Coconut Intercropping Guide No. 8

COCONUT–LANZONES
Cropping Model

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1. IMPORTANCE

Growing of intercrops in coconut lands produces more food and agricultural products, ensuring food security of the people in rural and urban areas. At the same time, the practice generates jobs and livelihood, enhancing farm incomes and the purchasing power of people, thus alleviating poverty in farming communities (Magat 2004). Moreover, successful farmers serve as inspiration and enterprise leaders in their communities, eventually treating coconut farming in an agribusiness way to create wealth and more capital resources.

Lanzones (Lansium domesticum Corr.) is a tree crop that is highly suitable or compatible under different production systems (intercropping or multistory farming, agroforestry, etc). Claimed as a forest plant species that has found its way to home gardens and commercial growing because of its unique and exotic character (Magat, 2003). An oval khaki colored fruit, lanzones has several segments within with white, translucent and juicy. The fruit is eaten fresh out of hand, with peel easily removed to get the flesh. It served as fresh fruit dessert or preserved (seedless fruit) in syrup for future use. Other parts of the plant (peels, seeds and bark) are used for medicinal cures. Fruit peels are burnt to drive mosquito away (insect repellant). The wood (light brown, medium hard, fine grained, elastic and durable) is utilized as house post, rafters, tool handles and small utensils.

It is a fruit tree native to Western Malaysia and have become a relative popular fruit in the Philippines and Indonesia (http://www.marketmanila.com/archives/lanzones-langsat). Known as langsat in Malay, these fruits grow wild and in cultivated plantations in Southeast Asia. Most common in Borneo, Java and Mindanao, these tropical fruits ripen and spoil relatively quickly. In the Philippines, over 75% of all lanzones is grown in Sulu province.

Lanzones, a popular, stable and marketable long-term fruit crop is widely planted under and between stands of coconut trees. To be a compatible and productive intercrop, lanzones tree is best planted not closer than 2 meters from the base of coconut trees, at 3 m between hills and 3 m between rows. Furthermore, where there is limited land for lanzones monocropping, the inter-spaces of coconut lands (with 8-15 meters of spacing of coconut palms) are amenable for several rows of lanzones crop. Also important, the bio-physical environmental conditions, soil-wise, sunlight-wise and
micro-climate variation within the 70-80% space between coconut trees in a farm has been known to be highly suitable for a coconut-lanzones ecosystem. These are shown in Figure 1 and 2.

Figure 1. A farm layout of a coconut-lanzones cropping model under square planting system of coconut 8-10 m.

Figure 2. A farm layout of a coconut-lanzones cropping model under triangular planting system of coconut 8-10 m.
2. ADVANTAGES AND BENEFITS

Coconut trees - produces many basic food products and non-food raw materials for high value products. If there is regular or seasonal demand for tender 8-month old nuts (buko) for tender nut water (buko juice) and tender nut for pies and desserts, the farmers get higher net income compared to the 12-month old mature nuts as buko nuts are usually priced 3-4 times higher than mature nuts. From its inflorescence, coconut sap can be produced which in turn can be processed into high value food products, e.g. coconut sugar, concentrate (honey or syrup), fresh drink and vinegar.

Lanzones is one of the major fruit crops throughout the Philippines. The relatively large areas planted to lanzones are situated in ARMM, Southern Luzon and Mindanao. In Camiguin Island, Northern Mindanao, the lanzones fruit is a major source of livelihood and an annual lanzones festival held every third week of October is celebrated for the bountiful harvest of this fruit crop (http://www.lakbaypilipinas.com/festival/lanzones_festival.html).

Lanzones fruit crop has two distinct groups or types: 1) Langsat and 2) Duku, based on the tree habit and fruiting characteristics (Magat, 2003). Langsat has generally slender body with upright branches; fruit spikes are long with 15-25 ovoid fruits, thin skin and exude latex until fully ripe; taste subacid and refreshing; and adapted to a more seasonal climates further from the equator. The Paete variety, highly desired in Luzon is a langsat type. Its fruit is elongated and small and grown widely in Luzon, Misamis Oriental and Camiguin Islands. While, the Duku type has a spreading habit with dense dome-shape canopy, with short fruit spikes (few fruits of 4-12), rounder fruit with thick skin and relatively without latex. The varieties under the Duku type or form are sweeter and aromatic, and these are more suited to the humid tropics. Other varieties that likely fall under the Duku type are: the ‘Longkong’ variety of Southern Thailand, noted to be nearly seedless type, brittle skin and soft aril; and the Mindanao or Jolo variety with quite sour taste.

In recent years, the Asian market (export) tends to prefer the Duku and the ‘Longkong’ varieties, thus more and more farmers have been interested in growing these in Mindanao region.

Some of the key benefits of the coconut-lanzones cropping/ecosystem are as follow:

1) The lanzones fruit, eaten fresh contains 68% edible portion (http://www.da.gov.ph/agribiz/lanzones.html). The composition per 100 g of the edible portion is: water, 84 g; carbohydrates with little of protein and fat, 14.2 g; fiber, 0.8 g; ash, 0.6 g; Ca, 19 mg; K, 275 mg. It contains vitamin B1, B2, and trace of vitamin C.

2) The lanzones seed and rind is rich in tannin and contains chemical substances that are medicinally and industrially useful (http://www.da.gov.ph/agribiz/lanzones.html). Lanzones flesh and juice are used by rural folk to treat sore eyes. The fruit peel serve as mosquito repellants while the bark is also used for malaria and dysentery patients.

3) From the coconut trees, obtained are many basic food products from nuts (like kernel/meat, coconut milk, coconut oil, coconut water/juice) and coconut sap (fresh sap, vinegar, coconut nectar/honey and natural sap sugar); non-food raw materials for various high value products (husked-based, shell-based). Many more products are derived from other parts of the coconut trees.
3. MARKET DEMAND AND PRACTICES

The DA-BAS (1998) estimated the area planted to the crop in the country at 10,530 ha and produced 26,724 tons during the year (Magat, 2003). While Thailand, as early as 1987, already produced 57,000 tons annually of Longsat and 39,000 tons of Duku (Logkong) in 16,000 ha and 7,000 ha, respectively, in the same year (Yaacob and Bamroonggrugsa, 1992 in Magat, 2003). Peninsular Malaysia produced 71,000 tons from its 7,600 ha in 1987.

The tree population is around 236.25 M lanzones trees (with an average of 150 trees per ha @8m x 8m spacing). With companion trees (other fruits crops), a spacing of 12m x 12m (50 to 60 trees per ha) is practiced as in Thailand.

With local production volume of planting of 26,700 t, the estimated value of the fruit reached P1.33 B (based @P50.00/kg of Paete/kg). The average productivity level had been estimated at 2.5t/ha (84 boxes @30 kg/box) from a production base of 10,350 ha (Borromeo, Pers. Comn, 2000 in Magat, 2003).

While the per capita consumption is estimated @380 g, locally, one of the biggest export market, Hongkong has a 13 kg per capita demand.

In 1988, the national area to the crop was 14,305 hectares (http://www.da.gov.ph/agribiz/lanzones.html). Areas planted grew by 0.9% during 1994 to 1998. On the other hand, national volume of production of 105,364 metric tons fell by 2% from the previous year’s level of 116,868 metric tons. From 1994 to 1998, volume of production declined by 10%. Camiguin posted a 40% volume of production growth rate during 1994 to 1998 while Laguna and Batangas registered negative growth rates of 13% and 3%, respectively.

Although these were relatively small volume of exports of lanzones fruit from 1995 to 1998, almost of the fruits that were produced were consumed domestically (Supply and Use, BAS, 1994-1998). While export value of lanzones to Hongkong totaled 8,636 FOB US$, a 12% increase from the 1997 value of 7,705 FOB US$. Export volume and value of lanzones to Hongkong decreased by 11% and 14% during 1995 to 1998, respectively. A negligible volume went to France, Switzerland, UAE, Saudi Arabia and Italy. (http://www.da.gov.ph/agribiz/lanzones.html).

4. GROWING CONDITIONS AND THE TECHNOLOGY

4.1 Environmental Requirements

To optimize the achievable yield of lanzones under the coconut-lanzones cropping system, it is essential to provide the suitable conditions (climate and soils) for the two crops. Moreover, the competition for light, soil and water resources usually results in marginal economic returns from one of the component crops or in both.
Climatic Needs:

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<thead>
<tr>
<th>Factor</th>
<th>Coconut</th>
<th>Lanzones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (m above sea level)</td>
<td>Less than 600</td>
<td>Less than 650</td>
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<tr>
<td>Temperature (°C)</td>
<td>24- 29</td>
<td>25-35</td>
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<tr>
<td>Light</td>
<td>&gt;2000 sunshine hours/year</td>
<td>Shade-tolerant crop</td>
</tr>
<tr>
<td>Total annual rainfall (mm)</td>
<td>1500- 2500 (well distributed)</td>
<td>2,000 -3,000 (with short dry spell period of 3-4 weeks to induce flowering)</td>
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<td>Typhoon frequency (%)</td>
<td>&lt; 20</td>
<td>&lt; 20</td>
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Soil Requirements:

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<tr>
<th>Soil Condition</th>
<th>Coconut</th>
<th>Lanzones</th>
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</thead>
<tbody>
<tr>
<td>Soil Depth (cm)</td>
<td>&gt;75</td>
<td>&gt;1500</td>
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<tr>
<td>Drainage</td>
<td>Moderate to well-drained</td>
<td>Well-drained</td>
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<tr>
<td>Soil Acidity (pH)</td>
<td>5.5-7.5</td>
<td>4.5 - 7.0</td>
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<tr>
<td>Soil Texture</td>
<td>Sandy, loamy, clayey (with good structure)</td>
<td>Loamy, clayey (with good structure)</td>
</tr>
<tr>
<td>Organic matter content</td>
<td>Medium to High</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Major nutrients</td>
<td>N, K, Cl, S, P, Ca, Mg, B</td>
<td>N, P, K, Ca</td>
</tr>
</tbody>
</table>

4.2 Technology

It is very important to apply the best package of technologies (POT) or better still, the site-specific technologies to achieve the maximum economic yield (MEY), highly desirable to obtain the least production cost per unit product or per ha, and the maximum returns to investment under the coconut-cacao cropping production system.


Following are some salient recommended farming pointers or practices in a coconut-lanzones cropping system:
LANZONES

1. As mentioned earlier, there are two distinct forms/types of lanzones fruit crop: the Langsat (ex. Paete variety) and the Duku (ex. Dokong or Longkong variety).
2. Langsats are commonly grown from seeds (high viability within 1-2 days after extracted from the ripe fruit). But remains viable for 2 weeks if stored in polybags conserved at 4-6 °C.
3. Seedlings usually starts fruiting in 12 to 20 years, thus for earlier flowering and fruiting (5-8 years), asexually produced planting materials (by cleft and side grafting and approach grafting) are highly recommended. Dukus are also propagated by seeds (polyembryonic), cleft grafting, as well as by marcotting.
4. For commercial growing, the recommended plant spacing ranged from 5 to 12 m, depending on the cropping system followed. Hence, in monocropping or without companion crops, an average planting density of 150 trees per ha is uncommon, while with companion cropping, a spacing of 10 to 12 m (60 to 100 trees per ha) is practiced by growers.
5. In the Philippines, lanzones are commonly planted around edges or boundaries of coconut farms or grown as its main intercrop (5m spacing from the coconut trees is common). Also, in home gardens or backyard farming, planting of the fruit crop (usually irregular spaced) is a traditional practice, particularly in areas where the fruit is desired as a table fruit or dessert.
6. During the establishment stage, the crop requires shading of 40-60%. In the absence of stands of mature coconut or other companion crops, multipurpose trees as Gliricidia and banana (Saba or Cardaba and other varieties) can be used as shade plants. These may be planted at least 6 months before lanzones crop is field planted. In the absence of shade trees, fronds of coconut plams are practical materials, but these should be replaced as practical.
7. Lanzones fruits mature in 5-6 months from flowering. Usually, a sharp knife or pruning shear is used to clip-off the fruit bunches (avoiding bruising the fruits as the fruit is highly perishable). To maintain top marketability, harvested fruits are packed in plastic containers, bamboo baskets or crates of suitable sizes, padded or lined with banana leaves or used papers on the inside to serve as cushion.
8. Generally, fruits in a bunch ripen (pericarp color changes from green to cream yellow) almost at the same time.
9. Fruit bunches must be harvested dry to avoid mouldy fruits.
10. Prior to post harvest handling, individually, fruit bunches should be graded, immature and damaged fruits separated.
11. The harvest period is normally short (4-5 harvest rounds are done to finish the tree of its crop). The Paete variety (Langsat type) usually matures earlier that the other varieties: the fruit is available for four months in the market: July to October (the Philippines and Thailand and June to February (Malaysia).
12. Its productivity (yield per tree or per ha) is normally variable. Characteristic biennial bearing is common in the country, likely attributed to the lack of the critical 3 to 4 weeks dry period to induce flower bud initiation in some years.
13. A productive langsat may average 1,000 fruit bunches/tree per year (2.5 t/ha) in the Philippines compared to the higher yield of Thailand (3.6 t/ha, Langsat and 5.6 t/ha, Duku or Longkong). However, very attractive yield of longkong trees may reached 40-50 kg (10 yrs old) and increasing further to 8—150 kg/tree (30 yrs old) with top yield of 300 kg/tree sometimes achieved in very exceptional years.
14. In Malaysia, grafted Lansium plants start fruiting in seven years and usually harvested when fruit skin turns from green to yellowish or straw color. From full-bearing stage of the fruit tree onwards, the normal annual yield
COCONUT

With the coconut trees are already established and already at bearing stage, the main farming practices are fertilization, underbrushing-weeding, mulching of the main rootzone of coconut (also considered the fertilizing zone at trunk base of trees), and harvesting. Post-harvest and primary processing practices (seasoning of partially immature nuts for 7–10 days, dehusking and copra processing) are common in small to medium scale farms. If sold to coconut desiccating plants, dehusked nuts are immediately marketed. Coconut husks await decortication/defibering, while coconut shells are converted to charcoal and sold to activated carbon processors.

4.3 Fertilization management on Coconut and lanzones

A recommended guide on the ISFM: average fertilization of coconut + lanzones agro-ecosystem (based on findings of the 15 years work at PCA-DRC)

<table>
<thead>
<tr>
<th>Component Crop/Stage</th>
<th>Inorganic Fertilizer (IF)(^1)</th>
<th>Organic Fertilizer (OF)</th>
<th>Timing of application</th>
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<tr>
<td></td>
<td>Grade/Kind</td>
<td>Rate/tree</td>
<td>Kind</td>
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<tr>
<td><strong>Nut-bearing Coconut:</strong></td>
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<tr>
<td>Year 1</td>
<td>NPK 14-5-20 (w/ Cl, S, B)</td>
<td>2-3 kg</td>
<td>(DCM/BOF)(^3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Year 2</td>
<td>NPK 14-5-20</td>
<td>2 kg</td>
<td>-ditto-</td>
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<tr>
<td>Year 3 and onwards</td>
<td>NPK 14-5-20</td>
<td>1 kg</td>
<td>Optional</td>
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<tr>
<td><strong>Lanzones Crop:</strong></td>
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<tr>
<td>Establishment time (field-planting or FP)</td>
<td>NPK 16-20-0</td>
<td>50 g</td>
<td>DCM/BOF</td>
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<tr>
<td>6 months</td>
<td>NPK 16-20-0</td>
<td>75 g</td>
<td>-ditto-</td>
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<tr>
<td>Vegetative to pre-flowering(^1):</td>
<td>NPK 14-14-14</td>
<td>400 g</td>
<td>-ditto-</td>
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<td>1 yr</td>
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</table>
Component Crop/Stage | Inorganic Fertilizer (IF) | Organic Fertilizer (OF) | Timing of application
---|---|---|---
2 yrs | -ditto- 500 g | -ditto 700 g | Split
3 yrs | -ditto- 500 g | -ditto- 700 g | Split
4 yrs | NPK 14-5-20 500 g | -ditto- 700 g | Split
5 yrs | -ditto- 500 g | -ditto- 1000 g | Split
6 yrs | -ditto- 500 g | -ditto- 1000 g | Split
Fruiting 2: | | | |
7 yrs | NPK 14-5-20 600 g | -ditto- 0 | Split
8 – 10 yrs and onwards | NPK 14-5-20 750 g | -ditto- 0 | Split

1 first ½ of fertilizer rate at onset of rainy season and remaining half at 1 -1.5 months before start of dry season; for areas with good distribution or spread of rainfall and no distinct dry season (short dry season), apply anytime during the year (avoid applying during strong rains)

2 first ½ of fertilizer rate 2-3 weeks after the annual final harvest, then, remaining ½ few weeks after fruit-set or mid period between fruit-set and fruit maturity (about 2-5 months before harvest, depending on the soil fertility level, meaning if general stand of fruiting trees is good (or above average performance), the last ½ of fertilizer rate better applied at mid-maturity (half-way) of fruits.

3 DCM – dried chicken manure; BOF – commercial or farm-based composted bioorganic fertilizers

5. INVESTMENT NEEDS: COSTS AND RETURNS (PRODUCTION ECONOMICS)

Based on the above recommended fertilizer guide and long-term ISFM coconut + lanzones agro-ecosystem established at the PCA-Davao Research Center, Bago Oshiro, Davao City, the production economics of this cropping system for 15 years (1993-2007) with 156 coconut palms/ha (8 m x 8m square system) and 469 lanzones trees/ha (4 m x 4 m) using the lowest rate of inorganic multnutrient 14-5-20-0.02 (B) fertilizer of 1.0 kg/tree for coconut and 0.38 kg/tree for lanzones showed a benefit cost ratio (BCR) of 3.94 and the net present value (NPV) @ 18% interest for this cropping system over the 15 years period is estimated to be Php 466,368.22 per ha.

The details of the simple costs and returns analysis (production economics) of coconut-lanzones cropping, per ha basis are shown in the following tables-Tables 5.1-referenced to production items/details on: 1) A Coconut Production Guide for the Use of Different Fertilizer Combinations” by S.S. Magat, M.N. Eroy and M.I. Secretaria (2005); 2) Techno Guide Series on Lanzones Production by the Bureau of Plant Industry-Davao National Crop Research & Development Center Information Service (2003); Table 5.2 (Assumptions used in the production economics); Table 5.3 (Actual yield of coconut and lanzones for 15 years at PCA-DRC) and Table 5.4 (Sensitivity Analysis).
Table 5.1 shows that this project on coconut + lanzones agro-ecosystem at PCA-DRC had profitability indices of (for total of 15 years): net present value (NPV) = Php 466,368.22 and benefit cost ratio of 3.94 at 18% interest to capital (or discount rate). The NPV is a way of comparing the value of money now with the value of money in the future taking inflation and returns into account. It is the difference between the present value of cash inflows and present value of cash outflows (http://www.investopedia.com/terms/n/npv.asp). It is used in capital budgeting to analyze the profitability of an investment or project. Thus, if NPV is negative, the project should be rejected because cash flows will also be negative. If NPV is positive and high, the project is highly profitable as in the case of coconut + lanzones agro-ecosystem. On the other hand, the benefit cost ratio is the ratio of the benefits of a project, expressed in monetary terms, relative to its costs, also express in monetary terms. (http://en.wikipedia.org/wiki/Benefit-cost_ratio). A BCR value of 1.0 means that for every peso invested, there is one peso profit, hence the higher the value of BCR (> 1) the more profitable is the project, as in this CBFS project.

It is worthy to note that net returns from coconut rose from Php24,534 in 1993 to Php 173,008 in 2000 and Php 223,821 in 2007 (Table 5.1) mainly due to the significant increase of copra yield of ‘LAGT’ coconuts one year after fertilization of the multi-nutrient inorganic fertilizer at treatment 1 (1 kg inorganic + no organic fertilizer). Furthermore, higher net returns were observed in the succeeding years (2000 onwards) due to very high copra yield records of 4-5 tons per ha. This was mainly attributed to the highly ideal growing conditions during these periods brought about by the improvement of climatic condition of the experimental location (PCA-DRC) after a long dry spell.

The profitability indices (NPV & BCR) increased as prices of crops (coconut and lanzones) also increased as reflected in Table 5.4.

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<td>Coconuts</td>
<td>42000.00</td>
<td>113400.00</td>
<td>112455.00</td>
<td>119077.75</td>
<td>123981.64</td>
<td>91892.27</td>
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<tr>
<td>Lanzones</td>
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<tr>
<td>TOTAL</td>
<td>42000.00</td>
<td>113400.00</td>
<td>112455.00</td>
<td>119077.75</td>
<td>123981.64</td>
<td>91892.27</td>
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<td>Coconuts</td>
<td>17465.68</td>
<td>15363.49</td>
<td>14832.96</td>
<td>16259.96</td>
<td>16376.59</td>
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<tr>
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<td>7884.38</td>
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<td>12150.69</td>
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<td>17213.3141</td>
<td>18055.47908</td>
<td>18939.75303</td>
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<tr>
<td>TOTAL</td>
<td>36898.13</td>
<td>26880.96</td>
<td>22717.34</td>
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<td>75506.37</td>
<td>75506.37</td>
<td>75506.37</td>
<td>75506.37</td>
<td>75506.37</td>
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<td>75506.37</td>
<td>75506.37</td>
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<td>-7884.38</td>
<td>-10440.48</td>
<td>-12150.69</td>
<td>-12749.19</td>
<td>-10737.41</td>
<td>-14157.03</td>
<td>-14649.88</td>
<td>-15977.81</td>
<td>-16341.29</td>
<td>-17213.31</td>
<td>-18055.48</td>
<td>-18939.75</td>
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<td>TOTAL</td>
<td>5101.87</td>
<td>86519.10</td>
<td>89737.66</td>
<td>91377.31</td>
<td>95454.38</td>
<td>62757.17</td>
<td>49725.64</td>
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<td>139866.47</td>
<td>246971.91</td>
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<td>25918.51</td>
<td>45399.20</td>
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</table>

NPV @18% 466,368.22  BCR (18%) 3.94

* Discount rate – refers to a percentage used to calculate the NPV and reflects the time value of money (typically used by banks for economic analysis of loan programs)

<table>
<thead>
<tr>
<th>PRICES YEAR</th>
<th>Lanzones price (Php) at 10% increase</th>
<th>Copra price (Php) at 10% increase</th>
<th>Price of fertilizer (Php/kg)</th>
<th>Price(Php)/1,000 nuts</th>
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<tbody>
<tr>
<td></td>
<td>P1 P2 P3 P4</td>
<td>P1 P2 P3 P4</td>
<td>16-20 14-14-14 BIOGRO COCOGRO Wage rate Dehusking Copra making</td>
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<td>1</td>
<td>0.0 0.0 0.0 0.0</td>
<td>30.00 36.0 43.2 51.8</td>
<td>20.00 7.00</td>
<td>90 80 120</td>
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<td>31.50 37.8 45.4 54.4</td>
<td>21.00 7.35</td>
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<td>33.08 39.7 47.6 57.2</td>
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<tr>
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<td>8.93 35.73</td>
<td>90 90 132</td>
</tr>
<tr>
<td>7</td>
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<td>40.20 48.2 57.9 69.5</td>
<td>9.38 37.52</td>
<td>90 90 132</td>
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<td>8</td>
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<tr>
<td>9</td>
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<td>90 90 132</td>
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<tr>
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<td>10.0 12.0 14.4 17.3</td>
<td>46.54 55.8 67.0 80.4</td>
<td>10.86 43.43</td>
<td>90 90 132</td>
</tr>
<tr>
<td>11</td>
<td>10.0 12.0 14.4 17.3</td>
<td>48.87 58.6 70.4 84.4</td>
<td>11.40 45.60</td>
<td>150 100 145</td>
</tr>
<tr>
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<td>10.0 12.0 14.4 17.3</td>
<td>51.31 61.6 73.9 88.7</td>
<td>11.97 47.88</td>
<td>185 100 145</td>
</tr>
<tr>
<td>13</td>
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<td>53.88 64.7 77.6 93.1</td>
<td>12.57 50.28</td>
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<tr>
<td>15</td>
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<td>59.40 71.3 85.5 102.6</td>
<td>13.86 55.43</td>
<td>185 100 145</td>
</tr>
</tbody>
</table>


Lanzones –based on Davao National Crop Research & Development Center Information Service (DIS) Techno Guide Series 2003 on Lanzones Production

Daily wage = Php 150.00
Ringweeding (coconut) man-days/yr = 27 md
Fert. Application (coconut) man-days/yr = 4 md
Fert. Application (lanzones) man-days/yr = 2 md (based on actual practice at DRC)
Harvesting = Php 3.30/tree, 6x/yr
Piling & hauling = 2 md,6x/yr
Copra making (splitting, scooping, drying, sacking)
Planting density: coconut = 156/ha   lanzones = 469/ha
Table 5.3 Annual yield of coconut and lanzones planted at PCA-DRC, 1993-2007.

<table>
<thead>
<tr>
<th>Year</th>
<th>Coconut copra (kg/ha)</th>
<th>Lanzones fruits (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>1,400</td>
<td>0</td>
</tr>
<tr>
<td>1994</td>
<td>3,600</td>
<td>0</td>
</tr>
<tr>
<td>1995</td>
<td>3,400</td>
<td>0</td>
</tr>
<tr>
<td>1996</td>
<td>3,400</td>
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</tr>
<tr>
<td>1997</td>
<td>3,400</td>
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<tr>
<td>1998</td>
<td>2,400</td>
<td>0</td>
</tr>
<tr>
<td>1999</td>
<td>1,900</td>
<td>0</td>
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<tr>
<td>2000</td>
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<td>0</td>
</tr>
<tr>
<td>2001</td>
<td>3,400</td>
<td>422.0</td>
</tr>
<tr>
<td>2002</td>
<td>4,100</td>
<td>1,938.5</td>
</tr>
<tr>
<td>2003</td>
<td>3,500</td>
<td>1,642.0</td>
</tr>
<tr>
<td>2004</td>
<td>3,400</td>
<td>0</td>
</tr>
<tr>
<td>2005</td>
<td>3,500</td>
<td>10,037.0</td>
</tr>
<tr>
<td>2006</td>
<td>3,200</td>
<td>755.0</td>
</tr>
<tr>
<td>2007</td>
<td>4,198</td>
<td>15,008.0</td>
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</tbody>
</table>


<table>
<thead>
<tr>
<th>Price Level*</th>
<th>Net Present Value (NPV) (Php)</th>
<th>Benefit Cost Ratio (BCR) (no.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price 1</td>
<td>466,388.22</td>
<td>3.94</td>
</tr>
<tr>
<td>Price 2</td>
<td>591,403.48</td>
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<td>Price 3</td>
<td>741,445.80</td>
<td>5.67</td>
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<tr>
<td>Price 4</td>
<td>921,496.59</td>
<td>6.80</td>
</tr>
</tbody>
</table>

* Refer to Table 5.2

6. POTENTIAL FINANCING SOURCES/CREDIT FACILITIES

- Self or In-House Finance (Private)
- Local Government Units (Municipal, Provincial, Congressional)
- Government Banks & Lending Institutions
- Private Banks and Lending Agencies
- Cooperatives
- Foundations

REFERENCES:


From the internet:
http://www.lakbaypilipinas.com/festival/lanzones_festival.html
http://www.marketmanila.com/archives/lanzones-langsat
http://www.investopedia.com/terms/n/npv.asp
http:en.wikipedia.org/wiki/Benefit-cost_ratio

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2) Mr. Joselito T. Francisco, RDEB Staff for his expertise in the drafting of farm layout of the coconut + lanzones cropping model.
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  Email: cbcrapio@mozcom.com or sev_magat@yahoo.com

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