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. 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.

Banana, 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, banana plants is best planted not closer than 2 meters from the base of coconut trees. Furthermore, where there is limited land for banana monocropping, the inter-spaces of coconut lands (with 8-15 meters of spacing of coconut palms) are amenable for several rows of banana 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-banana ecosystem. These are shown in Figure 1 and 2.
2. ADVANTAGES AND BENEFITS

Despite a low annual investment level (i.e., ranging from P 8,000 to P11,000) per ha, Saba banana variety), the benefits derived at different levels (farm, community and national) from the coconut-banana cropping provide substantial advantages, impacting on social, agro-economic and environmental dimensions. Meaning, the productive and sustainable coconut-banana cropping commonly results in multifunction. It is a widely grown fruit in the country, planted as a component of different farming systems or as a main crop in large farms in Mindanao.

For a 5-year cropping period, the average investment cost of P18,000 per year/ha generates a total net income of P434,000 per ha. The benefit/cost ratio increases from years 1 to 5, that is, year 1 = 0.5, year 2 = 4.0, year 3 = 5.7, year 4 = 6.5 and year 5 = 7.1 indicated in section 5.

The commercial banana cultivars grown popularly as intercrop of coconut are the table bananas, mainly Latundan, Lakatan and Bungulan; and cooking bananas, Saba and/or Cardaba.

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

1) Banana can be intercropped in coconut palms as young as 1-3 years old and when these palms reached 25 years (and beyond). Generally, banana and coconut do not compete for soil resources, except when grown in dry zones.

2) Banana is fast-growing fruit crop that starts fruiting in 8 to 12 months from field-planting. There is a stable and growing demand (locally and globally for different varieties (cooking and non-cooking) for various uses, i.e., table or fresh banana, chips, catsup, puree, flour and others.

3) Its nutritive value and health benefits are well-known. Banana fruit is high carbohydrates, potassium, calcium, vitamin C (ascorbic acid) and vitamin B6
(pyridoxine). Vitamin B₆ is essential for maintaining healthy skin and nerves, in the formation of red blood cells, in providing general disease-resistance, and stops the human premature aging (Geddes & Grosset Ltd. 1998).

4) 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.

2. MARKET DEMAND AND PRACTICES

About 66% of production is consumed locally (16.5% for processing; 45.5% as table bananas; 4% as feeds/wastes for animal consumption), 34% exported (PCARRD 1999). Export earnings averaged about US$244 M/year, with 1.14 M tons of fresh banana (mainly to Japan, Hongkong, Middle East countries). In 1997, 19.094 tons of banana chips (from Saba banana) were exported.

Domestic market for fresh banana is dominated by middlemen and traders, the export by multinational corporations. In small-scale farms bananas are sold on a finger count basis; in commercial plantations by weight basis. Local prices fluctuate, mainly due to the supply availability and fruit perishability which affects the quality.

3. GROWING CONDITIONS AND THE TECHNOLOGY

3.2 Environmental Requirements

To optimize the achievable yield of corn under the coconut-banana 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.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Coconut</th>
<th>Banana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude (m above sealevel</td>
<td>Less than 600</td>
<td>Less than 750</td>
</tr>
<tr>
<td>Temperature (°C)</td>
<td>24- 29</td>
<td>15-35</td>
</tr>
<tr>
<td>Light</td>
<td>&gt;2000 sunshine hours/year</td>
<td>3000-8000 ft-candles</td>
</tr>
<tr>
<td>Total annual rainfall (mm)</td>
<td>1500- 2500 (well distributed)</td>
<td>&gt;1000 (10-12 months)</td>
</tr>
<tr>
<td>Typhoon frequency (%)</td>
<td>&lt; 20</td>
<td>*/=10</td>
</tr>
</tbody>
</table>
Soil Requirements:

<table>
<thead>
<tr>
<th>Soil Condition</th>
<th>Coconut</th>
<th>Banana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Depth (cm)</td>
<td>&gt;75</td>
<td>&gt;75</td>
</tr>
<tr>
<td>Drainage</td>
<td>Moderate to well-drained</td>
<td>Well-drained</td>
</tr>
<tr>
<td>Soil Acidity (pH)</td>
<td>5.5-7.5</td>
<td>6.0-7.5</td>
</tr>
<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, Zn, B</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-banana cropping production system.

As a detailed guide on the cultural practices of banana, the Philippines Recommends for Banana (PCARRD 1987) is a popular reference-manual. For coconut, two booklets were produced by the PCA as quick references: 1) Production Management of Coconut (Magat 1999); and 2) Coconut-based Farming Systems (CBFS), Technology Notes for Practitioners (Magat 1999).

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

**BANANA**

1) Land preparation - After clearing the interspaces of coconut, mark the required spacing: 3 x 3 m, Lakatan and Latundan cultivars; 5 x 5 m, for Saba/ Cardaba.

2) Preparation of planting materials – bole out corms with 1-3 live buds per sword suckers/maiden suckers and cut all roots, leaving 1-2 cm long from the head; for corms, treat with 50 g Dithane M45 + 30 ml Basudin 60 EC + 1.5 ml sticker in 20 liters water or soak in 50-55°C hot water for 10 mins. For suckers, retain the 2 youngest leaves.

3) Field-Planting – Dig holes depending on size of planting materials; plant corms in slanting position with growing point on top. For suckers, plant in upright position and cover with soil up to the collar and press gently.

4) Field Maintenance – Fertilize banana with either one of the two options: 1) 100% inorganic fertilizer (IF); 2) 75% IF + 25% organic fertilizers (OF). These are indicated as follow:
### Option 1: 100% inorganic (mineral) fertilizers

<table>
<thead>
<tr>
<th>Age/Stage</th>
<th>Urea  (^a) (g/plant)</th>
<th>Solophos (^b) (g/plant)</th>
<th>KCl (^c) (g/plant)</th>
<th>14-14-14 or 14-5-20 (g/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting</td>
<td>70</td>
<td>50</td>
<td>80</td>
<td>-</td>
</tr>
<tr>
<td>3 months</td>
<td>100</td>
<td>65</td>
<td>105</td>
<td>-</td>
</tr>
<tr>
<td>6 months</td>
<td>115</td>
<td>80</td>
<td>125</td>
<td>-</td>
</tr>
<tr>
<td>9 months</td>
<td>115</td>
<td>80</td>
<td>125</td>
<td>-</td>
</tr>
<tr>
<td>Bearing (2x)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>500</td>
</tr>
</tbody>
</table>

\(^a\) 46-0-0 \(^b\) 0-20-0 \(^c\) 0-0-60-44 (Cl)

### Option 2: 75% Inorganic/mineral fertilizers + 25% Organic fertilizers

<table>
<thead>
<tr>
<th>Age/Stage</th>
<th>Urea (g/plant)</th>
<th>Solophos (g/plant)</th>
<th>KCl (g/plant)</th>
<th>14-14-14 or 14-5-20 (g/plant)</th>
<th>Chicken manure (g/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting</td>
<td>50</td>
<td>40</td>
<td>60</td>
<td>-</td>
<td>300</td>
</tr>
<tr>
<td>3 months</td>
<td>75</td>
<td>50</td>
<td>80</td>
<td>-</td>
<td>475</td>
</tr>
<tr>
<td>6 months</td>
<td>85</td>
<td>60</td>
<td>100</td>
<td>-</td>
<td>525</td>
</tr>
<tr>
<td>9 months</td>
<td>85</td>
<td>60</td>
<td>100</td>
<td>-</td>
<td>525</td>
</tr>
<tr>
<td>Bearing (2x)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>375</td>
<td>700</td>
</tr>
</tbody>
</table>

Ring-weed banana plants (within 1 m radius from pseudostem base); remove dry leaves regularly (as practical); allow only one sucker per hill at a time. Do either bud injection or pre-emergence bud spray and/or bunch spray. Debud and plastic-wrap developed the fruits. Wrap fruit bud with a sack and cut off when bunch are fully-developed.

Saba or Cardaba cultivars and to some extent Latundan are affected by Bugtok or Tibagnol disease. Infected fruits are discolored and exhibits hardness even when ripe and/or cooked (Saba). It is caused by the bacterium *Pseudomonas solanacearum*. A practical, effective and efficient way to control was formulated: pour 500 g of common salt (NaCl) by forming a hole on the harvested stump adjacent to the one bearing the inflorescence and apply the salt and dissolve by water at least 10 days before or at 5 days after flower emergence. (Pava and Franje 1997).

5) **Harvesting** – this is done at 10 to 15 months after planting or when the following are observed: fruits are full, plum, round and light green in color; angles of fingers rounded and leaves turn yellowish or yellowish orange.
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.

A separate fertilization for the stands of coconut and the banana crop is recommended. There are two average inorganic/mineral fertilizer recommendations for coconut: 1) using the combination of single fertilizers (ammonium sulfate plus common salt (for potassium-rich soils) or potassium chloride (0-0-60) for soils deficient in K; and 2) using ready-to-apply multinutrient fertilizers as the 14-5-20-0.02 (B), now commercially available like COCOGROW (ATLAS Brand) in 25 kg. capacity bags.

These two fertilizer recommendations are compatible with the application of appropriate organic fertilizers (compost, cocopeat, commercial organic fertilizers). If capital resources to purchase organic fertilizers is available, any of these organic fertilizers (total N, P and K of at least 5%) may be applied together with the mineral fertilizers (options 1 and 2) indicated below at the rate of 3-4 times of the periodic rates indicated. Organic fertilizers should be applied about a month ahead of the application of the inorganic/mineral fertilizers. Organic fertilizers serve best as soil conditioners and fertilizer supplements to the coconut-banana cropping system.

**Option 1**

Application of Single-Fertilizers (per tree):

<table>
<thead>
<tr>
<th>Age/Stage</th>
<th>Rate of Fertilizer Combination a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field-planting (FP)</td>
<td>150 g AS + 160 g SC or 200 g KCl</td>
</tr>
<tr>
<td>6 months from FP</td>
<td>200 g AS + 200 g SC or 200 g KCl</td>
</tr>
<tr>
<td>1 year</td>
<td>500 g AS + 450 g SC or 600 g KCl</td>
</tr>
<tr>
<td>2 years</td>
<td>750 g AS + 750 g SC or 900 g KCl</td>
</tr>
<tr>
<td>3 years</td>
<td>1.0 kg AS + 1.25 kg SC or 1.5 kg KCl</td>
</tr>
<tr>
<td>4 years</td>
<td>1.25 kg AS + 1.35 kg SC or 1.70 kg KCl</td>
</tr>
<tr>
<td>5 years and onwards</td>
<td>1.50 kg AS + 1.70 kg SC or 2.00 kg KCl</td>
</tr>
</tbody>
</table>

a AS – Ammonium sulfate (21-0-0);
SC – Sodium chloride (common salt);
KCl – Potassium chloride (0-0-60)
Option 2
Application of ready-to-apply multinutrient fertilizer (per tree):

<table>
<thead>
<tr>
<th>Age/Stage</th>
<th>Rate of 14-5-20 multi-nutrient Fertilizer a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field-planting (FP)</td>
<td>400 g</td>
</tr>
<tr>
<td>6 months from FP</td>
<td>600 g</td>
</tr>
<tr>
<td>1 year</td>
<td>1.25 kg</td>
</tr>
<tr>
<td>2 years</td>
<td>1.50 kg</td>
</tr>
<tr>
<td>3 years</td>
<td>2.00 kg</td>
</tr>
<tr>
<td>4 years</td>
<td>2.50 kg</td>
</tr>
<tr>
<td>5 years and onwards</td>
<td>3.00 kg</td>
</tr>
</tbody>
</table>

a contains 14% N, 5% P2O5, 20% K2O plus 15% Cl, 4.5% S, 0.02% Boron, Ca.

5. INVESTMENT NEEDS: COSTS AND RETURNS

Simple Costs and Returns Analysis (P) of Coconut- Banana cropping (Saba or Cardaba ), per ha (mainly adopted from Pava and Franje, 1997)

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BANANA:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A. Labor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Hauling (suckers)</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Plowing</td>
<td>1,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3. Harrowing</td>
<td>800</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4. Staking (2md a @ P100)</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5. Digging holes, 6 md @ P 100</td>
<td>600</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6. Planting, 5 md @ P100</td>
<td>500</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7. Weeding, Fertilizing &amp; Desuckering, (4 x), 24 md @ P100</td>
<td>2,400</td>
<td>2,400</td>
<td>2,400</td>
<td>4,800</td>
<td>4,800</td>
</tr>
<tr>
<td>8. Harvesting</td>
<td>-</td>
<td>900</td>
<td>1,800</td>
<td>1,800</td>
<td>1,800</td>
</tr>
<tr>
<td>9. 9 md @ P100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>6,000</td>
<td>3,300</td>
<td>4,200</td>
<td>6,600</td>
<td>6,600</td>
</tr>
</tbody>
</table>
Continuation…

<table>
<thead>
<tr>
<th>Item</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>B. Supplies &amp; Mat’ls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Suckers (555 pcs @P3.00)</td>
<td>1,665</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. lime, 75 bags @ P20.00</td>
<td>1,500</td>
<td>-</td>
<td>-</td>
<td>1,500</td>
<td>-</td>
</tr>
<tr>
<td>3. Fertilizers (14-14-14), 4 bags @ P 450</td>
<td>1,800</td>
<td>1,800</td>
<td>3,600</td>
<td>3,600</td>
<td>3,600</td>
</tr>
<tr>
<td>Subtotal</td>
<td>4,965</td>
<td>1,800</td>
<td>3,600</td>
<td>5,100</td>
<td>3,600</td>
</tr>
<tr>
<td>GrandTotal</td>
<td>10,965</td>
<td>5,100</td>
<td>7,800</td>
<td>11,700</td>
<td>10,200</td>
</tr>
<tr>
<td><strong>C. Income</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Yield (kg/ha)</td>
<td>none</td>
<td>16,650</td>
<td>33,300</td>
<td>49,950</td>
<td>49,950</td>
</tr>
<tr>
<td>b) Gross value (P)</td>
<td>none</td>
<td>41,625</td>
<td>83,250</td>
<td>124,875</td>
<td>124,875</td>
</tr>
<tr>
<td>c) Net Income (P)</td>
<td>(-10,965)</td>
<td>36,525</td>
<td>75,450</td>
<td>113,175</td>
<td>114,675</td>
</tr>
</tbody>
</table>

**COCONUT:**

(Copra yield @ 2 t/ha, @P15/kg Nuts= 8,000/ha)

| Cost of harvesting, piling, hauling, deshusking @ P0.35/nut | 2,800 | 2,800 | 2,800 | 2,800 | 2,800 |
| Copra making @P0.12/kg | 960   | 960   | 960   | 960   | 960   |
| Transport/Handling, @ P0.20/kg copra | 400   | 400   | 400   | 400   | 400   |
| Fertilizer application | 360   | 360   | 360   | 360   | 360   |
| Circle weeding, 4.5 md, 6x/yr | 2,430 | 2,430 | 2,430 | 2,430 | 2,430 |
| Fertilizer cost b | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Total Cost (P) | 8,950 | 8,950 | 8,950 | 8,950 | 8,950 |
| Yield (kg/ha) | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Gross Income (P) | 30,000 | 30,000 | 30,000 | 30,000 | 30,000 |
| Net Income (P) | 21,050 | 21,050 | 21,050 | 21,050 | 21,050 |
| **Total Net income (P) (coconut + banana)** | 10,085 | 57,575 | 96,500 | 134,225 | 135,725 |
| Benefit/cost ratio | 0.51 | 4.10 | 5.76 | 6.50 | 7.09 |

*a* man-day  

b 1.5 kg AS + 1.7 kg NaCl @ P5/kg and P4/kg, respectively, 135 trees/ha

**Basis**

- 2nd Year – 555 hills x 2 harvest = 1,110 bunches @ 15 kg/bunch = 16,650 kg @ P2.50/kg  
- 3rd Year – 555 hills x 2 suckers x 2 harvest = 2,220 bunches @ 15 kg/bunch = 33,300 kg @ P2.50/kg  
- 4th to 5th Year – 555 x 3 suckers x 2 harvest = 3,330 bunches @ 15 kg/bunch = 49,450 kg @ P2.50/kg
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:


PCARRD-DOST. 1999 (Revised). The Banana Industry. Los Baños, Laguna: Philippine Council for Agriculture, Forestry and Natural Resources Research and Development.


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6 Dec. 2004/ PCA/RDEB-ARMD