

Novelty. Flair. Allure. Sexy. Quality.



Superfruit should have these attributes and also be important for human health.



# Postharvest requirements: farm to market and is there a case for certifying superfruit?



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*Superfruits Symposium: myth or truth? Ho Chi Minh City, Viet Nam, 1 – 3 July 2013*

# Superfoods – 14 flagship foods said to confer health and wellbeing – most are fruit

- **Blueberries**
- **Oranges**
- Beans
- Broccoli
- Oats
- **Pomegranate**
- **Pumpkin**
- Salmon
- Soy
- Spinach
- Tea (black and green)
- **Tomatoes**
- Turkey
- Walnuts



All fruit are super.

But are some fruit  
more super than others?



# Superfruit – a marketing boom?

- A superfruit has appealing taste and appearance
- 1) high nutrient density,
- 2) superior antioxidant quality,
- 3) health benefits.
- *The popularization of superfoods means that many food and drinks now have a 'health-halo' which significantly influences consumer preferences."*



# Major superfruit



- Use of term ‘superfruit’ on labels banned unless specific nutritive and health attributes have been scientifically demonstrated, e.g. cranberries; too many spurious claims?
- Red, purple, black fleshed fruits have high antioxidant activity plus increasing number of health conferring attributes.
- Increased number of processed products (juices, purees, cosmetics) using combinations of superfruit.





# Supermarketing



An Extraordinary  
Antioxidant-Rich Palm Fruit



Alexander G. Schauss, PhD, FACN



The **BIG 3** benefits of  
**SUPERFOODS:**  
Antioxidants, Nutrients, Fiber

① **ANTIOXIDANTS** protect the body from wear and tear, while strengthening the immune system, muscles, bones and skin. They do this by stabilizing cell-damaging "free radicals" that form as we use energy and age. Unhealthy processed and sugary foods, stress, excessive exercise, extended sun exposure and some chemicals in our environment also spur free radical production. The more antioxidants present in the body, the less damage free radicals can cause.

**\* EXPERTS SAY \***  
Think ORAC! One of the many measures of the antioxidant activity in foods is the ORAC (Oxygen Radical Absorbance Capacity) value. Eating foods with high ORAC values (a.k.a. Anti-Aging Points) may help to slow the aging process. Daily recommended points is 3000-5000 (USDA Agricultural Research Service, February 1999).

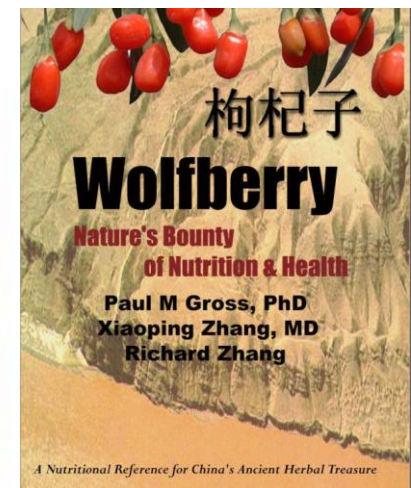
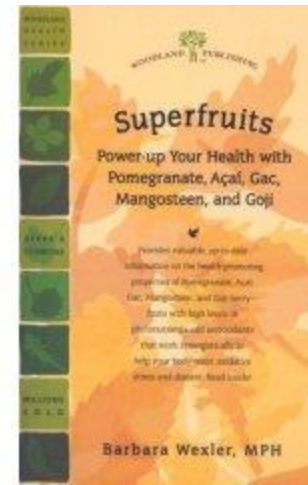
SAMPLE SUPERFOODS ORAC VALUES (PER 3½-OZ SERVING)

Blueberries	2400
Broccoli	280
Blackberries	2036
Kale	170
Spinach	1260



② **NUTRIENTS** In most superfoods consist of vitamins and minerals of the type found through studies to be lacking in many Americans' diets, yet key to health. They include vitamin A (as carotenoids), vitamin C, the B vitamin folate, magnesium and potassium. Some superfoods also contain protein, "good carbs" and disease-important healthy fats, such as omega-3s and GLA (gamma-linolenic acid).

③ **FIBER** aids digestion and improves absorption of nutrients, increases insulin effectiveness and feelings of "fullness," while decreasing the risk of certain diseases. The typical U.S. diet only includes about half the recommended 25-30g/day. See why you need more?





Plumegrantate – a new plum  
from Israel

# Superfruit



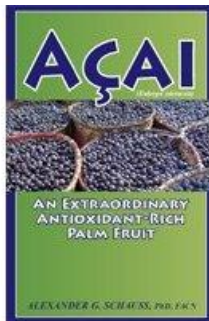
Cranberry



Elderberry



Concord grape



Blueberry



Pomegranate



Raspberry



Chokeberry



Boysenberry



Black currants



Goji berry

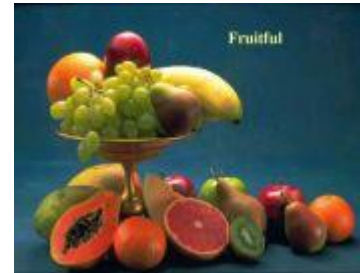
Blackberry



Bilberry



# Tropical and subtropical **superfruit**



# Baobab tree - *Adansonia digitata*

- Baobab grown in African countries in the savannah around the equator.
- Underutilized and not cultivated.
- Baobab is a supertree as all plant parts are useful to man and animals.
- Bark, leaves, fruit, seeds and trunk are all used.
- Leaves are used for condiments and medicines



# Superfruit are very perishable as are all fruit.

- All fruit have limited shelf life.
- All are susceptible to physical, physiological and pathological damage during and after harvest
- Most superfruit from tropical or subtropical regions and have relatively short postharvest lives.
- Supply chain management critically important.





# Supply chain concept

- Consumer satisfaction is the key and will ensure profits for all when quality maintained and losses minimised.
- Growers must understand the supply chain.
- Communication between all players along chain is essential.
- Constraints should be identified and fixed.
- Use available IT systems for real time product monitoring and connections along chain.

## Maintaining the Cold Chain for Perishables

### Harvest

- ¥ Protect the product from the sun
- ¥ Transport quickly to the packinghouse

### Cooling

- ¥ Minimize delays before cooling
- ¥ Cool the product thoroughly as soon as possible

### Temporary Storage

- ¥ Store the product at optimum temperature
- ¥ Practice first in first out rotation
- ¥ Ship to market as soon as possible

### Transport to Market

- ¥ Use refrigerated loading area
- ¥ Cool truck before loading
- ¥ Load pallets towards the center of the truck
- ¥ Put insulating plastic strips inside door of reefer if truck makes multiple stops
- ¥ Avoid delays during transport
- ¥ Monitor product temperature during transport

### Handling at Destination

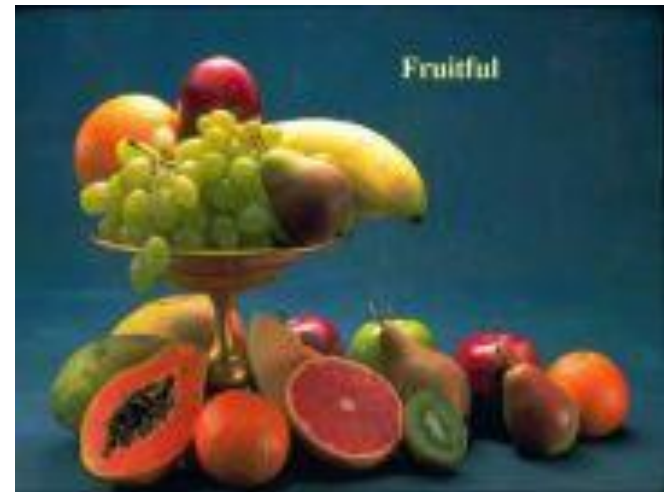
- ¥ Use a refrigerated unloading area
- ¥ Measure product temperature
- ¥ Move product quickly to the proper storage area
- ¥ Transport to retail markets or foodservice operations in refrigerated trucks

### Handling at home or food service outlet

- ¥ Display at proper temperature range
- ¥ Store product at proper temperature
- ¥ Use the product as soon as possible

# Key factors affecting postharvest quality

- Preharvest factors.
- Breeding and selection - cultivars must have desired attributes of size, shape, colour, juiciness and texture and taste.
- Cultivars with pest and disease resistance, long shelf life, high nutritional status.
- Tree management – pollination, pruning, thinning, spraying to optimise fruit quality.
- Nutrition, irrigation, fertilization, pest and disease control.



# Harvest maturity



- Optimum harvest maturity will depend on planned market; different for local and export.
- Too immature – lack of flavour, aroma and sweetness; susceptible to disorders, chilling injury and damage.
- Over mature – rapid senescence, softening, insipid flavour, susceptible to pathogens and physical damage.
- Physiological studies required to determine respiration and ethylene rate changes;
- Are fruit climacteric or nonclimacteric?





# Harvesting

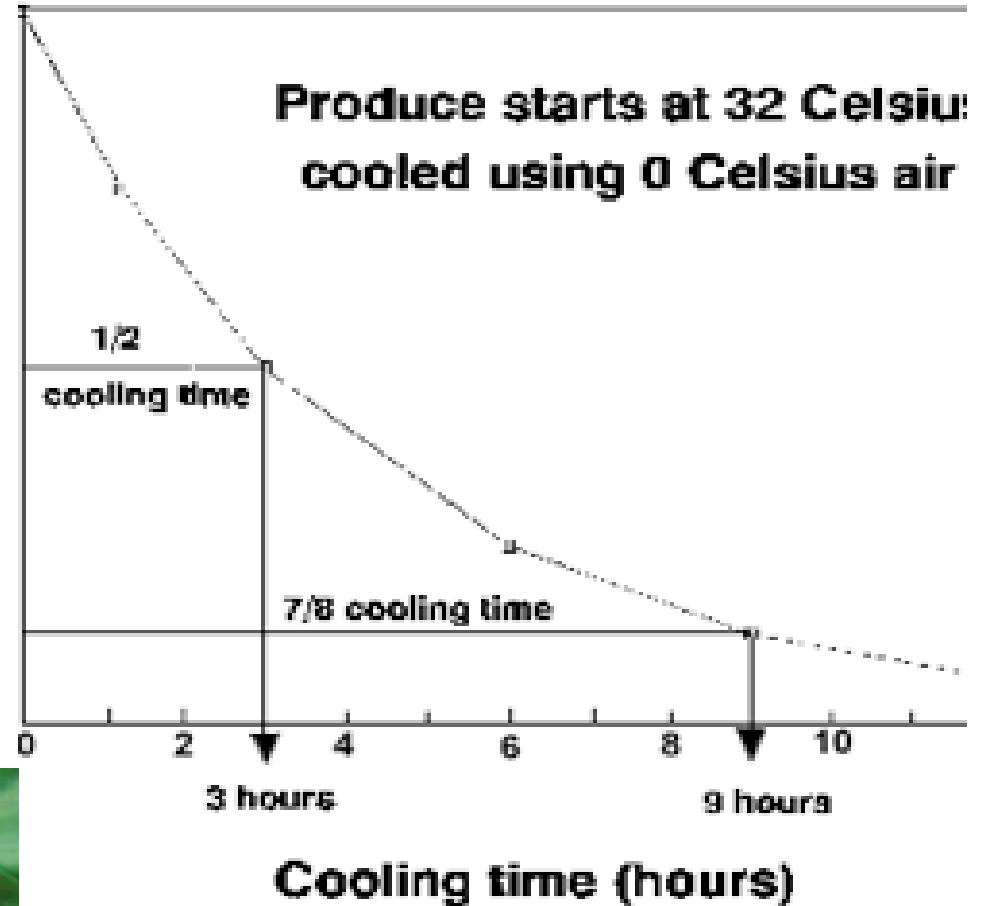
- Harvesting - coordinate with packaging, storage and marketing strategy.
- Avoid physical damage to products
- Train staff to adopt strict hygiene protocols – clean hands, short fingernails.
- Where possible harvest during cool time of day – e.g. early morning.
- Supermarkets must not be allowed to dictate harvesting time

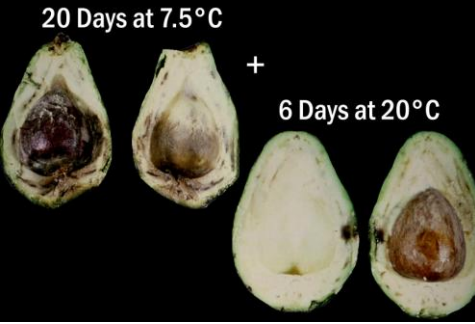


# Temperature management

## Most effective method to extend shelf life

- Postharvest deterioration is a function of temperature
- Place into shade and remove field heat quickly after harvest through precooling.
- Store at optimum temperature to reduce  $C_2H_4$  production and action as well as respiration.
- Avoid chilling temperatures





# Chilling injury [CI]

- Most tropical and subtropical fruit susceptible to CI.
- CI is result of physiological damage when products exposed to low BUT not freezing temperatures.
- Range of symptoms of CI – include pitting, water soaking, internal browning but eventually decay.

Chill sensitive fruit and lowest safe temperature	
Temp	Product
3	Jujube
4	Avocado (some cvs), lychee, tamarillo
5	Cactus pear, durian, guava, longan, mandarin, orange, feijoa
7	Some avocado cvs., olive, , pineapple, pomegranate
10	Carambola, lime, mango, papaya, grapefruit, some melons, passion fruit, rambutan, water melon.
13	Banana, breadfruit, cherimoya, mangosteen, jackfruit.



# Temperature summary

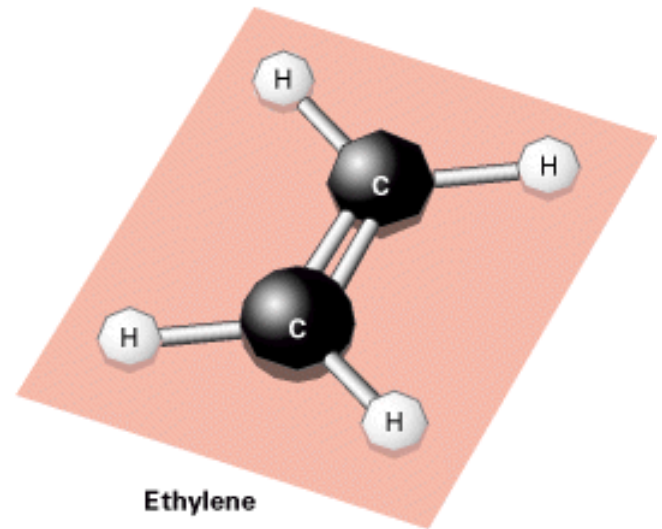
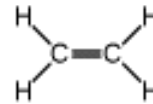


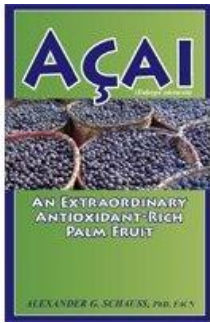
- Harvest products during cool of day - early morning or late evening
- Remove harvested product from direct sunlight, preferably into shade;
- If possible have packhouse cooled, or at least with good ventilation;
- Different technologies are available for rapid cooling of product after harvest
- Forced air cooling is applicable for many products;
- Hydro cooling can be used for fruit;
- Avoid chilling temperatures;
- Mobile units are available for forced air and hydro systems



# Ethylene

- Simple naturally occurring gas produced by all products
- Also produced from internal combustion engines, gas burning machines, industrial pollution and rotting vegetation.
- Positive and negative affects on quality.

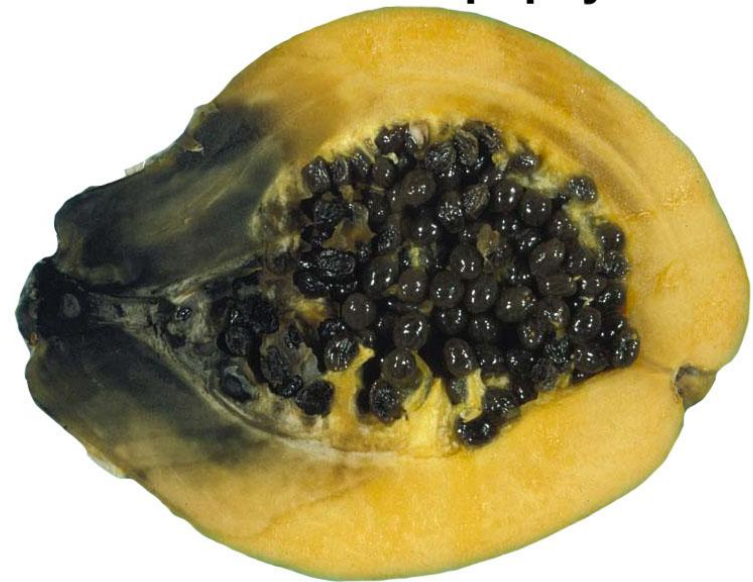




# Ethylene affects

- Positive affects: induces and modulates ripening
- Negative affects at very low concentrations: induces premature ripening, senescence and deterioration
- Avoid postharvest exposure to ethylene through chain
- Rotting fruit produce ethylene

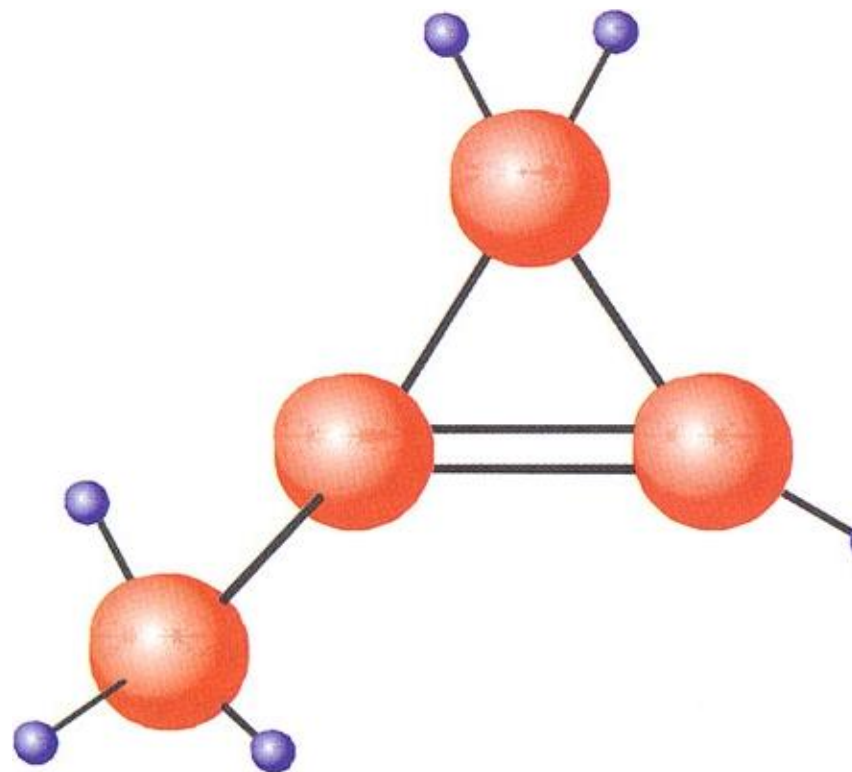
**Phoma caricae- papayae**





# 1-MCP SmartFresh<sup>SM</sup>

- Gas that inhibits ethylene action
- Patented application system released in air tight rooms
- Approved for use on melon, avocado, persimmons and kiwifruit in some countries.



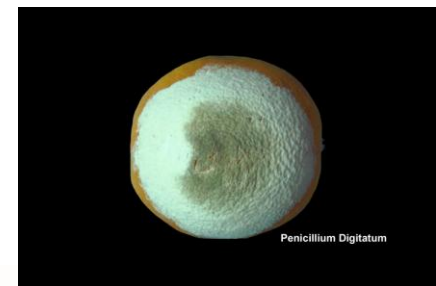
-Methylcyclopropene (1-MCP)

# How to reduce ethylene affects

- Avoid exposure to pollution that contains ethylene.
- Avoid physical, physiological and pathogen damage during harvesting, handling, packing, storage and transport
- Remove all reject product from packhouses and coolstores;
- Use electric forklifts in packhouses and coolstores;
- Use ethylene scrubbers to reduce ethylene concentrations;
- Run coolstores efficiently; maintain recommended temperatures to minimize ethylene production by products
- If permitted treat with SmartFresh<sup>SM</sup>;
- Use long life cultivars that have reduced production of and susceptibility to ethylene

# Postharvest pathogens and decay

- Most products resistant to most organisms
- Pathogen losses result from :
  - physical damage during harvest and handling
  - product stored too long after harvest
  - sustained chilling injury
  - physiological stress during the growing season
- Postharvest pathogens include:
  - *Rhizopus stolonifera*
  - *Botrytis cinerea*
  - *Alternaria alternata*
  - *Colletotrichum spp.*
  - *Fusarium sp.*



*Colletotrichum gloeosporioides*





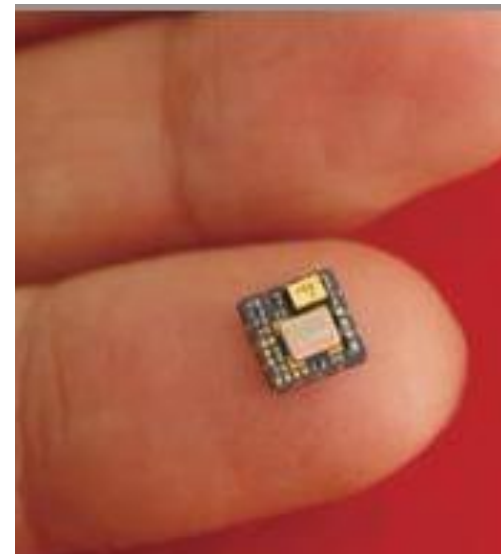
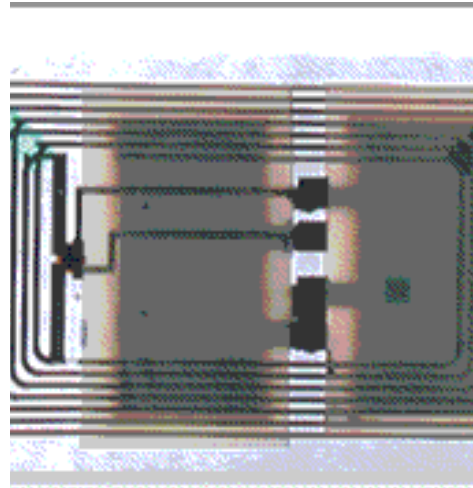
# Packaging –the 3 Ps

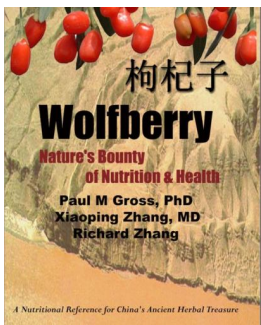
- **Protection:** from physical, physiological and pathological damage
- **Preservation:** shelf life extension;  $C_2H_4$  scrubbing; active packaging ( $O_2$  scavenging).
- **Presentation:** brand/logo for promotion, product traceability. Final presentation displays.



# Traceability

- Essential tool – food safety and biosecurity drivers
- Electronic product code identification, bar coding and RFID systems prevalent
- New technologies and systems becoming cheaper
- Cheap disposable sensors





# Certification – is it needed?

- Before certification can be created the following is needed:
  - \* Scientific proof required for health benefits of specific fruit.
  - \* Information required on component uptake in humans and subsequent positive physiological response.
  - \* Determination of component concentration or effectiveness as influenced by environment (including soil type, temperature, rainfall, biological stressors).
- More R&D essential to prove specific health benefits; collaboration between horticultural, food and medical scientists using 'omics.



# A challenge

- Actinidia [kiwifruit] genera have different composition and amounts of components.
- Grown in many regions of world.
- Will vary in chemical composition depending on growing environment.
- How can this be included in standard definition?



# GAP



- To meet market demands GAP must apply for all fruit –super or otherwise – to meet market requirements.
- Food safety, quality and price will continue to influence consumer purchase decisions.
- Knowledge about proven health benefits will hopefully increase sales of tropical and subtropical fruit internationally if marketed professionally.

# The future



- Superfruit will remain a **marketing** term but only when scientific proof exists.
- Some people might care where such fruit are grown
- But for most consumers generic fruit type and generic health benefits will be more important than locality of production.
- Most important objectives are:
  - \* to get more people in more markets to eat more tropical and subtropical fruit;
  - \* to eat a more diverse range of fruit on a daily basis.
- If Superfruit terminology promotes this then that is just fine but must not decrease diverse fruit intake..

Does use of the word  
**SUPERFRUIT**

**de-emphasise** the  
importance and value of  
other fruit? Yes.

Does it matter? Yes.



The end



# Baobab

- Baobab leaves and fruit are edible
- Fruit is eaten raw or processed into a local drink in Nigeria called “Kunnu” – a kind of yoghurt.
- Leaves rich in vitamin C, sugars, potassium tartrate and calcium.
- Fruit and seeds rich in macro- and micro-nutrients and amino acids.



# R&D and superfruit



- Plant hunting – seek out and utilise botanical biodiversity in flora
- Plant selection and plant breeding to develop unique cultivars
- Know your fruits –biochemical and metabolomic studies to identify nutritive and health conferring properties
- Identify unique characteristics for use as key attributes for eventual marketing emphasis
- Develop efficient, productive, sustainable [GAP] production and postharvest systems

