



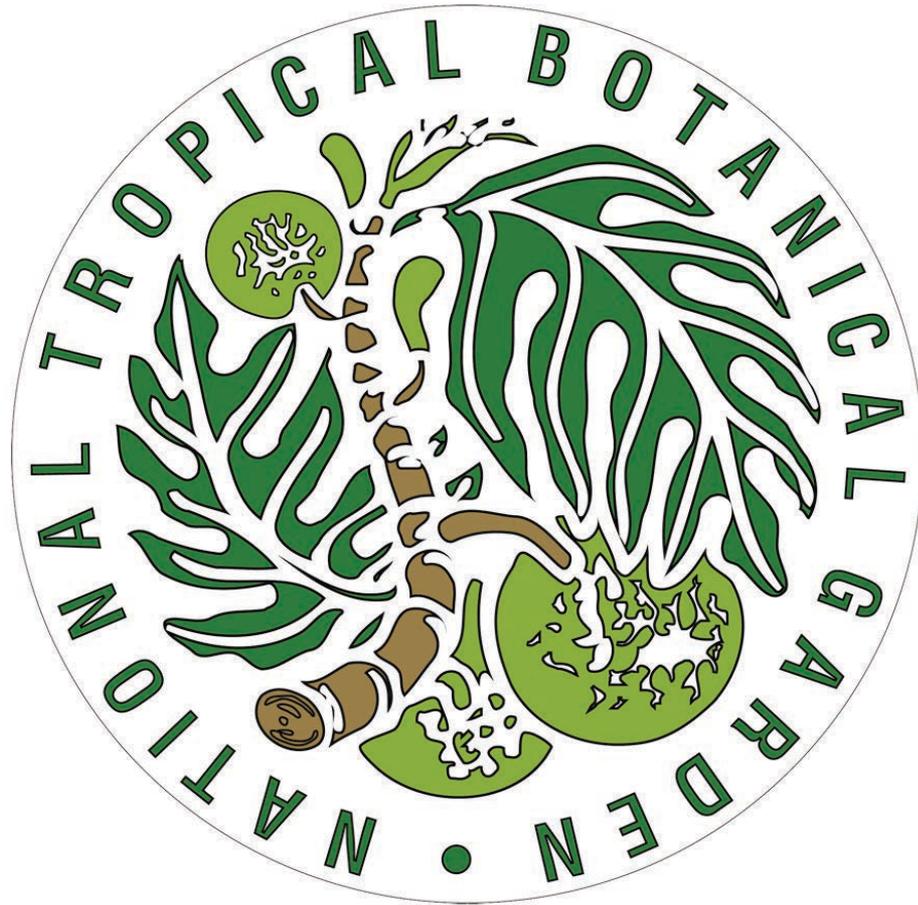
# *Breadfruit: From Orchard to Table and Around the Globe*

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Collection Manager / Curator  
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**Breadfruit Institute**  
Est. 2003

# National Tropical Botanical Garden



[www.ntbg.org](http://www.ntbg.org)





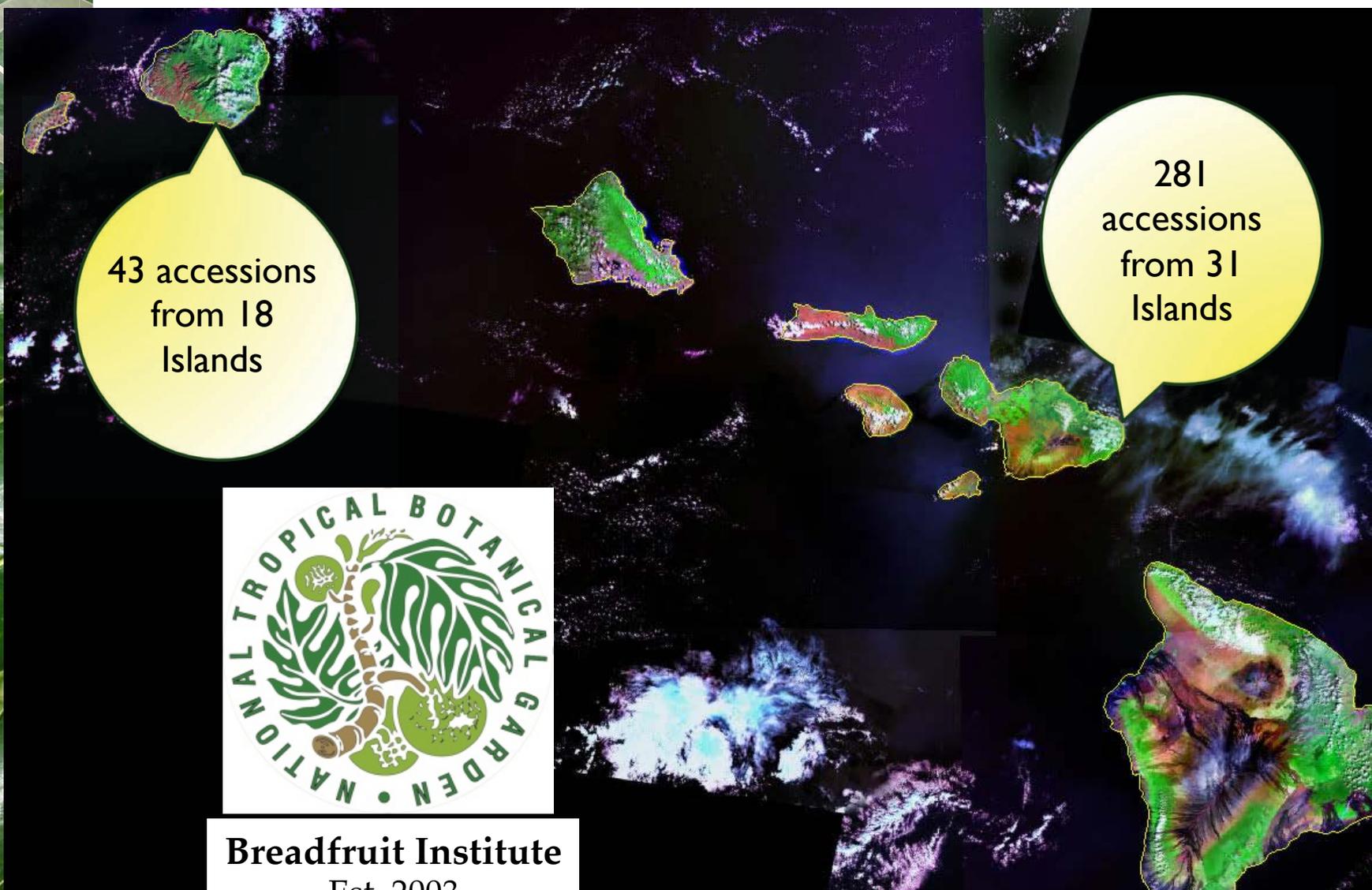
# Breadfruit Germplasm Repository



- 326 Accessioned trees
  - 34 Pacific Island
  - Seychelles
  - Indonesia
  - Philippines
  - Honduras

Dr. Diane Ragone  
Director, Breadfruit Institute  
National Tropical Botanical Garden

# Breadfruit Germplasm Repository



43 accessions  
from 18  
Islands

281  
accessions  
from 31  
Islands



**Breadfruit Institute**  
Est. 2003







**1978 – 1981** First  
plantings at KG

**1989 – 1991** Bulk of  
Collection planted

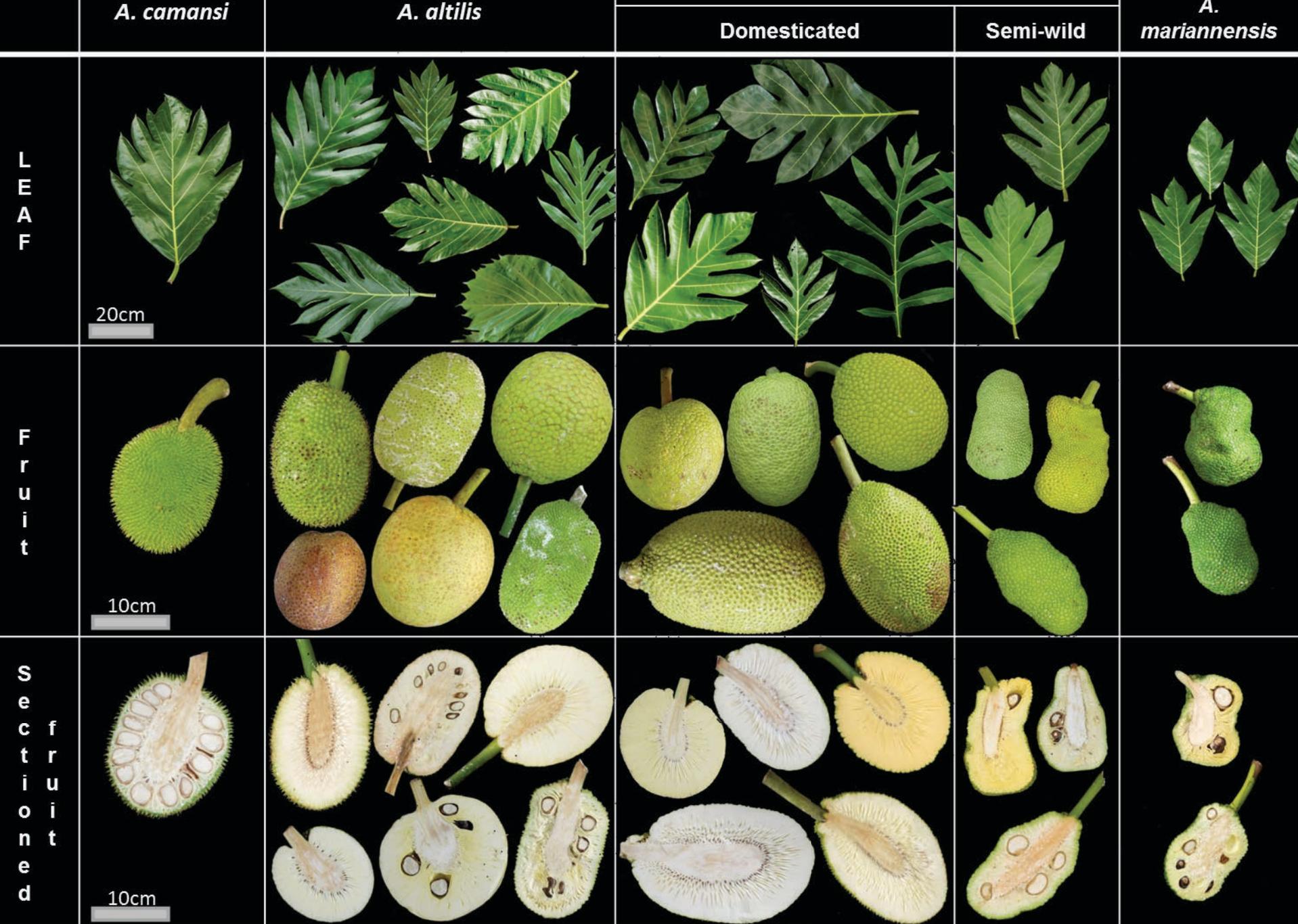
**1995** First tree fertilization  
**2003** Breadfruit Institute  
established

**Kahanu Garden ~120 acres in cultivation:  
never more than 5 full time gardeners**

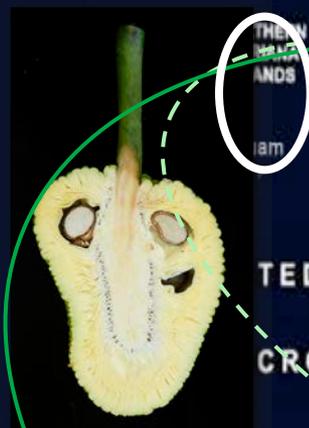




# 28 | Accessioned trees from 3 | Pacific Islands (on ~5.7 acres)



*A. mariannensis*



THE  
HAWAIIAN  
ISLANDS  
lam

UNITED STATES OF  
AMERICA  
INDONESIA



*A. a. x A. m.*

KIRIBATI

*A. mariannensis*



PAPUA NEW  
GUINEA

*A. camansi*



SOLOMON ISLANDS

VANUATU

NEW CALEDONIA



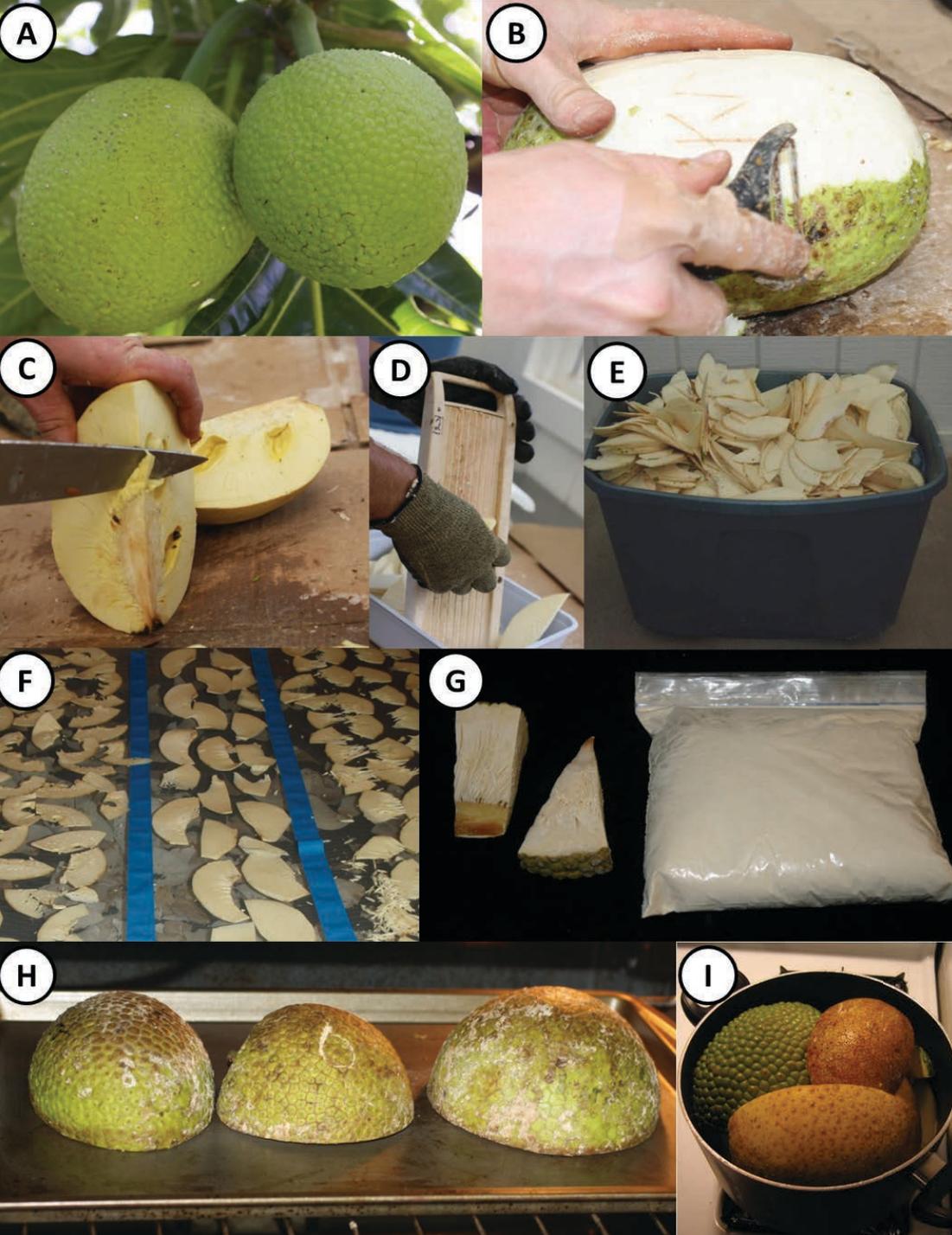
*A. atilis*

FRENCH POLYNESIA

ISLANDS

Pacific

Ocean



# Nutritional Characterization

- **94 cultivars/species**
- **3 fruit per tree**
- **2 years of collections**
  - Frozen
  - Flour
  - Baked
  - Boiled
- **Measures**
  - Edible Yield
  - Moisture
  - Protein
  - Ash / minerals
  - Starch
  - Carotenoids / Vitamin A



Published for The Society for Economic Botany  
 by The New York Botanical Garden  
 The New York Botanical Garden  
 Springer

# Protein Content - Fresh

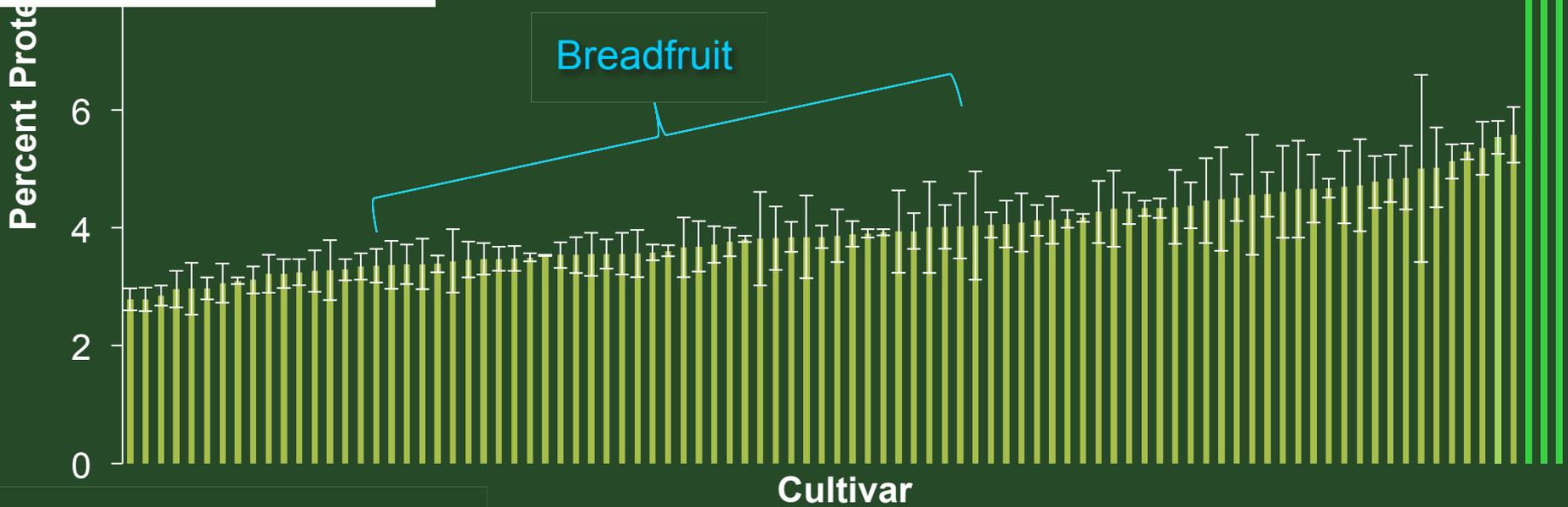
## Breadfruit

Range = 2.8 - 6.2%  
 Mean = 3.9%

## Breadnut

Mean = 13.1 %

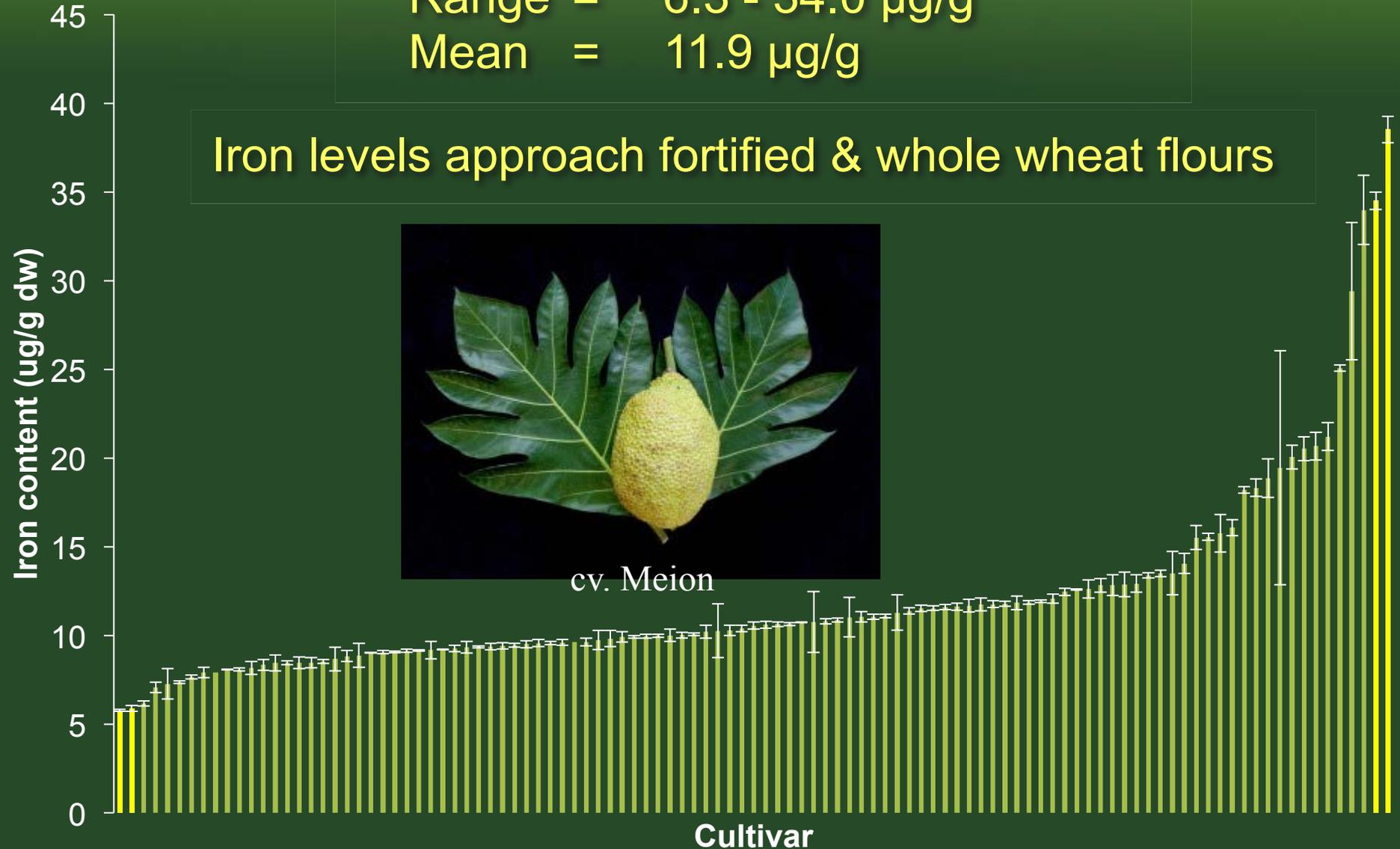
Breadnut



# Iron

Range = 6.3 - 34.0  $\mu\text{g/g}$   
Mean = 11.9  $\mu\text{g/g}$

Iron levels approach fortified & whole wheat flours

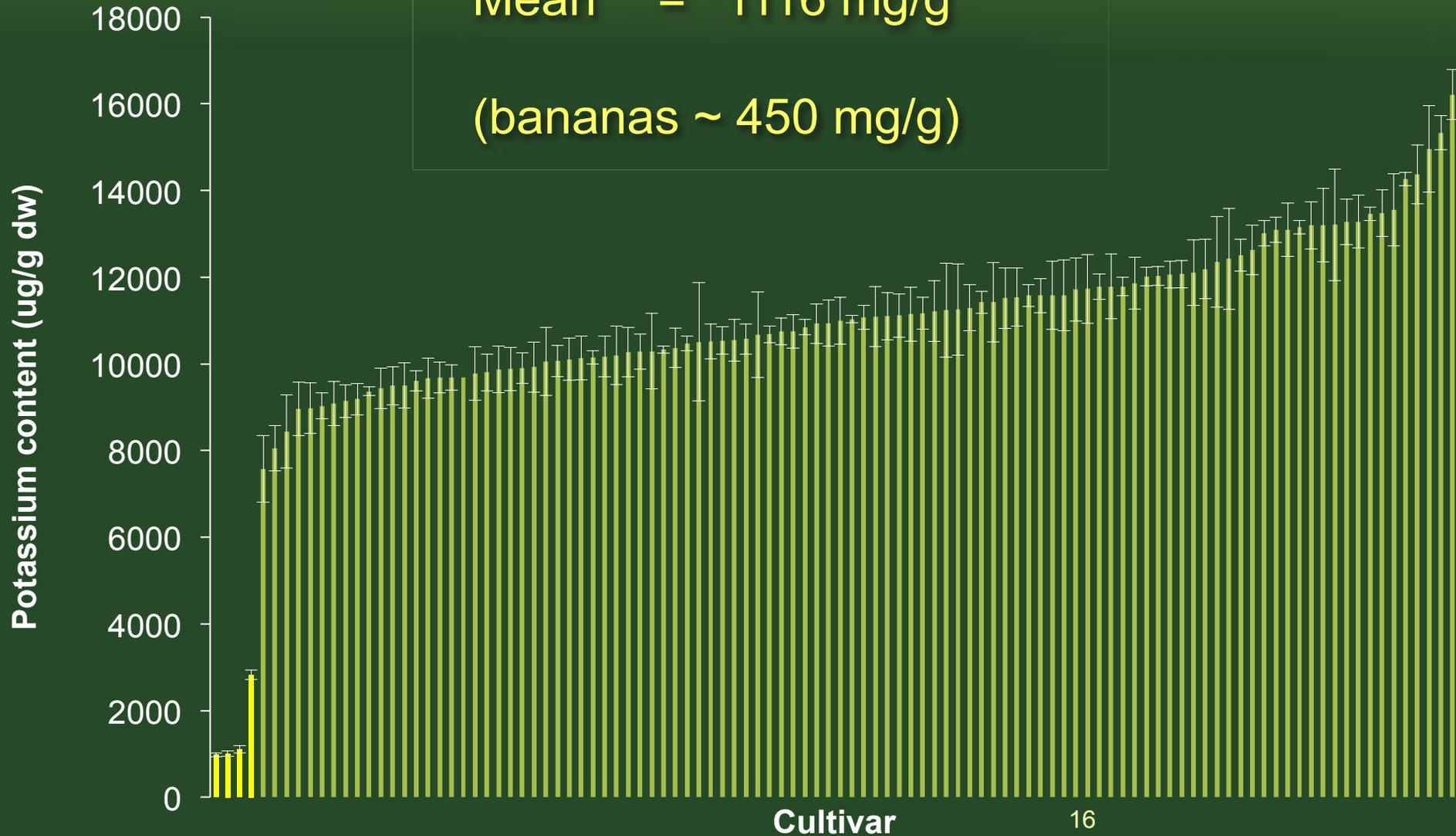


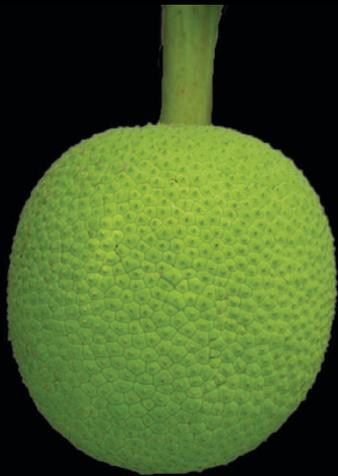
# Potassium

Range = 758 - 1621 mg/g

Mean = 1116 mg/g

(bananas ~ 450 mg/g)

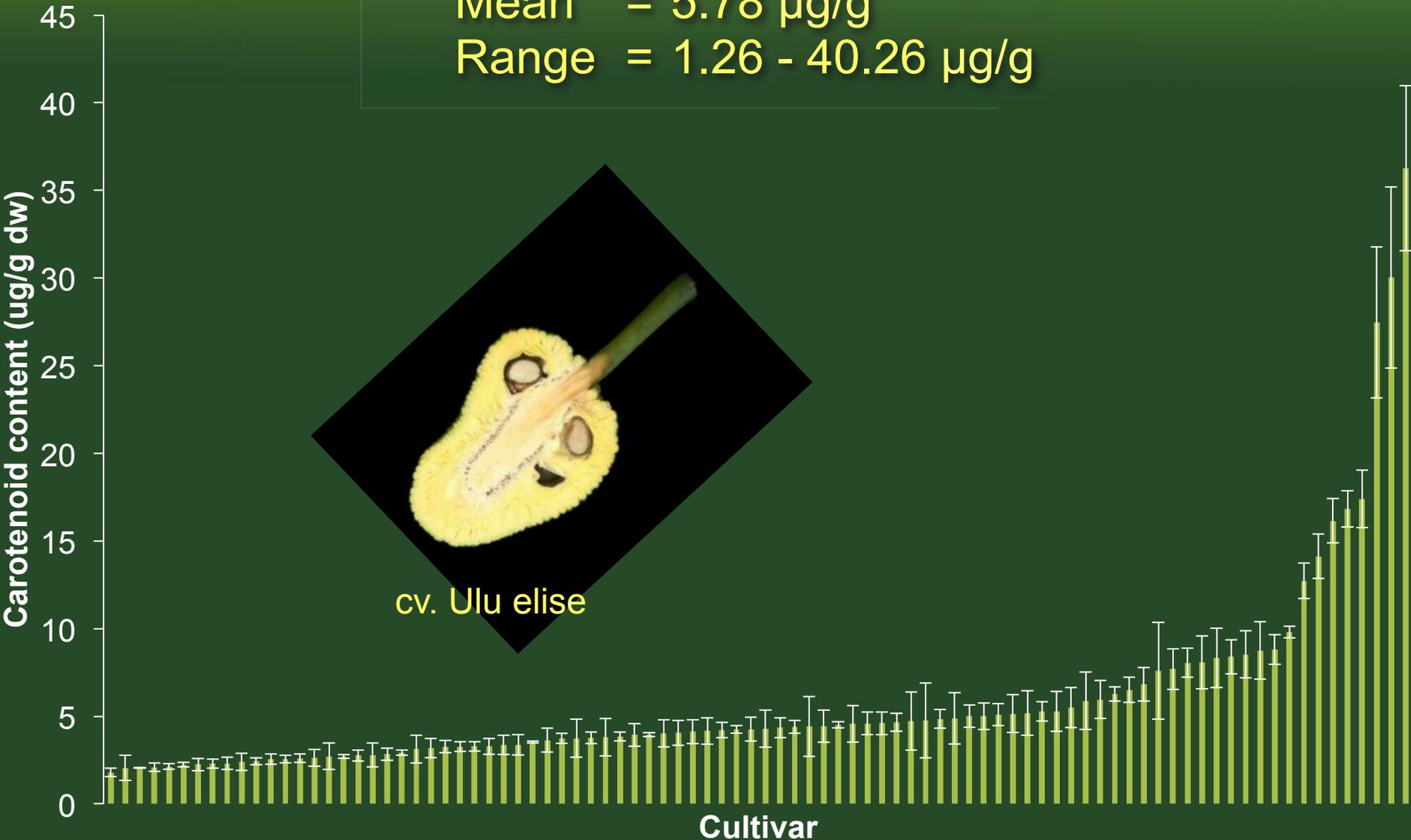




**Relative Potassium Levels**

# Total Carotenoids

Mean = 5.78  $\mu\text{g/g}$   
Range = 1.26 - 40.26  $\mu\text{g/g}$



cv. Ulu elise

# Value-added Products





**ti Champion**  
Veritab la  
Snack #1  
**PowerCakes**  
OVER Essential Vitamins & Minerals

**BREADFRUIT CAKES**  
Nutrition Facts  
Serving Size: 44 grams  
Calories: 129

**INGREDIENTS**  
Sugar, wheat flour, Breadfruit Flour, Yeast, natural, dark molasses, baking powder, vanilla, lemon zest

**VITAMINS & MINERALS**  
Iron, Zinc, Magnesium, Manganese, Phosphorus, Iodine, Copper, Vitamin C (ascorbic acid), Biotin, D3 (cholecalciferol), Folic Acid, Nicotinamide, Pyridoxine, Riboflavin, Thiamine, Vitamin B1 (thiamine), Vitamin B12, Vitamin D3, Vitamin E (dl-alpha-tocopherol acetate).

Produced in Jamaica...plans to export into the US market.  
Specifically for Afro-Caribbean neighborhoods and population  
centers



MARKET

**Nel's Old Time**  
AUTHENTIC JAMAICAN

FRESH

**ROASTED  
BREADFRUIT**

*Slices*

**REBANADAS DEL FRUTO  
DEL PAN ASADO**

ISO 14001  
Certified

Frozen for Freshness/ Congelado para conservar su frescura

Net Wt. / Peso Neto 400g (14.1oz)

JAMAICA

# Flour

- Bread (loaf & flat breads)
- Baby food
- Crackers/biscuits
- Snack foods (extruded)
- Cakes
- Pancakes
- Cereal
- Animal Feed



**The flour is  
Gluten Free!**

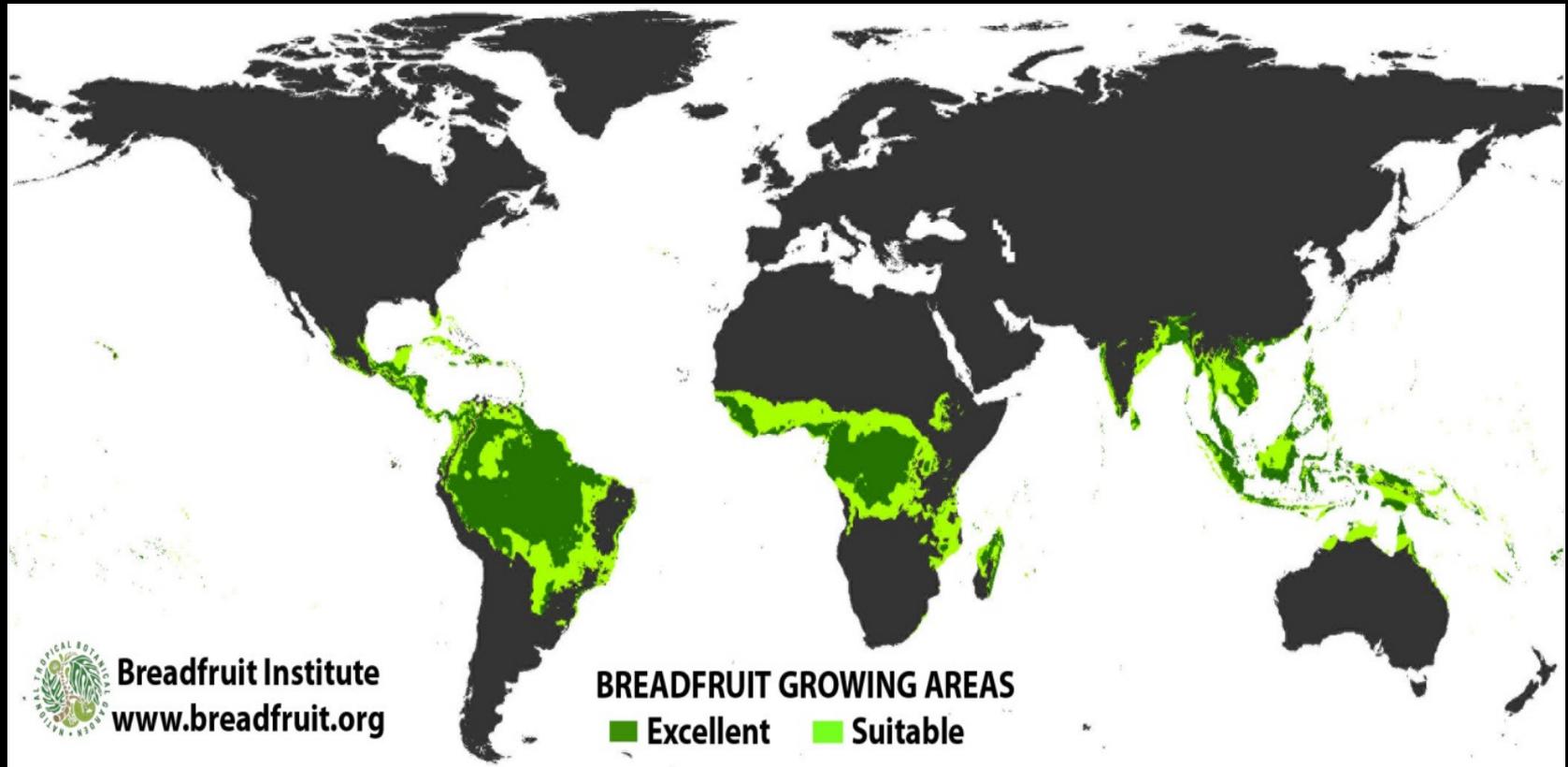


# Fish & Livestock



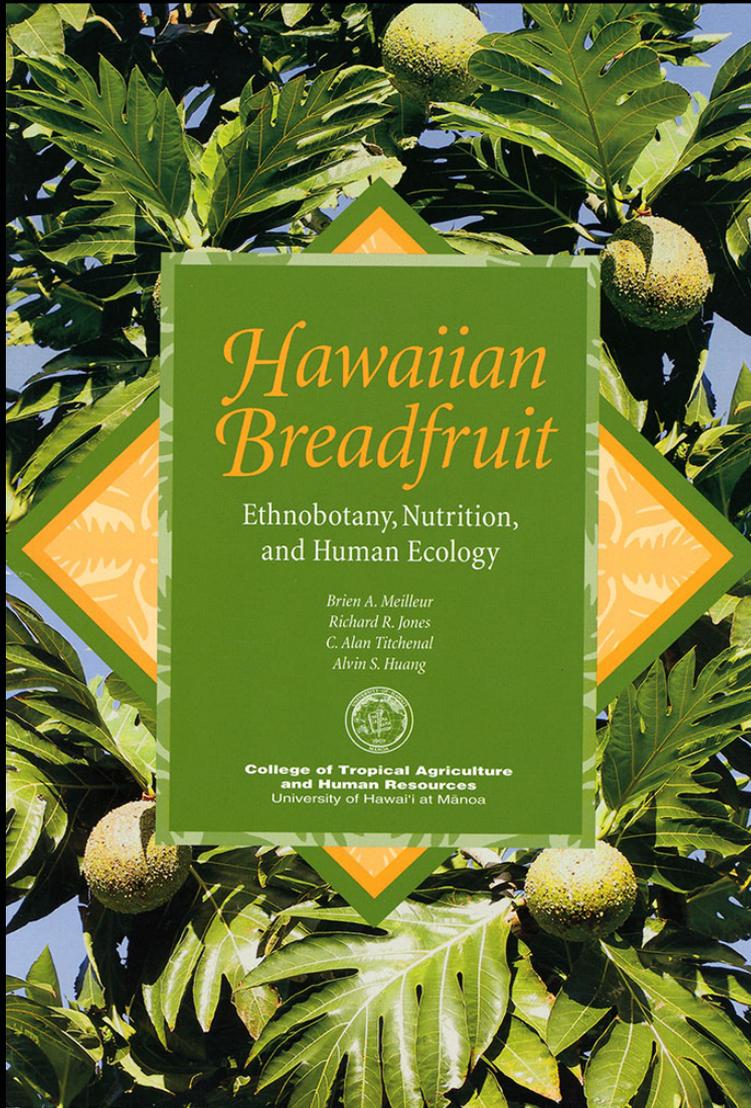
- Traditional and currently fed to dogs, pigs, goats, poultry, sheep.
- Hogs finished faster when diet was supplemented
- Also used to entice fish into fishtraps, and as chum.
- Peels, core over-ripe, unused fruit
- Natural Farming-type IMO machines?

# Will breadfruit grow (well) on my land?



- Will they grow at High Elevations (~2000' )?
- Will they grow where it is dry / windy / hot
- Need more Agronomic Data

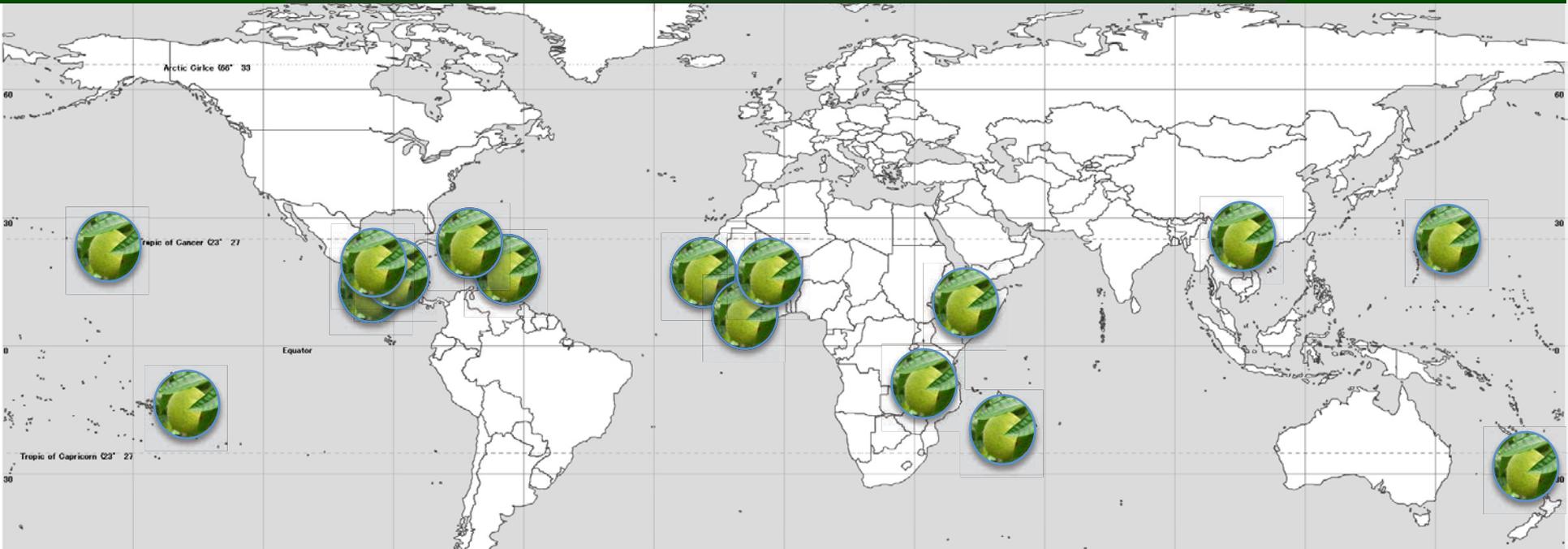
# Historical Account



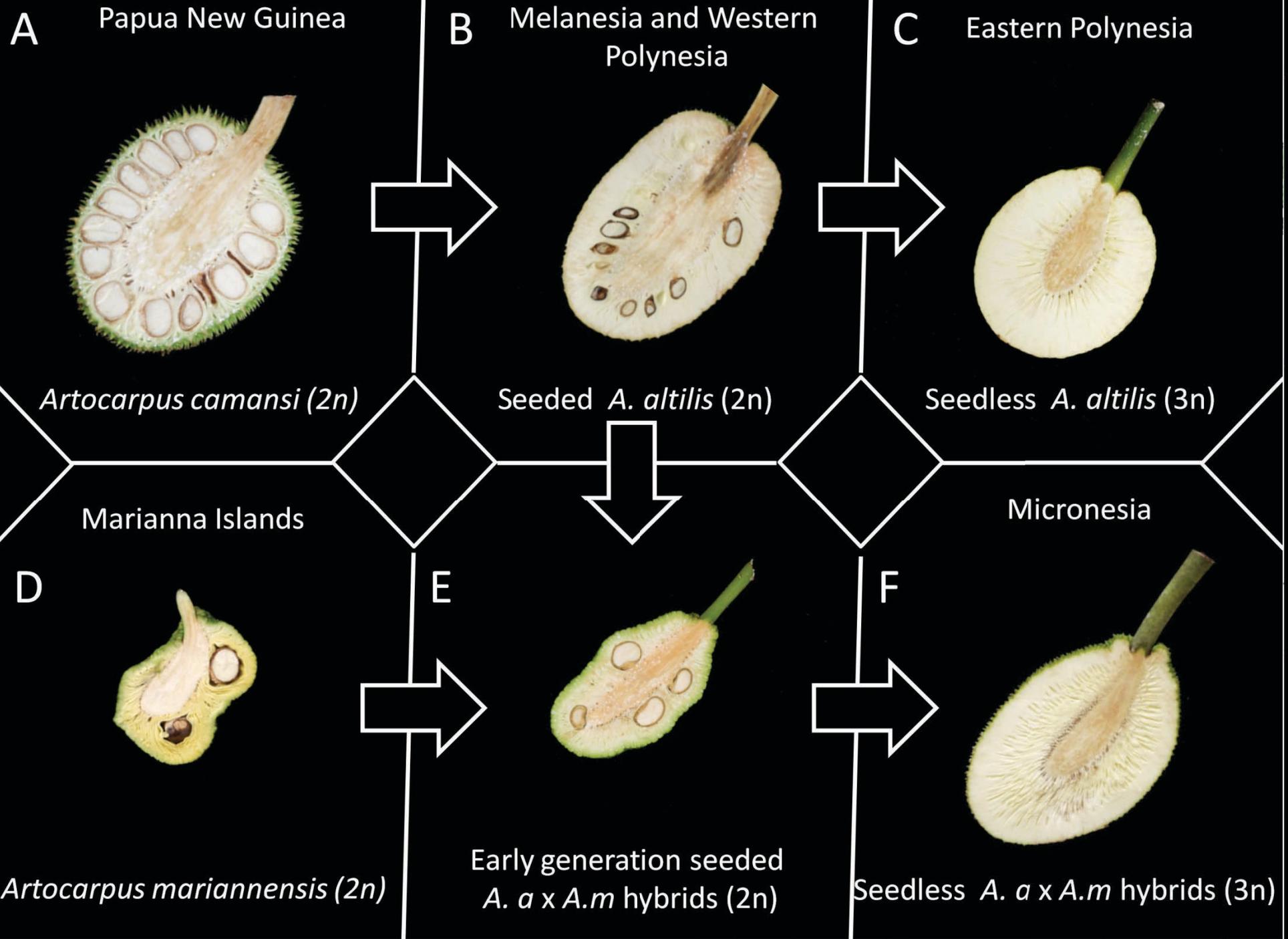
- May or June through summer into August.
- Cultivated from 30-1500 ft.
- Kona - groves located at 2000-2600 ft., most concentrated at 600-650 ft.
- Temperature: 60-82°F
- 12 tons fruit/acre (40 ft. spacing).



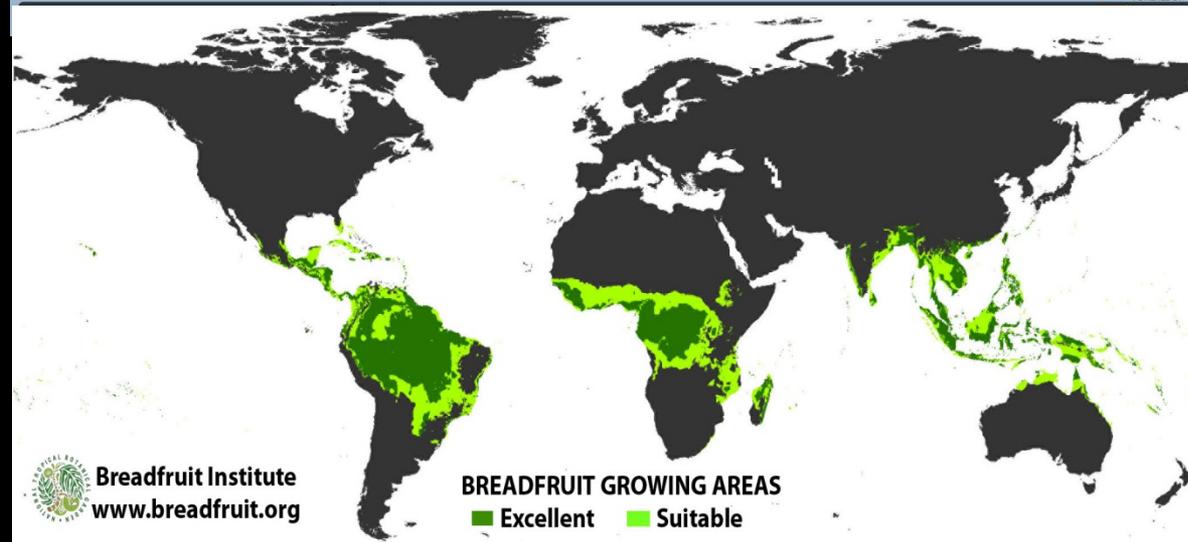
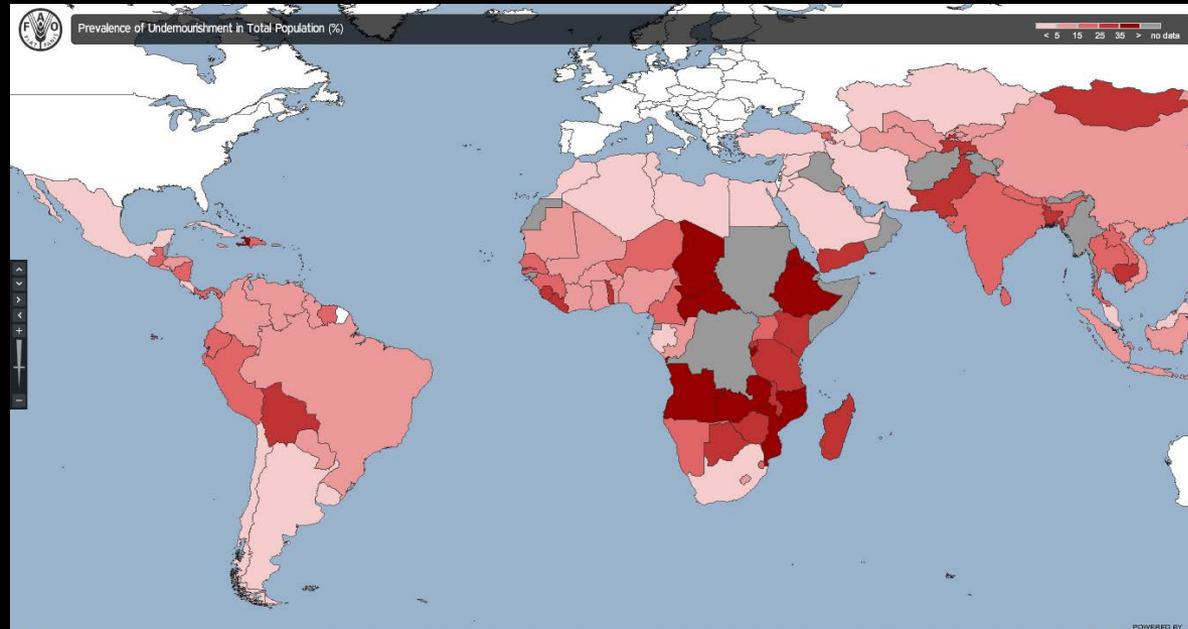
# Countries receiving breadfruit plants as part of Global Hunger Initiative



OCEANIA	CARIBBEAN	CENTRAL AMERICA	AFRICA		ASIA
American Samoa	Haiti	Costa Rica	Ghana	Mozambique	Myanmar
Guam	Jamaica	Honduras	Kenya *	Nigeria	
Hawaii		Nicaragua	Liberia *	Tanzania	
Tahiti *			Madagascar		

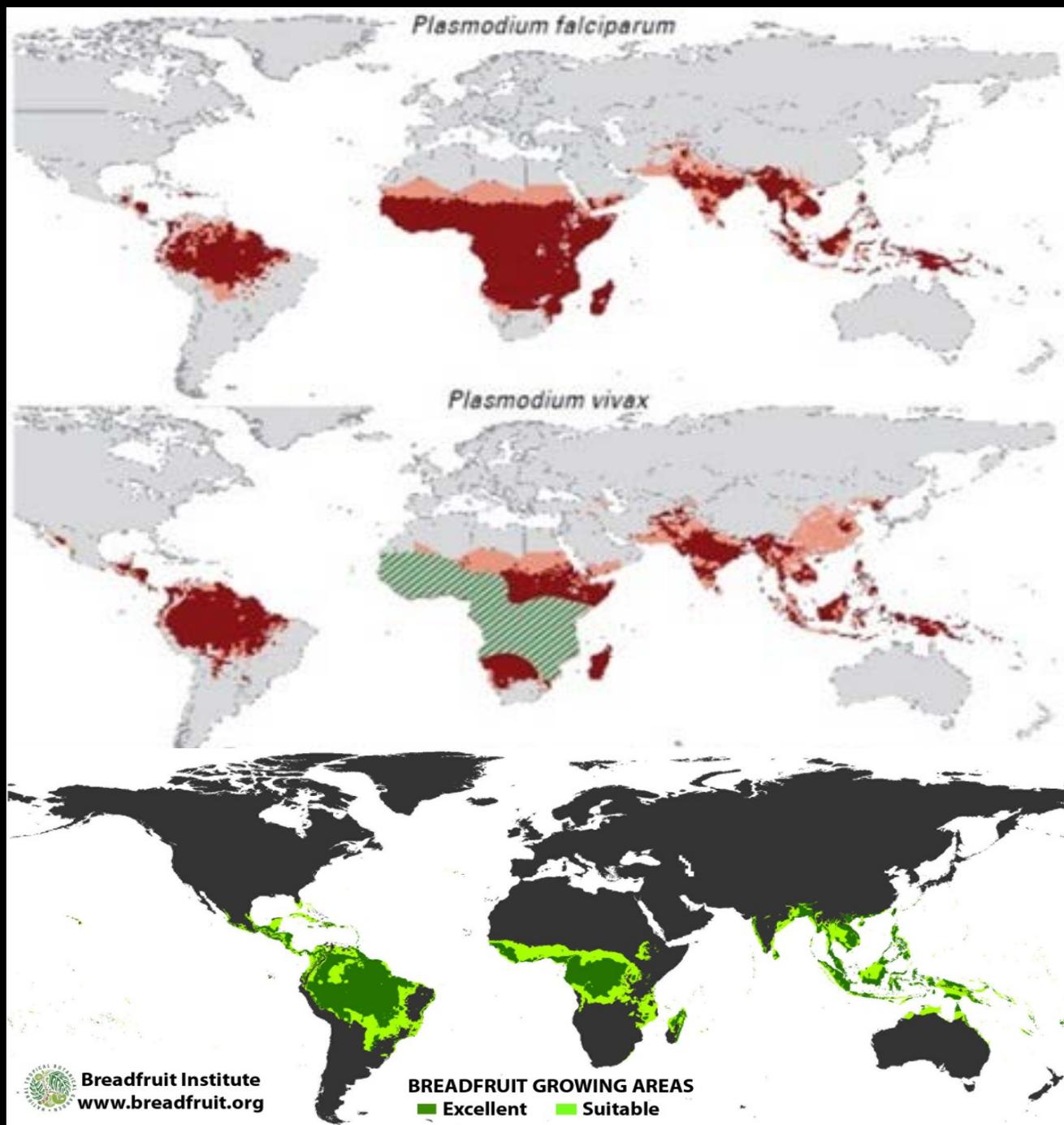


Asia and the Pacific region is home to over half the world's population and nearly two thirds of the world's hungry people (Source: *FAO news release, 2010*)



# Malaria Regions

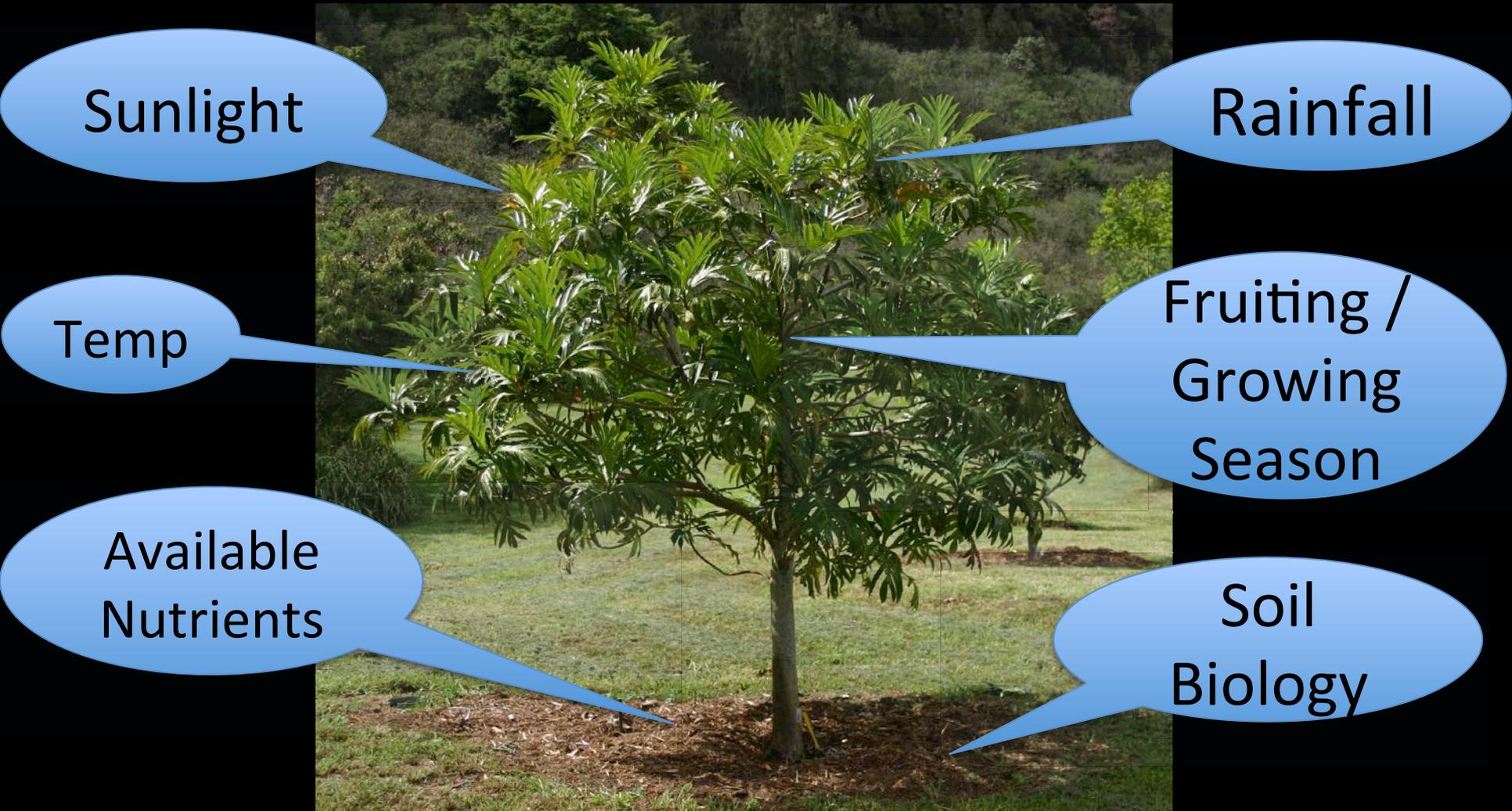
(*Plasmodium falciparum* &  
*Plasmodium vivax*)



A photograph of a large, mature tree with a thick, textured trunk and dense green foliage. The tree is the central focus, with its canopy filling much of the upper half of the frame. In the foreground, there is a grassy area with some fallen leaves and a dirt path. A yellow rectangular box with a black border is superimposed on the right side of the image, containing text. The background shows other trees and a clear sky.

How do we  
**PROPERLY** care  
for this collection?

# Tree growth is active, Tree care must be active too!



Sunlight

Rainfall

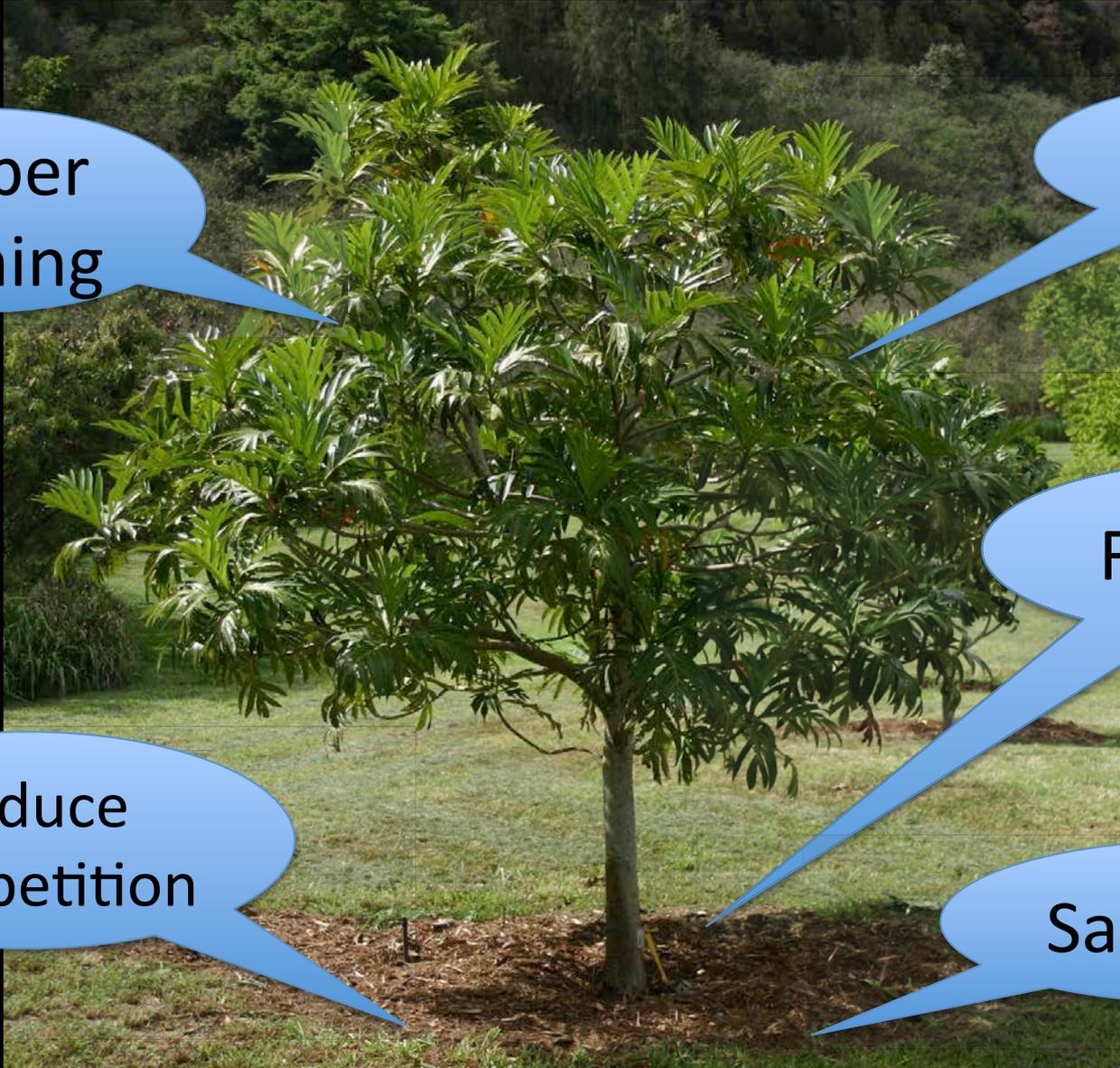
Temp

Fruiting /  
Growing  
Season

Available  
Nutrients

Soil  
Biology

# Tree Health(care)



Proper  
Pruning

Repair  
damage

Fertilizer

Reduce  
Competition

Sanitation

# Sanitation

- Best way to keep your trees healthy and producing fruit!
- Remove as much as you can (fruit, branches, anything that can rot)



**No Care =  
Disease and  
Decline**



# Fruit Disease and Tree Decline



**Breadfruit diseases are in Hawaii and can affect fruit, stems, leaves, and damaged areas of trunk**



Fusarium



Phytophthora

- *Phytophthora*
- fruit Anthracnose
- *Fusarium* twig rot
- *Rhizophus* soft rot



Phytophthora



Fruit anthracnose



Phytophthora





**Fruit trees NOT  
landscape plants**



Tree health  
begins from the  
ground up!

**Soil Health**  
**=**  
**Tree Health**

# Good Mulch:



- High quality material makes the best mulch [“trash in--trash out”]
- Provides nutrients to trees and soil
- Provides habitat and nutrients to beneficial micro-organisms
- Encourages feeder-root growth

# Bad Mulch

- Too close to trunk (should not be touching)
- Improper material provides little to no nutrients to the trees and can harbor pathogens



# Tree Health:

GOAL: to have the healthiest, most productive trees possible with a practical amount of management



- Proper Pruning
- Sanitation
- Soil Health
- Nutrition
- Best Practices

# Management Practices:

- Available management will dictate planting, pruning, etc
- Goals and objectives must be realistic



# Fertilizer

- For best results we recommend a soil test (UH / CTAHR or elsewhere)
- Mulch
- Compost



- Cal-Pril
- Rock Phosphate
- Azomite
- Perfect Blend 4-4-4
- 9-9-9 iron

CTAHR free publications

# Cover Crops

- Benefit soil structure
- Benefit microorganisms
- Suppress weeds
- Habitat for beneficial insects
- reduce nutrient loss (leeching)



Lab-Lab  
(*Lablab purpureus*)

### Benefits provided by lablab

**EXCELLENT** as a cover crop to suppress weeds and provide soil erosion control

**VERY GOOD** N-fixer and green manure to increase soil organic matter and improve soil structure and quality

**TOLERATES** acidic, low fertility soils and drought

**GOOD** forage production, nutritional quality, and palatability

**AVOID** climbing varieties; tends to be invasive

**USE IN** rotation with annual crops including vegetables, herbs, cut flowers, annual ornamentals, and root crops such as dryland taro





# Tree Pruning

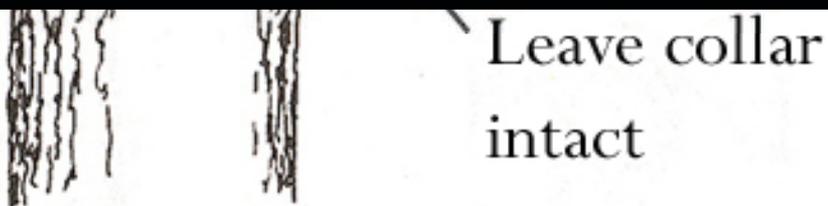
- **why** are you pruning?
- for **what** reason? (harvest, safety, etc.)
- suspected outcome / objectives?



# Tips / Suggestions:



# Who is Liable???



We recommend proper pruning (by a professional) annually following fruiting for mature trees, and as needed for young (>4yr old) trees











**Breadfruit are tough and proper pruning can yield successful and healthy trees**



# Tree Spacing

- What is the practical amount of management?
- What are the trees going to be used for?
- How much time / effort / money do I have to spend?







# Tree Spacing



35'

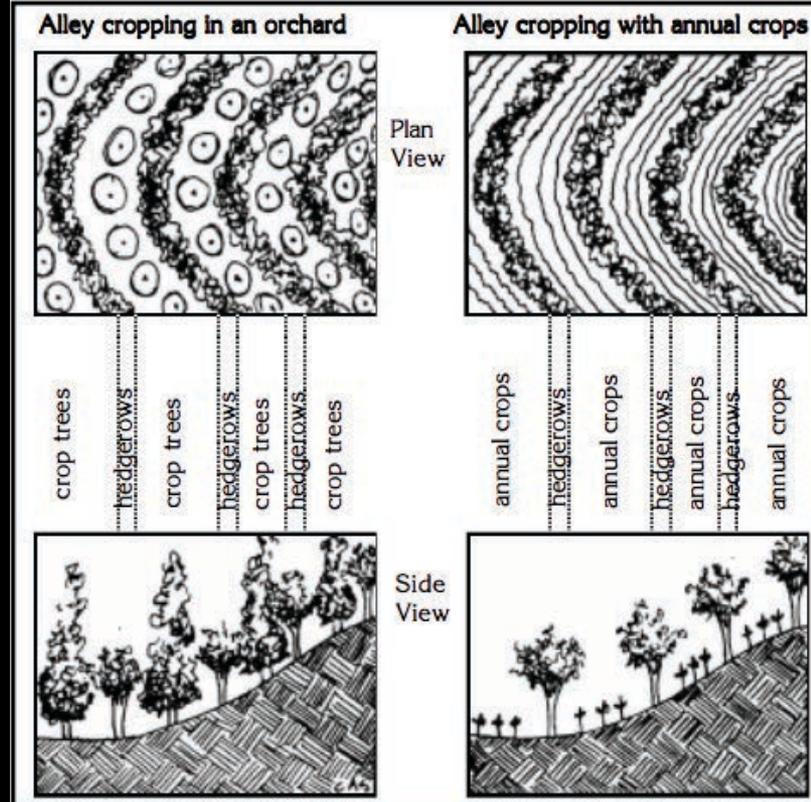


~35' trunk-to-trunk  
Space for equipment  
Sun for grass / weeds / cover crops

# Tree Spacing

- Could include management
- Help yourself out with materials, etc.

agroforestry.net



## Uses of NFTs in Cropping Systems



- Windbreak
- Living fence
- Fodder
- Timber
- Wildlife Habitat



- Mulch bank
- Fodder bank
- Timber/pole wood
- Wildlife Habitat
- Shade
- Bee forage
- Nurse trees



- Contour hedgerows
- Alley cropping
- Fodder hedges
- Erosion control

# What is the best variety to plant for..

- My location / elevation
- Abundance (year round harvest)
- My business / customers





**Afara**



**Lemae**



**Ma'afala**



**Maopo**



**Meiarephe**



**Meion**



**Meitehid**



**Meiuhpw**



**Meinpadahk**



**Otea**



**Piipiia**



**Puaa**



**Puou**



**Rotuma**



**Toneno**



**Ulu**



**Ulu fiti**



**Ulu tala**



**White**



**Yap**

# Harvesting Fruit



- When to harvest
  - Green
  - Mature
  - Ripe
- All varieties are not the same
- Best method to harvest
  - depends on size of tree

Could also be different based on VARIETY











September 2011



February 2012







# What are the specific needs / conditions of *your* trees?



**Why** are you growing breadfruit?

- Personal / Family use
- Small scale farming
- Orchard / Commercial scale
- Forestry / Shade
- Urban





# eat more `ulu

[www.breadfruit.org](http://www.breadfruit.org)

