A GUIDE TO
GROWING
ORGANIC
MANGO
WITH
NATURAL FARMING
SYSTEM

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# CONTENTS

- Introduction 3
- Description of mango 5
- Philippine Carabao Mango variety 5
- Nutritional Aspects 6
- Mango Products 8
- Mango Cultural Requirements 9
- Establishment of Mango Orchard 10
- Plant Propagation 12
- Field Planting 12
- Care and Management of Juvenile Trees 14
- Care and Management of Bearing Trees 22
- Herbal Organic Spray 27
- On Season Mango Production 29
- Off Season Mango Production 30
- Flower Induction 31
- Pest and Disease Control 36
- One Year Mango Production Cycle 38
- Flower and Fruit Protection 39
- Harvesting Mango 41
- Post Harvest Operations 43
- Preparing fresh fruits for shipment 44
- Post harvest Treatment 46
- Packaging Operations 48
- Grading Philippine Mango for Export 50
- Mango fresh fruit storage 50
- Ripening Mango Fruits 51
- Mango Trading 55
- Return on Investment (ROI) 61
- Mango Farm Requirements 63
- Mango Products, Processing and Utilization 63
- Mango Preparation and Recipe 65
- Natural Farming 73
- Simple guide to Growing Organic Mango 90
- Summary and Recommendations 93
- Acknowledgement 96
GROWING ORGANIC MANGO

INTRODUCTION

The growing domestic and export market demands for organically grown fruits and vegetables compel us to learn to grow ORGANIC MANGO using the Natural Farming System. This is a simple and basic study to help mango growers produce naturally grown mango free from toxic chemical residue, using both herbal organic fertilizers and concentrates with biotechnology and integrated pest management.

Let us recall that in the 1950s and earlier, before Dr. Ramon Barba discovered Potassium nitrate in 1970, as a good mango flower inducers; mangoes in the Philippines were not sprayed and cared the way we do today. They were producing good quality fruits, growing naturally. However, fruiting was seasonal. Smudging was the common ways of inducing flowering and fruiting and it was cumbersome.

Philippine Carabao Mango
Remember that when God created the universe, the earth and nature, it was complete and balanced. Man interfered with this balance in the environment and ecosystem for the desire to produce more of their selected and preferred crops, in the process destroying the equilibrium and disrupting natural laws and life. Its ill effects of toxic synthetic chemicals are now being manifested in making the land less productive and the life span of man is shortening. Other life forms are disappearing. It is time for us to learn natural laws and adopt Natural Farming System.

Before 1950 mango the trees were left alone to nature and bear fruits during season. Mango owners just harvested mango fruits without caring for the trees, just like coconut farmers. Today, as the prices of chemical inputs get too high, mango growers are starting to leave the mango trees to the care of nature. Added to this is the growing demand for chemical free mango or naturally grown fruits.

We are now introducing the use of herbal organic pest and disease control and biological measures. Our latest experience in growing organic mango show that natural farming system is easier to learn and adopted by farmers. Production cost is much lower than conventional chemical farming. Organic fertilizer and beneficial microorganisms increase soil nutrient year after year as the tree also grow bigger and increase their productivity.

The usual experience is that for the first to the second year, while the soil is still gaining the build up on plant food nutrient with organic fertilizer, compost in combination of microbial activities, the yield are still lower than with the use of chemical fertilizers and synthetic chemicals which have immediate effect on plant growth and nutrition. When soil nutrient have reached the optimum level and the beneficial bio-organisms bring back life to the soil, the health and productivity of plants surpasses those under chemical treatment, at much lower production cost. This has been tested and proven in many countries adopting the Natural Farming System.

This paper will be discussing more about growing mango with the Natural Organic and Biological Farming System.
DESCRIPTION OF MANGO

Scientific name: *Mangifera indica* L.
- Family: Anacardiaceae
- Origin: Mangos are indigenous to India & Southeast Asia
- Tree: medium to large (9.1 to 30.5 m)

Foliage: symmetrical, rounded canopy
- Leaves:
  - alternately arranged
  - 15 to 40.6 cm in length
  - Pinkish, amber or pale green- colour when young become dark green at maturity

Inflorescence:
- Primarily terminal
- Panicle length 6.4 to 40.6cm
- Panicles consists of main axis bearing many branched 2o axis
- 2o axis bear a cyme of 3 flowers
- Each flower borne in bracteate pedicels
- Flowers are small, yellowish to pinkish-white
- majority staminate (80%) and the remainder perfect (20%).
- 550 to more than 4000 flowers.

PHILIPPINE CARABAO MANGO VARIETY

- Mango (*Mangifera indica*) is the national fruit of the Philippines. It is indigenous and endemic to the Philippines and grows for centuries on its natural environment. It responds to human intervention on its culture and environment changes.
- It has a wide market potential both domestic and as exports fruit.
- It is a high value crop where mango grower can earn substantially per unit area or per hectare a year, provided planted at the right distance of 15x15, 20x20, 25x25 or 30x30 meters, with a population of 44, 25, 16, and 11 hills
respective per hectare and properly cared. (Space between for farm operations and inter crop).

- It is suitable to grow on upland areas with abundant sunlight and adequate moisture with free flow of air or breeze.
- Mango is a centennial crop that three or more family generation can benefit. There is no record of mango trees dying because of old age, Rather, many trees become unproductive or die because of crowding.
- It is a good retirement insurance, tree crop where production increases, as trees grow bigger and older.

**Nutritional Aspects**

Nutrient level per 100g of mango flesh

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>81.0 g</td>
</tr>
<tr>
<td>Energy</td>
<td>74 kcal</td>
</tr>
<tr>
<td>Protein</td>
<td>0.6 g</td>
</tr>
<tr>
<td>Lipids</td>
<td>0.4 g</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>16.9 g</td>
</tr>
<tr>
<td>Calcium</td>
<td>14 mg</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>16 mg</td>
</tr>
<tr>
<td>Iron</td>
<td>1.3 mg</td>
</tr>
<tr>
<td>Carotene</td>
<td>2743 microg</td>
</tr>
<tr>
<td>Thiamin</td>
<td>80 microg</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>90 microg</td>
</tr>
<tr>
<td>Niacin</td>
<td>0.9 mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>16 mg</td>
</tr>
</tbody>
</table>

Consumption of a medium size mango could provide the daily requirement of Vitamins A and C. The level of various nutrients may vary depending on the cultivar, ripeness of the fruit and area of cultivation.
MANGO PRODUCTS

The following are primary commercial mango products:
- Fresh table fruit, ripe and green.
- Dried or dehydrated ripe mango fruit.
- Mango Puree, concentrate, nectar and juices.

Secondary mango products:
- Mango fruit preserves in syrup, salted or fermented.
- Chilled fresh mango fruits. (Frozen fresh halves)
- Green mango pickle (Burong mangga)
- Powdered mango (green and ripe)
- Mango recipe and bakery additive.

Other mango products and by-products:
- Mango seeds for nursery planting materials.
- Mango seeds and shell for feeds
- Mango peel. Seeds, leaves, branch for organic fertilizer.
- Mango wood for lumber and furniture making and fruit boxes. Waste branches are made into charcoal.
- Specialize fruit, leaves and plant extract for drugs and medicine.
- Mango seed shell as crafted key holder and coin pocket. (Guimaras)
- Other products under development.
MANGO PRODUCTION
Estimated production of 50 trees per hectare.

<table>
<thead>
<tr>
<th>Age Range of Trees in Years</th>
<th>Estimated Production per Trees in Kilos</th>
<th>Gross Sales per Hectare at 50 trees x P10</th>
<th>Cost of Production at P4.00 per kilo</th>
<th>Gross Profit or Income per hectare with 50 trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 5</td>
<td>0</td>
<td>Juvenile Trees</td>
<td>(P50,000.00)</td>
<td>(P50,000.00)</td>
</tr>
<tr>
<td>5 to 10</td>
<td>50</td>
<td>P25,000.00</td>
<td>P10,000.00</td>
<td>P15,000.00</td>
</tr>
<tr>
<td>10 to 15</td>
<td>200</td>
<td>100,000.00</td>
<td>40,000.00</td>
<td>60,000.00</td>
</tr>
<tr>
<td>15 to 20</td>
<td>500</td>
<td>250,000.00</td>
<td>100,000.00</td>
<td>150,000.00</td>
</tr>
<tr>
<td>20 to 25</td>
<td>800</td>
<td>400,000.00</td>
<td>160,000.00</td>
<td>240,000.00</td>
</tr>
<tr>
<td>25 to 30</td>
<td>1,000</td>
<td>500,000.00</td>
<td>200,000.00</td>
<td>300,000.00</td>
</tr>
<tr>
<td>30 to 35</td>
<td>1,200</td>
<td>600,000.00</td>
<td>240,000.00</td>
<td>360,000.00</td>
</tr>
<tr>
<td>35 to 40</td>
<td>1,500</td>
<td>750,000.00</td>
<td>300,000.00</td>
<td>450,000.00</td>
</tr>
<tr>
<td>40 to 45</td>
<td>1,800</td>
<td>900,000.00</td>
<td>360,000.00</td>
<td>540,000.00</td>
</tr>
<tr>
<td>45 to 50</td>
<td>2,000</td>
<td>1,000,000.00</td>
<td>400,000.00</td>
<td>600,000.00</td>
</tr>
</tbody>
</table>

Mango is a high value and bigger earner crop, compared to traditional crops like rice, corn, coconut and sugarcane where income ranges only from P15,000.00 to P60,000.00 per hectare a year. This is why most farmers growing traditional crops remain poor. Mango can easily give P100,000.00 to P500,000.00 per hectare a year with trees 10 to 20 years old. Inter-cropping the mango orchard with seasonal or cash crops like grains and vegetables add more to farm income. The mango tree is benefited by the cultivation and application of fertilizers to the cash crops.

More income per unit area is better attained by growing mango with other crops. Distance of mango planting at 20 – 30 meters will allow bigger and more productive mango trees with less production cost and less pest and disease problems. The care, cultivation and fertilization of the intercrop will benefit the growth and productivity of the mango trees. This can be done in Natural Farming System.
MANGO CULTURAL REQUIREMENTS

Mango is a tropical tree. It can grow in most landmasses along and near the equator. Mango can be grown in almost all regions of the Philippines. They are more productive if grown in the following environmental conditions:

1. Elevation: 600 meters from sea level. 800 meters is still tolerable.

2. Mangoes need a dry period of 3 to 5 months to induce maturity of vegetative parts and flower. Rain water during flower bloom will wash off pollen induce growth of pathogens (Anthracnose) and result to dropping of both flowers and forming developing fruits. Fruit development also needs plenty of sunlight up to 120-135 days after flower induction. Mango is biennial bearer, fruits every two years. With human intervention, it can be made to bear yearly or even more often.

3. The ideal temperature for mango growing is 21 to 37 degree C.

4. Soils preferred are deep loamy, rich in organic matter, with balance content of macro and micro nutrient elements.

5. Water requirement: Optimum moisture is very important. Mango is successfully cultivated in areas where annual rainfall range from 500-2500 mm. For a successful crop, most important thing is the distribution of rainfall rather than the amount.

6. Soil pH 6-7 or (5.5-6.5 pH) is ideal for mango. At this, nutrients are available. Mango can be cultivated in a wide range of soil conditions. A well drained soil with 2 M depth is the best. Soils with high clay content or with frequent water logging is not suitable for successful cultivation of mango.

7. Topography: Flat to slightly sloping land, well drain but with good water holding capacity. Stiff mountainsides are also planted to mango, but with difficulty in production management.
8. Mango needs plenty of sunlight. Fully-grown mango trees should have enough sunlight from morning to evening, at the top of its crown to base of trunk. Shading even partially will limit its productivity. Crowded branch and foliage reduce yield.

9. Moderate airflow or wind is needed by mango trees to allow aeration to prevent the buildup of pest and diseases within the tree crown. Avoid strong winds especially during flowering and fruiting stage by growing windbreaker trees. Areas with sea breeze are found to favor mango growth and productivity.

AVOID AREAS THAT ARE:

1. High altitude over 500 meters above sea level, cool temperature, humid condition and rainy areas

2. Low lying areas, valleys at foot of hills and mountain where there is only partial sunlight, no free flow of air, humid and too wet soils. Forest areas are not suitable to mango production as the trees tend to grow vegetatively.

ESTABLISHMENT OF MANGO ORCHARD

Field preparation

Mango is cultivated both as a home garden crop and a commercial scale crop. Before establishment of a commercial cultivation, clear the land and plow and harrow. At the same time, take steps to adopt appropriate soil conservation, conditioning and enrichment measures. Check on irrigation and drainage as this will play very important role in growth and productivity of the mango trees.
A few pointers in establishing a good productive mango orchard:

Look for the ideal site of a mango farm base on the cultural requirement ideal for mango.

Select carefully your planting materials. Be sure you get the right variety and strain the market demands. Grafted seedlings are recommended to have uniform tree production. The Philippine Golden Mango (carabao – Lao and Guimaras selections) are preferred. Sanitize the seedlings with HOC and harden them for at least two weeks on direct sunlight before field planting.

The farm should be accessible with good roads and abundant clean water supply for irrigation and spraying.

Clear field of all trees and structure that will shed the trees to allow full sunshine and free airflow. Set rows at east-west orientation. Better plant them on triangle layout or quincunx.

Layout the farm and trees with access in-farm roads, farmhouse, working shed, water system and other farm structures.

Recommended planting distance is 20 x 20 + 1 meters quincunx with 50 trees population per hectare. The center hill may be eliminated when trees become bigger and crowded at 20 to 30 years old.

Weed, cultivate, fertilize and irrigate your trees regularly every 3 months. Combine organic and mineral fertilizers for faster and healthy growth. Use farm compost (Plant and animal waste).

See that the farm is well secured with strong fence, Electricity with lightings to discourage thieves and serve as light trap for insect pests.
PLANT PROPAGATION

Methods of Propagation

Sexual propagation with seeds. The trees grow big and productive in 7-15 years. However, fruits may not be the same with genetic variations.

Asexual propagation – grafting. Trees start bearing as early as 3–5 years. They produce more uniform true to type fruits, with scion coming from the same mother tree.

FIELD PLANTING

Steps in Field Planting:

1. Propagate and harden the seedlings or planting materials. Expose to direct sunlight at least one week before field planting. Spray or drench with herbal pesticide. (HOC)

2. Clear the field plows and harrows if possible. Stake planting site 20 x 20 + 1m quincunx or 15 x 15m triangle to have 50 hills / ha.

3. Dig 1 cubic meter holes and replace the soil with rich/fertile topsoil and fully decomposed organic matter or organic fertilizer. Earthworm casting is ideal mix to topsoil. Fully decomposed animal and plant waste with beneficial bacteria and fungi (EM, IMO, BMO, BYM). In deep organic rich loamy soil, one cubic foot hole will suffice.

4. Planting procedure: Drench the seedling in plastic bag and press the soil to loosen it in the bag.

5. Make a hole on the planting site and pour in water to drench the soil. Gently remove seedling from plastic bag and place in hole, cover and press soil.
6. Place a stake firmly besides the seedling and tie the seedling to it for stable support in case of strong wind and rain.

For a home garden, planting is possible at any time of the year except during periods of heavy rains. If a prolonged dry condition exists, plants must be watered or irrigated as and when necessary.

Use only very vigorous plants for field planting. Minimize the stress during field planting by hardening plants exposing to direct sunlight and with less water application. This hardening held improve the success rate of field establishment.

Another Procedure in planting mango seedlings:

- At planting remove the cover. Cut around the edge of the bottom of the pot and remove the intermingled roots by pruning tap root.
- Place the plant in such a way that the base of the plant in the pot is aligned with the ground level. Then remove the polyethylene bag with two longitudinal cuts from bottom up.
- After removing the polyethylene cover, fill the planting hole with soil and slightly tighten the soil. These steps help reduce root damage due to breaking and splitting of potting media block.
- Allow the plant to grow directly up. Use a stick closer to the plant and tighten it into the stick carefully. - To minimize water loss under dry weather conditions, remove half of each mature leaf.
- Use a mulch around the plant using easily available mulching material such as dry grass or cogon. Mulching helps to reduce soil temperature in the root zone. Weed control also become easy. It also reduces drying of soil and wind erosion of soil.
- After planting watering is an essential requirement. Construct a basin around plants to control runoff of applied water.
- Provide shade appropriately to protect plants from heavy sunlight.
Massive planting of rolling idle lands:

1. Stake the planting site 20 x 20 meters apart.
2. Dig one cubic meter hole, and replace with fertile soil mixed with organic fertilizer of fully decompose farm waste.
3. Plant directly healthy seeds one inch deep, water and cover with thick grass mulch to conserve moisture and prevent growth of weeds.
4. When the plants grow one meter high, field graft them with scion coming from one selected mother tree for uniformity.
5. Record all activities, name of owner and location of the farm, date, name of persons doing the operations especially the source of scion or planting materials. Mapping of the farm.
6. Keep farm animals from eating or destroying young plants.

CARE AND MANAGEMENT OF JUVENILE TREES

Proper care and management of young tree is necessary to ensure field establishment. High mortality of newly planted trees usually occurs during the dry months and they succumb to pest infestations if not properly monitored.

The establishment period for young mango tree is about four to five years, it is therefore important that the tree has attained the maximum canopy size before this can be induced to flower.

Pruning

Young trees are seldom pruned unless insects and diseases affect these. However, to ‘dwarf’ the tree, it is suggested that tips should be cut after reaching 1-meter height to encourage lateral branching. Otherwise, grafts have tendency to grow tall before giving out lateral branches. This is often referred to as “formative” pruning.
Crop Management

Training of trees

Training gives a tree good appearance, management of the tree becomes easy, high yields with quality fruit is possible and pest and disease incidence minimized. Training of trees must be started right from the early stages of growth. Pay special attention to train trees from the time of planting.

Allow a plant to grow as a single stem up to about 1/2 M. Let the first branch form at 1/2 M height. Then at about 15-20 cm spacing allow them to grow 3-4 branches around the tree. Let these branches to grow in opposite directions to give a tree a good appearance. This is also important to minimize break of branches at latter stages of growth. Natural shading of branches also minimized when branches are equally well distributed around the tree.

Shoots that do not receive sufficient sunlight do not produce enough food reserves for the tree. Thus, fruit set in such branches are not satisfactory. Such branches must be removed. Also diseased, dead and intermingling branches must be removed. In removing branches the cut must be very close to the main stem or limb when pruned. Prune trees under dry weather conditions. Do not apply paint as this will prevent the bark to close the wound. Instead a fungicide to the cut surface or a mixture of vinegar, soap and water may be applied.
Fertilization

It is very important that grafts be established in the field prior to fertilizer application. Fertilization is recommended 3 to 4 months after field planting and should be done before the end of rainy season. A practical guide for fertilizer application is the development of young shoots, weeks after transplanting.

The following are fertilizers requirements for non-bearing trees, if soil analysis is not available:

**One year old** - 1.0 kg organic fertilizer/guano/charcoal/ash.

**Two year old** - 2.0 kg organic fertilizer/guano/charcoal/ash.

**Three year old** - 3.0 kg organic fertilizer/guano/charcoal/ash.

**Four year old** – 4.0 kg organic fertilizer/guano/charcoal/ash.

**Five year old** - 5.0 kg organic fertilizer/guano/charcoal/ash.

The fertilizer should be placed 0.2 to 0.3 feet away from the stem of young grafts and cultivate the soil to incorporate the organic fertilizer 2-3 inches below the ground level.

**NOTE:** For Organic Farming.

**Urea** is considered as Organic Fertilizer because it has to undergo de-nitrification and feed to microorganisms and decomposition before it is taken up by the plant as nutrient.

**Phosphate** – can be sourced from Guano deposits from urine and droppings of bats in lime caves.

**Potash** – Can be sourced from charcoal, carbonized rice hull or wood ash.
**NPK Fertilizer requirement for Young Trees**

Annual dose of fertilizer per plant (g)

<table>
<thead>
<tr>
<th></th>
<th>Urea</th>
<th>Rock Phosphate</th>
<th>MOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>At planting</td>
<td>115</td>
<td>230</td>
<td>105</td>
</tr>
<tr>
<td>A year later</td>
<td>115</td>
<td>230</td>
<td>105</td>
</tr>
</tbody>
</table>

You may apply 1 kilo Organic fertilizer per hill 100 g guano and 500 grams carbonized rice hull and 100 grams wood ash to supply all nutrient requirement of the young plants. Supplement with HOC (Herbal Organic Concentrate) spray on foliage.

**NPK Fertilizer requirement for Bearing Trees**

Annual fertilizer dose per plant (g)

<table>
<thead>
<tr>
<th></th>
<th>Urea</th>
<th>Rock Phosphate</th>
<th>MOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>At fruiting</td>
<td>215</td>
<td>325</td>
<td>380</td>
</tr>
</tbody>
</table>

Increase rate of Organic Fertilizer as the trees grow bigger.

**Irrigation**

Manual watering during the dry months by saturating the soil with enough water followed by mulching to conserve moisture. It also serves as source of organic matter and protection or shield of beneficial microorganisms against direct sunlight and heat.

Drip irrigation if available could be incorporated with liquid organic fertilizer or compost tea.

Especially in areas when prolonged dry periods exist, it is imperative to irrigate the plants in the first three years after planting. Frequency
and amount of irrigation depend on rainfall and soil properties. When the tree reaches five meters tall, its root system will also be deeper, and could withstand long dry months especially if the soil surface is cultivated and broken to serve as mulch. Mango roots 2-3 inches on soil surface should be prune off by shallow cultivation to keep the roots at deeper level to avoid dehydration when top soil dry up. This will protect the tree from wilting and fruit drops.

For mango the most critical periods of moisture requirements is from flowering to fruit maturity and leaf bud burst (flushing) to leaf maturity.

From full leaf and bud maturity up to flower bud burst irrigation must be withheld. Irrigation during this period adversely affect flowering as too much moisture may induce vegetative or flushing new leaves instead of flowers. Avoid inducing trees just after or during rainy days.

**Intercropping**

Vegetables and legumes most adapted in the area with high market demands are recommended. The practice not only provide additional income to growers but keeps the area free from weeds, cultivated and improve fertility of the soil.

Short maturing trees (inter-fillers) such as citrus, papaya, pineapple, guava, pomelo and jackfruit are recommended as intercrops for mango with planting distance 15 meters apart or farther.

Intercrops should be managed separately from the main crop. It should not interfere with regular activities intended for mango.
Weed control

Ring cultivation is recommended for young mango trees. This is done by scrapping or hoeing the weeds around the base of the trunk. An area of about one meter radius should be maintained weed free. Thick mulching will also prevent weed growth.

Inter-row cultivation using plow/tractor is necessary for big plantations. Avoid deep plowing near the root system. Disk harrowing is recommended.

Cover cropping involves planting of leguminous and creeping crops like Tropical Kodzu, Centrocema pubesence and Arakis pintoy to suppress the growth of weeds provide soil protection, mulch and nitrogen organic fertilizer. However, cover crops should be cut or plow under as soon as these grow vigorously.

Chemicals (herbicides) should be avoided as much as possible. Herbicides are not recommended even for large mango plantation rather cultivate field with tractor and plant leguminous cover crops to replace weeds. Herbicides do not only kill weeds, but also other plants and the microorganisms in the soil. It kills soil life. It also affect adversely the mango.

Insect/Disease control

Scale insects (Aonidiella orientales, A., inorrata, Aspidiotus destructor, Phenocapsis inday and Hermiberlesia palmae)-These are small scale-like insects usually found underneath the leaves and branches. Both adults and nymphs destroy the plant by sucking the vital plant sap causing drying and falling of leaves. Abnormal growth of branches are due to toxic substances injected by the insects while feeding.

Control: Scale insects particularly the armored group are difficult to control with insecticides because their bodies are covered with wax. When contact insecticides are used, stickers are necessary. During heavy infestation, pruning of affected parts should be done
followed by spray application of organic base insecticide and organic fertilizers high in N. When infestation is minimal. Brushing with soap and water can minimize the problem. Spray or drench the whole tree from soil to trunk, branches and leaves with HOC-4n1 at weekly interval until scales and ants are eliminated. Home made lime sulfur is very effective control of scale insects.

**Tip borer (Chlumetia transversa)** - The adult moth lays its egg on flushes. The eggs hatch into small larvae that bore into the shoots and stems, feeding on the vascular bundles. Since, water and food are prevented from going up the tree (due to destruction of the food bundles), the top most portion dies. When dissected, small, pinkish larvae are present inside.

Control: With minimal infestation, prune the damage parts and burn them. During severe infestation, spray soil, trunk, branches and foliage with herbal organic concentrate (HOC-4n1) at 3-7 days interval. Trichogramma bio control of borers can help reduce infestation.

**Corn silk beetle (Monolepta bifasciata)** - The adults are small, yellow insects and are voracious leaf feeders. Newly formed leaves (flushes) are very attractive to the insect. Infested leaves produce several holes and under severe attack, the entire leaves are destroyed. Damage are easily infected with anthracnose.

Control: Avoid corn planting during mango production period. Timely application of HOC-4n1 during flushing. Use any contact organic or mineral insecticides recommended for mango. Spray with herbal organic concentrate (HOC-4n1) is a very good prevention and repellant at 3 days interval for two weeks.

**Grubs (Lecopholis irrorata)/termites (Macrotermes sp.)** - These insects feed on the roots and stems of the tree. Under heavy infestation, young mango trees die.

Control: Fertilizing organic herbal compost and drenching the soil around the tree trunk with HOC-4n1 will drive away grubs. It is important however, to expose the adults prior to application of organic insecticides by destroying earthen tunnels with cultivation and
pressurized water sprayers. You may spread grounded neem, ipil-ipil, madre de cacao and marigold leaves incorporate with the soil.

**Anthracnose (Collectorichchum gloesporioides)** - This is the most important disease of mango during rainy months. Leaves are susceptible to the disease, especially the flushes. The common symptoms are black spots and shot holes. Affected leaves dry and fall to the ground prematurely. Flowers and young developing fruits turn dark and fall.

Control: Pruning of affected parts and spraying the remaining parts with HOC-4n1 is recommended at weekly interval during critical growth stage and immediately after the rain to wash off the fungus sticking on wet foliage, flowers or fruits. You can minimize or prevent Anthracnose infection. The critical stages of growth are during flushing, flowering and early fruit development. Prevention is better than cure. A mixture of soap, cooking oil, coco vinegar and water can be use as spray drench to prevent fungal diseases like Anthracnose.

**De-blossoming**

This is the removal of flowers developed on young trees. De-blossoming allows vegetative growth and proper establishment of trees in the field. Flowers take up a lot of food nutrient and energy from the tree for growth of fruit bearing. So we discourage over flowering of trees beyond 80% of foliage.

**Care and protection during Flushing and Flowering:**

*Scale insects / mealybugs* – Pruning and Spraying with soap and water, / and HOC application / smudging

*Tip borer* – pruning / HOC application / smudging

*Corn silk beetle* – avoid corn as intercrop during production period / HOC application / smudging
Cecid fly – pruning of infested leaves/ HOC application / smudging

Grubs/termites – HOC soil drench / cultivation / Clean culture.

Anthracnose - pruning / application of HOC with soap, oil and water.

Scab – application of HOC with soap, oil and water.

CARE AND MANAGEMENT OF BEARING TREES

The health, vigor and size of the mango trees determine its productivity. Even if the Philippine Golden mango is biennial in nature, it can be made to bear yearly or more often if the right cultural management is done.

1. Fence and secure the area from stray animals and intruders that may damage the plants. Security is most needed 30 days up to harvest.

2. Practice clean culture. Cultivate and weed regularly. Remove all trees and shrubs that serve as host to insect pest and diseases.

3. Grow plants and herbs around the perimeter of the mango farm or orchard that are pest repellant, with pesticide and fungicide property and can be used as herbal concentrate spray. They can also serve as windbreakers in areas with prevalent strong winds. Plants like Neem tree, Madre de Cacao, Curry, Acacia, etc. that can also be shelter for diverse beneficial birds, insects and microorganism, that will suppress insect pests.

4. The trees should not shed one another. Prune off overcrowded branches. Mango is a terminal bearer, so avoid pruning off healthy terminal fruiting shoot buds.
5. Irrigate and keep the soil moist most at all times. Less water or drier soil is preferred one month before flower induction and one month before harvest. Avoid water logging by providing suitable drainage.

6. Fertilize quarterly with abundant organic fertilizer with macro and trace mineral elements. The use of organic compost from pest repellant herbs like most legumes will both increase plant food nutrient and protect the trees from pest and diseases.

7. Mango trees are perennial and organic fertilizers can sustain their nutrition year after year as they contain beneficial microorganisms that helps renew soil fertility. To keep the soil alive, avoid using chemical based fertilizers, pesticides and herbicide that kill beneficial fungi, bacteria and earthworms.

7. Spray herbal organic concentrate fertilizer on leaves and fruits when growth and fruit development needs supplemental nutrition. Herbal organic concentrate (HOC-4n1) with foliar fertilizer, pest repellent, insecticide and fungicide. Fish Amino Acid (FAA) with macro and trace nutrient elements will insure health, vigor and productivity of the mango trees. This is specially needed during flowering and fruit development stages. It makes the fruit grow bigger, heavier, and sweeter. Reduce or minimize fruit drops.

### Essential plant food elements

<table>
<thead>
<tr>
<th>MACRONUTRIENTS From water and air.</th>
<th>MACRONUTRIENTS From soil and fertilizers</th>
<th>MICRONUTRIENTS From soil and fertilizer</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Calcium</td>
<td>4. Molybdenum</td>
<td></td>
</tr>
<tr>
<td>5. Sulfur</td>
<td>5. Copper</td>
<td></td>
</tr>
<tr>
<td>7. Chlorine</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Kinds of Organic Fertilizers:

1. Foliar organic fertilizers derived from fermented animal of plants like fish and fruit amino acid.
2. Decomposed animal waste mixed with plant residues, leaves with beneficial microorganisms.
3. Vermin-compost or earthworm casting fed with decomposing organic materials. One of the rich forms of organic fertilizer with humic acid, a growth promoting and beneficial microorganisms.
4. Sludge or liquid organic waste materials rich in plant food nutrient with beneficial microorganisms.
5. Green manure. These are young plants usually legumes or beans that are plowed under and mixed with the soil during flowering stage.
6. Soil and seed inoculate such as nitrogen fixing bacteria and other microorganisms that help decompose organic materials.
7. Use of powdered charcoal, wood ash and carbonized rice hull.
8. Use of natural mineral deposits like lime stone powder, hydrated lime, guano, magnesium oxide, sulfur deposits or spring, ferrous etc. Plants get their food nutrient from both organic and mineral sources. The soil contain mixture of mineral plant nutrients.

Pest and disease prevention:

Spray HOC (Herbal Organic Concentrate) during:
Flushing of young leaves,
At bud break and flower elongation,
During fruit formation and development
Before bagging and
One month before harvest.

Spray the entire tree, leaves, branches, stem and the ground surrounding the trunk. Note that most pest and diseases come from the soil surrounding the tree and stay at the bark of stem and branches during hibernation.

Use biological controls to control insect pest and diseases are preferred. (Birds, animals, insects, bacteria, fungi and other living
organisms that help control and reduce pests) Maintain a mini-forest adjacent to your mango orchard to shelter biodiversity in the ecosystem of your farm.

**Insects vs. insects.** Use of insect predators/parasites like trichogramma, braconids and pirate bugs to counter insect pests.

**Microbes vs. microbes.** Use of microorganisms such as beneficial bacteria and fungi to counter diseases (Pathogens) and insect pests.

**Natural equilibrium and bio-diversity.** Allow bio-diversity and balance ecosystem in the farm by maintaining green belts or mini forest to shelter and provide breeding and favorable environment for all types of living organisms that will balance and prevent the breakout of infestation of one or more pests.

**Agro Chemicals** have been the major cause of destroying the equilibrium and balance of the ecosystem. They have killed the natural living enemies of pest resulting in recurrence of pests and the increase use and cost of chemical controls.

**Natural Flower induction:**

Before 1970 when Dr. Ramon Barba discovered the use of Potassium Nitrate as mango flower-inducer, mangoes were flowering naturally. Before that farmers practice smudging which is more laborious, time consuming and not precise on its effect. Today however smudging is used in aid to flower induction and driving away insect pest from the trees.

**Other ways of mango flowering and fruiting:**

Seasonal fruiting. These occurs when the trees are healthy and the season for flowering and fruiting comes usually from November to March at the start of dry season.

Smoking tree foliage (smudging) when they reach maturity.
Root pruning and partial girdling will also induce flowering and fruiting, as these are forms of stresses.

Application of high dosage of Phosphorous and Potash fertilizer with adequate nutrients will hasten maturity, flowering and fruiting.

Spraying cold water with HOC during hot dry days will shock and induce the mango tree to flower.

Dr. Hernani Golez, Head of the National Mango Research and Development Center (NMRDC) of the Bureau of Plant Industry (BPI) explains that the mango tree is ready for reproduction when it has accumulated enough plant food nutrients especially carbohydrate usually every two years. When the Gibberellic acid (GA) growth hormone is lowered. It occurs when the tree grows older with mature foliage; is stressed like dry hot weather with sudden shower, mechanical or disease damage and exposure to flower inducing nutrients in gas or liquid forms.

Care and management of flowers and fruit development.

As soon as the fruiting buds start breaking (Bud Break) adult insect pests hibernating or just waiting for new vegetative growth will be attracted to the bud and start laying eggs on them and the growing inflorescence.

Some control measures:

Sanitize the tree by spray and drenching the whole tree (soil, trunk, branches and leaves) with Herbal Organic Concentrate (HOC-4n1) with four properties (Pest repellant, insecticide, fungicide and foliar fertilizer) on a weekly interval starting with flower induction to fruit development. Spray after the rain. For heavy infestation areas spraying HOC on 3 days interval from bud break to 20 days was found effective control.

Remove all disease and infested parts of the tree, weeds and debris. Transport them to your composting area.

In a Farmers Field School (FFS) on mango conducted at Bry. Tucaual, Alabel, Sarangani Province, Trichogramma was used to suppress mango hoppers and borers effectively.
Spraying emerging flowers and developing fruits with organic fish amino acid (FAA) will greatly increase the development of healthy fruits, hold on to the panicle and mature into bigger and superior quality fruits.

Smudging the trees during fruit development will help drive away destructive insect pest and feed the leaves with gaseous carbon nutrients.

**HERBAL ORGANIC SPRAY**

A new product for Natural Farming

**HERBAL ORGANIC SPRAY** has been formulated for the easy and convenient use. Farmers’ who would like to produce organically grown food crops including fruits and vegetables without resorting to synthetic toxic chemicals that post danger to man and environment can use Herbal Organic Spray instead. Soon many companies will be having organic sprays for sale.

**HOC (Herbal Organic Concentrate)** was specially prepared by chemist and developed through research and efficacy test on farmer's field conditions. They were found to be effective pest repellant, insecticide, fungicide and growth promoting with a simultaneous and broad-spectrum effect.

The compound was developed using several tropical herbs with repellant, insecticide and fungicidal substances gathered from cultured and wild plants. Added to the compound is fish/fruit amino acid (FAA), which provides plant growth nutrients as a foliar fertilizer. It likewise contains trace mineral substances essential to normal and healthy plant growth derived from seaweed and other herbal and organic components.

**DOSAGE:**

1-2 tbsp. per gallon of water (4 tbsp. per knapsack sprayer load) or 250-500 ml per 100 liters water and one half to one liter HOC per 200 liter drum of water. Complete spray coverage from soil, stem branches and leaves for effective result. During heavy infestation the dosage is increased to 1% or one liter per 100 liters water.
SPRAY FREQUENCY:
Spray every 3 days then on weekly interval during critical stages of growth, flushing, flowering and fruit development. Monthly or as needed during growth and rejuvenation. Watering and drenching small plant may also be done at weekly interval.

HOC for MANGO:
Recommended HOC treatment for mango: HOC-4n1+ HOC-GO with FAA (amino acid) besides repellant, insecticide and fungicide properties. Mix HOC with nitrate flower induction to control adult insect pests to prevent them from laying eggs during flushing or flowering. Be sure to have a total coverage by spraying or drenching the soil surrounding the base of the tree, including its trunk and branches, where pest and diseases harbor.

Immediately after harvest and pruning, to induce flushing and growth of young shoots. Spray or drench the tree with HOC-4n1+ HOC-GO w/ FAA. Cultivate the soil, apply Nitrogen and organic fertilizer, then irrigate or water.

During rejuvenation from harvesting to next flower induction: Cultivate the soil around the base of the tree every 3 months and drench with a 1-% HOC-4n1 solution to control soil born pest and diseases including termites.

Spray trees with HOC once a month up to one month during rejuvenation and one week before scheduled flower induction.

During flowering and fruit development, spray HOC at 7, 10, 13, 16, 19, 22, 45, 60, 70 and 90 DAFI.
ORGANIC CULTURAL MANAGEMENT PRACTICES

ORGANIC CULTURAL MANAGEMENT & REJUVINATION

SANITATION – PRUNING – WEEDING & CULTIVATION
SOIL FERTILIZATION (ORGANIC FERTILIZER)
IRRIGATION & DRAINAGE
SHOOT INDUCTION - FLUSHING (HOC-4n1 + HOC-GO)
IPM (SANITATION, HOC & BIOCON)

FLOWER MANAGEMENT

FLOWER INDUCTION (HOC Flower Inducer or Smudging)
IRRIGATION & DRAINAGE
FOLIAR FERTILIZATION (HOC-4n1 + HOC-GO w/ BMO)
ENHANCE POLLINATION (Attract Pollinators)

FRUIT MANAGEMENT

IRRIGATION & DRAINAGE
FOLIAR FERTILIZATION (HOC-4n1 + HOC-GO w/ BMO)
IPM (BIOCON + HOC-4n1 + Bagging)
PROPER HARVESTING
PROPER POST HARVEST HANDLING & TREATMENT
PACKAGING & MARKETING

ON SEASON MANGO PRODUCTION

The regular season for mango is flowering from November to February and harvest from March to June. This is during the summer months. The Philippine Golden Carabao Mango is a biennial bearer. This means that by it’s nature it bears a good harvest every two years, but may bear every year too if conditions are favorable such as
the general health of the tree and summer intensity of the weather condition.

Understanding the natural laws governing the growth and production of mango will help us growers maintain their health and productivity through the years. The rainy or wet season will allow the tree to grow, rejuvenate and store food nutrients for its fruiting stage. During the summer months a period of stress, dry hot weather, flowering and fruiting naturally occur. In the 1950s and earlier, mango trees were left to nature and fruit on their own just like most coconut plantations. Farmers just come to harvest when fruits are mature. This is still happening in hinterlands where mango trees are left abandoned to nature.

<table>
<thead>
<tr>
<th>PERIOD</th>
<th>FLOWER INDUCTION</th>
<th>HARVEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Season</td>
<td>November to February</td>
<td>March to June</td>
</tr>
<tr>
<td>Off Season</td>
<td>March to October</td>
<td>July to February</td>
</tr>
</tbody>
</table>

OFF-SEASON MANGO PRODUCTION

Mango growers can produce mango fruits during the off-season especially in Mindanao, being outside the typhoon belt. Other areas of the country with less expected typhoon and heavy rains might venture into producing off-season fruits as the supply is low, demand is high and price is good.

Producing mango during off-season has its own unique challenges. Production falls during the rainy season. This will require a special care and cultural management. Be ready to spray herbal fungicide every after rain during flowering and early fruit development to prevent fungal infection and dropping.

Follow a one-year cycle of eight (8) months rejuvenation (from harvest to flower induction) and four (4) months of production (from flower induction to harvest.) Remember, plants also need time to absorb plant nutrients from soil, water and atmosphere,
carry them to the leaves for photosynthesis, then transport cooked nutrient to different parts of the plant for food storage and utilization for growth, flowering and fruiting.

<table>
<thead>
<tr>
<th>REJUVINATION</th>
<th>PRODUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 months</td>
<td>4 months</td>
</tr>
<tr>
<td>Flushing, maturation of foliage, absorption of nutrients, photosynthesis, food storage, maturation of fruiting buds.</td>
<td>Flowering to fruiting, development, maturity and harvesting</td>
</tr>
</tbody>
</table>

The success and productivity lies in proper rejuvenation of the trees immediately after harvest up to induction and care of flowers and fruits to full maturity.

After harvest flushing is induced, by pruning, fertilization with high nitrogen and irrigating. Spray HOC-4n1 with FAA. Application of weak acid like Amino Acid, Humic acid and Giberellic acid will help induce growth and flushing. After 3 months cultivate around the trunk to prune root and fertilize with guano and high potash or wood ash to induce maturity and dormancy to prepare trees to flower and fruit in 4 to 6 months hence. Powdered charcoal or carbonized rice hull will help in preparing the tree for maturity and be ready for flowering and fruiting.

**FLOWER INDUCTION**

Mango trees naturally flower and fruit when it is healthy and ready to fruit. Stress will help induce flowering during dry season for its seasonal bearing. However, flowering can be induced; by smudging (smoking), partial girdling branch stretching or other mechanical or chemical treatments. Chemical flower induction by using Potassium nitrate (KNO3) was introduced by Dr. Ramon Barba after his successful research in 1970 at UPLB, College, and Laguna, Philippines. Research on natural herbal organic base flower inducers is now being conducted in Mindanao and the Visayas.
PREPARING MANGO TREES FOR FLOWERING AND FRUITING.

It is easy to induce the trees to flower, but if the tree is not well prepared, the flowers will just fall off. The tree should be really healthy with adequate nutrient storage to support and sustain flowering and fruit development up to full maturity and harvest.

Here are a few pointers to remember and adopt:

1. Provide enough fertilizer and nutrient to the plant through the soil. Never rely only on foliar fertilization. That is only to augment nutrient needs during the production period (flowering to fruit development). To be sure, apply enough organic fertilizer every 6 months to every tree augmented with mineral fertilizer.

2. Insure that there is adequate soil moisture at all times. Over water is not good as well as water stress. Less moisture is needed before flowering and during later stage of the maturation of the fruits to keep them sweeter and firm.

3. Protect the trees with biological and organic herbal pesticides and fungicides. Microorganisms (IMO, BMO, EM, BYM) is now being recognized as helping enrich the soil, provide nutrient and protect the plants from pest and diseases.

4. Induce the trees to flush after harvest to have new shoot for next season fruiting. To induce the tree to flush, irrigate and fertilize with higher dosage of nitrogen, and or spray the leaves with half dose of Potassium Nitrate (KNO3) mixed with foliar organic fertilizer or home made lime sulfur solution.

5. Spraying and drenching the whole plant from the base of trunk to branches and leaves with foliar fertilizer rich in amino acid or other organic weak acid and containing micro-nutrient elements will help induce flushing. The use of Herbal Organic Concentrate (HOC) and homemade lime sulfur has been found to induce new vegetative growth.
6. Two months after flushing when the leaves start maturing, apply fertilizer rich in phosphorous and potash (guano and ash) to keep trees maturing and dormant in preparation for next season’s fruiting. Use organic fertilizer with guano and burnt rice hull or ash.

In selecting trees for flower induction, take note of the following:

1. The tree must have full mature leaves and buds. The leaves are crispy; dark-green in color, healthy plum dormant bud tips. At least 8-10 months rejuvenation.

2. The tree and leaves should be dry, with no rain expected within the day from spraying or smudging.

3. Trees that fruited the previous season but have not flushed should not be induced to flower. Many contractors and growers who want fast money often violate this practice. This will weaken the tree and will cause drop in production of death.

4. When spraying flower inducer, cover only 80% of the foliage. Allow 20% to remain vegetative to support and feed the tree during its productive stage (flowering and fruit development).
CONDITIONS IN FLOWER INDUCTION

<table>
<thead>
<tr>
<th>When not to use</th>
<th>Use High Dosage</th>
<th>Use Low Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When the tree is too small, young or juvenile.</td>
<td>1. When Trees are just starting to mature.</td>
<td>1. When trees are big, old or fully mature.</td>
</tr>
<tr>
<td>2. When the leaves and buds are young.</td>
<td>2. Leaves and buds are maturing</td>
<td>2. When leaves and buds are fully mature.</td>
</tr>
<tr>
<td>3. When the tree is weak and sickly.</td>
<td>3. The tree is healthy, with vigorous buds and leaves.</td>
<td>3. The tree is healthy with dormant-buds.</td>
</tr>
<tr>
<td>4. During rainy weather.</td>
<td>4. During cloudy weather.</td>
<td>4. During host sunny weather.</td>
</tr>
<tr>
<td>5. Just after harvest or when the tree has fruits or flushing.</td>
<td>5. Five to seven months after harvest after rejuvenation &amp; mature.</td>
<td>5. Eight to ten months after harvest after, rejuvenation &amp; dormant.</td>
</tr>
</tbody>
</table>

OTHER INDICATIONS

1. Check on the fruiting buds’ readiness. The buds are slightly rounded and mature or dormant, ready to flower. There are two types of buds, the leaf and flower bud.
2. If the buds are flattening with small dormant buds at the sides, they are most likely new flushing leaf buds for vegetative growth for next season’s fruiting.
3. The soil and the trees are dry. If it rained the previous days and the atmosphere is humid, induction may result to flushing or a combination of flowering with flushing.
4. Choose to induce during dry hot months or dry days. Flower induction up to 45 days during the early fruit formation are the most critical period where the flowers and young fruits are susceptible to infection and infestations. Rain an be damaging.
5. As a general rule, the mango flower and fruit if the tree is healthy and has accumulated enough carbohydrate and other plant nutrients, and is stressed.

6. A mango tree needs enough time of at least 8 to 10 months to accumulate and store food nutrients in its system from last fruiting, to support new flowering and fruiting cycle.

7. Too much flowering as in 90 to 100% of foliage flower are dangerous, since too much energy is released by the plant, and there will not be enough left for fruit development. Usual result is massive dropping and only a few fruits remain or even total crop fall. A 70% to 80% foliage flowering would be ideal to insure full fruit development with bigger and better quality harvest with enough vegetative leaves to feed the flowers and developing fruits.

8. Water or moisture is needed from bud emergence to one month before harvest to insure availability of plant food nutrients. The tree needs dry and sunny days before and during flowering. It also need one month dry period before harvest to insure full maturing, so fruits do not crack or drop up to harvest. Fruits will be heavier, firm and sweeter.

Additional Pointers:

• Mango can be induced any time of the year provided the fruiting buds are mature and ready and the weather condition is dry, warm and sunny for several days before and after induction. Be sure when Inducing both the tree, soil are dry and trees are clean.
• Induction response also increases if in the next 2-3 days after induction, a continued dry sunny days would prevail. Rain or excess moisture and humidity immediately after flower induction may result to flushing or vegetative growth instead.
• This can be done by monitoring the weather condition for the next tens days, thru weather reprts in the internet or access thru the local weather stations.
• Buds and leaves that are 8-9 months old from flushing. This can follow a one year cycle, more or less.
• Trees that were able to rest and rejuvenate following the fruiting season.
• Trees that were able to produce flowers during the last season but were aborted and did not produce fruits will have more food energy stored.
• Dormant trees that undergo pruning, cultivation, irrigation with good organic fertilizer application.

PEST AND DISEASE CONTROL

Natural farming methods of controlling pest and diseases in growing organic mango. Integrated Pest Management (IPM) is the use of different practical yet low cost methods:

1. Cultural practices that includes the right planting distance, periodic weeding and cultivation, irrigation and drainage, pruning, spraying, etc. See to it that the water source is not contaminated or carrier of pest and diseases.

2. The use of baits and insect traps (light traps, sweet juice *tuba* trap).

3. Spraying with herbal organic preparations with pest repellant, insecticide and fungicidal properties HOC (Herbal Organic Concentrate) with BMO (Beneficial Microorganism).

4. The use of beneficial microorganisms that control pest and diseases (BMO).

5. The use of insect predators, parasites like trichogramma, braconids, and pirate bug.

6. Crop rotation or inter-cropping with plants that will repel or reduce infestation.

7. Schedule and time production during least pest infestation and disease prevalence. There is less insect pest and diseases during summer months.
8. Cultivate and fertilize the soil around the base of the trunk periodically with organic fertilizer derived from herbs with pesticide and fungicidal properties as well as beneficial microorganisms.

9. Remove diseased or infested fruits and vegetative parts of the tree and dispose of them properly such as removing them from the field, burning, bury or composting them for fertilizer. Practice clean culture.

**Take note:** When spraying trees with herbal organic concentrate (HOC) or vermin-cast brew, start with the soil surrounding the trunk, upward around the trunk, branches then the underside of the leaves or foliage and last the top of leaves and crown. Insect pest and diseases comes from the soil and stay in trunk and branch where they hibernate and wait then wake or become active when new growth appears such as flushing and flowering to fruiting.
## ONE YEAR MANGO PRODUCTION CYCLE

<table>
<thead>
<tr>
<th>One-Year Cycle</th>
<th>Stage of Growth</th>
<th>Activity/Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 DAFI</td>
<td>Tree is ready for flower induction</td>
<td>Sanitize tree Prune &amp; Spray HOC. Smudge trees.</td>
</tr>
<tr>
<td>0 - 7 DAFI</td>
<td>Mature buds &amp; leaves</td>
<td>Spray flower Inducer + HOC-3n1</td>
</tr>
<tr>
<td>7-10 DAFI</td>
<td>Bud emergence</td>
<td>Spray HOC-4n1. Smudge trees</td>
</tr>
<tr>
<td>14 DAFI</td>
<td>Post emergence</td>
<td>Monitor &amp; spray HOC-4n1 + FAA Smudge trees. Use rice hull.</td>
</tr>
<tr>
<td>21 DAFI</td>
<td>Pre-emergence/bloom</td>
<td>Monitor &amp; Spraye HOC if needed. Smudge trees. Use rice hull in.</td>
</tr>
<tr>
<td>24 DAFI</td>
<td>Anthesis/blooming</td>
<td>Do not spray, unless it rains Pollinators are at work</td>
</tr>
<tr>
<td>28 DAFI</td>
<td>Full anthesis/bloom</td>
<td>Do not spray, unless it rains Pollinators are at work</td>
</tr>
<tr>
<td>30-32 DAFI</td>
<td>Post anthesis/bloom</td>
<td>Monitor - spray after it rains Pollinators are at work</td>
</tr>
<tr>
<td>35 DAFI</td>
<td>Fruit set</td>
<td>Monitor/spray HOC-4n1 + FAA</td>
</tr>
<tr>
<td>42 DAFI</td>
<td>Post fruit set</td>
<td>Monitor/spray HOC-4n1 + FAA Smudge trees. Use rice hull.</td>
</tr>
<tr>
<td>60 – 70 DAFI</td>
<td>Fruit enlargement</td>
<td>Spray HOC-4n1 &amp; fruit bagging. Smudge trees. Use rice hull</td>
</tr>
<tr>
<td>90 DAFI</td>
<td>Start of maturation</td>
<td>Monitor/spray HOC-4n1 + FAA. Smudge trees. Use rice hull.</td>
</tr>
<tr>
<td>120-130 DAFI</td>
<td>Full maturity</td>
<td>Harvesting, HWT and Packaging</td>
</tr>
<tr>
<td>130-140 DAFI</td>
<td>Natural ripening</td>
<td>Processing and Marketing</td>
</tr>
<tr>
<td>140-360 DAFI</td>
<td>Rejuvenation. Flushing, nutrient absorption, photosynthesis, food &amp; energy storage --- Dormancy</td>
<td>Cultural management: Pruning, Weeding, Cultivation, Fertilizing with organic compost, Irrigation and Foliar Spraying,</td>
</tr>
</tbody>
</table>
FLOWER AND FRUIT PROTECTION

The crucial stage of mango production is the attack of insect pests and diseases at flowering and fruit development stages. Insecticides and fungicides are commonly used, but to obtain good results, the recommended usage and dosage must be followed and control must be directed during the vulnerable stage of insect and disease development (not during the height of destructive infestation and infection). Prevention is better than cure. It is also less expensive and hence, more profitable.

Raining during flowering and early fruit development is damaging in this most critical condition as Anthracnose fungus disease is prevalent. It will rot the flowers and young fruits and they turn dark and fall off. Every time the rain stops or light drizzle, spray immediately HOC herbal fungicide with soap and water to wash off the fungus from the flowers and fruit panicles. Do not postpone or delay as the fungus can do damage within a few hours. Shaking the branches to remove water droplets from flowers and young fruits will help for few small trees.

<table>
<thead>
<tr>
<th>BEST TIME FOR PROTECTIVE CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Prior to Induction</td>
</tr>
<tr>
<td>(2) Flower Induction</td>
</tr>
<tr>
<td>(3) Bud Break</td>
</tr>
<tr>
<td>(4) Prior to bloom</td>
</tr>
<tr>
<td>(5) After flower set</td>
</tr>
<tr>
<td>(6) Before bagging</td>
</tr>
<tr>
<td>(7) Start of maturation</td>
</tr>
</tbody>
</table>

WRAPPING AND BAGGING FRUITS

Wrapping the individual fruit with newspaper should be done at about 55 to 60 days after induction or just after natural thinning or dropping when the mangoes are about the size of a pullet egg. New observation finds 70–80 DAFI is more practical period to bag, as there will be less fruit drops after bagging and only quality fruits may be bagged.
ADVANTAGES OF FRUIT BAGGING:

Bagging can reduce or eliminates the incidence of fruit fly and Capsid bug damage, sunburn and fungal infections.
Reduced incidence of mechanical damage while the fruit still hung on the tree and during harvesting and handling operations. It protects fruits from wind scars.
The paper serves as absorbent of latex flow during harvest.
The fruit skin is cleaner and more attractive light green color.
Bagging provides more or less an accurate estimate on the number of fruits per tree. This is important in cases where marketing is done on contract basis, or estimated on the total volume and weight of harvest.

PRE HARVEST PROTECTION

Spraying foliar fertilizer high in potash with trace mineral elements during fruit development will make the fruits sweeter. It will make the peel more flexible and will lessen cracking of fruits during the final stage of maturity, even when humidity rises and rains.

Spraying with herbal organic concentrate or HOC-4n1 will do this. It will also protect the fruits from insect pests and fungal diseases.

Let us not forget that friendly insects, birds and microorganisms are very helpful in reducing the population and incidence of insect pests. Providing favorable natural environment in the orchard for friendly biological organisms will greatly reduce cost of production and good quality fruits.
HARVESTING MANGO

It is very important to keep in mind that the preservation of the superior quality fruit, especially if it is intended for the fresh table use that is critical during the harvest and post harvest period. Harvesting and handling of fruits should be entrusted only to properly trained, preferably experienced workers. It is also advisable for beginners to first observe professional harvesters during harvest operations.

The utmost care in harvesting and handling of mango should be emphasized. Workers and harvesters should first be given a briefing before releasing them to the field. It takes a one-year cycle of care and culture to bring the fruits ready for harvest. It takes less than a second to drop the fruits does and break or bruise does.

Use the right harvesting poles with soft nets to avoid bruising. Use wooden or plastic harvesting crates with clean soft padding. Avoid using banana leaves or other materials that may have fungus diseases that will infect the fruits.

Do not remove fruit bags in the field, as they will serve as cushion and absorbent of latex. They may be removed during grading and classification before washing and hot water treatment.

GUIDE TO HARVESTING MANGO

Maturity of mango fruits ready for harvest.

1. The mango start maturing at 90 days and reach full maturity in 120 to 135 days after flower induction (DAFI). Note: Earlier fruit ripening on tree and dropping may occur in hot arid areas. Delayed maturity occurs in cool humid areas.
2. In hot and dry areas, the fruits tend to ripen earlier, (110 – 115 days). It does not mean that they have reach full physiological maturity (lesser weight and sugar content). In cooler, humid and shady areas, the fruit take more time (135 days) from flower induction to reach full maturity, as sunlight may be less. When
new flushing comes together with flowering, the fruits likewise
take more time to mature (130 DAFI).

3. If the tree flowers naturally, count 85 to 95 days from flower
bloom to determine the approximate date of full maturity.
Blooming is when flowers open, release odor that attract insect
pollinators.

4. One sure test is to get samples randomly picked from the tree
and slices the fruits at the apex portion. If the flesh is still white,
it is immature, while if it is turning yellow; it is ready for harvest.

5. Floatation checks. Dip the fruit in 1-% salt solution. Seawater
may be used. The floaters are immature while those that sink
are mature, and ready for harvest. 90% sinkers are ready for
harvest.

6. The presence of bloom, or powdery deposit on the surface of
the skin is an indication of full physiological maturity.

7. Mature carabao mango fruits have flattened shoulders at the
stem end. While immature fruits have slope shoulders with full
cheeks.

8. The pedicel of mature fruits turns yellow green in color.

9. Laboratory test may not be practical for field operations. The
Titrable Acid of fully mature fruits is less than 45 miliequivalents
per 100 grams and the total soluble solids at table ripe is 15%
or higher. ++++++++++++++++++++++++++++

10. Consider that 5% of fruits are ahead by 5 to 10 days and
another 5% are later developed from the 90% fruits. So expect
early maturing and late maturing fruits.

Maturity check of fruits on trees in the field:
• Flattened shoulders at the stem–end
• Fullness of cheeks
• Presence of white powdery deposits on the peel
• Yellow-green pedicel-end in some of the fruits
• Yellowing of the pulp.
HARVESTING METHODS

1. Hand picking is still the best method, but it is difficult and time consuming for large orchards. Using picking poles and ladder is a common practice, especially with commercial mango production and big plantations with big tall trees. Avoid bruising the fruits with the picking pole.

2. To avoid bruises and damage, in handling and transport, trim off the pedicel before packing when latex flow has dried. It is done easily by pulling off horizontally the pedicel and it will just snap at the neck of the pedicel. Leaving short pedicel (2.0 – 5.0 cm) on the fruit to minimize latex flow

3. The best time of the day to harvest is between 9:00 a.m. to 3:00 p.m. when the tree and fruits are dry and latex flow is minimal. Latex cause acid burning and brownish discoloration of the skin, which also make it, open to fungal infection. However for large orchard and big harvest, this cannot be followed, as time will be limited to meet scheduled shipments. Fully mature fruits have less latex flow.

4. Place the fruit in an inverted position with the pedicel down on absorbent paper materials, which are free from disease contamination.

5. Keep the fruit bags until sorting, washing, HWT, drying and packing. Treat the mangoes within 2-4 hours from picking.

POST HARVEST OPERATIONS

CLASSIFYING

Sorting and classifying occur at the following stages:
   1. During harvest
   2. During field packing.
   3. Before and during washing
   4. After HWT just before final packaging for shipment.

Fruits are classified according to size, weight and the general appearance.
KIND OF FRUIT DEFECTS:

**Deformity** – Abnormality in shape affecting fruit appearance.

**Wind Scar** – Dark streaks slightly elevated are attributed to abrasion due to wind.

**Latex Burn** – Brownish black streaks that may be sunken are attributed to aged latex stains.

**Ugat** – Netted appearance at the peel due to the prominent vascular bundles.

**Insect Damage** – Lesions (fresh or healed) due to insect attack.

**Scab** – Patches of fissured corky tissue on the peel.

**Sooty Mold** – Black powdery deposit (mold) concentrated on the shoulders.

**Balat Kawayan** – Unusually, the deep green color of the peel. The affected fruit fails to change color when ripe.

**Mottling** – Blotchy uneven green color, some of it remains even when the fruit is fully ripe.

PREPARING FRESH FRUITS FOR SHIPMENT

1. Grade and classify fruits according to size, weight and peal appearance.
2. Wash fruits with clean warm water with detergent or chlorine.
3. Hot Water Treatment. Dip fruits in 52 to 55 degrees centigrade water for 10 minutes.
4. There is new innovation to HWT as spraying or dipping fruits for one minute in 60 degrees heated water.
5. Air-dry the fruits to remove all moisture on the peel and allow them to cool off.
6. Pack in clean paper and boxes for shipment or ripening.

See to it that the fruits remain dry in cool ventilated place. Avoid re-contamination of diseases or exposure to pests while in storage or transit.
SORTING

Prior to packing for export, meticulous grading and sorting of mangoes are done based on the degree of cleanliness of the skin, size, weight of the fruit, as small, medium, large, and extra large. Mango exports are graded as either “Fancy” or “Standard” depending on the extent of superficial skin markings. All exports must comply with the strict requirement of sweetness (full maturity of 120 to 135 DAFI -15 – 18 brix), firmness and absence of infestation and infections.

GRADING OF PHILIPPINE MANGO FOR EXPORT
(Based on the draft revision of Standards for Mango of the Bureau of Product Standard)

<table>
<thead>
<tr>
<th>SIZE</th>
<th>WEIGHT IN GRAMS</th>
<th>No. Of 2.5 kilo box</th>
<th>No. Of 5.0 kilo box</th>
<th>No. Of 10 Kilo box</th>
<th>No. Of 12 Kilo box</th>
</tr>
</thead>
<tbody>
<tr>
<td>X L</td>
<td>357 up</td>
<td>6 – 7</td>
<td>12 – 14</td>
<td>24 – 28</td>
<td>30 – 32</td>
</tr>
<tr>
<td>Large</td>
<td>290 – 356</td>
<td>8</td>
<td>16</td>
<td>31</td>
<td>41 – 43</td>
</tr>
<tr>
<td>Medium</td>
<td>241 – 289</td>
<td>10</td>
<td>20</td>
<td>40</td>
<td>44 – 50</td>
</tr>
<tr>
<td>Small</td>
<td>190 – 240</td>
<td>12</td>
<td>21</td>
<td>48</td>
<td>51 – 63</td>
</tr>
<tr>
<td>Super Small</td>
<td>160 – 189</td>
<td>14 – 16</td>
<td>28 – 32</td>
<td>56 – 64</td>
<td>65 – 75</td>
</tr>
<tr>
<td>Bioco</td>
<td>85 – 159</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SOME QUALITY CRITERIA OF IMPORTERS:

Physiologically mature. (120-135 DAFI) Sugar content of 15% to 18% brix.
Beginning to ripen, with 30 to 50% yellow coloring for Philippine golden Mango or the carabao variety.
Significant area of red color on the fruit shoulder for varieties with reddish shine like Florida and some Indian mangoes.
Free from disease, decay, sunburn, cracks, bruises, latex stains, insect and mechanical damage. Relatively firm.
Conform to the weight and size specification
Contained in preferred or specified packing.
Underwent pytho-sanitary treatment and quarantine inspection with approval certification.
POST HARVEST TREATMENT

There are several post harvest treatment being employed:

1. **Plain warm water washing** with 1-% salt solution or detergent and chlorine. Dry fruits after washing as re-infection occur when fruits are moist.

2. **Hot Water Treatment (HWT)** where fruits are dipped in 52-55 degrees water for 10 minutes. A new innovation dips in 59 to 60 degree water for 30 seconds to one minute. The temperature range should be strictly maintained and monitored to avoid scalding if it rises, and if it drops, may not control the pest and diseases of the fruits. Air-dry immediately after dipping. Adding chlorine to the water helps control diseases. **Cost about P2.00 per kilo treatment.**

   The author designed and fabricated a simple HWT tank made out of one sheet stainless steel plate heated by LPG. Dimension is 20 x 30 inches and 18 inches high. It has a capacity of 2 crates of 20 kilos per crate per loading. The unit can easily be transported to the site of harvest. It cost P8, 000 to P10, 000 per complete unit with stand, gas-stove burner, LPG tank with hose, regulator and thermometer. A bigger stainless steel tank with 6-crate capacity cost P20, 000.00 fabricated by a machine shop in Gen. Santos City.

3. **Extended Hot Water Treatment (EHWT)** – Dipping the fruit in 46 - 48 degrees Centigrade for 90 minutes. This treatment is practiced in Mexico for mango exported to the USA.

4. **Vapor Heat Treatment (VHT)** where fruits are subjected to heated vapor until the inner flesh of the fruit reaches 46 degrees for 10 minutes. This treatment is required for mangoes exported to Japan, and Korea. It is non-toxic and non chemical disinfectant. **Very expensive, cost about P40.00 per kilo treatment.**
5. **Chemical Treatment** – Using fungicide to control fruit rot. Fungicides are dissolved in water where the fruits are dipped. Benomyl (500-1000 PPM) and other suitable fungicides are used. **This practice is no longer accepted.**

6. **Fumigation with Ethylene dibromide (EDB)** at the rate of 16 grams per cubic meter for 2 hours at 25°C is done for mangoes exported to Australia and New Zealand. This will control and destroy the insect eggs in the fruit. The Australian government has now banned the use of EDB. The Philippine government is negotiating to replace it with VHT to control fruit fly. Irradiation seems to be more favored by Australia. **This procedure is no longer acceptable.**

7. **Irradiation** – This is a new introduction to access fruits and food preparation to USA and other countries requiring such quarantine procedure. **However, many are critical with this procedure.**

These treatments tend to control fruit born diseases like Anthracnose and Stem End Rot as well as kill insect eggs like Fruit Fly. Be sure to fully dry the fruits after treatment, before packing because wet and moist fruits are easily re-infected by fungal rot diseases.

**STEPS IN HOT WATER TREATMENT**

1. Heat water up to 55°C and maintain the temperature range at 52-55°C during operations. A 59-60 degrees for fast treatment.
2. Place mango in perforated plastic crate or basket that fits into the hot water tank to maximize the number of fruits that can be treated in one dipping. In the absence of plastic crate, any other suitable containers that will not cause bruises on the fruits may be used. This will also avoid direct contact of the fruits with the hot metal bottom of the tank that can cause heat injuries or scalding.
3. Dip the mango into the hot water submerged for 5 to 10 minutes, checking the temperature is between 52-55°C. A faster procedure is 30 to 60 seconds dipping in 59 to 60
degrees water. It is advisable to move the crates now and then to equalize the heat and help remove the dirt from the fruits.

4. Use electric fan to hasten fruit drying. When fully dried, sort them and pack carefully into fruit boxes or crates for storage or shipment to the market.

5. Some buyers do not want chemically treated fruits, so HWT or VHT are done without using fungicide of chemicals.

The above operations should be done within 4 to 8 hours after harvest. It is even preferable for small quantity harvest to do the whole operation right in the field or farm. The best time is treat fruits within 4 hour of picking while latex is still wet.

Harvested mangoes should never be exposed to direct sunlight, wind, rain and other contaminants, either in the farm or during transport to the processing plant and packaging site. If this cannot be avoided, thorough washing and hot water treatment should be done and completely dried and packed avoiding re-contamination.

PACKAGING OPERATIONS

Packaging consists of three stages.

1. Packing from field harvest to processing or packaging house.
2. Packing of fresh fruits for domestic and export market.
3. Packing of processed fruit products.

PACKING HOUSE FACILITIES AND EQUIPMENT

A packing house is basically a building with shed and open sides, preferably high roofing and elevated cement flooring with good drainage, aeration and lighting. It should have adequate floor area to accommodate the equipment, working space and storage space. There should also be a provision to shed vehicles loading and unloading fruits during rains and inclement weather. The perimeter area of the packinghouse should be well secured from stray animals and vandals.
HARVEST AND POST HARVEST FACILITIES:
Harvesting tools, equipment from farm to Packaging House
Buying Station with Packaging House
  a. Packaging equipment for fresh fruits
  b. Boxes, containers and accessories
Processing Plant
  a. Processing facilities (Dehydrated, puree, juices, frozen halves, etc).
  b. Packing materials and equipment
Storage facilities (dry or cold)
Transport and delivery vans

PACKAGING FACILITIES AND EQUIPMENT NEEDED

1. Plastic Fruit crates for field howling.
2. Sorting area or tables. (fans)
3. Washing tanks or basin. packing tables
4. Plastic Fruit crates for HWT
5. Hot water tank: equipment
6. Stainless steel water tank. and/or boxes
7. Electric water heater
8. Thermostat and thermometer
9. Gas stove with regulator and gas tank.
10. Boiler and water pump with piping.
11. Dripping stand
12. Air drier or blower
13. Grading and packing tables
14. Weighing scales
15. Pack-Strapping equipment
16. Fruit cartoons
17. Hand carts
18. Storage area
19. Loading area
20. Conveyor system

FRUIT CONTAINERS

Assuming one hectare produces 50,000 kilos per season and packed in 10 kilo crates or boxes, this will require 5,000 boxes per hectare every year.

BAMBOO AND RATTAN BASKETS – “Kaing or Bukag” with a load capacity of 30 to 70 kilos are commonly used by farmers and mango traders. Bruising and mechanical injuries can be
minimized with the use of liners, wooden support planks on vehicles during transport.

**Hard Plastic or Fiberboard Cartoons** – These cartons have a capacity of 12 – 20 kilos. They are used for transporting mango from the field to the packinghouse.

**Containers of Utility** – Some traders and mango exporters provide contractors and farmers with returnable plastic crates. Others provide cartons that are use to pack fruits for direct market delivery.

**Wooden crates** – Commercial mango growers are also advised to grow fast growing trees like G’melina, Neem, Bagrass, Falcata and even big bamboo variety for fruit crates and box manufacture to provide packaging materials.

### GRADING PHILIPPINE MANGO FOR EXPORT

<table>
<thead>
<tr>
<th>SIZE</th>
<th>WEIGHT in grams</th>
<th>NUMBER per 2.5 kilos</th>
<th>NUMBER per 5 kilos</th>
<th>NUMBER per 10 kilos</th>
<th>NUMBER per 12 kilos</th>
</tr>
</thead>
<tbody>
<tr>
<td>LARGE</td>
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<td>16</td>
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</tr>
<tr>
<td>BIOCO</td>
<td>085 – 159</td>
<td>18 – 20</td>
<td>34 -40</td>
<td>65 – 70</td>
<td>76 – 80</td>
</tr>
</tbody>
</table>

### MANGO FRESH FRUIT STORAGE

Newly harvested, washed and Hot Water Treated mangoes may be stored for 7 days at 15°C. Do not store mangoes below 12.5°C, as this will cause chilling injuries. Ripening mangoes can have another 14 days shelf life. Mangoes for processing may be stored for 21 days in temperature ranging from 1°C to 5°C. Buyers and contractors prefer to harvest green mangoes 100 to 110 days from flower induction as these have longer shelf life than those
harvested at 115 to 120 DAFI. However mangoes harvested before 120 days have not reach full maturity, and their sugar content much lower, affecting quality of fruits when ripe. Mangoes harvested when they are fully mature are sweeter with superior eating quality but have a shorter shelf life.

RIPENING MANGO FRUITS

Mango fruits may be ripening in the following manner:

The natural way. After the hot water treatment and air-drying, place fruits in clean plastic or wooden crates and store them in a ripening room well sealed so as not to allow entry of moisture and infection. Well mature fruits ripen in 4 to 6 days. The shelf life may extend from 5 to 12 days.

Use of carbide. Place a tablespoon of carbide wrap in paper at the bottom of the ripening basket or crate. The container is well padded with paper to be airtight. Place the fruits until filled and cover to secure the fruits is totally sealed. After four (4) days they may be open for aeration and display. Note that the shelf life of this method of ripening is only 3 to 4 days.

Use of ethylene. Fruits are sprayed or dip in ethylene solution, air dried and stored in the ripening room. Fruits ripen in 3 to 4 days.

Ripening mango with madre de cacao leaves. Pack the fruit in container with fresh semi dried leaves and close airtight. After 4 to 5 days fruits can be taken out and exposed to air and continue ripening.

MANGO TRADING

Mango trading is the last step in the mango industry. This is where the money is. Most growers give little attention to this stage of the mango industry, and the traders who come to them make the most profit. It is suggested that mango growers form their own marketing group even only at their community level, consolidating the fruits and deal with regular traders and exporters on a more stable and long range agreements.
MARKETING CHANNELS:

1. From the farm traders and consolidators buy directly from growers. Other buyers even do the harvesting. Harvesting is the responsibility of the growers.
2. Where there are buying stations, farmers or domestic traders deliver the fruits to the station with packaging facility.
3. Local traders and consolidators also deliver fruits to processors to shipping ports by boat or plane to wholesalers or exporters. Wholesalers distribute to retailers, sell to exporters and fruit processors.

STAGES OF TRADING:

1. Production of mango fruits.
2. Contract growing.
3. Consolidation of fruits
4. Packaging for domestic and export markets.
5. Processing
   a. Fresh fruit processing and treatment
   b. Fruit processing to other product forms with value added.
6. Whole selling, Distribution
7. Retailing or door to door sales.
   a. Ripening
   b. Display or direct delivery to customers.
### PHILIPPINE MANGO EXPORTERS

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>BRAND (S)</th>
<th>EXPORT MARKETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond Star</td>
<td>Diamond, Blue, Ruby</td>
<td>Hong Kong, Japan</td>
</tr>
<tr>
<td>Flying Horse (Eden)</td>
<td>Flying Horse</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Fruitful</td>
<td>Golden Harvest Fortune</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>GHL Marketing, Inc.</td>
<td>Golden Leon</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Inner town Enterprises</td>
<td>Cal Fruits</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Jovin</td>
<td>Jovin</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>KS New Regency</td>
<td>New Legend, Fortune View</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Sally</td>
<td>Sally</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Succrex</td>
<td>Golden Swallow</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Tadyason</td>
<td>Tadyason</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Tricon</td>
<td>Tricon, Flying Tiger</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Venvie International</td>
<td>Prime, Bountiful Mango King, Gold Leaf</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Cindy</td>
<td></td>
<td>Hong Kong</td>
</tr>
<tr>
<td>ABC</td>
<td>Fiesta</td>
<td>Hong Kong</td>
</tr>
<tr>
<td>Marsman-Drysdale</td>
<td>La Nuvia, Luna, Sampaguita</td>
<td>South Korea, Japan</td>
</tr>
<tr>
<td>Pelican Agro Products</td>
<td>La Nuvia, Luna, Sampaguita</td>
<td>South Korea, Japan</td>
</tr>
<tr>
<td>DHM and Dole Tropifresh</td>
<td>Dole</td>
<td>Japan</td>
</tr>
<tr>
<td>Hi-Las Marketing, Inc.</td>
<td>Tropical Star</td>
<td>South Korea, Japan</td>
</tr>
<tr>
<td>Del Monte</td>
<td>Del Monte</td>
<td>Japan</td>
</tr>
<tr>
<td>Other Companies</td>
<td></td>
<td>Hong Kong, Japan</td>
</tr>
</tbody>
</table>
RETURN ON INVESTMENT (ROI)

The cost of production, productivity and profit vary from farm to farm as the situation and factors affecting the trees and the market change from time to time. Producing mango during off-season is more expensive since more protective spraying during rainy days is required to suppress pest and diseases. However, there are basic fixed costs of production and operational activities that can be fairly estimated on prevailing conditions.

It is very important for mango growers to have and keep record of every farm activity. Every year there should be prepared a farm plan and budget.

An accurate recording of all expenses and revenue are necessary to determine the profit or loss per season or year of farming. This will guide the farmer as to his next year’s operations and activities. To improve or change some of the practices such as the use of indigenous organic and renewable farm inputs as against the conventional farming using imported fertilizers and chemicals.

NURSERY (Seedling Production)

<table>
<thead>
<tr>
<th>NURSERY (Production cost of one seedling)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Seeds</td>
<td>P 0.50</td>
</tr>
<tr>
<td>b. Plastic bag</td>
<td>1.00</td>
</tr>
<tr>
<td>c. Garden soil and bagging</td>
<td>1.50</td>
</tr>
<tr>
<td>d. Watering</td>
<td>3.00</td>
</tr>
<tr>
<td>e. Scion material</td>
<td>2.00</td>
</tr>
<tr>
<td>f. Grafting work</td>
<td>5.00</td>
</tr>
<tr>
<td>g. Fertilizer and Chemicals</td>
<td>3.00</td>
</tr>
<tr>
<td>Total cost for grafted seedling</td>
<td>16.00</td>
</tr>
<tr>
<td>Price increase per added flushing and maturing</td>
<td>5.00</td>
</tr>
<tr>
<td>Selling price after 3 flushing and maturing</td>
<td>35.00</td>
</tr>
<tr>
<td>Price of Large Planting Material (LPM)</td>
<td>100.00</td>
</tr>
<tr>
<td>Ready for planting after 22 months nursery and hardening period.</td>
<td></td>
</tr>
</tbody>
</table>
FIELD PLANTING OF TREES

<table>
<thead>
<tr>
<th>FIELD PLANTING (Per Tree)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Land Preparation</td>
<td>P30.00</td>
</tr>
<tr>
<td>b. Staking</td>
<td>5.00</td>
</tr>
<tr>
<td>c. Digging and soil refilling</td>
<td>20.00</td>
</tr>
<tr>
<td>d. Labor (Planting, fertilizing, watering, mulching)</td>
<td>15.00</td>
</tr>
<tr>
<td>e. Planting Material (LPM)</td>
<td>100.00</td>
</tr>
<tr>
<td>Tree guard or fencing</td>
<td>30.00</td>
</tr>
<tr>
<td><strong>Total Planting Cost</strong></td>
<td><strong>200.00</strong></td>
</tr>
<tr>
<td>Labor cost may vary depending on soil condition (Hard clay or Sandy loam)</td>
<td></td>
</tr>
</tbody>
</table>

COST OF FIELD CARE OF JUVENILE TREES
PER YEAR UP TO BEARING AGE (1 – 6 YEARS)

<table>
<thead>
<tr>
<th>MAINTENANCE COST OF CARING JUVENIL TREES (1-6 years old)</th>
<th>Cost per yr. of maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Labor and maintenance cost for cultivation, irrigation spraying, pruning, weeding, etc.</td>
<td>P 60.00</td>
</tr>
<tr>
<td>b. Fertilizer and soil conditioners (organic compost)</td>
<td>30.00</td>
</tr>
<tr>
<td>c. Chemicals: Insecticide, fungicide and growth regulators</td>
<td>50.00</td>
</tr>
<tr>
<td>d. Water supply</td>
<td>20.00</td>
</tr>
<tr>
<td>e. Tools and equipment</td>
<td>20.00</td>
</tr>
<tr>
<td>f. Miscellaneous</td>
<td>20.00</td>
</tr>
<tr>
<td><strong>Average yearly cost of maintenance (1 to 6 yr.)</strong></td>
<td><strong>P 200.00</strong></td>
</tr>
<tr>
<td><strong>Total cost of maintenance for 6 years to bearing</strong></td>
<td><strong>P1,200.00</strong></td>
</tr>
</tbody>
</table>
### MAINTENANCE AND PRODUCTION COST OF BEARING TREES.

Production and maintenance cost of bearing trees with average estimated production of 2,000 fruits / 4 = 500 kilograms.

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gross Sales (500 kgs. x P15.00 = P7,500.00)</strong></td>
<td>P7,500.00</td>
</tr>
<tr>
<td><strong>Cost of production and maintenance of tree</strong></td>
<td></td>
</tr>
<tr>
<td>a. Labor: Weeding and cultivation</td>
<td>20.00</td>
</tr>
<tr>
<td>Pruning and Sanitation</td>
<td>20.00</td>
</tr>
<tr>
<td>Fertilization and Soil Conditioning</td>
<td>20.00</td>
</tr>
<tr>
<td>Irrigation and Drainage</td>
<td>20.00</td>
</tr>
<tr>
<td>Spraying</td>
<td>50.00</td>
</tr>
<tr>
<td>Wrapping (2,000 x P0.20)</td>
<td>400.00</td>
</tr>
<tr>
<td>Harvesting (2,000 x P0.05)</td>
<td>200.00</td>
</tr>
<tr>
<td>Processing and Packaging (500 kgs x P2.00)</td>
<td>1,000.00</td>
</tr>
<tr>
<td>b. Fertilizer and Soil Conditioner</td>
<td>200.00</td>
</tr>
<tr>
<td>c. Chemicals: Insecticides, Fungicide, Inducer</td>
<td>300.00</td>
</tr>
<tr>
<td>d. Packaging Materials (50 x P30.00)</td>
<td>1,500.00</td>
</tr>
<tr>
<td><strong>Total Cost of Production</strong></td>
<td>P3,730.00</td>
</tr>
<tr>
<td><strong>Profit before taxes</strong></td>
<td>P3,770.00</td>
</tr>
</tbody>
</table>

Prices and ex farm gate fluctuates. We base on average prevailing prices in year 2003 – 2004

<table>
<thead>
<tr>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex Farm Gate Prices (All in)</strong></td>
<td>P 15.00</td>
</tr>
<tr>
<td><strong>Cost of production per kilo</strong></td>
<td>7.46</td>
</tr>
<tr>
<td><strong>Net income per kilo</strong></td>
<td>5.54</td>
</tr>
<tr>
<td><strong>Return on Investment</strong></td>
<td>74.26 %</td>
</tr>
<tr>
<td><strong>50 Trees per Hectare (20 x 20 +1 meters) Cost</strong></td>
<td><strong>Profit</strong></td>
</tr>
<tr>
<td>P3,730 x 50 = P186,500 and Profit P3,770 x 50 = P188,500</td>
<td>P186,500.00</td>
</tr>
</tbody>
</table>
### MANGO PRODUCTION PER TREE

<table>
<thead>
<tr>
<th>AGE RANGE YEARS</th>
<th>PRODUCTION IN KILOS</th>
<th>GROSS SALES at P10 per Kilo</th>
<th>PRODUCTION COST at P4 per Kilo</th>
<th>PROFIT BEFORE TAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 5</td>
<td>No production</td>
<td>Juvenile trees</td>
<td>P1,000.00</td>
<td>(P1,000.00)</td>
</tr>
<tr>
<td>6 to 7</td>
<td>50</td>
<td>500.00</td>
<td>200.00</td>
<td>300.00</td>
</tr>
<tr>
<td>8 to 9</td>
<td>100</td>
<td>1,000.00</td>
<td>400.00</td>
<td>600.00</td>
</tr>
<tr>
<td>10 to 11</td>
<td>200</td>
<td>2,000.00</td>
<td>800.00</td>
<td>1,200.00</td>
</tr>
<tr>
<td>12 to 13</td>
<td>300</td>
<td>3,000.00</td>
<td>1,200.00</td>
<td>1,800.00</td>
</tr>
<tr>
<td>14 to 15</td>
<td>400</td>
<td>4,000.00</td>
<td>1,600.00</td>
<td>2,400.00</td>
</tr>
<tr>
<td>16 to 17</td>
<td>500</td>
<td>5,000.00</td>
<td>2,000.00</td>
<td>3,000.00</td>
</tr>
<tr>
<td>18 to 19</td>
<td>600</td>
<td>6,000.00</td>
<td>2,400.00</td>
<td>3,600.00</td>
</tr>
<tr>
<td>20 to 21</td>
<td>700</td>
<td>7,000.00</td>
<td>2,800.00</td>
<td>4,200.00</td>
</tr>
<tr>
<td>22 to 23</td>
<td>800</td>
<td>8,000.00</td>
<td>3,200.00</td>
<td>4,800.00</td>
</tr>
<tr>
<td>24 to 25</td>
<td>1,000</td>
<td>10,000.00</td>
<td>4,000.00</td>
<td>6,000.00</td>
</tr>
<tr>
<td>26 to 30</td>
<td>1,500</td>
<td>15,000.00</td>
<td>6,000.00</td>
<td>9,000.00</td>
</tr>
<tr>
<td>31 to 40</td>
<td>2,000</td>
<td>20,000.00</td>
<td>8,000.00</td>
<td>12,000.00</td>
</tr>
</tbody>
</table>
Note:

The above production estimates are pre conditioned, that the planting distance is 15 to 20 meters apart and the tree is allowed to grow to its natural size with minimal pruning growth restrictions. The bigger the tree crown supported by healthy root system penetrating deep and wide, the more production capacity it has. The bigger the main trunk and branches, the more plant food storage capacity the tree has to sustain its yearly production. The more healthy leaves to cook the nutrients absorbed by the roots through the process of photosynthesis, the more food nutrients are stored for vegetative growth, flowering and fruiting.

It is important to keep the soil rich in plant food nutrients with liberal application of organic fertilizer and compost. Using herbal organic concentrated and biological pest and disease control measures without depending on synthetic toxic chemicals that harm the environment and bio-ecosystem. The closer the mango trees are grown to its natural habitat, the healthier and more productive it becomes.

Growing herbal plants with pest repellant properties around and within the mango orchard will greatly help reduce insect infestation. Plants that harbor insect pests and diseases should be avoided.

Promoting the growth and multiplication of beneficial microorganism such as pro-biotic bacteria and fungi will greatly reduce pathogens causing diseases. Nitrogen fixing bacteria and decomposing microorganism will help maintain and enrich the soil fertility. Fungus that kills pathogens and cause sickness to insect pests, are also natural controls to balance life in the ecosystem of mango orchards. Spraying these microorganisms to the plant, soil and organic compost should be a part of organic mango cultural management.
MANGO FRESH FRUIT MARKETING COST BUILDUP

<table>
<thead>
<tr>
<th>PARTICULARS</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting and handling</td>
<td>P2.00</td>
</tr>
<tr>
<td>Transport to packing house</td>
<td>0.50</td>
</tr>
<tr>
<td>Sorting, washing, treatment &amp; packing</td>
<td>3.00</td>
</tr>
<tr>
<td>Cost of packaging materials</td>
<td>3.50</td>
</tr>
<tr>
<td>Transport to market or shipping point</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>SUB – TOTAL Cost up to packaging</strong></td>
<td><strong>P10.00</strong></td>
</tr>
<tr>
<td>Sea transport (boat) Gensan to Manila</td>
<td>5.00</td>
</tr>
<tr>
<td>Air transport (plane) Gensan to Manila</td>
<td>18.00</td>
</tr>
</tbody>
</table>

**Price Buildup**   **Quality**   **Standard**

**GROWERS**
- Cost of production   P8.00   P5.00
- Profit base margin   8.00   5.00
- Farm gate price      **16.00**   **P10.00**

**CONSOLIDATOR/WHOLESALER**
- Ex-farm gate price   P16.00   P10.00
- Marketing cost       5.00   5.00
- Shipping cost        5.00   5.00
- Mark-up (profit margin)   9.00   5.00
- Whole sale price     **P35.00**   **P25.00**

**RETAILERS**
- Whole sale price     P35.00   P25.00
- Marketing cost       5.00   5.00
- Mark-up (Profit margin)   15.00   10.00
- Retail price         **P55.00**   **P40.00**

MARKETING COST PER KILO
MANGO FARM REQUIREMENTS

To have a successful and productive mango orchard, the farm should be provided with the necessary facilities as farm structures, equipment and tools, such as the following:

FARM STRUCTURES:
1. Farmhouse for farm supervisor and workers quarters.
2. Bodega, storage room, tool room and equipment input supplies and farm produce.
3. Working shed and packinghouse to be used for multiple activities especially during harvest.
4. Water system, with water pump, storage tanks and water distribution lines.
5. In-farm road network to facilitate field operations and access.
6. Fence and other security structures to keep out animals and intruders.
7. Power source (electricity) and communication facilities.
8. Nursery facilities including a greenhouse.

FARM EQUIPMENT

1. Service and transport vehicle.
2. Farm tractor with implement attachments (plow, harrow, trailer, douse, etc.) For small farms, carabao drawn implements will suffice.
3. Mower and cultivator.
4. Generator, water pumps and reservoir.
5. Power sprayer with accessories (drums, pressure hose, sprayer lance and nuzzle, etc.
6. Cart or wheel borrow.
7. Rain gage, thermometer, soil tester.
8. Weighing scales, (1, 10, 60 kilo capacity)
9. Packinghouse with tanks, air blower, and packaging equipment.
FARM TOOLS

1. Bolo, knives and pruning sheers.
2. Shovel, rake and other garden tools.
3. Hammer, saw and other carpentry tools.
4. Harvesting poles, rope crates etc.
5. Hoe, cultivating tools, rake, etc.
6. Other tools that may come for need.

MATERIALS:

Fertilizers: Chemical, organic, foliar and soil conditioner.

Agricultural Chemicals (Insecticides, fungicides, herbicides, growth regulators, rodenticides, etc.) Chemicals can be replaced with herbal and organic fertilizers and pesticides.

Packaging materials, (Plastic crates boxes, cartoon, paper, fruit caps, etc.)

Protective clothing and disposable gadgets, gloves, rubber boots, etc.

PROCESSING FACILITIES

1. Fresh mango processing with sorting, washing, hot water treatment, air-drying, weighing and packaging.

2. Processing facilities for dehydration of fruits and packaging.

3. Processing facilities for puree, juice, preserves and other mango products and packaging.
MANGO PRODUCTS
PROCESSING AND UTILIZATION

The major purpose for processing mangoes is to preserve them against chemical and microbiological deterioration. The high temperature, high humidity and intense sunlight during the harvest season accelerated the metabolic processes in fresh fruits. This makes them susceptible to microbial attack.

Thus the physical and chemical changes that occur during the ripening of mango lead to fruit deterioration. By processing mango however, the uniform quality and sufficient supply of the commodity are assured throughout the year. Processing of mango also makes available convenient food items for those who cannot convert them from the fresh fruits to new product forms.

Moreover, one of the significant effects of mango processing is the improved distribution of mango products. Farmers are also encouraged to plant more and grow better quality produce because of the ready market, which offers fair prices.

Mangoes are usually eaten fresh as dessert or as relish depending on their maturity. Due to their perishable and seasonal nature, however, they are only available 3 or 4 months a year. During the peak of the harvest season, moreover, the fruit supply increases, thus, depressing the price to the detriment of the mango growers. Hence, mango is often processed into a more stable form to facilitate better distribution and stabilize prices, as well.

The demand for processed mango is increasing. This is shown by the influx of mango preparations in supermarkets and grocery stores. Among the popularly known mango products are dehydrated mango, candied mango, puree, mango juice drinks, nectar, jam, chutney, pickles and mango scoops, halves or cubes in light syrup.
The ripe mango is likewise used as tropical fruit salad. It can also be used for flavoring confectioneries, ice cream, sherbet, and bakery products.

In processing, most of these products, ordinary stainless steel or enameled cookware can be used. Specially, a regular kitchen blender is used for making mango puree from which mango juice is drink, nectar, and jam may be prepared. The production of dehydrated mango and candied mango, on the other hand, needs a forced draft oven or drier for fast drying and for hygienic reasons.

For large scale, set-up, however, a boiler, weighing scales, steam jacketed kettle, can seamier, exhaust box, and a small retort are needed for a more efficient operation.

We encourage mango growers to start learning and processing mango products in their homes or farms to save and utilize left over of fresh fruit market. This is additional income.
MANGO PREPARATIONS AND RECIPE

NILASING NA MANGGA

Materials:
- 2 large half-ripe (manibalang) mangoes peeled and sliced.
- ½ bottle beer
- 1 teaspoon white sugar

Procedure:
- Dissolve the sugar in the beer.
- Add the sliced mangoes and toss lightly.
- Marinate overnight in a cool place.
- To serve, add sliced tomatoes and shallots (sibuyas Tagalog).
- Garnish with fresh coriander (wansuy) or chopped green onions.
- Ready to serve.

HOME MADE DRIED MANGO

Materials:
- Half-ripe mango (Manibalang).
- Refined sugar, preferably white
- Stainless steel knife
- Plastic basin
- Plastic screen

Procedure:
- Peel off the skin of the mangoes.
- Slice in pieces thinly at desired size.
- Place in clean plastic basin.
- Place refined sugar enough to cover and mix slightly.
- After 12 hours, drain off liquid.
- Air and sun dry mango slices on plastic screen.
- When moisture content goes down to 10% pack and seal in thick .003 plastic bags of uniform weight.
- Store or distribute for sale or serve.

COMMERCIAL DRIED MANGO

Process:
- Freshly harvested mature green mangoes are classified, sized and graded removing diseased and damaged fruits.
- Fruits as subjected to Hot Water Treatment (HWT) then air-dried.
- Ripening is done placing 20 grams pack calcium carbide (kalburo) wrapped in paper and placed strategically among the fruits, placed in Kaing lined with newspaper and filled with 60 to 100 pieces of mangoes and covered airtight for 3 days.
- After 4 days, the fruits are removed and sorted for ripeness and size. Those still with fungal infection upon ripening are discarded. Those
still hard and green are separated and allowed to ripen fully. The fruits are sliced at the lateral axis from both sides at the middle seed section, following the contour of the seed to maximize recovery. The pulpy flesh is scooped from the peel using stainless steel spoon to avoid acid reaction. Aluminum should not be used, as it will cause discoloration. The cheeks are cut lengthwise into two to three pieces depending on the size of the fruit. Mango slice are then blanched in syrup, as 2 to 3 hours delay will cause discoloration. 50 Brix syrup is prepared by boiling 60 kilos sugar in 40 liters water. When the slices become translucent, they are removed from the fire and allowed to cool. 1-% metabisulfite is dissolved in the syrup. Mango slices are then added to the syrup and soaked overnight. Mango slices are removed, drained and rinsed in clean water to remove excess sugar that may crystallize when dried. The slices are spread on trays lined with cheesecloth, properly spaced to allow maximum load. Trays are placed in cabinet drier with 50 to 60 degrees centigrade temperature for one to two hours. Immediately after drying they are loosely packed in plastic bags and stored at ambient (room) condition for 24 hours to allow equilibration of moisture among pieces. The slices are rolled in confectioner’s sugar and the excess coating is brushed off. They are then weighed, then packed in boxes and shipped to market outlets.

ANOTHER PROCEDURE IN DEHYDRATING MANGO

Container:
Glass jars Aluminum pouch or laminated plastic bags of suitable thickness.

Quality of Raw Materials:
Firm and ripe mangoes. (Over ripe fruits will give a dark colored product with shorter shelf life). Fruits weighing 200 grams or less.

Preparation:
a. Wash fruits to be processed thoroughly.
b. Slice the cheeks with a sharp stainless steel knife.
c. Cut each cheek into two equal halves.
d. Scoop the pulp from the peel with a stainless scoop or ladle.
e. For mango chips, each cheek should be diced into four to eight pieces depending on the fruit size.

**Processing:**
- a. Heat the prepared mango at 80°C in medium syrup
- b. Syrup (45°C) with 1% sodium metabisulfite (Na2S2O4) and
- c. Steep for 6 hours.
- d. Remove the mango strips or chips from the syrup.
- e. Rinse with clean water.
- f. Arrange the materials in the drying tray.
- g. Dehydrate at 40°C to 50°C in a drying oven.
- h. Drying time is usually 18 hours.
- i. Remove the dehydrated mango strips from the trays.
- j. If candied mango is desired, increase the syrup strength to 60 Brix by adding more sugar after steeping. Follow same procedure as above.
- k. Allow the dehydrate mango to cool to room temperature.
- l. Pack in the desired containers and seal immediately.

**MANGO PUREE (Flow)**

**Procedure:**
- a. Pre-wash mangoes with chlorinated water.
- b. Slice and scoop out pulp.
- c. Pulpier / finisher use blender or micro-mixer.

**Processing:**
- d. Heat and pasteurize in 60 to 80 degrees centigrade for 30 minutes.
- e. Fill container to the brim or full exhausting out air.
- f. Seal container.
- g. Heat puree with sealed container for 33 minutes in 100°C boiling water.
- h. Cool and store or deliver to market.

**ANOTHER WAY OF PROCESSING PUREE**

**Container:** Glass jars with PVC lined closures or C enamel cans.

**Quality materials:** Fully ripe and firm mangoes.

**Preparation:**
Wash fruits thoroughly and drain out water.
Slice and scoop the pulp.
Weigh
Pass through a pulpier or blender.
Add 0.3% citric acid and 0.1 sodium metabisulfite. Base on the weight of the scoop.
Mix thoroughly.

**Processing:**
Heat the pulp to 90°C in a steam jacket kettle or stockpot with constant stirring.
Pack immediately in pre sterilized enameled cans or glass jars. Exhaust jars to remove bubbles trapped inside the liquid. If the hot mango is added to container, there is no need for exhausting.

**Packaging:**
- a. Seal the cans immediately.
- b. If glass jars are used, half close only.
- c. Process in boiling water for ten minutes.
- d. Cool in running water or air cool.

**Take note:** Preservative chemicals like sodium metabisulfite or sodium benzoate may not be used as long as the product is properly cooked pasteurized, sealed and stored.

**MANGO LEATHER FROM MANGO PUREE**

MANGO LEATHER is also called Mango Roll Toffees is prepared from the mango puree, dried to form glossy sheets and cut into desired size and shape. It is 1 mm thick, deep orange in color with characteristic mango flavor. The product is leathery but chewable, pliable and can be cut into pieces.

It is eaten as snack or desert or used in pie fillings. It can be stores for years in freezer, for months in refrigeration and 7 months in ambient (room) condition.

**Its composition is:**
- 15 – 17% moisture
- 1.3 – 3 % Titrable acidity
- 80 – 82% soluble solid
- 16.5% ascorbic acid Aw=0.56-0.64 water activity (Highly stable)

**Process:**
- a. Wash ripe mangoes, peel and remove pulp from seeds.
- b. Blend pulp thoroughly to obtain a homogenous puree.
- c. Adjust sugar content from 17% - 19% Brix of the puree to 20% Brix using refined sugar using the Pearson square method in computing the required amount of sugar.
- d. Pasteurize the mixture to 80°C for 20 minutes to destroy spoilage organisms as well as inactivate the enzymes.
- e. Dehydrate the puree by spreading it evenly on grease-stained steel trays and drying in cabinet drier at a temperature of 80+-5°C for one hour or until dry.
- f. Remove the mango leather from the tray, roll or cut into desired size and shape.
- g. Package mango leather by wrapping with
paper/foil/polyethylene (PER). This will protect it from light, oxygen and moisture. High-density polyethylene (PE) and polypropylene (PP) may be used but ascorbic acid degradation and rate discoloration are faster.

h. Packed products may be stored in freezer, refrigeration units or in shelves at ambient condition that has a shelf life of 7 months.

SALTED MANGO (Burong Mangga)

Materials:
Young unripe mangoes (Murang mangga).
Salt and water or boiled sea water.
Knife, Kettle, plastic or glass jar container.

Procedure:
Boil water and place salt until saturation point.
Cool and place salted water in a jar or plastic container.
Wash and slice young mango with peel in quarter lengthwise.
Remove the seeds.
Place sliced mangoes in the salt solution.
Keep them submerged for 15 to 18 days.
Remove salted mango slice and rinse with clean heated water.
Dry to 12 - 14% moisture.

Pack and seal in thick polyethylene bags (.003) for storage and sale.

Another Procedure:
a. Cover mango slice with dry salt.
b. Let them stand for 4 hours.
c. Soak in water containing 1-% sodium benzoate.
d. Pack in gallon jars.
e. Keep slice submerges in water containing benzoate.
f. Refrigerate for 7 to 15 days.
g. Pack slices in glass jars.
h. Fill the container with salt containing 1-% sodium benzoate.
i. Heat to 80'C for 15 minutes.
j. Seal immediately.

MANGO SCOOPS

Materials:
Glass jar or C-enamel cans.
Firm and fully ripe mango fruits

Preparation:
a. Cut the mango into halves.
b. Scoop the mango flesh from the skin.
c. Deep the mango scoops in a solution of 0.4% CAOH and 1%citric acid.
d. Drain and weigh the mango scoops.
e. Fill into sterilized 30 C enamel cans.
f. Pour hot 30 containing 0.01% citric acid
g. Allow 0.5% - 0.6% cm headspace.

h. Exhaust to remove air bubbles

i. By heating in boiling water until the internal temperature reaches 80°C.

j. Seal the can immediately.

k. If glass jars are used half close only.

l. Process the mangoes in boiling water for 15 minutes.

m. Cool the cans in running water.

MANGO JAM

**Container:** Glass jar with PVC-lined closures.

**Quality of raw materials:** Fully ripe mangoes (Carabao or Pico varieties)

**Preparation:**
Wash mangoes to remove surface dirt.
Slice and scoop off the pulp.
Pass through a blender or fruit pulpier.
Weigh the pulp or puree.
Add 1 ½ part sugar per two parts of pulp.

**Processing:**
Heat over low fire with constant stirring.
When almost thick, add 0.3% citric acid base on the weight of the pulp or adjust the pH to 3-4 with citric acid.

Continue heating until temperature is 105°C (221’F) or until the mixture can be spooned out when lifted from the pan.

**Packaging:**
Fill into sterilized jars while hot and seal at once. Air-cool, label and store.

MANGO NECTAR

**Container:** Glass or Enamel Cans.

**Quality of materials:** Ripe and firm mangoes.

**Preparation:**
Wash mango fruits thoroughly and drain to dry excess moisture.
Peel and remove the pulp from the seed stone.
Macerate the pulp using pulpier or blender.
Add 0.3% citric acid and 0.1% sodium metabisulfite base on pulp weight.
In four parts pulp, add one part sugar and 20 parts water.
Mix or blend well.

**Processing:**
Heat the mixture at 80°C for 5 minutes.
Fill in sterilized bottles and exhaust until nectar temperature is 80°C.
Maintain for 3 minutes.
Packaging:
Seal tightly and pasteurize, at 100˚C for ten minutes. Air-cool and store in clean dry and dark place at ambient temperature.

CANDIED AND GLAZED MANGO

Container: Aluminum pouch, cellophane paper, or laminated plastic bags of suitable thickness (substance .005).

Quality of raw material: Fully ripe and firm fruits. (Over ripe fruits will give dark colored product with a shorter shelf life.)

Preparation:
Wash the fruit to be processed thoroughly.
Slice the cheeks with a sharp stainless steel knife.
Cut the cheeks into two equal halves.
Scoop the flesh from the skin with a stainless scupper.

Processing:
Heat the prepared mango in 90˚C light syrup (30-35˚C) with 1-% sodium metabisulfite (Na2S2O3) and 0.5% acetic acid.
Steep for 6 hours.

Keep the fruit completely submerged in the syrup at all times.
Remove the mango strips from the syrup and increase the concentration to 40’Brix by adding sugar.
Steep for 6 to 12 hours again.
Drain the fruit.
Make the syrup to 50’ Brix and set aside at 12 to 24 hour’s interval.
Increase the sugar to the final concentration of 60’B to 70’B.
Drain and rinse in hot water.
Arrange the materials in drying trays and dehydrate at 40˚C to 50˚C.
If glazed finish is desired, coat the candied fruits with corn syrup.
Place in a dryer to give a transparent glaze to the surface.

Packaging:
Allow the glazed fruit to cool at room temperature.
Wrap in cellophane or pack in the desired containers and seal.
Store in cool, dark, clean and dry place.

MANGO PASTE

Container:
Cellophane paper, wax paper, or laminated plastic bags (4 mil. Thickness)

Quality of Raw Material:
Mango puree prepared from fully ripe and firm mango fruits.

**Preparation:**
Sift together ½ cup powdered milk, into all-purpose flour and 1 ½ refined sugar into a mixing bowl.

**Processing:**
Cool mixture over with constant stirring mixture until it no longer sticks to cooking pan. Turn into board sprinkled with sugar or to a cookie sheet. Let it stand until cool and slightly stiff. Cut into strips and roll in powdered or confectioner’s sugar.

**Packaging:**
Wrap, in cellophane paper lined with wax paper. Pack in plastic bag. Then store or deliver to market.

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**MAGO FRUIT BAR**

**Container:**
Cellophane paper, wax paper, or laminated plastic bags (4-mil thickness).

**Quality of raw materials:**
Mango puree prepared from fully ripe and firm fruits.

**Preparation:**
Weigh 1 kg. of mango puree. Adjust total solids to 25°C Brix by adding sugar to the puree. Add two grams of citric acid (or 20 ml of Calamansi juice) to inhibit the possible growth of microorganisms during drying. Heat the mixture for two minutes at 80°C and partially cool. Add 2 grams of potassium or sodium metabisulfite to the mixture. Transfer the mixture to stainless steel trays precisely smeared with glycerin (40 ml/m2). Plastic sheets may be substituted for stainless steel tray. Load tray in the drier and dry for ten hours at 55°C and 16 hours at 70°C. At the end of the drying operation, the moisture content should be between 15 and 20%. Unload the trays and cut the leather into suitable shape and size.

**Packaging:**
Wrap in cellophane paper. Pack in cartons, and store at ambient temperature. Pieces of unsuitable shape and size. May be further cut into small pieces. Use them to prepare along peanuts, cashew, and similarly prepared fruits – a variety of “finger foods”.
Excess liquid sugar on the surface of the dried product may be eliminated; by sprinkling it with confectioner’s sugar.

NATURAL FARMING
By: Rex A. Rivera
Agronomist

To understand natural farming we need to know the cycle of life and matter. Natural farming as we envision is learning nature’s laws, and using them with care. Take note: Natural Laws are the laws of God who created Nature.

Natural farming is a culture where plants are grown in 100% natural environment with the least human interference and no harmful chemicals or synthetic products used. It is practically leaving the crops grow and produce in their natural environment, and man comes enhances the natural conditions to improve productivity. Then, harvest or gather its products for man’s use. However, in the context of our discussion, we will be introducing farming systems that will employ and apply more and more organic and biological farm practices.

Dr. Saturnina Halos, an agricultural scientist says: “Strictly speaking, farming interferes with nature. There are a lot of human interventions in farming.” This is very true, and if we are not careful enough, we may totally lost natures’ resources and capacity to produce the food that our growing population needs. We seek to learn natural organic and biological farming to safeguard the environment and sustain its productive capability.

While there is a growing demand for organically grown fruits and vegetables, it is difficult and almost impossible not to use chemical products to increase the production per unit area in a shorter period of time to meet the growing food demand of the increasing population. Besides plant roots and leaves can only absorb nutrients in their chemical form. Organic materials have first to be broken down into its basic
chemical component to be utilized by plants. Synthetic chemical products being used in Agriculture were processed and synthesized from organic and/or mineral materials.

Before life was created, matter first existed. In the beginning we have water, rocks, gases, light, solar energy, the earth and atmosphere. There was yet no life. (Read the Holy Scriptures ‘The Holy Bible’ Genesis on Creation). When the environment became ready, life began to appear in many forms from single cell to the complex form of plants and animals. We learn that evolution is God’s continuing process of creation.

Matter on the other hand is never lost. It just change in form and substance from solid to liquid and gas and back to solid. From its mineral chemical form to organic compound and back to mineral and chemical. (Remember man that thou art dust and unto dust thou shall return.). Roots absorb nutrient in simple chemical form decomposed organic compounds have to be converted to chemical form and are absorbed by plants.

Evolution as science discovers, life started in the waters in single cell microorganisms in animal and plant form. In ages and millennium the seed of life developed into higher forms as we see them today. Together with life or biological progression, weathering of the environment prepared the development of ecological diversity. So even at our time, we witness the continuing process of creation and evolution of new varieties and forms of life.

Man with his God given intellect is an instrument in the development through the science of breeding and lately genetic engineering and cloning. Man’s technological advances are still following natural laws, which without that, it will be impossible.

If we observe the growth and vegetation of natural forests, we will notice the healthy growth of trees, shrubs, grass and other forest vegetation. The soil is fertile, rich in organic humus and there is very limited pest and disease damage. Animal life, also abound from microorganisms like bacteria, fungus to worms, reptiles, birds and mammals.
The plants and animals have grown in their natural environment without interference of man. They may not be as productive as we wish them to be, but we can learn from their growth, survival and production in their natural habitat. Ecological and biological diversity can be observed existing and living in harmony.

The soil is kept fertile with the leaves, branches and other plant parts that mature and drop to the soil surface are decomposed with the aid of bacteria, fungi and other minute organisms that eat and digest them up with moisture (water). This results to the buildup of humus and organic fertilizer, which break down into simple chemical form rich in readily available plant nutrients for roots to absorb.

Beneficial microorganisms abound in the fertile organic rich soil that help both in the decomposition of organic materials and suppress or control the spread and multiplication of pests and diseases. Pro-biotic or beneficial microorganisms help suppress and control the growth of disease causing microbes or pathogens (bacteria, fungus and virus) and even soil born pests like nematodes and insects.

Insect pests are kept down as both destructive and friendly insects are balancing their population in their natural habitat. This control the buildup of insect infestation is a continued process when left to their natural estate. Example of these are: the use of *Trichogramma ostriniae* against corn corer and *Braconidae* or Braconid Wasps which parasitize other arthropods. Braconid wasps can be endo- or ecto-parasite, solitary or living in groups as primary or secondary parasites. Different species may attack every stage of an insect development; there are braconids that are egg parasites, larval parasites, and parasites of pupae and adult insects. Many parasites are valuable as biological control of pests.

Big and tall trees protect the soil and other living organisms beneath from too much heat and inclement weather conditions. Soil erosion and depletion is minimized or totally prevented. Trees serve as umbrella in forest and natural habitat. Tree planting in certain sections of the farm is
advisable and encouraged. Keep and grow spots of mini forest in your farm to preserve and protect the environment and eco system for the habitation of bio diversity.

The environment is preserved as bio-diversity is protected in natural forest vegetation where man has not set its foot on. All of creation and living things have a purpose and role. Herbal and medicinal plants have been destroyed and eliminated with the past century of clearing and cultivating lands for agriculture and crop production. Mono cropping has destroyed the balance and diversity of the eco system of farm lands.

Zero tillage is propagating plants without the artificial means of cultivation. Plants and seeds are spread by growth of rhizomes, vines, carried by wind, water and birds. Modern natural farming systems can learn much from nature’s way of propagating and preserving its species even without the usual land clearing and land preparation involving digging, plowing and harrowing.

Following is a farming practice by ancient farmers up to the 50s where the land is made to rest for a year or two to allow nature to rejuvenate it and enrich the soil fertility and productive capacity. Resting the soil for one year after six years of crop production. Today, this is less practiced due to the limited farming areas. Farmlands are chopped down by CARP into small lots 3 hectares and smaller. Farmers need to make them produce continually without resting, so artificial methods are done to keep it producing using chemical and organic fertilizers.

To adopt natural farming system, we have to understand how the ecosystem responds to man’s interventions. The moment we clear the land, remove the protective trees and cultivate the soil, we have destroyed the natural environment and the existing eco-system and bio-diversity. The lesser we destroy or remove the natural environment; the closer we get into natural farming. However, we can gradually return to natural ways by learning the natural laws governing plant and animal propagation, growth and production. Intercropping or multiple cropping is one step to returning to natural eco balance and bio diversity in our farms.
NATURAL FARMING PRACTICES:

1. Zero cultivation and following, allowing the soil to rest and rejuvenate.
2. Integrated Pest Management (IPM).
3. Insect traps, lure and attractants.
4. Use of Biological pest control (natural enemies of pest)
6. Use of Organic Pest and Disease control materials.
7. Use of indigenous resistant plant varieties and strain.
8. Practice crop rotation and following (resting the soil for some time).
9. Growing and inter-cropping of pest repellant and herbal plants.
10. Integrated cropping pattern to prevent growth of toxic weeds.
11. Growing the right crop on the right soil, climate and at the right time.

While the above practices are good and desirable, they have to be done in combination with modern agricultural technology to increase productivity per unit area at shorter possible time. This is because the farming and food production areas do not increase, while population continues to increase. Feeding the growing world population needs the ingenuity of man, his talent and ability to invent and innovate as his Creator endowed in him.

Zero cultivation, following and allowing the soil to rest and rejuvenate.

Zero cultivation has been a long and original practice of man in its first attempt to grow crops. Even today, kaingineros (slash and burn), those who clear the forest or trees to grow seasonal crops do not cultivate the soil, since it is soft, friable and very fertile.

They just make small holes with pointed stick and drop seeds of rice, corn, vegetable or any crop they wish to grow. After one or two seasons as the earth is exposed to the elements and weathering, the soil hardens. It becomes hard to work on because of exposure to sunlight, necessitating soil cultivation, as the humus and organic content of the soil is reduced. Then the farmer starts depending on commercial chemical fertilizers to replace nutrient loss. Unless organic compost materials are
augmented to the soil, it will continue deteriorating.

To remedy the situation, following, or resting the field for one year, allowing all vegetation including weeds to grow, to bring back the natural fertility and bio-organic life into the soil. The use of organic fertilizer in combination to commercial chemical fertilizer will help preserve and sustain the productivity of the land. This has been the practice of ancient farming in Egypt, Babylon and Israel.

Tilling on the other hand promotes healthy soil in cultivated agricultural lands. It exposes the pest and soil born diseases, increases soil aeration and oxygen supply to microorganisms and promotes root growth and penetrates better as the soil is loose. This is done after destroying the natural soil environment through tillage.

In orchard farms (fruit tree plantations) where permanent trees are growing, zero tillage can be done, by growing low creeping leguminous cover crops like Arakis pintoy or Australian peanut weed (mani-man) around and in between tree rows.

**Practice clean culture.**

Keeping the field clean will help in preventing the growth and multiplication of pest and diseases. All plant waste and droppings should be gathered in one place to be composted and converted into organic fertilizer. Before using the composted organic materials for fertilizer, sanitize them first by exposing them to direct sunlight and dried to eliminate any diseases and eggs of insect pests. Defoliate over mature and diseased and infested leaves. Allow sunlight and aeration to penetrate between plants and within the foliage of trees. It will promote the growth of normal and healthy branches and eliminate abnormalities.

Cultivation and weed control will also help not only in soil aeration and softening of soil mass but will also reduce or disturb the breeding place of insect pests and fungal diseases.

To bring back the natural organic matter, these materials have to be incorporated with the soil as organic fertilizer and manure.

**Integrated Pest Management (IPM).**
Integrated Pest Management (IPM) is a pest control program using combination of all practices to reduce or eliminate pest damage. This includes natural, biological and mechanical practices as well as bio and chemical pesticide application.

Among these practices include the following:

Planting resistant or tolerant plant varieties. Growing indigenous crop varieties with reasonably high productivity should be encouraged. New breeds and genetically modified plants are being developed like Bt Corn which are resistant to corn borer infestation. New pest and disease resistant with high nutrient food value varieties are being bred and produced through genetic engineering (GM) and natural cross breeding.

Timing planting so as the growing and fruiting stages does not coincide with inclement weather conditions and high incidence of pest population.

Growing boarder or inter-crops that are repellant to insect pests.

Practice clean culture, proper pruning and removal of diseases or infested plant parts especially with fruit trees. Remove all breeding places of insect pests and infected debris rotting near plants and field.

Use organic fertilizer in combination with chemical fertilizer and supplement the field with compost and probiotic (bacteria, yeast & fungus). Sanitize compost and organic materials by exposing them to direct sunlight before applying it as fertilizer.

Learn to prepare and use bio-organic fertilizer, pesticides and fungicides as substitute for toxic chemicals. HOC (Herbal Organic Concentrate) is one.

IPM may also include the following:

Keep the garden small and the plants varied to prevent insect pest infestation. Solo or mono cropping tends to encourage the multiplication and outbreak of insect pest that feed on the particular plant grown. Multiple cropping or maintaining a green belt in the farm where vegetation is allowed to grow naturally will be a shelter and home to beneficial organisms, plants and animals including
variety of insects that will check and control any outbreak of pests. This will be a natural check and balance.

A basic principle in pest management: Plant the right crop on the right soil at the right time. Plant crops at a time when its particular pest is inactive or off season.

Plant indigenous cultivars or plant varieties native to the place. They are resistant to the pests and adapt very well to the local environment. The introduction of hi-breeds and high yielding commercial seeds have the tendency of eliminating indigenous varieties that are adopted to the environment as they have survive decades and century of adjustments.

Healthy organic soil, grow healthy plants that resist pests and diseases. In soils applied with organic matter or humus, animal manure and compost, the soil host a wide variety of micro organisms that are harmful to nematodes and cause diseases to some insect pests thereby allowing the increase in population of beneficial organisms and insects.

Crop rotation dissociates microorganism buildup around the plant roots as each crop has a characteristic microbial association. (Example is probiotic and nitrogen fixing bacteria for legumes. Mychorriza phosphate builder in grasses). New microbes are being developed to inoculate the seeds just before planting to introduce them into the soil and help in nitrogen fixation that enriches the soil.

Aromatic herbs like mint, garlic, marigold, oregano, onion, control nematodes and repel insects, and should thus be grown as companion crop to your garden or farm.

Tilling promotes healthy soil as it allows aeration bringing supply of oxygen promoting root growth and permit better root penetration breaking soil compaction. It exposes pest and soil born diseases to sunlight and disturbs their growth and multiplication. Sunlight is a very good and free sanitizing agent.

Crop combination such as legumes and potatoes, control nematodes. Learn and find out the best crop partners and combinations. Planting tomatoes in between rows of eggplant and cabbages will
reduce fruit fly infestation on eggplant fruits and diamond back moth. Growing marigold at the border of vegetable plots will also help repel some insect pests.

**Insect attractant, traps and lure.**

There are many practical and inexpensive ways of controlling and managing the population of insects pests in your garden and fields. Here are some of them that you may adopt. However, they may also eliminate beneficial insects:

**Light Traps** - This practice have been found effective in unlighted areas. Light is provided with a basin of water. As the nocturnal insects are attracted to the light, they fly and dip into the water, or the flame of the firelight singes their wings.

**Lure with attractants** – The lures derived from molasses and flower scent (odor) tantalize both male and female moths (the caterpillar adult stage) with the promise of nectar. The insects fly into the opening of a lure-dispensing trap, never to return.

**Chemical sex attractant** – The use of PHEROMONE a chemical with female insect odor that confuses the male and attracts them to bait treated with toxic insecticide or they fail to mate with the female insects.

**Blue electric lamp** surrounded with electrically charged mess wire that electrocutes insects upon contact.

**Yellow pads** – Most insect pests are attracted to bright yellow color. Yellow pad with grease or paste, attract insects during the day and sticks to the pad as they come in contact. The pad may also be treated with molasses and pesticide to give added attractant and killing potential.

**Use of Biological Pest and Disease Control.**

The use of living plant and animals or living organisms to control pest and diseases are called Biological Control. They may be microorganisms such as bacteria, fungi, virus or bigger life forms like insects, worms, reptiles, mammal and birds. You can learn to increase the beneficial insects, microorganisms and other animal and plant life in your
farms to counter pests and diseases harming your crops. Let us protect and increase these beneficial enemies of pests.

Use of Organic Fertilizer

Fertilizers coming from fermented and decomposed organic materials are very nutritious safe fertilizer materials. They are both enriches the soil plant food nutrients, improves the texture for easier root growth and preserve the soil life such as beneficial bacteria and fungi. We have several recommended formula in preparing organic fertilizer both liquid and solid form in this handbook. These natural fertilizers carry both plant food nutrients and microorganisms with pesticide, fungicide and nitrogen fixing property.

Used of Herbal Organic Pest and Disease Control

Herbal preparations to control pest and diseases can easily be made by farmers themselves since we have abundant plants in the Philippines that are suitable ingredient. We offer you several formulations and methods of preparing Botanical or Herbal pest and diseases concoctions in this handbook to guide you make your own. For farmers who would not have the time and facilities to prepare herbal organic pesticides and fungicides, there are now ready prepared and tested herbal organic concentrates (HOC-4n1) with four properties as foliar fertilizer, pest repellant, insecticide and fungicide.

The finding of such drastic health problems from exposure to an age-old organic preparation should act as a wake-up call to organic growers. It is a reminder that many natural plant products can be toxic when they are extracted and concentrated. It is a reminder that the philosophy of organic growing is not that of replacing synthetic chemicals with natural chemicals. Rather it is to strive for balance in an Agro-ecosystem, or home garden, in which the grower works with nature as much as possible rather than trying to control it. Pesticide preparations, even those of natural occurring substances, should be the last port of call not the first
remedy. They may control the pest at that moment in time, but they do not encourage a balanced system that looks after itself. Derris Dust also kills valuable biological control insects like ladybirds. This is counterproductive. In our city garden, we have fed the birds to encourage their presence for many years. We have no problem with white cabbage butterfly, or any other insect pests. After dining on the birdseed and left over bread crusts, the birds make a beeline to the garden and clean up any insects they can find. Mind you they are also partial to lettuce and silver beet - these we net. If your bird populations are not sufficient for natural control, try squashing the caterpillars with your fingers. It may be messy, but it is preferable to Parkinson's disease. Or use Bt. (Bacillus thoringensis)

**Practice crop rotation and following (resting the soil for some time).**

Crop rotation or changing crops grown in certain areas to avoid the buildup of certain pest or disease affecting certain crops. Example, rotating onions with pepper or cassava. Resting the soil for one to two years to allow natural vegetation and the growth of natural enemies to introduce balance of nature, while enriching your soil environment for future crop production.

**Growing and inter-cropping of pest repellant and herbal plants.**

There are crops that repel certain insect pests. Inter-cropping tomato and marigold with cabbages and cauliflower will help reduce the diamondback moth attacking cabbages. Learn what these crop combinations. You will not only reduce your cost of pest and disease control but may even increase your income per unit area with the crop combination. Okra is a good attractant of Coconut

**Use of indigenous resistant plant varieties and strain.**

There are several plant varieties and species that are found resistant or tolerant to certain prevalent pest and diseases. It will be wise for farmers to know them and grow these types of plants especially during months or season that certain pest and diseases are abundant.
Rhenoserous Beetle. Grow patches in your coconut farms and manually gather the beetles that come down to feed on the soft tender okra plant.

**Integrated cropping pattern to prevent growth of toxic weeds.**

Certain weeds are difficult to remove or control, like grasses. Planting vines and crawling crops like sweet potato and cover crops will help suppress weeds. Replacing the weeds with other beneficial creeping plants like Arakis pintoy (mani-man) that covers the spaces between fruit trees and help supply nitrogen to the soil. Cover crops also help prevent soil erosion and protect the beneficial microorganisms in the soil and other soil life.

**Growing the right crop on the right soil, climate and at the right time.**

There are suitable crops that are ideal for certain season of the year and suitable soils for their healthy and productive growth. Learn the nature of the plants and their preferences before deciding what to grow in your farm. The Philippines is located at the tropical zone, so ideal for tropical crops and not much for temperate crops. Let us learn the advantages we have by growing the right crops best suited to our land with good market demand.
HERBAL TEA PREPARATIONS FOR PLANT PROTECTION
By: REX A. RIVERA, Agronomist/Mango Specialist

HERBAL TEA preparation for plant protection can be made by the farmers right in their own farm without depending too much on commercial chemical pesticides and fungicides. The following procedures are simple and low cost.

MATERIALS NEEDED:
MGA HALAMANG GAMIT OTHER BERBS
200 liters capacity plastic drum. *(200 litrong dram na platik)*
IBANG HALAMAN
Grinder / chopper and mortar & pestle *(lusong pambayo)*
Tobacco *(Tabako)*
Strainer/screen/cloth *(salaan)*
*(Kamantigui)*
Dipper *(tabo).*
Marigold *(Bulaklak)*
Wooden ladle / paddle *(Kahoy na panghalo)*
Guava *(Bayabas)*
Fresh clean water *(tubig na malinis)*
Wild Tea *(Tsanggubat)*
Herbal materials *(Halamang panginghalo):*
Tamarind *(Sampalok)*
10 kilos Ginger *(Luya)*
Oregano *(Origano)*
5 kilos Garlic *(Bawang)*
Black pepper *(Paminta)*
5 kilos Aloe vera *(Sabila)* *(Dulao)*
10 kilos Hot pepper *(Siling labuyo)*
Mimosa p. *(Makahiya)*
10 kilos Curry leaves *(kari)* *(Hagunoy)*
10 kilos Ipil-Ipil leaves (*Ipil-Ipil*)
Acasia (*Akasya*)
20 kilos Neem tree leaves (*Dahon ng Neem Tree*)
Legumes and beans
20 kilos Madre de Cacao leaves (*Dahon ng Kakawati*)
Papaya (*Papaya*)
5 kilos Derris (*Tubli*)
Coco juice (*Tuba*)
5 kilos Bitter vine (*Panyawan//Makabuhay*)
Other herbs with insecticide, fungicide and pest repellant properties.

PROCEDURE: *MGA HAKBANG:*
1. Prepare the above materials.
   *I-handa and mga gamit.*
Grind or pond the herbs separately.
   *Durugin at bayuhin and mga halaman na magkakahiwalay.*
Place all ground and pounded herbs in the plastic drum.
   *Ilagay ang lahat ng dinurog at binayong halaman sa dram na plastik.*
Fill the drum with fresh clean water.
   *Punuin ng malinis na tubig ang dram.*
Mix the materials with a wooden ladle
   *Haluin ang tubig at dinurog na halaman gamit ang kahoy na panghalo.*
Stay overnight or one day to allow the herb juice to mix with water. Herbal tea..
   *Pabayaan magdamag upang katats ng halaman ay mahalo sa tubig magiging tsaa.*
Get herbal tea from drum pass through screen strainer
   *Kunin ang tubig o tsaa sa dram paraanin sa screen na salaan.*
Add equal amount of fresh clean water to the herbal tea.
   *Dagdagan ng preskong tubig ang tsaa na kasing dami.*
Place in sprayer or sprinkler.
   *Ilagay sa sprayer o sa rigadera.*
Spray on plants, drench from soil base, trunk, branches, leaves, flowers and fruits..
Spray o diligin ang halaman, mula lupa, puno, sanga, dahonbulaklak at bunga
Repeat spraying 3 or 7 days interval as the need arises.
Ulitin ang pag spray o pagbibisbis tuwing 3 o 7 araw ayon sa pangangailangan.

HOW TO MAKE ORGANIC COMPOST FERTILIZER

The sandwich method:

Organic materials such as animal waste, finely chopped plant waste and topsoil are placed in layers one on top of the other until they reach a height of 3 feet.
The material is watered moist and covered with coconut leaves or plastic sheet in order that moisture will be retained.
Mix the compost pile after two weeks, moist and cover again.
Repeat mixing once a week, until the compost materials are totally decomposed with the appearance of soil.
Dry in direct sunlight to kill or eliminate unwanted pathogenic microorganisms such as fungus and bacteria.
The material is now ready for use or placed in sacks for storage or shipment and sales.

Biological fast composting:

a. Gather the organic material, chop finely or hammer mill and mix thoroughly. Add humus soil and Beneficial Microorganism (BMO).
b. Water them moist with pro-biotic microorganism (Lactobacilli or Trichoderma) mixed in the water.
b. Cover the compost pile with plastic sheet, grass or leaves.
c. Mix the material every week, keep moisture optimum.
d. It will usually take only 4 weeks to decompose the material with the aid of the microorganisms that help digest the cellulose materials.
e. Sundry the decomposed organic material (fertilizer) to kill unwanted microorganisms (Pathogens).
f. The material is now ready for use or bagging for storage or shipment.

**Field composting:**

After harvest and just before plowing and land preparation, gather the organic materials, chop or hammer mill. Spread the materials evenly in the field. In case the plant waste residues are in the field, then just spread them evenly and broadcast animal waste to mix. Spray the organic material in the field with pro-biotic microorganism. Plow and harrow the field to mix the organic material with the soil. If possible do the above operation just before an expected rain or irrigate the field after the plowing and cultivation. This will allow the microorganism to work fast, and multiply. In the process, they digest the organic material into organic fertilizer or soil amendment. As the microorganisms multiply and die, their body will also decompose and be rich source of plant food nutrient in the soil.

**Green manure:**

Planting beans and other legumes and plow under when they flower to enrich the soil. Tender plant parts, will easily be eaten up by microorganisms when plowed into the soil. Note that the pro-biotic organisms will continue working in the soil, as long as favorable conditions like adequate soil moisture and presence of organic materials as their food.

**Soil and Seed inoculants:** Microorganism nitrogen fixing bacteria are incorporated on seeds, seedlings and soil during land preparation and planting.

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**BUSINESSES IN MANGO**

1. Land banking. Acquiring lands planted or to be planted to mango. Real Estate Farming.
2. Mango growing and production.
4. Service provider: Labor, farm operations, transport.
5. Contracting, joint ventures.
6. Trading – Consolidator
7. Fruit processing and manufacturing, treatment.
9. Supplier of production inputs.
11. Financing and Credit facility.
SIMPLE GUIDE TO GROWING ORGANIC MANGO

By: REX A. RIVERA, Agronomist

1. Plant mango far apart to allow full sunlight and free flow of air. (20x20 meters quincunx will have 50 hills per hectare.)
2. Practice clean culture. Keep weeds and grasses short. Grow creeping leguminous cover crop to protect soil and beneficial microorganisms.
3. Cultivate and plow the soil at least once every year to aerate and prune off roots at the soil surface that are sensitive to heat and dry spell. Top roots should at least be 3 inches below soil surface.
4. Drench with BMO (Beneficial Micro Organism) and HOC (Herbal Organic Concentrate) the compost and organic materials. Spread organic fertilizer, decomposed plant and animal waste before plowing and cultivation so the organic materials will be well mixed with the soil.
5. Prune and remove diseased and infested branches and other plant parts and bring debris to compost pile. Chop and shred them to small pieces for faster decomposition. The compost pile is drench with BMO and covered.
6. Provide enough water and keep soil moisture adequate at all times. Cover crops and mulching will help maintain soil moisture especially during summer months. However, less moisture is required one (1) month before flower induction and one (1) month during fruit maturation (100 to 130 days from flower induction.
7. When the leaves are mature and the flower buds are ready evidence by plump and pointed bud tips (about 7 to 9 months from flushing), the tree may by induced to flower. The types of natural flower induction are:
   a. Smudging or smoking the tree.
   b. Spraying Herbal and Mineral concentrate (Substitute to KNO3 and other chemical flower inducers)
8. After flower induction, drench the whole tree from soil, trunk, branches to the leaves with HOC-4n1 (Herbal Organic Concentrate) to drive away insect pest especially mango hoppers to prevent them from laying eggs on emerging flower after bud break.

9. The most critical period on mango production is from flower induction up to 45 day the period of flowering, blooming, and fruit formation and development.

10. Spraying HOC every 2 to 3 days interval from 7 to 21 days after flower induction (DAFI) will greatly help in repelling insect pest and curing diseases. Do not spray or disturb the flowers during bloom and pollination stage (22 to 40 DAFI). Insect pollinators should be encouraged to come.

11. If it rains during the flowering and fruit formation, spray HOC-3n1 (Fungicide) with soap immediately after the rain. Gently shake branches to remove water droplets on flowers as this is a good medium for growth and development of anthracnose and other fungal diseases.

12. At 45 to 90 days Spray HOC-4n1 and HOC-GO alternately every 15 days to help in fruit development and prevent infestation.

13. At 60 to 70 days bag the good fruits candidate for export. Leave alone those partly damaged or deformed fruits as these will be for domestic market or for processing. This will greatly reduce your bagging cost and labor expense.

14. Allow the fruits to fully mature at 120 to 130 days to gain full sweetness and aromatic odor. Fully mature fruits command a better price.

15. Before harvesting, see to it that you have all the harvesting tools, equipment, containers and a packing shed close or within the farm.

16. Give proper instructions and guidance to your workers and harvesters before sending them off to harvest. Make them remember that every single fruit has value and they should handle them with care, avoiding bumps and bruising.

17. Have a separate group of workers, especially trained to sort, grade, scale, and package the fruits.
18. Another group at the packing house will do the washing, hot water dip treatment, air drying, final sorting or grading, packing and weighing to be transported to market destinations.

19. After harvest, a new cycle of tree management start. This will be the rejuvenation stage from post harvest to flower induction. A period of 7 to 9 months.

20. The trees are prunes and sanitized by clearing the surrounding and drenching the whole tree with HOC-4n1.

21. Spread the organic fertilizer and decompose farm waste materials around the trees.

22. Plow and cultivate the soil from under and outside canopy cover. Follow this by harrowing to pulverize and level the soil.

23. Water the trees and spray HOC-GO to initiate new flushing. Two to four new shoots will emerge which will be potential bearing buds sticks.

24. During flushing, spray HOC-4n1 at 3 to 4 days interval. The young leaves are very susceptible to mango leaf hoppers and anthracnose infection and other insect pest attack being soft and tender.

25. Provide adequate water at all times, and keep down the weeds by slashing.

26. Monitor the trees until they are ready for another flower induction.

End and Beginning of cycle

Other Interventions:

1. Preferably, intercrop between mango trees with low growing high value seasonal crops such as vegetables, grain, legumes, root crops and spices.

2. Maintain a mini forest for bird sanctuary and other wild life and bio diversity to complement the needed balance of nature ecosystem.

3. Grow a wide range of herbal plants that will help in pest and disease control. Grow mint and other herbal plants repellent to insect pests.
4. Raise poultry and livestock to augment your farm income and provide you with rich animal waste for organic fertilizer conversion.
5. Avoid as much as possible burning and application of toxic chemicals as this will kill the beneficial life in the soil and in the farm.
6. Visit your farm regularly. The foot prints of the owner are the best fertilizer.

SUMMARY AND RECOMMENDATIONS

Why grow organic mango?

There is a growing market demand for organic fruits. For safety and health of growers and consumers. Cost of imported chemical inputs is getting too high. Natural organic farming can make farmers self-reliant. Organic farming can cost less and environment friendly.

What is Natural Framing?

It is growing and caring for plants to be more productive using the laws of nature to better advantage. Farmers need to know and understand natural laws governing plants and their environment.

Know more about the nature of mango.

The Philippine mangoes are big trees that can grow up to 30 meters high, 30 meters radius and root system are as expanded as the crown. Close planting makes roots compete for soil nutrients.

The Philippine carabao mango is a biennial bearer (fruit every two years) but can be made to fruit more often with certain interventions. It needs time to rejuvenate and gather enough nutrients for next bearing season.
The mango tree needs full sunlight from sunrise to sunset. They do not favor crowding or partial shedding. Close planting 10 meters or closer will make the trees compete for space, sunlight and soil nutrients. Distance of 20 to 30 meters apart would be preferable. This will allow the farmer to intercrop with other high value trees and seasonal crops that will also benefit the growth and productivity of the mango trees.

It needs time to accumulate enough nutrients for bearing. At least one to two years rejuvenation period is needed.

It needs natural and artificial stress to flowers and fruits like a hot dry summer with a sudden rain shower to shock it. Natural maturity of fruiting buds, disease, root pruning, girdling, smudging, spraying chemical flower inducers and application of growth regulators help induce flowering and fruiting.

Mango grows well and productive in areas where there are distinct dry and wet seasons.

Mango trees produce better quality fruits where pest and diseases are naturally controlled or nil. Mangoes growing in natural condition, with balance ecosystem and biodiversity have less pest and diseases. Beneficial insects counter balance the population of insect pests.

Bigger and older trees properly distanced produce more per unit area than smaller and crowded trees.

Juvenile trees up to 15 years have upward branches and crowded crown and less productive; while trees 20 year and older tend to spread and bend branches allowing more aeration and sunlight penetration, more fruiting branches and buds, resulting in better and higher production.

Most mango trees 50 years ago were left to nature yet they are very healthy and productive, fruiting on season. Today’s intensive culture disrupts the natural growth and fruiting of mango.

Man, in his desire to improve and innovate crop production have created more problems than solutions. It is about time that we study nature and the laws governing it and try to follow and abide with them in our quest to improve and enhance our farming and Agricultural Practices, resulting in a sustainable and greater productivity.
FINAL RECOMMENDATIONS

Agriculture is a living science. We find changes and the need for innovation as we progress on our farming venture.

We encourage every mango grower to join Mango Associations in your area, and if possible form your own marketing firm (cooperative, association or corporations) to insure a good market linkage with processors and reputable traders. Attending, seminars, gathering and reading printed mango technology, visiting farms, and conducting your own trials and researches will be very helpful.

Keep a farm record. This will guide you on the status and progress of your trees.

We also encourage grower to complete and improve their farm facilities. Farm Structures, buildings, fence, tools and equipments.

Give special attention and time in harvesting. It is during this critical stage where you gain or lose your investments. Secure your harvest with honest co-workwers.

If your plantation is bigger than ten (10) hectares, start learning and processing left over (LO) fruits and fruit drops. If you are observant, about 10 % to 20% of the developing fruits drop off, and you can process these into mango pickle and preserves. 10 to 20% of mature harvested fruits are considered leaf over (LO) or rejects by fruit buyers. You can process them to dried, puree, concentrates, powder, candies, preserved and others.

The Department of Science and Technology will be glad to train interested growers how to process their fruits into dried mango, puree, concentrates, chilled halves, candies, preserves, powder, etc. Through your Mango Association DA and DOST including DTI can be invited to help you in your processing, packaging and marketing requirements. Many LGUs also actively support the Mango Industry.
No one is more interested and concern than the owner. So farm owners should take more time in caring, supervising, monitoring and being in the farm. **The best fertilizers are the footprints of the owner around his trees and farm.**

**THE PHILIPPINE GOLDEN CARABAO MANGO IS A GIFT OF GOD TO THE FILIPINOS. IT IS TRULY A TREE OF LIFE. THOSE THAT GROW AND CARE FOR IT SHALL BE REWARDED WITH ECONOMIC PROSPERITY IN THEIR LIFETIME AND THE GENERATIONS THAT COME AFTER THEM.**

We hope these materials and information will help you. Thank you for taking time reading and trying to understand them. We will appreciate if you also share them with other farmers.

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