References

AVRDC Vegetable Genetic Resources Information System (AVGRIS). 2005. AVRDC-The World Vegetable Center, Shanhua, Tainan,Taiwan.Website: http://203.64.245.173/avgris/

Facciola, S. 1990. Cornucopia, A Source Book of Edible Plants.

Hutchinson, J.1973. The Families of Flowering Plants. London. Oxford University Press. pp. 42- 59, 279- 280.

Indigenous Vegetables of Southeast Asia. AVRDC— The World Vegetables Center. http://203.64.245.173/sea_iv/

Olson, M. E.1999 , The home page of the plant family *Moringaceae*. http://www.mobot.org/gradstudents/olson/moringahome.html

Siemonsma, J. S. and Kasem Piluek (eds.) 1993. PROSEA 8: Vegetable. The Netherlands: Pudoc, Wageningen. 1994. pp. 213- 215.

Palada, M. C. and Chang L. C. Suggested Cultural Practices for Moringa. International Cooperator's Guide. March 2003. AVRDC pub# 0.-545.

Yang Ray-Yu, Samson CS Tsou, Tung-Ching Lee, Wan-Jan Wu, Peter M Hanson, George Kuo, Liwayway M Engle and Po-Yung Lai. Distribution of 127 edible plant species for antioxidant activities by two assays. J Sci Food Agric 86:2395-2403. 2006.

Utilization

- Leaves and twigs are used as fodder.
- An edible oil (Ben oil) extracted from the seeds is used for illumination, cosmetics and lubrication.
- Bark is suitable for making mats, paper and cordage.
- Stems are used for production of α-cellulose pulps for the cellophane, dye and textile industries.
- Root bark has pungent taste of true horse-radish and used as condiment or garnish.
- Almost all parts of the tree, in particular the leaves and root bark have medicinal application (e.g. as diuretic, disinfectants).

Cassava con Moringa Patty
(Source: Mga Lutuing Katutubong Gulay)

Ingredients

1 ½ kg cassava, grated
¼ cup of alamang (salted shrimp paste)
1 egg, beaten
1 medium garlic, diced
1 medium onion, diced
1 tsp black pepper
1 leaf of oregano, cut into small pieces
1 cup moringa leaves
1 cup bread crumbs
cooking oil

Procedure

- Mix all ingredients except for the cooking oil.
- Shape the mixture into several medium-size balls.
- Fry the "balls" until reddish-brown.
- Serve it hot with vinegar dipping.

Other ways of food preparation

- Young fruits are often used in curries.
- Leaves and flowers are eaten as cooked vegetable or put in soups.
- Mixed with other vegetables in soup flavored with ginger (e.g. "bulanglang" in the Philippines).
- Dried and powdered leaves can be sprinkled on any dish to make it more nutritious.
- Dried and powdered leaves mixed with flour for breadmaking (nutri-buns in Philippines used in school-feeding programs.
- Seeds are fried.

AVRDC
The World Vegetable Center

ADB Asian Development Bank

Republic of the Philippines
Department of Agriculture
BUREAU OF AGRICULTURAL RESEARCH

SANREM CRSP

Know Your IVs

Moringa

Introduction

Moringa, sometimes called the "Miracle tree", is one of the world's useful plants. It has multiple uses, e.g. human food, livestock forage, medicine, dye, fibre, shade, ornamental and water purification. Ounce for ounce, the leaves of moringa have more beta-carotene than carrots, more protein than peas, more vitamin C than orange, more calcium than milk, more potassium than bananas, and more iron than spinach. This fast growing tree has great potential to relieve malnutrition in the developing world.

Local Name

English — *moringa, horseradish tree, drumstick tree, West Indian Ben*
Bangladesh — *sajina*
Cambodia — *mrum'*
France — *Ben ailé*
Indonesia — *kelor, marunga*
Laos — *'ii h'um*
Malaysia — *meringgai, gemunggai, kelor*
Myanmar — *dandalonbin*
Philippines — *malunggay*
Thailand — *marum, phakihum, makhonkom*
Vietnam — *ch[uf]m ng[aas]y*

Biodiversity

There are 13 species of Moringa and categorized into 3 groups.

- Bottle tree- *M. drouhardii. M. hildebrandtii, M. ovalifolia* and *M. stenopetala.*
- Slender tree- *M. concanesis*, *M. oleifera* and *M. peregrina.*
- Tuberous shrub/ herb- *M. arborea*, *M. borziana*, *M. longituba*, *M. pygmaea, M. rivae* and *M. ruspoliana.*

Moringa is fast-growing, much-branched, often crooked tree or shrub.

M. oleifera is underexploited at the moment. It is indigenous and found growing wild in northern India and Pakistan. It was introduced into Southeast Asia at an early date,

- Leaves - deciduous and alternate 2 to 3 pinnate, pinnate opposite, up to 75 cm long.
- Flowers - aromatic, auxiliary panicles with 5 petals that are white, cream or red and 1- 2 cm long. Stamens 5, 0.7- 1.2 cm height. Pistil 0.7- 1.7 cm height.
- Fruits - 3 angled, dagger- shaped, pendant capsule, 28- 59 cm X 1.4- 3.1 cm, green at first, later brown, glabrous.
- Seeds - subglobose, trigonous, 3 winged or not.
- 100 seed weight- 18 to 36 g.
- pollen fertility- 13- 81 %.

Cultivation

- Tolerate a wide range of environmental conditions.
- Grows best between 25 to 35℃, but will tolerate up to 48℃ in the shade and can survive at light frost.
- Drought-tolerant; grows well where annual rainfall ranges from 250 to 1,500 mm.
- Best at altitudes below 600 m but can grow in altitudes up to 1,200 m in the tropics.
- Grow in various soils but thrives best in fertile, well-drained sandy loams.
- Propagated by direct seeding, transplanting or cutting.
- Seed germinate within 2 weeks, and seedling tree flower after about 2 years.
- Suggested spacing
  Leaf, pod and seed production: space plants 3-5 m apart between rows and plants.
  Leaf production: space plants 30-50 cm X 10-20 cm.
- Propagation method
  Transplanting: Grow seedlings in divided trays, individual pots, plastic bags or seedbeds.

  - Use peat moss, commercial potting soil or a potting mix prepared from soil, compost or rice hulls or sand.
  - Irrigate seedlings thoroughly every morning or as needed (moist, but not wet).
  - Transplant seedling one month after sowing.

Stem cutting: grows faster but develop a shallow root system that makes them more susceptible to moisture stress and wind damage.

  - Use cuttings 45-150 cm long with diameters of 4-16 cm from at least one year old branches.
  - Cutting can be dried in the shade for three days before planting in the nursery or field.
  - Irrigate regularly to keep the soil moist but not wet.
  - Irrigate newly transplanted trees immediately after transplanting to promote early root development. In dry and arid climate, irrigate regularly for the first two months. Once established, rarely need watering.

Nutritional value

Table below shows the nutrition value of Moringa leaves per 100g of edible portion.

Nutrition Value (per 100 g edible portion)	
Water	75 g
Protein	6.7 g
Fat	1.7 g
Carbohydrate	13.4 g
Ash	2.3 g
Fibre	0.9 g
Vitamin A	11300 IU
Vitamin B1	0.06 mg
Vitamin B2	0.05 mg
Niacin	0.8 mg
Vitamin C	220 mg
Ca	440 mg
P	70 mg
Fe	7 mg
Energy value	385 KJ/ 100 g
Antioxidant (by ABTSM) water extract	74 µm/g (Medium)