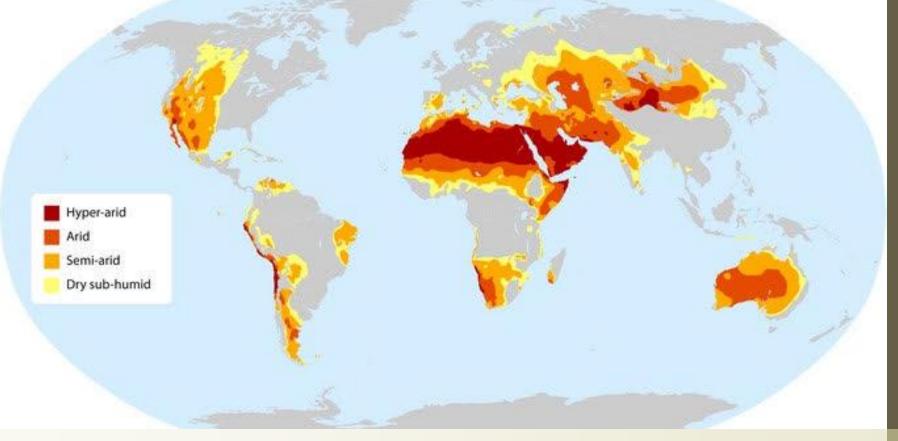
Highly palatable goat forage

Why Mulberry?

- Delicious fruit, some types marketable
- Extremely nutritious leaves
- Grows in almost all climate types of the world
- Nutrient dense animal forage
- Precocious fruiting
- Drought resistant



A diverse group of desert plants that yield fruits and vegetables in the world's harshest climates

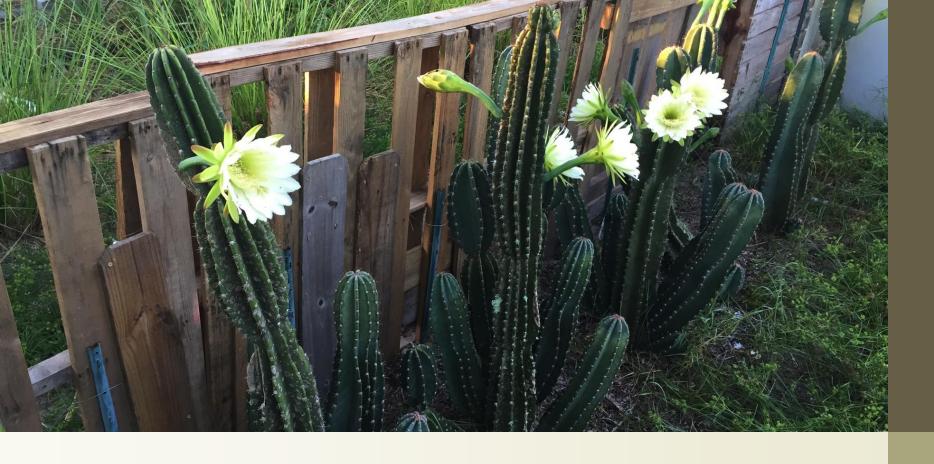


FAO Drylands Map





Opuntia fruits come in a variety of colors.

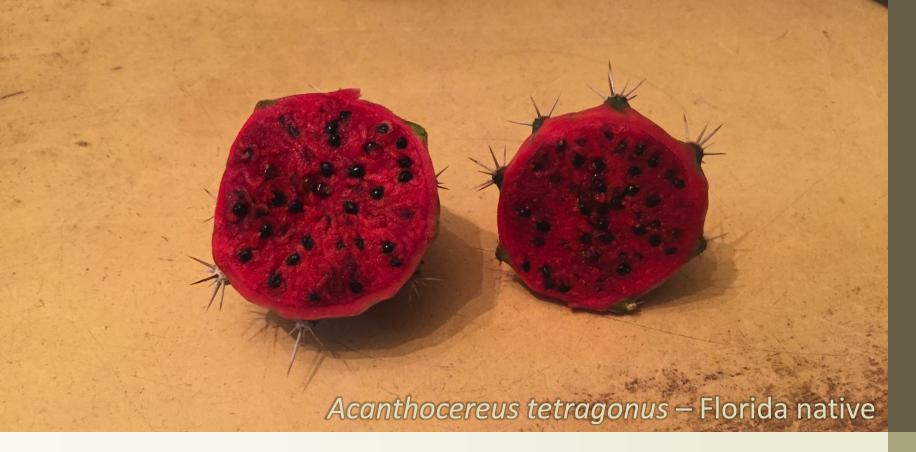


Columnar cacti offer many fruiting species for drylands.





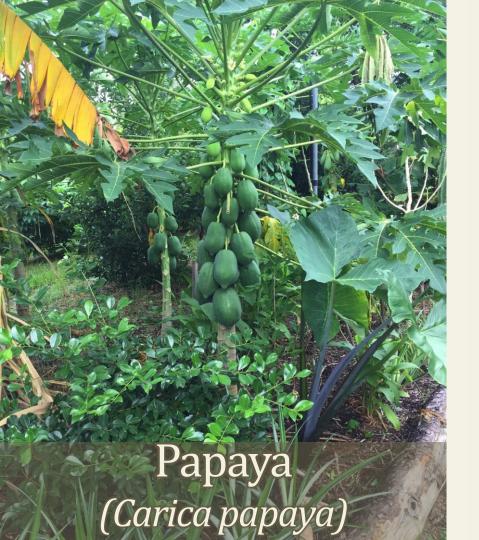
Large cuttings make for an immediate living fence.



Dozens of promising, but almost unknown species wait to be developed as dryland fruit crops.

Why Cactus?

- Produces food in climates too harsh for most plant life
- Edible fruits
- Edible pads/leaves
- Some types makes impenetrable fences and enclosures
- Animal forage
- Biogas feedstock
- Ancient usages include brick binding gel, lumber and more



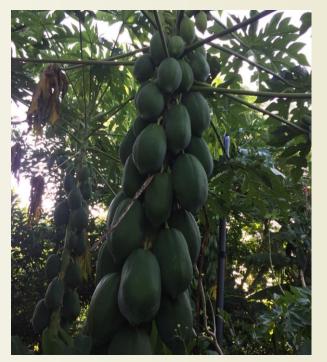
A rapidly producing and enormously productive fruit for the tropics

Why is papaya underexploited?

Typical poorly managed papaya



Production in 9 months





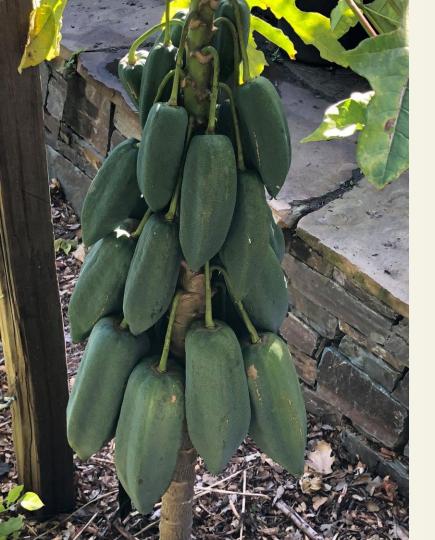
Papaya fruit is delicious and nourishing, especially for at-risk children.



Unripe, green papaya is an excellent vegetable.

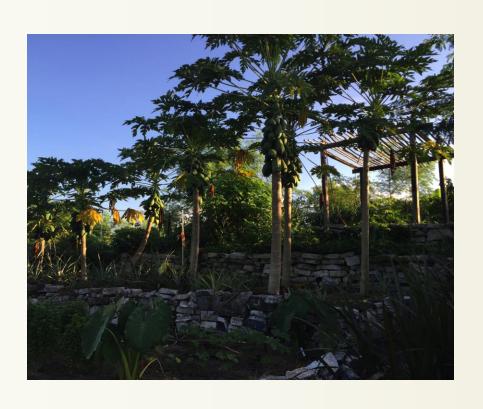


Fruit fly control technique – sticky glue on green ball

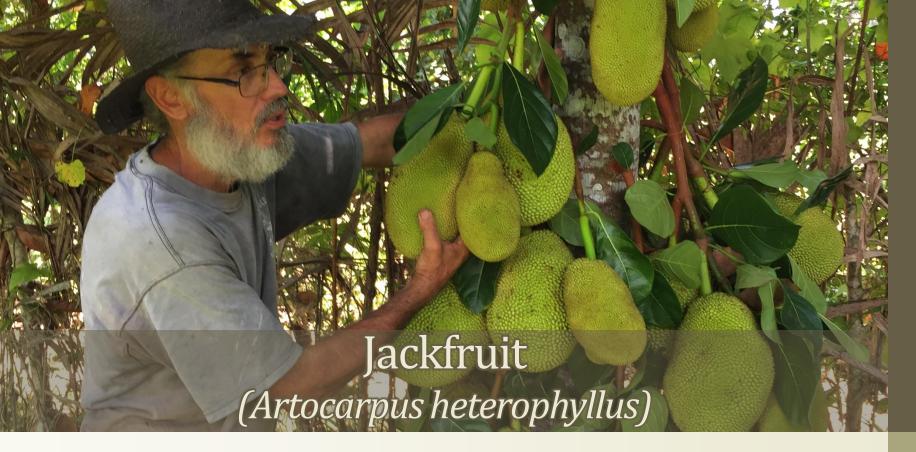


Babaco – cool weather tolerant papaya relative for highlands

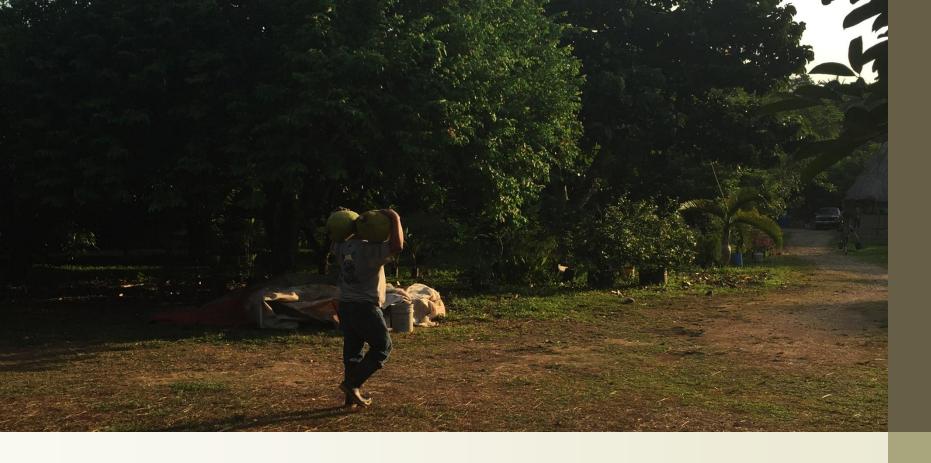
Why Papaya?



- Produces rapidly less than a year
- Huge volumes of fruit
- Year-round production
- Diverse uses
- Widely adaptable and drought tolerant
- Useful for medicine
- Highly nutritious



A vigorous tree providing massive dessert fruits which also contain nutritious edible nuts. Thrives in humid tropical lowlands.



Enormous fruits, sometimes exceeding 100 pounds



One of the best tropical fruits in the world





Why Jackfruit?

- Large, delicious fruits
- High calorie nuts for food or animal feed (similar to chestnut)
- Fruit available for many months of the year
- Fruits can be eaten green as a vegetable or substitute meat
- Highly productive
- Prunings good for animal forage



A starchy staple food borne from a resilient tree. A "potato tree" for hot, wet parts of the tropics.



Comparable dry weight yield to potatoes per year on per hectare basis from a low maintenance tree



Breadnuts are a life sustaining food.



Breadfruit field grafted to breadnut seedling



Crop Champions – The Breadfruit Institute

Why Breadfruit/Breadnut?

- A tree can provide food for 50 years or more
- High yielding starchy food for low labor input
- Wide season with diverse cultivar selection
- Fruits and nuts can sustain chickens and pigs
- Thrive in diverse climates and soil types
- Trees fit well into agroforestry schemes

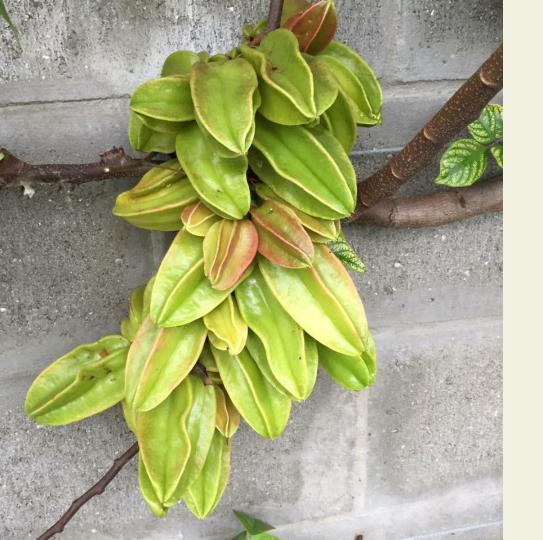


An optimal fruit tree for the tropical homegarden because of remarkable productivity and wide seasonal availability.



A succulent, tasty hand fruit for tropical homegardens

Getting high quality cultivars is important. Seedlings are variable and often sour.



Incredible production on a per tree basis



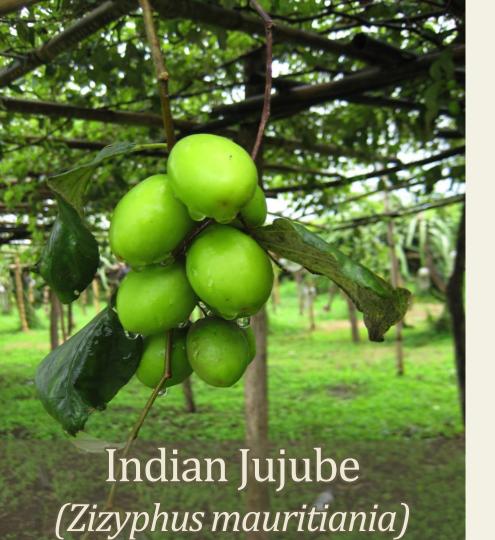
Wide seasonal availability – Mature fruit, young fruit and flowers all at once



Carambola can be grown with intensive trellising and pruning regimens. Fruiting can be induced any time of the year.

Why Starfruit?

- Delicious, sweet hand fruit
- Provides nutrition to vulnerable children
- Produces flushes of fruit throughout the year
- Fairly adaptable to various climatic conditions
- Well adapted to small yards and other space-limiting situations – even viable as a container plant
- Fruit can be processed into vinegar or other value added products



A tough and productive fruit tree for tropical drylands and beyond - an apple for the desert.



Improved forms are a huge gain on small, semi-feral forms common throughout the tropics. (Thai Giant)



Very quick to produce from seed, flowers within two years



Why Improved Jujube?

- Apple like fruit
- Produces in locations too hot and dry for most fruit crops
- Several fruit flushes per year in some places
- Highly productive
- Works well in highly managed, intensive farming regimens
- Prunings can provide dry season goat forage and fuel wood
- Very precocious (2 years to fruit from seed)



An ideal "GMCC" (Green Manure Cover Crop) that fertilizes soil while simultaneously choking out weeds in crop fields.



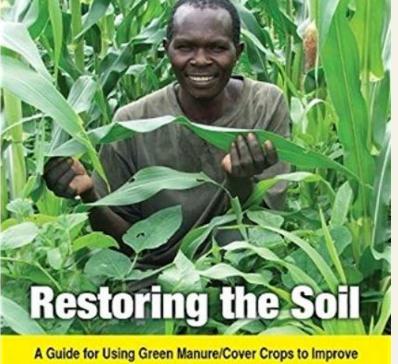
A huge volume of biomass in short period of time smothers and chokes out virtually all weeds.

Complete groundcover in future vegetable bed



Slashed bed ready for planting





Essential resource on GMCC's

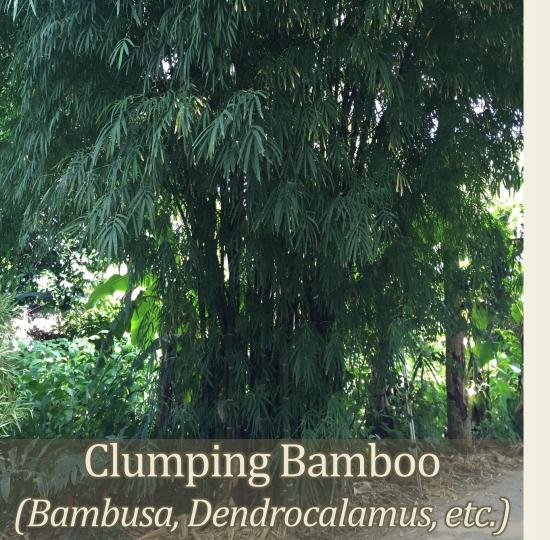
the Food Security of Smallholder Farmers

Roland Bunch



Why Velvet Bean?

- Chokes out all weeds aggressively
- Can produce as much as 140 kg of N per Hectare and 75 metric tons of biomass (green weight) per year (Bunch)
- Above figures indicate high potential for improving marginal soils
- Animal forage
- Not weedy, easy to remove with one cut to the base
- Appropriate for a wide variety of cropping systems



An indispensible small farm sustainable wood resource and healer of degraded landscapes.



An essential on-farm resource with dozens of uses.
Asia has valued bamboo for millennia, what about the rest of us?



Bamboo windbreaks protect crops, mark property boundaries and provide useful poles.



Thick walled types are a strong construction material.



Bamboo furniture generates income for craftspeople.



Building structures such as greenhouses from bamboo can save farmers money on construction materials.



Treated bamboo is an excellent material for housing construction.

It is highly earthquake resistant.



Bamboo shoots are an important vegetable and market crop in Asia.



There is a huge gene pool to choose from.
This type is solid!

The best species are not well distributed throughout much of the world.



Simple boric acid treatment procedure on ECHO farm

Treatment can greatly extend the life of the poles.



Incredible fibrous root system holds soil together.



Bamboo roots holding bank of river from eroding away in Honduras

River bank stabilization can provide a community building resource.

Why Bamboo?

- Versatile uses of poles plant stakes, house construction, farm structures, etc
- Stabilizes soil
- Wildlife habitat
- Sequesters carbon from the atmosphere with high efficiency
- Produces raw materials for income generating ventures
- Windbreak
- Animal forage



A multi-purpose shrub for small farms. Provides abundant animal forage and biomass for compost and mulch.



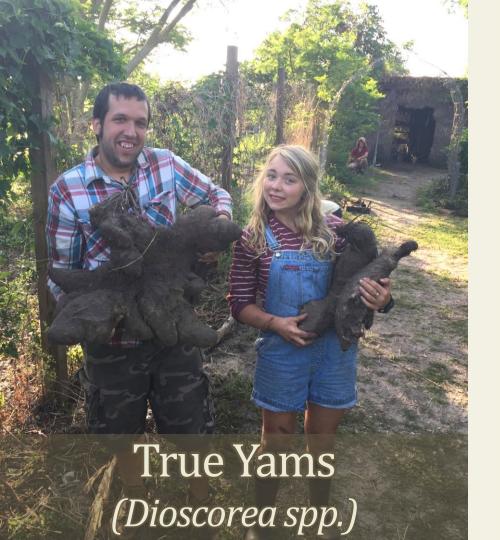
Mexican sunflower produces more biomass than any other plant on the h.e.a.r.t. farm.



Cut and carry goat forage bank after heavy harvesting

Why Mexican Sunflower?

- Incredible biomass production
- Grows on extremely poor soils
- High nutrition animal forage
- Accumulates nutrients very efficiently
- Soil improving ability as cut-and-lay green manure
- Potentially useful in producing liquid plant fertilizer
- Useful for producing biological pesticides



An important staple in some regions that has yet to reach its global potential as a "back up food reserve", hiding in the ground for times of need



Incredible yields, sometimes over 100 pounds per plant after a few years in the ground. Some types can be stored for up to 6 months.





Huge diversity of genetics adaptable to widely varying conditions. 60+ edible species of Dioscorea exist.



Dioscorea bulbifera – A potato that you pick like a fruit Caution: some types are toxic





goats and soda

FOOD

The Yam That Deserves To Win The Internet

November 23, 2017 · 7:00 AM ET

COURTNEY COLUMBUS



Yams in the news – lesser known species of Madagascar



Suitable crop for multistoried agroforests

Produces reasonably in mixed plantings and growing on live trellises



Dioscorea esculenta produces small, potato sized tubers that are more marketable to some consumers.

Why Yams?

- Productive crop despite drought and poor soils
- Tubers are stored alive in the ground, leaving a reserve food for times of need
- Suited to agroforestry schemes, filling unique ecological niches on the farm
- Tubers store for months
- Large genetic diversity



A perennial squash for a variety of climate zones. Bears good tasting squash fruits, nutritious edible leaves and edible shoot tips.



A squash that is resistant to the many issues that plague cucurbits in the tropics. Plants can live 3 years or more.



Chayote shoot tips – a lesser known gourmet vegetable.



Commercial production in Honduras with a walk under trellising system

Why Chayote?

- Easy and productive squash for the
- Year round production in some climate zones and certain cultivars
- Yields multiple edible parts fruits, shoot tips, leaves and even edible tuberous roots
- Fruit are a durable and marketable item
- Plants live for multiple years, unlike other squash



The world is filled with thousands of amazing plants. Find ones that work where you live, then be fruitful and multiply them.