

## CASHEW PRODUCTION

### THE CASHEW PLANT

In the Philippines, cashew (*Anacardium occidentale* L.) is called kasoy or balubad in Tagalog or Balogo in Ilokano. It originated from north-eastern Brazil and was brought to the Philippines in the 17<sup>th</sup> Century. In 2008, top cashew nut producing countries were Vietnam (1,190,000 mt), India (665,000 mt), Nigeria (660,000 mt), Côte d'Ivoire (280,000 mt) and Brazil (243,253 mt).

The cashew plant is an evergreen tree that grows up to 12 meters tall, with a dome-shaped crown or canopy bearing its foliage on the outside, where flowers and fruits are found.

The growth of the taproot reaches a depth of 1.5 – 2 times the height of the plant during the first 4 months. Extensive lateral roots are formed later and reach far beyond the canopy spread of the tree during the first year of growth. In mature trees, the root volume is generally confined within the tree canopy. Very few laterals are formed beyond the 6 meter drip-line of the tree.

The fruit has a kidney-shaped nut, about 3 cm x 1.2 cm attached to a much enlarged and swollen pedicel or receptacle forming the fruit-like cashew apple. The cashew apple is pear-shaped, 10-20 cm x 4-8 cm, shiny, red to yellow, soft and juicy. The seed is kidney-shaped, with reddish-brown testa, two large white cotyledons, and a small embryo. The kernel remaining after the removal of the testa is the cashew nut of commerce.

Cashew is one of the many fruit species in the Philippines that is gaining importance both in agriculture and commerce. This promising fruit crop has a strong export potential. Its commercial production could be an important source of income for many Filipino farmers in the countryside. Cashew is practically grown throughout the country. In 2010, there were 28,114 hectares planted to cashew with 3,783,210 bearing trees. Total production reached to 134,681.24 mt. Preliminary estimate on the average production was ₱479.00 per hectare (Bureau of Agricultural Statistics).

The present production of cashew is mainly for local consumption although there is a big potential market abroad for the kernel and other cashew products. Unfortunately, except for a few enterprising individuals very few have invested capital in exploiting the potential of the cashew tree as an industrial crop.

The cashew industry when fully developed and industrially exploited can help alleviate many of our socio-economic problems by way of offering employment to the many unemployed Filipinos. A cashew cottage industry for instance, can easily absorb idle manpower in the rural areas since only the normal skills of the workers are required in processing many cashew products.

## ECONOMIC IMPORTANCE

The cashew tree is a very versatile crop that has many economic uses. The uses of the cashew tree, particularly the fruit, are varied and profitable. As an edible product, the cashew fruit or “apple” can be eaten as fresh fruit and can be processed into jams, candies, juice and juice blends and chutneys. The juice extract can be processed into wine that are of high export value. The apple is also utilized as animal feeds. The cashew nuts or its kernels are consumed primarily as “dessert nut” used in bakery goods and confectionary and as flavoring ingredient for ice cream.

The shell of the nut is known to be a good source of an important liquid known in commerce as “cashew nut shell liquid” (CNSL). CNSL is a dark brown, sticky liquid extracted from the honeycomb structure of fresh shells. It is one of the few major economic source of natural phenols. This phenolic compound when properly processed yield chemicals which when added to other chemical products resulted to industrial products with great diversity of uses for typewriter rollers, automobile brake lining, clutch facings (exceedingly resistant to high friction and temperature), magneto armatures for airplane, floor tiles and cold-setting cements. CNSL is also used in the preparation of laminating resins, varnishes, baking enamels, adhesives, inks, paints and for finishing and waterproofing for paper and cardboards.

The cashew tree has been found to be a suitable reforestation species. When planted in critically denuded areas, the tree can substantially reduce soil erosion, slow down the flow of water and minimize flash floods.

## PRODUCTION

Cashew is a drought resistant crop. It can grow successfully in areas with a very distinct dry season or where the annual rainfall is as low as 50 cm. It can likewise grow well in areas with high levels of rainfall (as much as 350 cm annually) provided the soil is well-drained.

## VARIETIES

At present, only few cashew varieties had been identified. These varieties are as follows:

1. Guevarra (Acc. No. 1849)  
This variety is a local seedling selection from Western Luzon Agricultural College (WLAC) in San Marcelino, Zambales. It is a prolific bearer which produces yellow apple with a medium nut containing about 2.7 g kernel.
2. Nagbayto (Acc. No. 1851)  
This is a seedling selection from WLAC in San Marcelino, Zambales. It is moderately prolific. Its apple is yellow and the nut contains about 2.9 g kernel.
3. Makiling (UPL-Cs-1)

The first locally named cashew cultivar which originated from Rio Frio, Columbia. This variety is fairly productive and produces a big, red skinned apple with a large nut containing about 3.2 g kernel.

The National Seed Industry Council (NSIC) also approved several varieties of cashew namely:

1. Farinas (NSIC 95 Cs 01)- owned by Federico Fariñas of San Marcelino, Zambales
2. Dayap (NSIC 95 Cs 02) – owned by Alvino Dayap of San Antonio, Zambales
3. Makiling (NSIC 97 Cs 03) – owned by Dept. of Horticulture-UPLB College, Laguna
4. Zambales Beauty (NSIC 01 Cs 04) – owned by RMTU, San Marcelino, Zambales
5. Magsaysay (NSIC 01 Cs 05) - owned by RMTU, San Marcelino, Zambales
6. DLR (NSIC 01 Cs 06) - owned by RMTU, San Marcelino, Zambales
7. Gene (NSIC 01 Cs 07) - owned by RMTU, San Marcelino, Zambales
8. Red Princess (NSIC 01 Cs 08) - owned by Institute of Plant Breeding, UPLB-CA

There are NSIC-accredited cashew

NSIC 1995 Cs02	Dayap	Alvino Dayap, San Antonio, Zambales
NSIC 1995 Cs01	Fariñas	Federico Fariñas , San Marcelino, Zambales
PSB 1991 Cs01	Guevara/WLAC 501	Mr. Noli Corpuz, Western Luzon Agric'l Colleges, New Lawin, San Marcelino, Zambales
PSB 1991 Cs02	Mitra/R2T4-QP	Palawan Seed Farm, Palawan
PSB 1991 Cs03	R2T3-QP	Palawan Seed Farm, Palawan
NSIC 2001 Cs04	Zambales Beauty	RMTU, San Marcelino, Zambales
NSIC 2001 Cs05	Magsaysay	RMTU, San Marcelino, Zambales
NSIC 2001 Cs06	DLR	RMTU, San Marcelino, Zambales
NSIC 2001 Cs07	Gene	RMTU, San Marcelino, Zambales
NSIC 1997 Cs03	Makiling	UPLB
NSIC 2005 Cs08	Red Princess	UPLB

In addition to the above mentioned varieties were those approved and released by the Philippine Seed Board (PSB) namely:

1. Guevarra - owned by Institute of Plant Breeding/Western Luzon Agricultural College
2. Mitra (R2T4-QP) - owned by Palawan Seed Farm
3. R2T3-QP - owned by Palawan Seed Farm

## SOIL AND CLIMATIC REQUIREMENTS

1. Soil – Cashew is a very hardy plant and can grow well on almost any type of soil. It is reported to grow successfully on soils so shallow and impervious where other fruit trees species have failed. It also grows well on sandy soils as in the experience in Zambales. However, a deep (at least 3-4 m) loam soil with adequate moisture and good drainage offers the best opportunity for higher yield.
2. Climate – Cashew is a drought resistant crop that it can grow successfully in areas with a very distinct dry season or where the annual rainfall is as low as 50 cm. It also grows well in areas of much higher rainfall (as much as 350 cm annually) provided that the soil is well-drained. A climate with a distinct wet and dry season and a temperature ranging from 26 °C to 32 °C and dry atmosphere ranging from 70-85 percent relative humidity offers the most suitable condition which is favorable for flowering and fruit setting.
3. Elevation – Cashew can be grown successfully at lower elevation ranging from 700-800 meters above sea level particularly in areas with Type 1 climate. Flat to rolling lands of second growth forest where the soil is too poor for other fruit crops can be planted advantageously to cashew.

## CULTURAL PRACTICES OF CASHEW

### A. NURSERY SITE

The nursery site should be well-drained and exposed to sunlight. It should have a good source of irrigation water for the maintenance of the plant materials. It should be protected against stray animals.

### B. NUT SELECTION

Nuts for planting should be obtained from mother trees of known performance. They should be fully matured and of high density (heavy) grade to ensure good germination and vigorous seedlings.

Seeds are water tested; those that sink are chosen since they have higher viability and germinate quickly.

### C. SOWING THE SEEDS

Cashew seeds expire easily. Dried and newly collected seeds must be sown/propagated as soon as possible to prevent loss in viability. They are sown on individual polyethylene bags containing an equal mixture of fine sand and organic matter.

Seeds are sown 5-10 cm deep with stalk end facing upward in a slanting position. This prevents the emerging of cotyledons at the soil surface from being destroyed by rats, ants, snails and birds.

#### D. CARE OF SEEDLINGS

Seeds will germinate within 1 to 2 weeks after sowing. Excessive watering should be avoided. If seedlings are weak and stunted, urea solution at the rate of 10 tbsp per gallon of water should be applied.

The seedlings must be properly taken care of until they are ready for field planting or for use in asexual propagation (grafting). Seedlings are ready for field planting when they have a height of 20 - 50 cm.

#### E. PROPAGATION

Cashew can be propagated sexually or asexually. Sexual propagation is done by sowing the seeds directly on individual polyethylene bags. It should be done during the dry season so that the seedlings could be planted in the field at the start of the rainy season.

Asexual propagation can be done through airlayering, inarching, marcotting or grafting. Grafting is the best method for large scale asexual propagation of cashew. With cleft grafting, the rootstock is cut in traverse section (crosswise) and the remaining stem is cut longitudinally (lengthwise). The scion taken from a selected mother tree is cut into the shape of a wedge and is inserted in the rootstock. The union of the scion and the rootstock is tied with a plastic strip to ensure good grip.

Up to 100 percent success has been obtained with 10-week old seedlings.

The use of young seedlings of about two months old result in more rapid takes, and the plants are ready to be planted at the age of 3 ½ months.

#### E. LAND PREPARATION

For commercial purposes, the land should be thoroughly prepared. Plow the area 2-3 times followed by harrowing until the desired tilth of the soil is attained. It should be done before the start of the rainy season. For backyard or reforestation purposes, just underbrush the area and if possible collect all cut grasses, shrubs and other rubbishes. These can be used as mulch for the newly planted seedlings. The soil should be cultivated properly in order that the seeds may be sown with the required depth or that holes may be dug deep enough to bury the ball of seedlings.

#### F. DISTANCE OF PLANTING

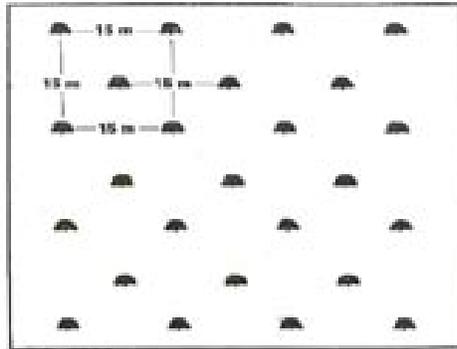
Distance of planting varies according to the purpose for which the trees are planted. For reforestation, 3m x 3m is recommended to encourage early shading and to aid in smothering weeds.

For commercial plantings 6m x 6m can be used. A wider spacing can be adapted if intercropping is planned. A high density planting gives more kernel

per hectare up to 7 years. Low density planting gives less per hectare but more per tree.

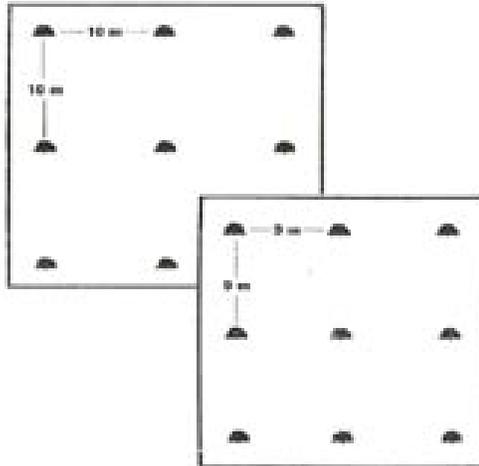
#### F.1 Quincunx (15m x 15m)

An alternative and easier method is the quincunx arrangement and should also be tried.



#### F.2 Square

The simplest recommended planting distances are 9m x 9m at the less fertile lower slopes and 10m x 10m at the more fertile lower slopes.



#### G. LINING, STAKING AND DIGGING HOLES

Rows of cashew should be properly laid out by placing markers between rows and between hills in a row.

The holes should be dug a month before planting of seedlings. The holes should have a dimension 20cm x 20cm.

#### H. PLANTING TIME

In places with distinct dry and wet seasons, planting is best done at the start of the rainy season.

## I. PLANTING

There are two methods of establishing cashew that may be employed. These are direct seeding and transplanting of seedlings or asexually propagated materials.

In direct seeding, 2 to 3 seeds are planted 5-10 cm deep with the stalk end facing upward and in a slanting position. This prevents emerging cotyledons at the soil surface from the ravages of field rats, ants, snails and birds.

Seeds are planted 30 cm apart in a triangular position when 3 seeds are used. The seeds will germinate 1-2 weeks after sowing provided that the soil has sufficient moisture.

Thinning should be done leaving only the most vigorous plant to develop 1-2 months from germination. Thinning is preferably done during the start of the rainy season.

Always take note that when transplanting seedlings or asexually propagated materials, remove carefully the polyethylene plastic before setting the seedlings in the holes or remove the bottom portion of the bag to give way for the expansion and growth of the root system.

Fill the holes with surface soil first and firm the soil at the base of the seedlings carefully allowing the roots to remain in as natural as possible.

## FIELD MAINTENANCE

### A. WEEDING AND CULTIVATION

The plants should be cultivated and free from weeds at a distance of 1 meter around the trunk. The orchard should be weeded as often as necessary. Cut grasses should be left in the area between the hills to dry and to be used later for mulching. Mulching helps conserve moisture around the plant during the summer months, keep down the weeds and increase the amount of humus in the soil when it decays.

### B. IRRIGATION

Irrigation is needed during the first dry season. In the subsequent years, when the root system has already been established and has reached the layer with sufficient moisture, irrigation is applied only when necessary. For better yield, it is advisable to irrigate the field regularly especially during summer.

### C. INTERCROPPING AND COVERCROPPING

A considerable part of the land is available for intercropping during the early years after the establishment of the cashew orchard.

To provide sufficient protection from heavy growth of weeds and grass, the spaces between rows may be used for planting cash crops. This would enable the grower to earn additional income.

Annual crops can be interplanted between rows of cashew provided they are not closer than 2 meters from the cashew tree.

When growing of intercrops are no longer feasible, the field should be planted to leguminous covercrops. The planting of covercrops will prevent further soil erosion, conserve moisture, and add organic matter to the soil. The area within 1 to 1 ½ meters from the trunk should be kept free from weeds and covercrops should not be allowed to cling to the tree.

### D. PRUNING

Little pruning is practiced in cashew. However, it may be necessary to prune regularly to get the desirable shape of the tree and to facilitate cultural operations.

It is also necessary to remove the diseased and infected branches and unnecessary water sprouts.

Cut wounds should be properly treated with chemicals (coal tar) to facilitate healing and avoid infections.

### E. FERTILIZATION

It is advisable to apply fertilizers especially when soil analysis dictates specific soil nutrient deficiencies.

The general recommendations are the following:

1. Seedlings – At planting time apply complete fertilizer (14-14-14) before the seedlings are set in the holes at the rate of 200-300 g/plant.
2. Young trees – Apply complete fertilizer at the rate of 300-500 g/tree plus Urea (45-0-0) at the rate of 200-300 g/tree.
3. Bearing trees – Apply complete fertilizer (14-14-14) at the rate of 1.5 to 3.0 kg/tree.

Recommended rate of fertilizer application is applied two times a year. One half of the total requirement per tree should be applied at the start of the rainy

season and the remaining half should be applied toward the end of the rainy season.

On established trees, fertilizer should be dug with a depth of 5-10 cm. The fertilizer is then distributed equally. Cover the holes/canal properly with soil to prevent the fertilizer from evaporating or from being washed out by heavy rains.

## CROP PROTECTION

### CONTROL OF PESTS

Among the major pests of cashew are:

- A. Twig borer (*Niphonoclea albata* N./ *N. capito* P.) - This insect pests are common during the dry season. The adult beetle girdles the small branches causing them to dry up or break and drop to the ground. Its creamish larvae bore into the pith of the branches. As they feed, they move downward until they pupate. All affected twigs and small branches may eventually die.

Control Measures: To prevent or minimize damage, spray the whole canopy with Karate at  $\frac{3}{4}$  to  $1\frac{1}{2}$  tbsp per 16 liter water and other pyrethroids. Repeat application after one month. Infected portions have to be pruned.

- B. Mealybugs (Gray Mealybugs – *F. virgata*) – These pests feed on the flushes by sucking the plant sap. Affected parts turn yellow, dry up and eventually fall. Mealybugs also excrete a sticky fluid known as ‘honey dew’ where the sooty molds grow. The latter covers the leaf area producing black papery film on the surface. Sooty molds affect the photosynthetic activity of the leaves.

Control Measures: Pruning creates an environment that is not favorable for the growth of mealybugs. Mealybugs have symbiotic relationship with red ants. They provide food for the red ants through their excreta (honey dew). In return, ants offer protection and distribute the insect to the different parts of the tree. Spray the red ants with Malathion ( $1\frac{1}{2}$  to 3 tbsp per 16 liter water), Decis (1 to 5 tbsp per 16 liter) and Karate ( $\frac{3}{4}$  to  $1\frac{1}{2}$  tbsp per 16 liter) to prevent the spread of mealybugs

- C. Thrips (Red-banded thrips – *Selenothrips rubrocinctus* Glard) - These pests suck the sap of young leaves and shoots. When severe infestations occur, the tree is weakened and the leaves and fruit may fall prematurely.

Control Measures: Both young and adult insects are sensitive to light. Prune crowded branches to allow light penetration, which create an environment less favorable for their development. Many insecticides are effective in the control of thrips, provided these are sprayed in fine mist

and sprayed in fine mist and sprayed underneath the leaves where they hide

- D. Leaf Miner (*Acrocercops syngramma* M.) - Young plants in the nursery and in the orchard are more affected by these pests. Caterpillars of this silvery gray moth mine through the tender leaves, thus, severely damaging them.

Control Measures: Spray recommended insecticides at manufacturer's recommended dosage as soon as infestation is detected on new leaves.

- E. Tea Mosquito (*Helopeltis antonil* S.) - A reddish brown mirid bug which normally appears at the time of emergence of new growth and panicles. Nymphs and adults suck the sap from tender nuts.

Control Measures: Spray insecticides at manufacturer's recommended dosage on new flushes and inflorescence preferably in the afternoon. A third spray may be done at the time of fruit setting to reduce immature fruit drops.

- F. Saw-Toothed Grain Beetle (*Cryzaeophilus surinamensis* L) - This pest is known to attack the nuts during storage.

Control Measures: Nuts should be thoroughly dried and placed in air tight containers. Surface treatment is recommended. For finished products, fumigation is recommended.

- G. Slug Caterpillar (*Lamantridae spp.*) - The caterpillar feeds on the leaves causing semi-defoliation.

- H. Termite - Termites attack the roots and the trunk of cashew trees. They burrow on the bark of roots and branches especially of old trees. They build their soil mounds or nest on dead parts of the tree.

Control Measures: Paint or brush the trunk with used diesel oil to discourage the movement of termites from the soil to the upper parts of the tree. Prune crowded branches to allow light penetration. This will provide unfavorable environment for the multiplication of the insect. Termites have soft bodies and die upon exposure to sunlight. Insecticides can be sprayed to control termites. Be sure to destroy the earthen tunnels before applying insecticides. For termite mounds, make a hole on one side, deep enough to reach the nest and pour kerosene.

- I. Scale insects – Leaves of cashew are readily infested by this pest causing them to dry and fall. At high populations tree canopy turns black due to the growth of sooty mold.

Control Measures: Young scale insects are carried and distributed by red ants. To prevent infestation, destroy red ants by spraying Malathion at 1.5 tbsp per 16 liters water, Decis at 1-5 tbsp per 16 liters water or

Karate at  $\frac{3}{4}$ -1.5 tbsp per 16 liters water. Prune and burn heavily infested plant parts and leaves.

## CONTROL OF DISEASES

The major diseases of cashew are as follows:

- A. Dieback or Pink Disease - This disease is caused by fungus *Corticium salmonicolor* B. that usually occurs during the rainy season. Affected shoots initially show white patches on the bark; a film of silky thread or mycelium develops. Later, the fungus develops a pinkish growth which is the spores that make the bark split and peel off. Affected shoots start drying up from the tip.

Control Measures: All possible sources of inoculum should be removed. Affected shoots are pruned. The tree should also be sprayed with fungicide at manufacturer's recommended dosage.

- B. Anthracnose - This disease is caused by the fungus *Colletotrichum gloeosporioides* that usually infect tender leaves, shoots, inflorescences, young fruits (apples) and young nuts. This disease is most prevalent when there is excessive rainfall coinciding with the appearance of new growth and flowering. Infected parts in its early stage show shiny, watersoaked lesions which later turn reddish brown. At the lesion site, resinous exudation can be seen. As the disease progresses, the lesions enlarge in size, all affected tender leaves wrinkle and the young apples and nuts become shriveled. Inflorescences become black.

Control Measures: Prune crowded branches to allow light penetration and good air circulation that will create an environment unfavorable for disease development. Remove all infected parts (source of inoculum) before spraying the tree with fungicide at manufacturer's recommended dosage of application. Ring cultivation can lessen relative humidity underneath the trees, which discourage germination of spores.

- C. Damping-off - This disease is caused by fungus *Fusarium*. This disease normally occurs in the nursery and affects cashew seedlings especially when the soil medium gets too wet.

Control Measures: Since the fungus is soil inhabiting, sterilize the potting media by pouring boiling water to reduce the source of infection before bagging the seedlings. Water the plants only when necessary. Avoid planting the seedlings in water logged areas.

- D. Gummosis (*Phytophthora palmivora*) – This fungal disease causes stem bleeding, crown and root rot.

Control Measures: Plant cashew in well-drained soil. Spray Ridomil MC at 100 g per 16 liters of water.

- E. Leaf Spot Disease (*Pestalotia* sp) – is characterized by the formations of an ash-white covering on the surface of the attached figure. The pathogen infects young growing tissues on all aerial parts of the cashew tree including shoots, leaves, flowers apples and nuts. Infected young leaves are deformed, infected flowers often become necrotic, fail to open and frequently abscise.

Control Measures: Cultural control measures include sanitation and thinning of cashew trees.

## HARVESTING AND POSTHARVEST HANDLING

### MATURATION PERIOD

Some cashew trees start to bear few fruits after 2 to 3 years from planting. During the 4<sup>th</sup> or 5<sup>th</sup> year, harvest can already be considered profitable. Full bearing capacity of the tree is reached in the 10<sup>th</sup> to 15<sup>th</sup> year and continues for another 20 years or more. The tree may have a life span of 30 to 40 years or more.

### MATURITY INDICES AND HARVESTING

Harvest season of cashew may start at the month of February up to June reaching its harvest peak at the month of May. Cashew trees bear flowers as early as November up to February or March. The fruits (apples) are ready to be harvested when they become yellow or red and the nuts turn ash gray in color.

Harvesting cashew is normally done manually. This is done either by collecting the fallen fruits or by using a pole with a wire hook attached to its end. If the apples are to be used, the pole should be provided with a net or cloth bag to its end. Nuts are removed/detached from the apple and dried for two or more days under the sun.

### PACKAGING

Wipe ripe fruits with the use of soft rag after harvesting. After which, individual fruit is put in a cellophane and placed on winnowing basket/kaing for sale in the market. Individual cellophane prevents bruise/damage in order that the sap will not leak.

For each product like fresh juice, cashew liquor and roasted white kernel are packed according to the kind of processing.

### DRYING OF CASHEW NUTS

Nuts should be dried under the sun immediately after harvesting. The first few days after harvesting are critical leading to irreparable damage if nuts are not dried properly.

Spread out the cashew nut on clean, sun-warmed drying grounds or in any suitable container in layers not more than four inches thick. The nut should be constantly raked with a wooden tool for uniform drying. Use a wooden scoop to prevent and lessen damage to the nuts. Drying may take two to three days so the nuts should be heaped and covered overnight. Heap while the nuts are still warm.

Cashew nuts to be stored for longer time must be dried for about two to three days to reduce its moisture content to about 7 percent. Properly dried nuts produced a brittle, rattling sound when shaken together.

## STORAGE

Dried nuts should be stored properly. They are kept in sacks or bags for use throughout the year. Storage experiment have also indicated that nuts kept about 70 percent relative humidity at 27 °C are subject to the attack by microflora including members of the genera *Aspergillus*, *Fusarium*, *Pascilomyces*, *Penicillium* and *Rhizopus* which results to discolored kernels. The maximum safe moisture content of raw nuts for storage has been found between 8.2 to 9.2 percent, this being in equilibrium with surrounding air at 70 percent relative humidity at 27 °C.

To ensure safe storage under any circumstances, the storeroom must have a sound roof, walls and dry floor. It should be kept clean so as not to attract insect pests.

## PROCESSING

### PROCESSING OF CASHEW NUTS

Cashew nut kernels are the chief products of economic importance obtained from the cashew nut tree.

#### A. Kernel extraction

Cashew processing starts from the recovery of kernels from raw nuts. Mechanized equipment for kernel extraction have already been developed and are being utilized in other countries but these are not yet available locally.

In the Philippines there are several methods of extracting or shelling kernels from cashew nuts, however most operations are done by hand.

##### A.1.1 Roasting

Roasting renders the shell brittle and loosens up the kernels inside. In the Philippines, the open-pan roasting method is used for small quantities of kernels. Here, the raw nuts are placed in a shallow container over an open fire with constant stirring until the shell gets brittle.

Another roasting method is the placement of the raw nuts in a wire mesh container suspended over a low burning fire until all the nuts are brown. Water is splashed over the nuts to cool them after which they are carefully pounded to extract the kernels.

#### A.1.2 Shelling

The roasted nuts, while still warm are cracked or pounded carefully with a wooden mallet or a small hammer and the kernel is extracted manually using any pointed device. In some countries, shelling machines are used.

In shelling roasted nuts, the use of wood ash is extremely important. The nuts, the sheller's hands, the shelling mallet and the striking post should be dusted with wood ash or cooking oil. Wood ash protects the shellers fingers from the irritating action of the CNSL and helps keep the kernel clean.

#### A.2.1 Shelling without roasting

Most of the cashew processors use an improvised nut cutter called 'kalukati' in shelling. This consists of a blade with one end attached to a steel platform held in place by wooden support. The dried nut is placed in a steel platform with the concave side down. Then the blade is gradually lowered until the nut is cut longitudinally into halves, exposing the kernel. The kernel is then extracted from the shell with the use of a pointed device. This practice requires agility and speed since a worker can shell two sacks (50 kg) of raw nuts per day.

### B. Drying

The shelled kernel should be dried either under the sun or placed in an oven to loosen the skin and facilitate the removal of the testa. Sundrying is hardly adequate but it produces a fine white kernel without risk of scorching. Small processors dry the shelled kernels under the sun for two to three days. Artificial drying is essential for factory operations where shelled kernels are dried in an oven at 50 – 55 °C for 6 to 8 hours.

The drying operation reduces the moisture content and kills the insects present should there be any infestation.

Dried kernels are brittle and susceptible to breakage so careful handling is necessary.

#### C. Peeling

Peeling refers to the removal of the brownish, thin covering of the kernel called testa either by hand or with the use of knives. Hand peeling is preferred to avoid kernel damage like chips, cuts and blemishes. Peeling is followed by winnowing or the application of air pressure to get rid of the testa and recover all cashew kernel pieces

#### D. Sorting and grading

This involves separation of kernels into certain grades. The simplest operation involves separation into wholes, pieces, browns and refuse. Classified as refuse are the very fine pieces which cannot be peeled while the badly diseased kernels and pieces are the browns.

### PROCESSING OF CASHEW KERNELS

Processed cashew kernels available locally are either in plain roasted form or salted, deep fried. They are packed in aluminum foil or in oriented polypropylene (OPP) foil at 100 g per pack and are vacuum-sealed.

Some local processors packed whole roasted white kernel in one kilo, ½ kilo and ¼ kilo in cellophane and properly sealed. These are distributed to cashew processors for further processing.

#### Classification and Grading

In the absence of a local standard, the Philippines follow the international standard, wherein cashew kernels for exports are generally sorted and classified into the following grades;

1. cashew kernels (whole)
2. scorched cashew kernels (whole)
3. dessert cashew kernels (whole) and
4. cashew kernels (white pieces)

### PROCESSING OF CASHEW APPLES

The swollen peduncle of hypocarp, commonly known as cashew apple, is considered as a 'false fruit'. The spongy pulp has a must-like fragrance. Fairly juicy and sweet, the ripe cashew apple can be eaten as fresh but is not popular due to its astringent taste.

Researchers at the Bureau of Plant Industry (BPI) found that its juice can be made into fine fruit wine. Moreover, with improved processing techniques to remove its astringent and acrid substances, a number of products can be prepared from the fruit such as juice, jam, pickles and candies.

## REFERENCES

- Anonymous, 1972. Planting Cashew for Profit and Conservative Forestry  
Popular Bulletin No. 9. pp. 1-20.
- Agricultural Communication Section (AG COM). Cashew Production (1995). In  
support to Medium Term Agricultural Development Plan (MTADP) Key  
Cash and Commercial Crops Development Program (KCCDP). DA-RFU  
6, Iloilo City.
- Bureau of Agricultural Statistics. 2011. CountrySTAT Philippines 2010.  
<http://www.countrystat.bas.gov.ph> (January 2012 downloaded)
- Cashew, An Industry Profile. Agribusiness Information Division. Department of  
Agriculture, Quezon City.
- Claudio, Tomas L. 1975. Plant Cashew on Poor Lands. Plant Industry Digest.  
38:2-20.
- Coronel, Roberto E. 1983. Promising Fruits of the Philippines. pp. 83-115
- Covacha, Sofia A. 1990. On-Farm Trials on Cashew in Guimaras. Paper  
submitted to DA-Bureau of Agricultural Research National Research  
Symposium. Diliman, Quezon City
- DA- Information Division in cooperation with Bureau of Plant Industry.  
Cashew. Elliptical Road, Diliman, Quezon City (Leaflet).
- Guimaras Experiment Station. 1981. Station Annual Report. San Miguel,  
Jordan, Guimaras. pp.26-30.
- Jocson, Antero and G.A. Pangga. 1972. Cultural Directions: Philippine  
Agricultural Crops. Bureau of Plant Industry. 1:72-78
- Philippine Recommends for Cashew. Primer.
- Queddeng, Andres. 1976. Ang Kasoy. Plant Industry Digest. 30-31:41-42.
- Save-Phil . 1983. A catalog of Noteworthy Vegetables and Fruits in the  
Philippines. First Edition.
- Suyat, Mario N. (1986). Plant Industry Production Guide No. 69. Cashew.  
Ministry of Agriculture and Food. Bureau of Plant Industry, Manila.
- Training Manual on Cashew Production and Management. Agribusiness System  
System Assistance Program (ASAP)

## PRODUCTION COST AND PROFITABILITY

The following cost of production of establishing and maintaining a one hectare of cashew (10 years period) and return analysis is based on observations in the field. Prices and cost of labor and materials fluctuate with time and place. The figure given may not hold true in some particular areas.