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The OKRA Plant

Okra is botanically known as *Hibiscus esculentus* L (*Abelmoschus esculentus L. Moench*). It is also known as "saluyot a bunga" (Ilocano) and kaluyot (Ifugao) and a most popular and common vegetable in the market (http:www.pcarrd.dost.gov.ph). The immature fruits can be eaten raw, boiled, blanched, or fried. It is also an indispensable component of a Filipino dish "pinakbet" and a common ingredient in soups/sauces. The fruits can be dried or pickled. The leaves are sometimes used as spinach and the seeds as a substitute for coffee. Okra seeds also contain a considerable amount of good quality oil and protein.

Okra is widely grown throughout the year because it is resistant to either drought or water logging. It is grown in area of 3,570 hectare with production of 29,716 metric tons (mt) all over the country (Bureau of Agricultural Statistics, 2010). Central Luzon has the highest production of okra in the country of about 10,851 mt or 14.6 yield/ha.*(mt.)* with an area of 743 hectares. Exportation of okra to Japan started in 2006 with an estimated export value of US$ 7-8M at an average export price of US$ 12-14/box of 4-6 kg net weight.

This crop is also considered as one of the most nutritious vegetables. Its nutritional composition is as follows.

Table 1. Okra Nutritional value per 100 g (3.5 oz)

Energy	30 kcal 150 kJ
Carbohydrates	7.6 g
Dietary fibre	3.2 g
Fat g	0.1
Protein	2.0 g
Folate (Vit. B9) 87.8g	22%
Vitamin C 21 mg	35%
Calcium 75 mg	8%
Magnesium 57 mg	15%
Water (g)	90.0%
Vitamin A	(660 IU) Percentages are relative to US recommendations for adults

Source: http://en.wikipedia.org/wiki/Okra

According to Sylvia W. Zook, Ph.D. (nutritionist), okra is considered as versatile vegetable. It has many health benefits: (1) it has superior fiber that helps to stabilize blood sugar as it curbs the rate at which sugar is absorbed from the intestinal tract (2) It has mucilage not only binds cholesterol but bile acid carrying toxins dumped into it by the filtering liver. (3) It has no adverse side effects, is full of nutrients, and is economically within reach of most people. (4) It is one of the best, along with ground flax seed and psyllium good for bacteria serve as probiotics. Unlike harsh wheat bran can irritate or injure the intestinal tract. Most of okra's nutrients are retain when cook and have self-digesting enzymes. (http://www.eatinaftereden.com/)

Okra is an annual or perennial crop popularly known as Okra (English, French, Dutch, German); Lady's finger (English); Gombo (French, Italian, Spanish); Abelmosco (Italian); Quimbombo (Spanish); and Ocra (Spanish). Its scientific name is *Abelmoschus esculentus* (L.) Moench and is synonym to *Hibiscus esculentus* L.. It is from the Malvaceae (Mallow) family in the order of Malvales.

It is know to have come from Ethiopia and is grown in tropical regions and the relatively warmer temperate regions.

The flowers are 4 to 8 centimeters in diameter that are either yellow or white in color with 5 petals and have a red or purple spot at the base. The leaves on the other hand, are hand-shaped which are 10 to 20 centimeters long with 5 to 7 lobes. The fruits (or pods) are fibrous with round, white seeds. When

sliced, the fruits show a pentagonal (having five sides) cross-section. They can reach a length of 18 centimeters. Okra is pollinated by insects such as bees, wasps, flies and beetles. It can reach a height of up to 2 meters.

Warm and tropical climates are suitable for okra. It is very heat and drought tolerant and can tolerate poor soils. However, seedlings need sufficient water, but when older, okra is a very drought tolerant vegetable. Okra is grown from seed. Okra needs 50 - 65 days to reach maturity. It should be planted in 30 x 60 cm (the least) or 60 x 90 cm (the maximum)

Propagation:

Okra is commonly infested with flea beetle, Japanese beetle, blister beetles, corn earworm and root knot nematode. Its common diseases are stem blight and wilt.

After pollination the fruits soon become fibrous and woody, therefore the fruits are harvested when immature to be used as a vegetable. The plant will continue to produce fruits while they are being harvested. When mature, fruits are left on the plant this will reduce flowering and fruit set.

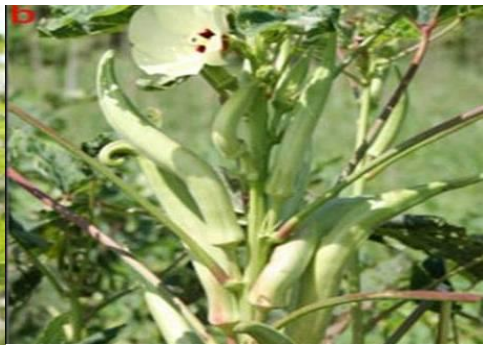
Medicinal uses

The roots, leaves, young pods, and seeds (Philippine Medical Plants, 2012) of okra are known to have medicinal uses. Following are their uses:

- Decoction of roots and leaves as a tea or for washing.
- Decoction of young fruit useful for catarrh, urinary problems.
- Syrup from mucilaginous fruit used for sore throat.
- Poultice of roots and leaves for wound healing.
- Young pods for fevers, difficult urination and diarrhea.
- Decoction of roots for headaches, varicose veins, arthritis, fevers.
- Decoctions of leaves for abdominal pain.
- Leaves also useful as emollient poultice.
- Seeds used a coffee substitute. Paste of seeds, mixed with milk, used for pruritic skin lesions

Recommended Varieties

Smooth green type pod or fruit



Native white variety

The two most popular recommended varieties of okra are smooth green and the native variety. Smooth green is preferred by the consumers because of the deep green appearance while the native variety with yellowish white fruits is preferred by retailers because it does not appear wilted even kept for several days. Both of the varieties are prolific and mature at 45 days after emergence.

There are two more commercial varieties of okra namely Camiling smooth and Green light. For export, Green Emerald variety is popularly grown. This variety is about 1.5 m tall. Pods are 18 to 20 cm long slightly ridged and green color.

Aside from this, the Bureau of Plant Industry, National Crop Research Development Center at Los Banos had 3 newly collected varieties of okra from China, AVRDC-World Vegetable Center and Singapore as shown in Figure 1.

Figure 1. The three (3) newly collected germplasm of Okra at BPI-LBNCRDC, Los Banos, Laguna.

CULTURE AND MANAGEMENT

A. Soil and Climate Requirements. Okra can be grown throughout the year from low -to mid – elevation areas with adequate supply of water. However, production is best in sandy loam with pH 5.5-7.0 during long warm season.

B. Land Preparation. Before plowing the area, broadcast organic fertilizer or compost (1kg/m^2) and plow and harrow the area/field twice. Set furrows or make plots 0.75 m wide for 2 rows planting with a distance between rows of 0.75 m. For clay soils, incorporate rice hull and compost liberally.

C. Planting. Plant the okra seeds by direct seeding. Seeding rate of okra is about 3 kg seeds. To assure the 100% germination of seeds, soak the seeds in warm water overnight to hasten germination. Air-dry the soaked seeds. Sow 2-3 seeds/hill, 1cm deep with a distance of 20 cm between hills and 25 cm between rows. Two (2) seedlings/hill should be maintained. The excess seedlings can be pricked and replanted to missing hills.

D. Fertilization. During land preparation or bed preparation, 5 kg/m^2 of compost (vermi compost + guano) can be applied. For basal application, 500g/hill of mixture of vermi compost + guano (2:1 ratio) can be used. Thirty days after emergence, side dress with guano.

E. Water Management. Water the plants regularly or 2-3 times a week. If possible use furrow irrigation every week or depending on the soil moisture and season.

F. Pest and Disease Management. Okra is tolerant to most insect pests specifically during wet season because of the profuse growth of foliage, but diseases are common because of the wet–warm condition of the environment. However, during summer or second crop, leafhopper is the most damaging pest with occasional diseases. These can be managed using the suggested biological and remedial control measures presented in the Table 2 below.

Table 2. Biological and remedial control of insect pest and diseases of okra.

Pest and Diseases	Suggested Management
A. Insect Pests	
Leaf hopper	Irrigate the area planted with okra twice a week to prevent or minimize drying of the leaves sucked by the pests. Enough water that is absorbed by the plant will compensate the sap sucked by the pest. Practice organic farming because organic nutrients will boost the immune system of the plant against pests.
Cotton stainer	Collect the insects and eggs and burn or bury these into the soil. Use overhead irrigation to reduce insect population.
Leaf folder	Crush folded leaves with thumb and forefinger to kill the larva inside the fold. Do not open the fold because the worm inside will quickly slide, fall, and hide in the soil. Use light trap to kill adults
	Collect infected leaves; place these in a plastic bag and then seal. Expose the plastic bag under the sun to kill the worms.
	Spray with Thuricide HP or Dipel (*Bacillus thuringiensis*)/Halt following manufacturers' recommended dosage. These are bacterial pesticides.
B. Diseases	
Cercospora Leaf spot	Gather all infected leaves as soon as the symptoms start to appear. To avoid transferring the disease to healthy leaves, burn infected leaves or bury these outside the area. Spray unaffected leaves with decoction of guava, avocado and akapulko leaves (1 L decoction to 16 L of water)
	Remove some leaves (leaf thinning) so that the ultra violet rays of the sun can penetrate in between the leaves and kill the pathogens.
	Preparation of decoction: boil 1 kg leaves of each of guava, avocado, and akapulko in 3 gallons of water for five minutes, start counting 5 minutes when the water is already boiling. Strain after cooking then store the decoction in plastics containers.
	Avoid mono-cropping. Intercrop with botanical plants (marigold, ginger, basil, sunflowers and etc.).
	Remove infected plant parts, spray with compost tea and tea manure, prune excess leaves to improve air circulation, and water in the morning.

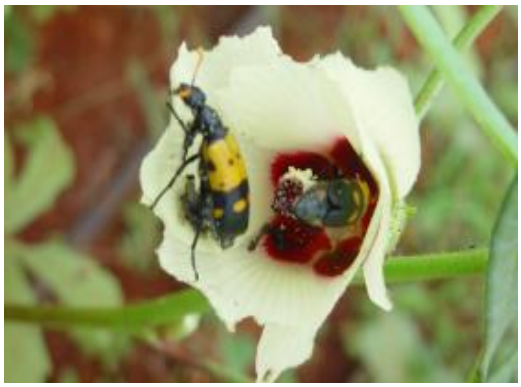
Insects Attacking Okra

Figure 2 shows the insect pests attacking okra plant.

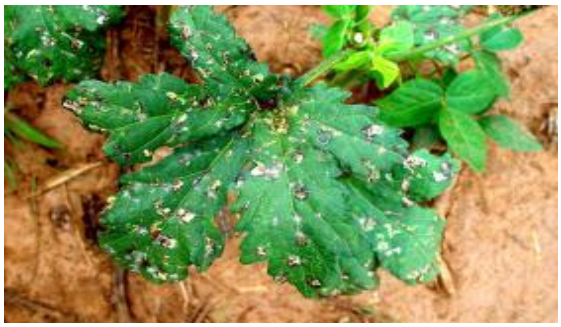
Leaf Folder (*Lamprosema sp.*) larva

Polyphagous incest

Leaf hopper (*Impoasca* sp.)



Flower beetles (*Mylabris* spp. And *Coryna* spp.)



Okra leaf severely damaged by leafminer (*Liriomyza* spp.) larvae

Brown stink bug (*Halydicoris* sp.) okra

Cotton aphid (*Aphis gossypii)*

Thrips (*Frankliniella* spp.) on okra flower

Figure 2. Insect pests attacking Okra

Diseases of Okra

Figure 3 shows the diseases infesting okra plant.

Cercospora leaf spot symptoms

Black mould (*Cercospora abelmoschi*) leaf spots on the leaf

Early blight symptoms on the leaf

Powdery mildew on upper surface of okra leaf. Infection occurs when humidity is in the range of 52 to 75% and air temperatures are around 26 to 27°C

Bacterial blight (*Xanthomonas campestris* p.v.*malvacearum*) on young okra pod

Figure 3 Diseases of Okra

G. **Weeding**. Cultivate and hill-up by hand-hoeing in between furrows at 14 DAE and 42 DAE to suppress the emerging weeds (1st side dressing). Finally uproot the remaining weeds (spot weed) that were missed during the previous cultivation.

H. **Harvesting**. Okra pods or immature fruits are ready to harvest 5-10 days after flowering or about 10-12 cm long (the pods are young, tender and snappy). Use a sharp knife or pruning shears during harvesting. Harvesting should be done every day. To facilitate harvesting and control diseases, prune all leaves below the lowest fruit at regular interval. Okra crop can be harvested 40-45 times in cropping season.

Pack the fruits in 10 kg polyethylene bags for convenience in hauling and to maintain freshness. Too much moisture favors the development of molds on the packed fruits so puncture 4-5 small holes on each plastic bag.

To store pods/fruits in large volume, store it at 10° C and 90-95% relative humidity to avoid wilting. Then the pods will be graded according to market standards and packed in plastic crates or in cardboard trays covered with plastic film.

COSTS AND RETURNS ANALYSIS PER HECTARE-OKRA

Table 3. **COST AND RETURN** analysis of planting a one hectare Okra

ITEMS		AMOUNT (PhP)
Variable Costs		
A. Labor (@ PhP250/MD; @ PhP500/MAD)[1/]		
Plowing	5 MAD	2,500.00
Harrowing	3 MAD	1,500.00
Furrowing	1 MAD	2,500.00
Compost Application	6 MD	1,500.00
Compost Basal[2/]	2 MD	500.00
Side Dressing of Guano	10 MD	2,500.00
Planting	2 MD	500.00
Irrigation after Planting	2 MD	500.00
Releasing of Biological Agents[3/]	2 MD	500.00
Thinning	4 MD	1,000.00
Weeding	15 MD	3,750.00
Hilling-up	3 MAD	1,500.00
Irrigation (2-3 x a week)	24 MD	6,000.00
Spraying of Botanical or Biological Agents[4/]	8 MD	4,000.00
Harvesting	40 MD	10,000.00
Sorting/Packaging	40 MD	10,000.00
Miscellaneous Activities		10,000.00
Sub-Total		58,750.00
B. Materials		
Seeds	3 kg/ha	1,732.50
Vermi Compost	10 T	11,000.00
Guano - Vermi Compost (1:2 ratio)	14 bags	7,440.00
Guano	8 - 10 bags	4,620.00
Biological Pesticides (Halt)	5 - 6 canisters	11,000.00
Miscellaneous		6,000.00
Sub-Total		41,792.50
TOTAL (A + B)		100,542.50
C. Contingencies (15%)		15,081.38
GRAND TOTAL (A + B + C)		115,623.88
	MIN	**MAX**
Gross INCOME	180,000.00	210,000.00
Net INCOME	64,376.13	94,376.13
with marketable yield of 12 - 14 T/ha at a farmgate price of PhP15/kg		
Return on Investment (ROI)	56%	82%

[1/]MD is man day and MAD man and animal day.
[2/]Compost basal is a mixture of guano and vermi.
[3/]Biological agents are earwigs for aphids and Trichograma chilonis for lepidopteran species.
[4/]Botanical pesticides are guava, avocado, and akapulko leaves depending on pests or diseases.

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