Typhoon Pablo Disaster Recovery Assistance Project

Crop Diversification Options for Davao Oriental
Focusing on Baganga-Boston-Cateel

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LIST OF ABBREVIATIONS

A & D	Alienable and Disposable
ACDIVoca	Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance
ASEAN	Association of Southeast Asian Nations
BBC	Boston, Baganga, Cateel
CARP	Comprehensive Agrarian Reform Program
CIDAMI	Cacao Industry Development Association of Mindanao, Inc.
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DEPEd	Department of Education
DILG	Department of Interior and Local Government
DTI	Department of Trade & Industry
FFB	Fresh Fruit Bunch
FIDA	Fiber Industry Development Authority
GEM	Growth with Equity in Mindanao Program
Ha	Hectare
HY-LTC	High Yield Latex-Timber Clones
KFI	Kennemer Foods International
Kg	Kilogram
KPH	Kilometers per Hour
LGU	Local Government Unit
LPM	Large Planting Materials
masl	Meters Above Sea Level
MCDC	Mars Cacao Development Center
MinDA	Mindanao Development Authority
MNF	Multi-Nutrient Fertilization
NSCB	National Statistical Coordination Board
NGA	National Government Agencies
NGO	Non-Government Organizations
NIA	National Irrigation Administration
NR	Natural Rubber
PCA	Philippine Coconut Authority
PDAP	Partnership for Development Assistance in the Philippines
Philrice	Philippine Rice Research Institute
PhP	Philippine Peso
PNPL	Plant Now Pay Later
PNTC	Plant Now Take Care
PTL	Poverty Threshold Level
QPM	Quality Planting Materials
SMFI	San Miguel Foods Inc.
UPLB	University of the Philippines - Los Banos
USAID	United States Agency for International Development
USDA	United States Department of Agriculture

EXECUTIVE SUMMARY

As Typhoon Pablo (international name Bopha) made landfall in Davao Oriental on December 4, 2012, it wrought severe devastation to the province's population centers, infrastructure, agricultural and fishery production areas. The magnitude of the storm and the extent of damage are unprecedented in the history of Mindanao, an island-region that has, until recently, been referred to as typhoon-free.

According to the Climate Change Vulnerability Assessment (June 2013) commissioned by the United States Agency for International Development (USAID), Typhoon Pablo was the most southerly Category 5 typhoon to have occurred to date throughout the world. Changing weather trends point to the distinct possibility of a recurrence of extreme weather events in the region.

To help accelerate the restoration of livelihood while increasing the food sufficiency and climate resilience of communities affected by Typhoon Pablo, USAID is funding agriculture and aquaculture activities through its Typhoon Pablo Disaster Recovery Assistance Project, implemented by the Growth with Equity in Mindanao (GEM 3) Program.

The following report presents the findings of a crop diversification study for the province of Davao Oriental, focusing on the municipalities of Baganga, Boston and Cateel (BBC), which are among the hardest hit areas. Based on an examination of the extent of damage to agricultural crops, the study recommends suitable short and long-term alternative crop options for affected growers and proposes immediate and long-term strategies for introducing these crops in the three municipalities.

With a combined area of 198,172 hectares (ha), BBC represents 38% of the total land area of Davao Oriental (516,445 ha). 214,168 ha or 75% of the province's crop area is planted to coconut. In BBC, the percentage of agricultural land devoted to coconut is even higher at 85%. Other crops such as abaca, rice, corn, banana, fruit trees and vegetable crops are grown in limited scale.

Typhoon Pablo uprooted six million coconut trees or at least 90% of all coconut trees in these three municipalities, while completely destroying other standing crops such as corn, vegetables, bananas and other fruit trees. Total damage covered 62,867 ha of agricultural land, of which 46,407 ha or 74% were planted to coconut. Total damage to all crops is estimated at PhP 5.149 billion. Coconut accounts for 80% or PhP 4.10 billion.

For almost a century, coconut production through monocrop farming has been the main agricultural activity in BBC. The average income of local farmers, with an average

land size of 2.5 ha, is below the poverty threshold level mainly due to the low productivity of old and insufficiently fertilized coconut trees. Intercropping, which could provide alternative crops and additional income, is rarely practiced.

In the official poverty statistics report published by the National Statistical Coordination Board (NSCB) in April 2013, Davao Oriental ranked as the sixth poorest province in the Philippines, with 48% of its population living below the poverty line. Over-dependence on monocrop coconut farming is perceived to be a major contributor to the high poverty incidence in the province.

While Typhoon Pablo swept most of BBC's agricultural production areas, it highlighted the rich agricultural resources and unique agro-climatic endowments in the area that could be harnessed for long-term agricultural rehabilitation and development. Among these natural resources are fertile soils; high rainfall that is evenly distributed throughout the year, except for a three-month heavy rainfall period; abundance of large and relatively untapped areas which are plain and slightly sloping and; vast tracts of land situated below 700 meters above sea level (masl). These unique agronomic conditions provide BBC with enormous opportunities for crop diversification, particularly the introduction of short-term cash crops and long-term high-value commercial crops.

These agro-climatic attributes were considered in the formulation of an appropriate crop diversification strategy for BBC, which identifies the range of suitable crops that could be viably introduced to local farmers. The strategy also took into account other important factors in order to address the immediate needs of affected growers while laying the foundation for BBC's long-term agricultural development requirements.

- In the short-term – recommended crop alternatives should be short-gestating; should provide immediate food supply and/or income; should have existing markets; technology should be acceptable to and can be easily be adopted by farmers.
- In the long-term - recommended crops should provide steady income above poverty threshold levels to help reduce poverty; should have good market potential; should be consistent with planned or existing government programs and; could potentially attract private investments.
- In general, crop alternatives should be adaptable to climate change-induced abnormalities in weather patterns such as higher incidence of typhoons, higher rainfall rates and frequent flooding.

The recent devastation of mono-cropped coconut areas resulting from a severe typhoon that may have been intensified and directed further south due to climate change is

expected to occur more frequently. Dependence on mono-cropping intensifies the effects on rural incomes of both natural phenomena and plant diseases. Diversification helps to reduce the resulting risks to the local economy, while increased incomes improve the resiliency of communities.

RECOMMENDED ALTERNATIVE CROPS

Crops selected for diversification are categorized as short-duration crops and medium- to long-duration crops.

Short-duration crops have a growing period of less than one year. These could adequately meet the immediate sustenance requirements of the local populace and help hasten recovery from the impact of Typhoon Pablo. These include rice, corn, vegetables, cassava and other rootcrops.

- Rice in BBC is predominantly grown in Cateel and Baganga with total area of less than 3,000 ha. There are opportunities to expand existing lowland rice production to about 5,000 ha to support the areas' short and long-term food sufficiency requirements.

- Corn production in BBC has been minimal (below 1,500 ha) in the past few years. White corn production can be intensified and expanded to supplement existing rice production and to help supply the areas' food demand in the immediate term.

- Vegetable production has also been very limited (less than 250 ha). Tropical vegetable production can be expanded in the three areas to supplement existing food supply. Excess vegetable produce can be sold to neighboring demand centers (i.e. Bislig in Surigao del Sur) to generate additional income for growers.

- Cassava may be a new crop to BBC growers but it can be viably introduced in the area. It is easy to grow and maintain and can be planted even in small plots of land and upland areas. It can also be intercropped with remaining coconut trees to provide additional income. Cassava can serve as an alternative food staple, in addition to rice or corn. Good drainage, however, is needed to attain high levels of productivity.

- Other rootcrops such as *ube* (yam), *gabi* (taro) and sweet potato can also be introduced, especially in marginal lands and can be intercropped with existing

coconut trees. These crops can supplement existing food supply and can be easily sold in neighboring markets.

Medium to long-duration crops have gestating periods of more than one year. These crops are expected to provide a steady flow of income over a longer period of time and can potentially generate employment through farm labor and value-added processing activities. These include coconut, rubber, oil palm, coffee, cacao, abaca, other fruits and bamboo.

- Coconut production or rehabilitation of damaged coconut areas still remain the easiest option for many farmers in BBC. For existing or standing coconut crops, rehabilitation should include fertilization using salt, multi-nutrient fertilizer (MNF) and Mykovam, an environment-friendly microbiological application. Intercropping with cash crops such as corn and cassava as well as commercial crops like cardaba banana, coffee or cacao is also recommended to generate additional income.

- For heavily damaged coconut areas, replanting of hybrid coconut seedlings, especially high yielding varieties, is recommended. These hybrid seedlings may be sourced from the Philippine Coconut Authority (PCA) but are in very limited quantities. There is a need, therefore, to propagate these hybrid seedlings through partnerships between local government units (LGUs) and private nursery operators. Planting of special coconut varieties (aromatic) can also be introduced. The sweet and aromatic juice of these special varieties is preferred by niche markets like restaurants, hotels and supermarkets.

- Rubber is a commercial crop that is highly suitable for BBC given its high rainfall conditions. Large tracts of land (below 30% slope) can be planted to rubber. It can replace uprooted coconut trees and can also serve as a reforestation crop for moderately sloping areas.

- Banana, specifically the *cardaba* variety, is another good alternative crop for BBC area. *Cardaba* banana can be a stand-alone crop or an intercrop to coconut. It can supplement rice as staple food, and can be sold in local markets or to traders as raw material for banana chip processing. The crop is easy to grow and maintain.

- Other tropical fruits such as durian, mangosteen, lanzones, rambutan, etc. can also be produced in BBC. These fruit crops are suited to a high rainfall environment and can thrive in both low and high elevations. These can also be intercropped with coconut and other commercial crops. Fruit harvests can be consumed locally while

excess production can be sold to nearby demand centers such as Mati, Tagum and Bislig. High quality planting materials and Good Agricultural Practices (GAP) are needed to ensure productivity and to maintain a level of quality that will be acceptable to major local and export markets.

- Oil Palm can be planted in many areas in BBC and is suited to the areas' agronomic conditions. It is becoming an increasingly important crop in Mindanao due to high demand and income-generating potential. Although a new crop to BBC farmers, oil palm is currently grown in neighboring Agusan and Surigao provinces. Existing palm oil processors in the area are willing to absorb potential oil palm produce from BBC.

- Cacao is another emerging crop in Mindanao which can be grown in BBC. Cacao production in Mindanao is expanding due to increasing demand in the local and export markets. Philippine cacao production has been very limited, supplying less than one fourth of the domestic requirement. It is now being aggressively introduced in other towns in Davao Oriental as an intercrop to coconut. Cacao production can be introduced in BCC with appropriate training for farmers and provision of good quality planting materials.

- Coffee, like cacao, is another viable intercrop to coconut. It can be grown in both low and high elevations, which makes it a good alternative crop in BBC's lowland areas and upland communities. Coffee production in the Philippines has been declining in recent years resulting in the importation of about two thirds of domestic requirements. Coffee can be propagated in BBC with specific varieties targeted for lowland areas as an intercrop to banana or in upland communities as a monocrop or part of a mixed cropping system.

- Abaca is a popular crop among BBC farmers especially those in upland areas. Before Typhoon Pablo, close to 3,000 ha of land were planted to abaca. While much of the production area was completely damaged by the typhoon, abaca still remains to be a viable crop for the BCC area. Rehabilitation of abaca will involve replanting of damaged areas using disease-free planting materials through tissue culture technology. Abaca can be grown as a monocrop or can be intercropped with high-elevation crops and forest trees. It can also co-exist with coconut or rubber and can provide short-term and regular income to local growers.

- Bamboo is multi-purpose crop that can be cultivated in BBC. It can be used as a wind-breaker for standing tree crops to minimize the impact of strong winds that

sweep across the three areas during the months of December to February. Bamboo can also be planted and harvested as propping for the Cavendish banana industry in nearby Compostela Valley Province, and can be used as poles in the construction of fish cages for planned high-value aquaculture production activities. Bamboo can be grown in lowland areas as well as upland communities including marginal lands.

IMMEDIATE IMPLEMENTATION STRATEGIES

To fast-track the introduction of these crops in BBC, the following strategies are proposed:

Short-duration crops for immediate food supply and income. In the immediate term, crop diversification efforts should focus on the introduction of short-term crops to address urgent income and food requirements. Rice, corn, cassava and vegetables are among the easiest and thus, the most viable crops to plant. Existing assistance from government agencies, particularly the Department of Agriculture (DA), non-government organizations (NGOs) and donor institutions are focused on the production of these crops to provide livelihood opportunities to affected growers. The provincial and municipal LGUs in BBC should take advantage and maximize the benefits of these assistance efforts and ensure that they become building blocks for sustained cash crop production.

The LGUs should also develop plans to gain access to high quality seeds for these short-term crops through partnerships with private seed companies (for vegetables) or state universities (for white corn and cassava).

Rehabilitation and replanting of damaged coconut areas. The provincial and municipal LGUs should request or work closely with the Philippine Coconut Authority (PCA) to prioritize the distribution of its limited hybrid seed nuts to BBC. The LGUs, in partnership with the PCA, should also pro-actively work with private nurseries to access available hybrid seedling materials that could be set aside for BBC's coconut replanting efforts. For remaining coconut trees, fertilization using salt, MNF or Mykovam is recommended to growers. Intercropping with cacao, coffee or banana, or short-term cash crops like corn or cassava should also be encouraged to provide additional income.

Access to planting materials of long-term crops such as rubber, cacao, fruit crops, banana, oil palm. The provincial and municipal LGUs should support and collaborate with the DA's on-going distribution of planting materials to growers in BBC. The LGUs should also study and replicate successful experiences of other LGUs such as the Plant Now Pay Later (PNPL) or Plant Now Take Care (PNTC) schemes in North Cotabato and Agusan del Sur. The LGUs should also pro-actively invite private nursery operators to

consider setting up satellite nurseries in BBC to support the planting materials requirements of local growers.

OTHER IMPORTANT STRATEGIES

The following strategies are proposed for the medium term:

The provincial and municipal LGUs should undertake an extensive information campaign and promote the alternative short-, medium- and long-duration crops to local growers through techno-transfer training, establishment of techno-demo sites, cross-visits to other production areas and capability building of local technicians.

The provincial and municipal LGUs should also support existing or potential investors in their on-going or planned agribusiness projects in BBC. These include the Kennemer Group (cacao production and marketing), Puenstespina Group (cacao production and marketing), Dizon Farms (Cavendish banana plantation) and, the Manny Pangilinan-Indofood Group (oil palm plantation).

The provincial and municipal LGUs should also formulate an integrated multi-year crop development project which incorporates the province's existing Rapid Agriculture and Fishery Production Integrated Development (RAFPID) plan as a long-term crop rehabilitation and diversification framework. This project may entail the solicitation of funding commitment from national and government agencies and donor organizations for the identified project components as well as the identification of potential private sector investors in specific agribusiness development projects. To effectively undertake this effort, a full-time professional management team may be needed to implement the various project activities and components in the short and medium term.

Other important infrastructure facilities which were damaged by Typhoon Pablo need to be repaired or upgraded to support on-going and planned agricultural rehabilitation efforts. These include:

- Rehabilitation of Cateel irrigation system
- Completion of the Cateel-Compostela-Montevista Road
- Repair of damaged bridges connecting BBC to Mati
- Rehabilitation of damaged farm support infrastructure such as farm-to-market roads, small irrigation systems, post-harvest facilities, trading centers and markets

- Clearing of debris (especially of uprooted coconut trees) to prepare the areas for rehabilitation or diversification

The following report provides detailed discussions on alternative crop options and recommended strategies for crop diversification.

Chapter 1

INTRODUCTION

On December 4, 2013, Typhoon Pablo (Bopha) made landfall in Davao Oriental Province, taking hundreds of lives, sweeping public and private property and agricultural resources along its path. Three coastal municipalities facing the Pacific Ocean -- Baganga, Boston and Cateel (BBC)–were most severely affected. Strong winds uprooted six million or 90% of tall coconut trees, covering 85% of agricultural cropped areas in BBC. Minor crops such as corn, vegetables, bananas and other fruit trees were completely damaged.

Over three generations of farmers in the BBC area have depended on traditional coconut farming as their main source of subsistence. In recent decades, these farmers' incomes gradually slid below the poverty threshold as trees grew older and less productive. Even before the typhoon, the future already appeared bleak as the World Bank projected that by 2020, the price of coconut oil in the world market will decline. All these considered, there was little hope that their economic condition would improve.

In the face of adversity, government and development organizations have discovered an opportunity to revitalize the livelihood of agricultural communities in BBC. With the aftermath of Typhoon Pablo came the challenge of providing the immediate food requirements and income to the populace in a sustainable manner. This urgent need called for innovation, which resulted in crop diversification program suited to the rich agro-climatic resources of the area. This development is expected to lead to the re-direction of resources towards the cultivation of crops that have high national and global market demand and command higher farm-gate prices.

Apart from the meticulous selection of crops based on a strict set of criteria, the crop diversification study also considers capacity building of local farmers through the introduction of modern production technologies and best practices that can be easily adopted by farmers. Local government units (LGUs), national government line agencies, non-government organizations (NGOs), international donors and others are also implementing parallel efforts.

The crop diversification program is envisioned to be far-reaching. It will help raise and sustain farmers' incomes, and create new economic opportunities which could potentially increase LGU tax revenues, and result in the capability to provide better social services. The program also aims to serve as a model for other coconut-growing communities in the province and its environs.

1.1 Background

In partnership with the Philippine Government, USAID, through its Growth with Equity in Mindanao (GEM) Program, is implementing a multi-component disaster recovery assistance program in Compostela Valley and Davao Oriental, the two provinces most severely affected by Typhoon Pablo. This includes the provision of livelihood technical assistance, training and farm input to affected agri-based growers in the target areas.

One of the priority projects under this effort is the conduct of a rapid crop diversification study for damaged coconut areas in Davao Oriental, particularly in the towns of Cateel, Baganga and Boston. The study will serve as a valuable resource for farmers, LGUs, national government line agencies, and local industry stakeholders for future agri-related developmental planning activities in Typhoon Pablo-affected areas. The study Terms of Reference is provided in the following section.

1.2 Terms of Reference

The Crop Diversification Study seeks to:

- Review and analyze data on the estimated total coconut hectarage destroyed by Typhoon Pablo in the municipalities of Cateel, Baganga and Boston;
- Assess the over-all agro-climatic conditions of the three municipalities, especially in the heavily damaged coconut production areas;
- Examine traditional cropping and inter-cropping patterns and farming practices in these municipalities especially in damaged and existing coconut areas;
- Identify a long-list of suitable short-term (cash) and long-term (commercial) crop alternatives for damaged coconut areas, given prevailing agro-climatic conditions and cropping patterns;
- Assess market opportunities for the list of suitable short and long-term crop alternatives and identify prospective buyers and markets;
- Recommend strategies to promote and fast-track the development of these alternative short- and medium-term crops in the three municipalities.

Chapter 2

DAVAO ORIENTAL: RESOURCES AND ECONOMIC SITUATION

Davao Oriental is strategically located in the eastern most part of Region XI. It is bounded by the Pacific Ocean in the east, Davao province in the west, Agusan del Sur and Surigao del Sur in the north and Davao Gulf and Celebes Sea in the south. The province is divided into two congressional districts. The town of Banaybanay, Gov. Generoso, Lupon, San Isidro and the City of Mati constitute the first district. The second district is made up of the town of Baganga, Boston and Caraga, Cateel, Manay and Taragona as shown in Fig 1. The province has a total land area of 516,446 ha of which 235,680 are classified as agricultural land. A total of 214,168 ha are planted to various crops. Coconut, the main crop, is grown in 160,638 ha representing 75% of the total agricultural land area.

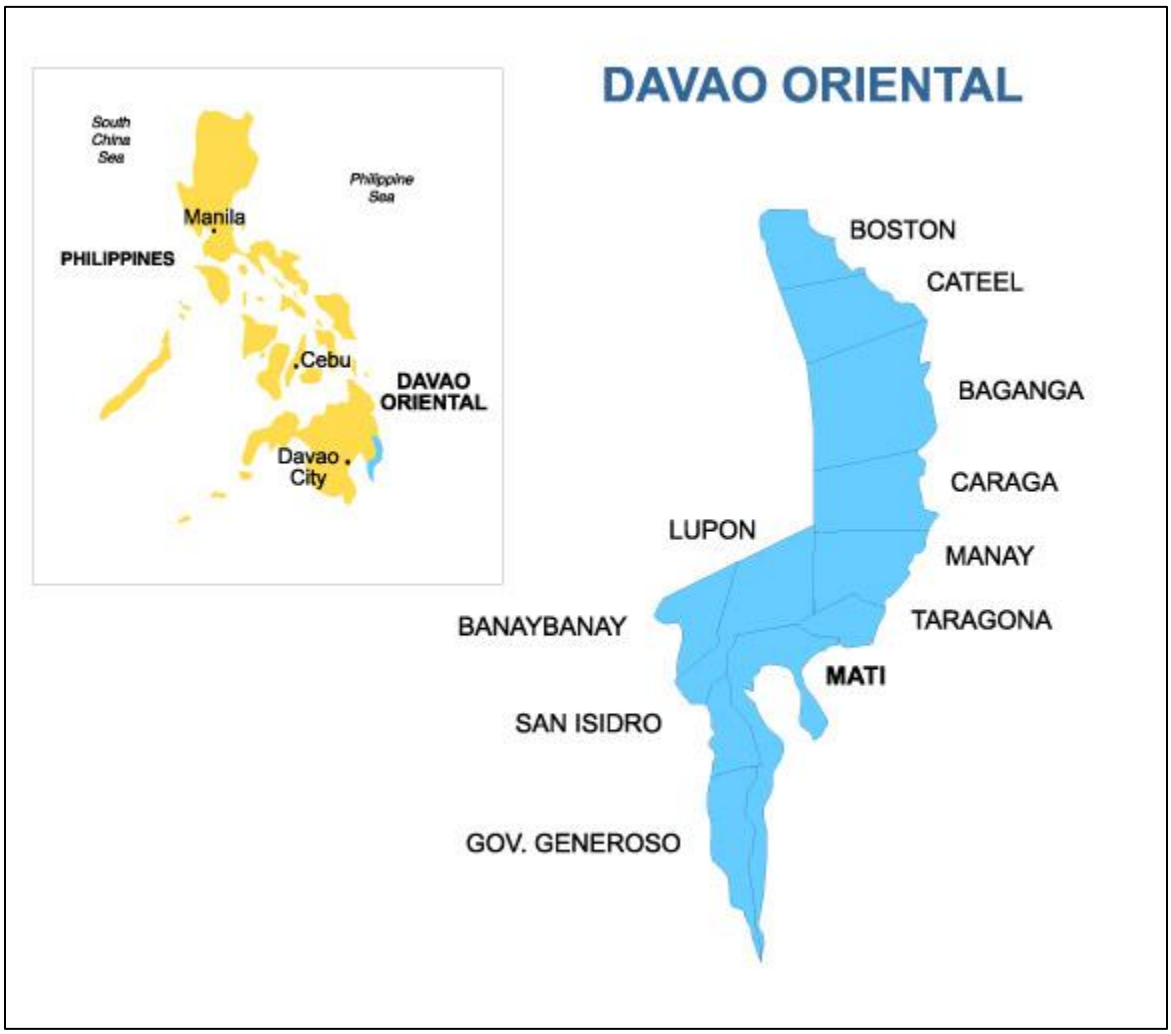
Davao Oriental is the Philippines' leading provincial producer of coconut, the biggest abaca producer in the region, a major producer of banana, a significant contributor to corn and mango production, and a minor producer of rice (Table 1). Table 1 indicates that Davao Oriental is basically a "coconut monocrop province".

Table 1.Utilization of the land resources of Davao Oriental.

DAVAO ORIENTAL			
Particular	**Hectares**		**% Share**
Total Land Area	516,446		100
Forest Land		315,600	61
A & D		201,846	39
Agricultural Land	238,680		
A & D		183,999	
Public Land		54,681	
Crop Land	214,168		100
Coconut		160,638	75
Rice		8,191	4
Corn		16,733	8
Abaca		14,350	7
Fruit Trees		20,800	10
Industrial		16,274	7
Vegetable		1,532	1
Fisheries			
Fishpond	760		3
Tilapia		60	
Milkfish		700	

The vast rich soils of the province coupled with evenly distributed rainfall throughout the year (with the exception of high pronounced rainfall from November to March) makes it highly suitable for agricultural production almost year-round. While the area is replete with agricultural resources, these have been underutilized in the socio-economic development of the local population. The National Statistical Coordination Board (NSCB) of the National Economic Development Council (NEDA) reported that Davao Oriental is among the 16 poorest provinces in the Philippines, with a poverty incidence of 48% (December 2012). Overdependence on coconut farming contributes significantly to this high poverty incidence. The low yield and productivity of senile tall coconut trees is mainly responsible for the low income of coconut farms. This clearly emphasizes the need to diversify to other high value crops.

Fig.1 Map of Davao Oriental



Source : Davao Oriental Website

Chapter 3

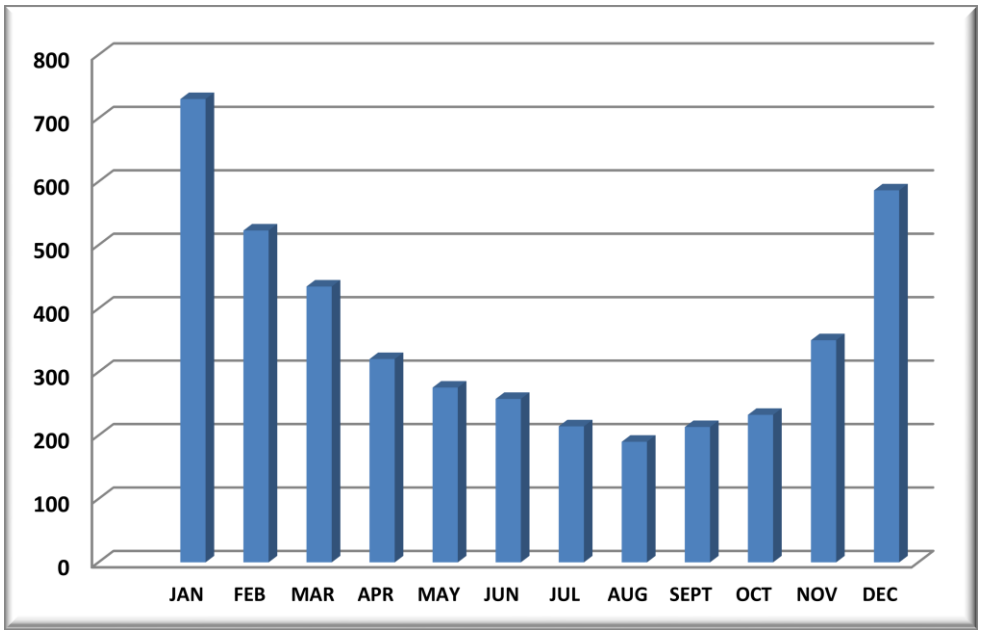
AGRICULTURAL PROFILE OF BAGANGA, BOSTON AND CATEEL (BBC)

3.1 Climate and Soils

The climate in BBC is classified as Type II, characterized by the absence of a dry season and very pronounced rainfall from November to March, with average monthly rainfall of 480.86 mm. As illustrated in Fig 2, May to October is considered the dry period, with an average monthly rainfall of 250.53 mm. The area has an average annual rainfall of 4328.4 mm. The highest recorded daily rainfall is 375.5 mm and the lowest is 93.7 mm. High rainfall which is almost evenly distributed suggests that various crops requiring water year-round are suitable for cultivation. Temperature ranges from a minimum of 22°C and a maximum of 30°C. The average temperature in BBC is 27°C.

The larger portion of soils in BBC is classified as Bolinao clay (52%), followed by Camasa sandy clay (28%) and San Manuel silty clay loam (7%). These soil types are highly suitable for the cultivation of a variety of short-term crops like rice, corn, cassava, banana and many long duration higher value crops such as coffee, cacao, coconut, abaca, rubber, fruit trees, and oil palm, among others.

Fig. 2 The rainfall pattern in the BBC.



3.2 Land Resources

The BBC has a total land area of 198,172 ha, representing approximately 38% of Davao Oriental (Table 2). The land area of BBC represents 38% of the total land area of Davao Oriental. Table 2 shows the importance of BBC in terms of expanse. At 117,710 ha, Baganga occupies the largest area, covering about 23% of the province. Boston has an area of 33,750 ha while Cateel has 46,712 ha.

The topography of BBC consists of various slopes (Table 3) and elevations (Table 4). There are areas below 18° suited for intensive crop cultivation; areas above 18° suitable for tree farming with zero to minor cultivation, forest reserves and parks; a wide portion below 1000 meters above sea level (masl) which is suitable for tropical crops; and a significant portion above 1000 masl which can be devoted to sub-tropical crops particularly vegetables and fruits.

Table 2. Land areas of the municipalities in the BBC.

MUNICIPALITY	LAND AREA (HA)	% of Davao Oriental
1. Baganga	117,710	22.79
2. Boston	33,750	6.54
3. Cateel	46,712	9.04
Sub-Total for BBC	198,172	38.37
Total of Davao Oriental	516,446	100.00

3.2.1 Slope

Slope influences the intensity of land cultivation and the extent of mechanization that may be applied in an area. This, in turn, determines the types of crops that may be grown. Intensive land cultivation is generally applied to areas that slope below 18°. Employing this practice in areas that slope above 18°may cause loss of surface soil due to soil erosion and is therefore not recommended. This defines the parameters for the production of crops that necessitate intensive cultivation such as short duration crops like corn, rice, peanut, cassava, banana, root crops and vegetable. The cultivation of lowland rice is limited to areas within 3° slope as this requires diking and storing irrigation water during land preparation and while growing the crop. While long duration crops like banana, fruit trees, oil palm, coconut, rubber, abaca, coffee, cacao, etc. thrive best in areas that slope below 18°, these can also be grown productively in areas that slope above 18° up to 30°, provided minimum to zero tillage is carried out to prevent soil erosion. This means that most long duration crops allow a wider limit than short duration crops.

Areas that slope between 30° to 50° to may be utilized for tree farming e.g., falcata, g'melina, bamboo, mahogany and rubber, particularly latex-timber clones. Crops like abaca and coffee may be integrated between rows of forest trees, to increase farm productivity and income. Areas that slope above 50° are reserved for watersheds, parks and wildlife. These are not suitable for intensive crop diversification.

As shown in Table 3, Baganga has more than 27,000 ha below the 18° slope. Boston has 12,000 ha and Cateel has 10,000 ha. These vast tracts of land may be used for intensive cultivation of short duration crops. The BBC has wide areas that slope between 18 to 30° which are suitable for tree farming.

Table 3. Slope classification in the three municipalities of the BBC.

Slope Classes	MUNICIPALITY					
	Baganga		Boston		Cateel	
	Area	% of Total	Area	% of Total	Area	% of Total
0 – 3°	6,160.02	5.23	761.21	2.26	3,865.87	14.86
3 – 8°	8,980.68	7.63	3,044.86	9.02	228.05	0.88
8 – 18°	17,712.49	15.05	8,965.40	26.56	4,718.65	18.14
18 – 30°	42,451.82	36.07	9,980.37	29.57	7,532.75	28.96
30 – 50°	39,446.71	33.51	8,542.50	25.31	9,380.42	36.06
> 50 °	2,956.28	2.51	2,455.66	7.28	284.26	1.09
TOTAL	117,708.00	100.00	33,750.00	100.00	26,010.00	100.00

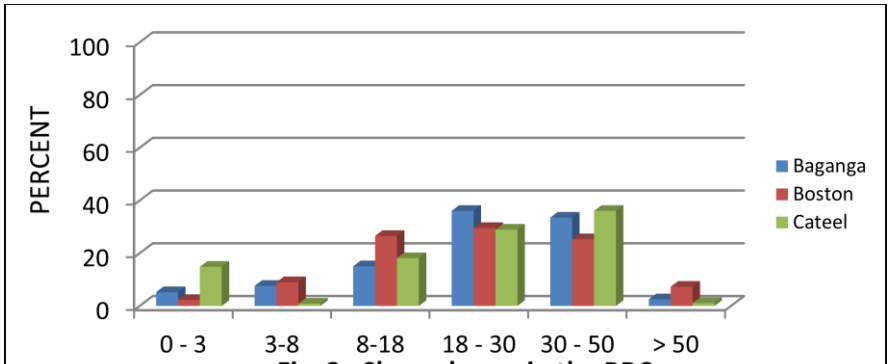


Fig. 3. Slope classes in the BBC

3.2.2 Elevation

Land elevation limits the extent of crop diversification and the area in which a particular crop may be suitably grown. Most tropical crops thrive best at an elevation of sea level to 700 masl. This includes short duration crops such as rice, corn, peanut, tropical vegetables, banana, abaca, and long duration crops like oil palm, coconut, rubber, coffee, cacao and fruit trees like longan. Cavendish banana, when grown in higher elevations, bear sweeter fruits that may be sold to a more lucrative market segment.

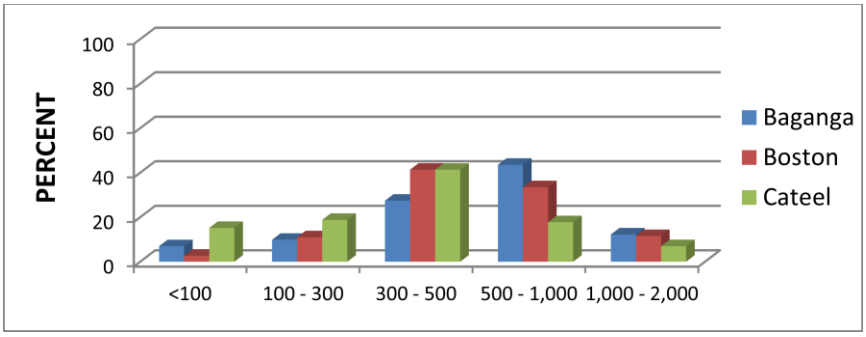
Table 4 presents areas in the BBC that are below 700 masl: Baganga has 70,000 ha or 60% of its total land area, Boston has over 25,000 ha and Cateel has over 20,000 ha. These vast land areas may be used for diversification into a broad range of crops. There is also an opportunity to develop high elevation areas for the cultivation of sub-tropical crops such as fruits, vegetables and specific varieties of rubber, oil palm, coffee and abaca.

Table 4. Elevation classes in the three municipalities of the BBC.

Elevation Classes	MUNICIPALITY					
	Baganga		Boston		Cateel	
	Area	% of Total	Area	% of Total	Area	% of Total
<100	8,191.60	6.96	894.21	2.65	3,948.81	15.18
100 - 300	11,568.98	9.83	3,707.10	10.98	4,886.58	18.79
300 - 500	32,279.31	27.42	13,957.10	41.35	10,745.62	41.31
500 - 1,000	51,255.75	43.54	11,292.17	33.46	4,615.27	17.74
1,000 - 2,000	14,412.36	12.24	3,899.42	11.55	1,813.72	6.97
TOTAL	117,708.00	100.00	33,750.00	100.00	26,010.00	100.00

The three municipalities have wide areas below 500 masl which are suitable for the cultivation of annual crops such as rice, corn, vegetable and long-term crops like banana, coffee, cacao, rubber, oil palm and coconut. Selective crops may be grown in elevations between 500 to 1000 masl. An elevation above 1000 masl provides an opportunity for the production of high value subtropical crops particularly vegetable such as cabbage, potato and subtropical fruits like longan.

Fig. 4. Elevation classes in the BBC



3.3 Human Resources

3.3.1 The People

The BBC has a population of 104,675 representing approximately 25% of the population of Davao Oriental. Table 5 shows the distribution of population in the three municipalities: Baganga (pop. 53,426), Boston (pop. 12,670), and Cateel (pop. 38,579). It is said that inhabitants settled into the area as far back as 300 years ago, during the Spanish colonial period. Migration and intermarriages resulted in a population of sturdy, hardworking, peace loving, law abiding and religious people with a largely Roman Catholic orientation. Today, these communities are dominated by Dabaweños and to a lesser extent, by Mandayas. The BBC is far from the troubled zones of Central Mindanao where a long-standing Muslim rebellion has held the attention of the international press for over four decades.

Table 5. Population, density and household size in the BBC.

Municipality	Population	Density (Pop/km^2)	Ave. HH Size
1. Baganga	53,426	48.19	5.06
2. Boston	12,670	33.11	5.08
3. Cateel	38,579	70.88	4.76
Total	104,675		

3.3.2 Farm Size and Tenure

Except for a few areas, most large tracts of cultivated agricultural land are subsidized under the government's Comprehensive Agrarian Reform Program (CARP). Agricultural areas not covered by CARP are either owned or leased on shareholder basis. While the average farmland size in BBC is small (between 2.5 to 3.0 ha), it is still larger than the average farm land size in Mindanao (2.40 ha) and the Philippines(1.95 ha).

3.4 Prevailing Farming System

3.4.1 Dominance of Monocropping

Farming is the main occupation of people in the BBC, with a small percentage engaged in fishing. Monoculture of coconut has dominated the agricultural landscape for centuries. Coconut is grown in 85% of agricultural areas, higher than that of the entire province of Davao Oriental (75%). Coconut is easy to cultivate and has once provided farmers with good income when trees were young and productive. Today, majority of the

trees are old, senile and are becoming increasingly less productive. The lack of initiative to pursue crop diversity and promote productivity in the past may be attributed to several factors: (a) the area, until recently, was isolated from many progressive agricultural communities in Mindanao, (b) the absence of institutions like agricultural schools or corporate farms which can catalyze innovation and increase productivity, and (c) the overall neglect of the national government to improve the coconut industry, resulting in very low productivity and income. Such neglect is affecting farmers in BBC and in all of the 3.56 million ha of coconut plantations throughout the country.

3.4.2 Previous Crop Diversification Efforts

Prior to Typhoon Pablo there were efforts to diversify farming to boost land productivity and income. This included the introduction of crops that could potentially bring greater returns than coconut. Modern farming of high yielding rice and corn, vegetables and root crops was introduced. In recent years, the commercial production of abaca, rubber, coffee and cacao was introduced on a limited scale. Additionally, there had been efforts to integrate high value crops in coconut farms. This included planting between the rows of coconut such crops as *cardaba* banana, upland rice, abaca, coffee and cacao. Moreover, abaca was integrated in the timber farming of falcata to increase land productivity.

3.5 Farmers' Income

As discussed in the previous section of this study, the income level of farmers before Typhoon Pablo was marginal. This is generally attributed to the low yield and productivity of coconut, and partly to small farm size. The average copra yield is only 1,200 kg/ha per year. A farmer with 2.5 ha can produce about 3,000 kg/ha per year. At a price of PhP 20 per hectare, his annual income would come down to only PhP 60,000. This assumes that he merely provides farm labor. If he tills his own land, a third of his gross income would have to be spent on harvesting and processing. In both scenarios, his earnings would still fall below the poverty threshold of PhP 72,000/family per year (PhP 93,852 in 2012 per latest data from the National Statistics Coordination Board). The cultivation of crops like abaca, rubber, coffee and cacao could have provided farmers with high potential yield. Even then, because of inadequate adoption of modern farming practices, these only allowed them to generate minimal yield and income.

3.6 The Future of Farming in BBC without Typhoon Pablo

If Typhoon Pablo did not happen, agriculture in the BBC would have remained a coconut monocrop-based farming industry with decreasing crop yield and proportionately diminishing farmers' income. The government has not demonstrated adequate efforts to introduce modern technologies that could increase coconut yield such as fertilization, salt application and replanting unproductive trees with high yielding varieties/hybrids. Under Republic Act (RA) 8048 or *The Coconut Conservation Law*, farmers may cut unproductive tall coconut trees but are required to replace these with coconut seedlings. This was not practiced in the area because of the difficulty of obtaining seed nuts of high yielding varieties or hybrid.

As the yield from old coconut trees continue to decline, the World Bank projects that the price of coconut oil, at the worst case scenario, will decrease along with prices of other tree crops (Table 6). At US$ 1,200/ton, the current price of coconut oil, which is 60% of its price in 2010, is estimated to dive to US$ 780/ton by 2020. This means that the economic plight of farmers in BBC will continue to worsen, with the exception of a few who are shifting to higher value crops and/or intensifying cropping systems in coconut plantations. By increasing land productivity through diversification and intensification, farmers will be able to cope with decreasing commodity prices to maintain or increase farm income.

Table 6. World commodity price prospect of tree crops.

(US$ cents per kilo, except coconut and palm oils, in US$/ton, all in current US$)

PRODUCT	2010	2012	2015	2020
Coconut oil	1916	1300	850	780
Palm oil	1171	900	800	715
Rubber, TSR 20	531	300	240	220
Coffee, Arabica	620	450	330	280
Coffee, Robusta	251	200	160	150
Cacao	318	260	220	200

Source: Price Forecast, World Bank, June 2011.

Chapter 4

TYPHOON PABLO: DAMAGE DONE TO CROPS

Super typhoon "Pablo", internationally named "Bopha" hit the eastern municipalities of Davao Oriental on December 4, 2012. Moving at a speed of 175 kph near the center with gustiness of up to 210 kph for six hours, it brought severe devastation to crops and property in Baganga, Boston and Cateel. As shown in Table 7 the estimated cost of damage to crops was placed at PhP 3.66 billion. Coconut trees which provided the bulk of income to the populace for over a century were almost completely wiped out. Other crops were completely damaged. Total damage to crops, livestock, buildings and infrastructures like roads and bridges is estimated at PhP 6.5 billion.

According to the Department of Agriculture (DA) Regional Field Unit-11, total damage from Typhoon Pablo in the Davao Region is estimated at PhP 30 billion; in Compostela Valley Province at PhP 13 billion, largely in banana plantations; in Davao Oriental Province at PhP 10 billion; and in Davao del Norte at PhP 6 billion. Total crop damage per municipality is shown in Table 7.

Table 7. Leading crops of the different BBC municipalities and the extent of damage by Typhoon Pablo.

	BEFORE PABLO			DAMAGED BY PABLO		
MUNICIPALITY	CROP	AREA (HA)	% OF TOTAL CROP LAND	AREA	% of CROP AREA	VALUE PhP '000
Boston	Coconut	4,570	83.00	4,204	92	329,063
	Abaca	737	13.39	737	100	51,557
	Rubber	100	1.82	100	100	4,500
	Banana & fruit trees	500	9.08	500	100	50,000
	Rice	598	10.86	590	99	14,750
	Corn	250	4.54	250	100	5,000
	Vegetables	83	1.51	83	100	5,520
	Sub-Total	**6,838**		**6,464**	**95**	**460,390**
Baganga	Coconut	36,983	94.14	33,284	90.00	2,662,755
	Abaca	1,279	3.26	1,279	100	89,496
	Rubber	500	1.27	500	100	27,000
	Banana & fruit trees	2,740	6.97	2,740	100	274,000
	Rice	1,220	3.11	600	49	15,000
	Corn	987	2.51	987	100	29,610
	Vegetables	85	0.22	85	100	5,660
	Sub-Total	**43,794**		**39,475**	**90**	**3,103,521**
Cateel	Coconut	9,695	63.72	8,919	92	1,101,300
	Abaca	869	5.71	869	100	60,851
	Rubber	700	4.60	700	100	31,500
	Banana & fruit trees	3,000	19.72	3,000	100	300,000
	Rice	3,211	21.11	2,860	89	71,500
	Corn	500	100.00	500	100	15,000
	Vegetables	80	0.53	80	100	5,320
	Sub-Total	**18,055**		**16,928**	**94**	**1,585,471**
TOTAL BBC	**All Crops**	**68,687**		**62,867**	**92**	**5,149,382**

Chapter 5

OPPORTUNITIES FOR CROP DIVERSIFICATION

5.1 Rationale

The onslaught of Typhoon Pablo created difficulties but more importantly, it also created important crossroads. The most urgent challenge is how to grow crops to produce food in order to support immediate needs. This resulted in the opportunity to formulate a diversified farming system that could help accelerate recovery and address pressing requirements in the short term, and generate higher productivity and income within the medium- to long-term.

Typhoon Pablo damaged most of the standing crops but the rich agricultural resources of BBC remain intact, ready for the cultivation of a variety of high value crops. Coconut alone, the main crop grown prior to Typhoon Pablo, has become an unsustainable means of livelihood. Crop diversification and the intensification of crops that could deliver higher income than coconut may soon materialize. This will lay the foundation for progressive rural communities in BBC, comparable to the transformed prosperous communities in neighboring provinces that have similar or inferior agro-climatic resources. In a post-Typhoon Pablo scenario, the people of BBC can hope for a better farming system and work towards attaining income levels that will lift them out of poverty.

5.2 Criteria for Crop Selection

The crops for diversification and/or integration were carefully selected to help transform the economic condition of agricultural communities in the BBC.

The following criteria were considered:

1. **Crop suitability** – crops are suitable to the agro-climatic endowments of the BBC and adaptable to anticipated changes in weather patterns resulting from climate change.
2. **High productivity and income**– crops to be planted alone or to be integrated with other crops can provide small landholders (with 2.0 to 2.5 ha) with income above the poverty threshold level of PhP 72,000/ha per year.
3. **High market demand**– crops should have good national and international market prospects and can compete under a regional (ASEAN) and global trade regime.
4. **Technology availability** – advanced technologies for high yield, productivity and income are available within the country or are accessible from neighboring countries.

5. **Food security** – crops selected and/or integrated should contribute to the food security of the province and the country.
6. **Short gestation period** – crop selection should include short duration crops to aid the early recovery of affected growers and early maturing tree crops to provide immediate income.
7. **Attractive for investments among farmers and businessmen** – crops should have potential to attract private sector investments.
8. **Farmers receptivity and familiarity** – crops should be familiar to farmers and should address long-standing misconceptions
9. **In harmony with government programs**– crops selected should be consistent with national government programs although the overall welfare of the farmers for high income should take greater precedence.

In general, the proposed crop diversification strategy should also incorporate mitigation measures to minimize the adverse impacts of extreme weather conditions brought about by climate change, such as more frequent incidence of typhoons, higher rainfall rates and greater occurrences of flooding.

5.3 Agro-Climatic Basis of Crop Diversification

The components of the agro-climatic endowment of BBC which could affect the extent and site of crop production are rainfall, slope and elevation. The types of soil have less influence in the overall crop diversification scheme as the three soil types existing in the area allow the cultivation of most, if not all crops, with only slight modifications to improve suitability.

1. **Crops suited to high rainfall** - The abundant rain throughout the year of over 4300 mm is favorable for year-round production of short maturing crops which include tropical vegetables, field legumes, rice and root crops. Crops like soybean which require dry period during harvest may not thrive in this environment. It also favors the production of long duration perennial crops for optimum growth, fruiting and/or production. These include abaca, banana, rubber, oil palm, coconut, fruit trees such as rambutan, lanzones, mangosteen and durian.

The high rainfall during four months each year plus the clay nature of the soil will require interventions like providing the fields with canals for drainage to support the production of such crops as banana, cassava, sweet potato and papaya. Rainguard is needed to allow year-round harvesting of latex of rubber. Plastic roofing may be used for high value vegetable production.

2. **Crops unsuitable with high rainfall** - High rainfall is unfavorable to the production of crops requiring lower amount of rain like Cavendish and *lakatan* banana as high rainfall favors the multiplication and spread of the diseases like Sigatoka. Other banana varieties like *latundan* and *cardab*a are less affected by the disease and can therefore be commercially grown under this high rainfall situation. The cultivation of corn is limited during the dry period. This eight-month stretch would still allow two croppings per year.

High rainfall is unfavorable to the cultivation of crops which require dry months to generate water stress, which will trigger flowering and/or fruit development following dry months. These include *carabao* mango and pummelo. Introduction of Thailand pummelo, "*Vichit*" and mango *"nam doc mai"* may solve this problem. While high rainfall has less effect on the fruiting of other fruit tree crops like mangosteen, lanzones, calamansi, however, this may trigger the increased occurrence of diseases which would adversely affect production costs.

3. **Slope limits the planting of some crops** - Intensive cultivation to grow most crops are limited to 18° slope and lower, except for lowland rice which is limited to the plains or less than 3° slope. Extensive cultivation and planting of crops in areas sloping higher than 18° may encourage soil erosion and is, therefore, not suggested under good agricultural practices.

Some crops which can be grown without land cultivation may be planted in areas that slope above 18°. These crops may also serve as land cover to reduce erosion. Crops under this category include abaca, rubber, coffee and cacao which can be grown up to 30° slope. Areas that slope above 30° should be reserved for forest cover, parks and wildlife.

4. **High elevation provides opportunities for the planting of some crops -** Most tropical crops are limited for planting below 700 masl. The availability of parcels of land in elevations of over 700 masl provides potentials for the cultivation of high elevation crops like Arabica coffee, subtropical vegetables like cabbage, carrots and fruits trees like longan. This is expected to expand the breadth of farming in the BBC to include the cultivation of crops with high demand in the domestic and export markets.

5. **Erosion and wind control** - High rainfall during the last four months of the year of over 600 mm/month can trigger serious soil erosion in sloping lands, particularly light soils. It can also trigger flooding and degradation of creeks and river banks. This would require the incorporation of crops like bamboo for erosion control, and the protection of creeks and river banks. Fortunately, bamboo is a crop with many uses other than erosion control. It is utilized in the construction of post, bamboo slats for flooring,

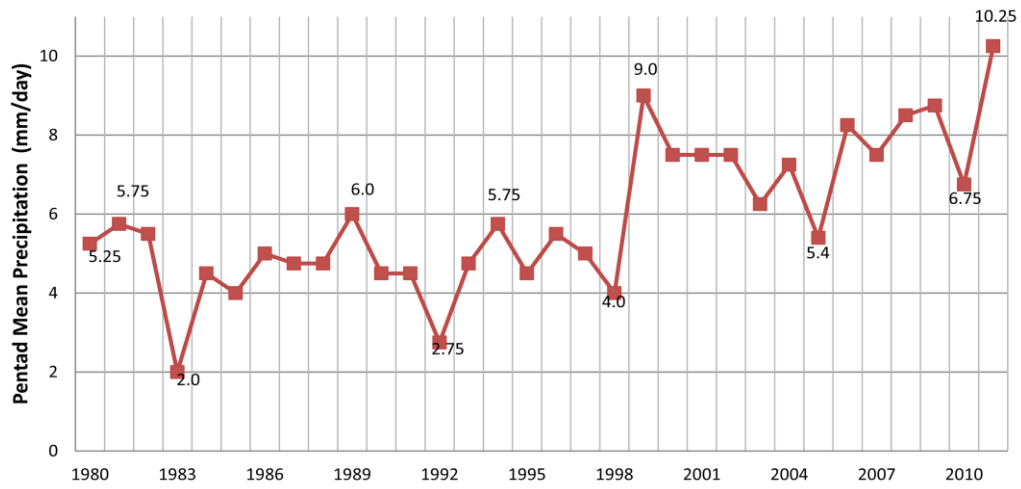
bamboo poles in fishponds and outriggers of fishing boats. The shoots are also consumed as vegetable.

The presence of moderate to strong winds during certain parts of the year would require the extensive planting of wind-break plants like bamboo, eucalyptus and other tree-break species in some areas.

5.4 Climate change mitigation and adaptation measures applied in crop diversification

Significant changes in weather patterns resulting from climate change have been observed in the BBC area recently which could affect prevailing agronomic conditions for growing of crops. An examination of rainfall data in the BBC showed that the amount of rainfall has been increasing during the past decade. As shown in Fig. 5, the mean rainfall rate during the period 1979 to 1998 (20 years) ranged from 5mm to 7 mm. During the succeeding 12 year period, however, from 1999 to 2011, the mean rainfall rate rose significantly to 6.5 to 8mm. This rainfall trend showed greater amounts of rainfall and increased in number of rainy days during the past few years.

Fig. 5 BBC Rainfall Data 1979 to 2011 (July to July)



These new weather patterns highlight the need for crops which are well suited for high precipitation and have good water holding and storing capability to abate soil erosion and help prevent siltation of rivers and waterways. Bamboo and other fast growing timber

species such as Eucalyptus are crops that can be propagated to control erosion, help mitigate overflowing of major rivers and waterway and serve as wind breaks for other commercial crops.

Other crops that can thrive under a high-rainfall environment are fruit trees like banana, durian, mangosteen and commercial crops such as rubber and cacao. With good drainage, rootcrops such as cassava and sweet potato can also be grown under these conditions and can serve as effective cover crops to prevent water logging during periods of heavy rain.

Crop diversification, through the introduction of a wider variety of crops suitable to the area's agro-climatic conditions and adaptable to changing weather conditions, helps improve the over-all resiliency of communities to climate-induced weather abnormalities by providing multiple sources of income and reducing over-dependence on traditional cropping systems.

The recent devastation of mono-cropped coconut areas resulting from a severe typhoon that may have been intensified and directed further south due to climate change is expected to occur more frequently. Dependence on mono-cropping intensifies the effects on rural incomes of both natural phenomena and plant diseases.

5.5 Selected Crops for Diversification

Having considered the unique and diversified agro-climatic conditions of the BBC and the criteria for diversification, the list of crops for diversification are provided in Table 8. These crops are divided into three groups, according to their maturity period: short-, medium- and long-term duration. Short duration crops which mature in less than nine months are expected to hasten recovery, provide sustainable food supply and early income. These may also be used for intercropping in the planting of medium- and long-term duration crops. Long duration crops are expected to potentially provide higher income in the long-term and generate productivity levels higher than before the typhoon.

To some degree, these recommendations have similarities to the recommendation in the Davao Oriental Rapid Agriculture and Fisheries Production Integrated Development (RAFPID) framework (Table 9) except that the former is expanded based on the number of crops. The advantages and disadvantages of these crops are shown in Table 10 (short duration crops) and Table 11 (long duration crops).

Table 8. Basket of crops carefully selected for diversification of the BBC.

SHORT DURATION (less than 9 months)	**MEDIUM DURATION** (up to two years)	**LONG DURATION** (over two years)
Rice Corn Cassava Vegetables Root crops (sweet potato, *ube, gabi*)	Papaya Pineapple Banana ▪ *Cardava* ▪ *Lakatan* ▪ *Bungulan* ▪ Cavendish Abaca Sugarcane (for specialty sugar)	Coconut ▪ Copra ▪ Special purposes Oil palm Rubber Cacao Coffee Fruit trees (Durian, Mango, Rambutan, Mangosteen, Guava, Avocado) Calamansi Bamboo

Prior to this survey and recommendation, the provincial staff of Davao Oriental prepared the Rapid Agricultural and Fishery Production Integrated Development (RAFPID). All the crops proposed under the RAFPID are captured in the crops selected for diversification.

Table 9. Proposed area under the Rapid Agri and Fishery Production and Income Development (RAFPID) Framework of Davao Oriental

COMMODITY	**LOCATION/AREA**			**TOTAL**
	Cateel	**Baganga**	**Boston**	
Oil Palm	4,615	51,255	11,292	67,162
Coconut	10,745	32,279	13,957	56,981
Rice	2,500	1,250	-	3,750
Cacao/Coffee	4,886	11,568	3,707	20,161
Rubber/Abaca	1,813	14,412	3,876	20,101
Sugarcane/Pineapple/ Bamboo	4,886	11,568	3,701	20,155
TOTAL (Hectares)	29,445	122,332	36,533	188,310

Source: Provincial Development Planning Office of Davao Oriental.

Table 10. Selected short duration crops, their advantages and limitations.

CROP	ADVANTAGES	LIMITATIONS	IMPACT[1/]
1. Rice	▪ Source of staple food and cash	▪ Low to medium income; require good irrigation	Medium
2. Corn	▪ Source of staple food and feeds ▪ Can be intercropped with coconut and rubber and other crops	▪ Low to medium income ▪ Require government support for good seeds and/or input provision	Medium
3. Cassava	▪ Source of staple food and cash ▪ Can be intercropped with coconut	▪ Demo on crop production and food preparation is important ▪ Require chipping machine and drying facilities for commercial used	Medium
4. Sweet potato	▪ Source of staple food, feed and cash	▪ Limited market which can be developed	Medium
5. *Gab*i	▪ Source of staple food, vegetables and cash	▪ Limited market	Medium
6. Ube	▪ Source of food and cash	▪ Limited market	Medium
7. Vegetable (Lowland)	▪ Source of food and cash	▪ Perishable	High
8. Vegetable (Upland)	▪ Provide food and income	▪ Perishable	High

Table 11. Selected long duration crops, their advantages and limitations.

CROP	ADVANTAGES	LIMITATIONS	IMPACT[1/]
1. Coconut	▪ Low investment ▪ Diversified income ▪ Potential for crop/livestock integration	▪ Long maturity period ▪ Low income unless modern farming practices is allocated	Medium
2. Oil palm	▪ Early income ▪ High income for farmers ▪ Potential for crop intensification	▪ High investment on seedlings ▪ Requires good extension services	High
3. Rubber	▪ Early and high income ▪ Potential for crop intensification	▪ High investment on seedlings ▪ Require technology training dissemination	Very high
4. Coffee	▪ Early income ▪ Can be intercropped with coconut and many other tree crops	▪ Require technology training ▪ Quality seedlings needed	High
5. Cacao	▪ Early and high income ▪ Can be intercropped with coconut	▪ Require quality seedlings, pest and disease control ▪ Access to fermentation technology is necessary	High

CROP	ADVANTAGES	LIMITATIONS	IMPACT/[1]
6. Banana *a. Cardaba* *b. Latundan* c. *Lakatan*	▪ Can be intercropped with coconut and rubber ▪ Medium high income ▪ Provide staple food	▪ Medium to high investment ▪ Requires good pest and disease control ▪ High investment	High
7. Abaca	▪ Can be intercropped with coconut and or falcata	▪ Quality seedlings is needed ▪ Require good disease control management	High
8. Fruit trees (durian, rambutan, etc)	▪ High to farm income ▪ Supplement nutrition	▪ Require good production and post-production training	High
9. Bamboo	▪ Good for erosion/flood control and aqua poles ▪ Easy to plant	▪ Training on production technology is needed	High

1/ To generate rural employment.

Chapter 6

UNIQUE FEATURES OF SELECTED CROPS

6.1 Short Duration Crops to Meet Immediate Food Supply Needs

6.1.1 Vegetable Crops

Diversified short term crops are suitable for cultivation in every farm. A production area of 1500 to 2000 square meters per family is enough to meet the immediate need for sustainable food supply. Produce from these crops shall support daily food needs while excess production can be sold to the community. The selection of these crops to meet food needs take into consideration the components of balanced nutrition or the daily requirements for energy, protein, vitamins and minerals.

Crops which are included as sources of energy and could also help reduce dependence on rice, include cassava, sweet potato, banana (*cardaba* and *latundan*), *gabi*, etc. Sources of protein include various types of beans (string beans, peanut and others). Sources of vitamins and minerals include lowland vegetables (e.g., squash, okra, *ampalaya*, eggplant, *kangkong, pechay*, etc.) The relative cost of establishing any of these short duration crops for food is presented in Table 12.

Table 12. Short- to medium-term crops: investment cost, duration to maturity and projected income.

CROP	INVESTMENT COST (PhP)	DURATION TO MATURITY (MONTH)	EST. INCOME (PhP)
1. HYV Rice	12,000	4	15,000-20,000
1. HYV Corn	16,000	4	12,000-16,000
2. Cassava	14,000	6	18,000-24,000
3. Vegetables	18,000	2	16,000-34,000
4. Papaya	16,000	6	10,000-12,000
5. Pineapple	30,000	12	18,000-25,000
6. Abaca	25,000	10	12,000-16,000

An important strategy in introducing small-scale vegetable farming is making vegetable seeds readily available to farmers. Farmers could also be provided with farm demos in strategic locations to showcase appropriate farming practices. This will help ensure food sufficiency at the village level.

6.1.2 Rice

Rice is the country's main staple crop. Demand has steadily grown by 1.8% per year in the last ten years, to about 120 kg per capita. The main driver is population, which has been growing by an average of 2% per year. Rice is regarded as a political crop, and this receives the bulk of support from the government.

Being a political crop, rice farming captures the largest portion of government funds for agriculture. Farms are provided with good irrigation, seed and fertilizer subsidies. In recent years the income of farmers derived from rice farming have fallen below the poverty threshold level. The BBC has a limited area of less than 5,000 ha devoted to irrigated lowland rice production. Among those damaged by Typhoon Pablo was the irrigation infrastructure in Cateel. Lowland rice cultivation can be expanded to the plains previously planted to coconut but damaged by the typhoon. Expanding rice production in these areas can help ensure food sufficiency in the short term.

Due to the high priority on lowland rice, irrigation facilities damaged by the typhoon should be prioritized for repair and expansion. Farmers should also be organized to access more inputs such as seeds and fertilizer from the government. Post-harvest facilities, particularly solar driers and warehouses, should also be provided. With these support infrastructure facilities, rice production in the BBC may be expanded to 10,000 ha or more.

6.1.3 Corn

BBC has wide areas suitable for corn production. These include flat lowland areas and lands with slopes below 18°. Support from the government is needed to develop and expand corn farming in the BBC. This includes the construction of farm to market roads, assistance inland preparation, and provision of good-quality seeds and fertilizer. Post-production facilities like mechanical and/or solar dryers should also be established in strategic sites to service identified production areas.

6.1.4 Cassava

The cultivation of cassava in BBC has not been significant. The crop, however, offers opportunities to these three municipalities, considering the wide areas which are highly suited to this crop. Cassava is also easy to grow, matures in six to eight months and has potentials for income as staple food or raw material for feeds and other industrial products.

This crop is grown for multiple uses - food, feeds and biofuel. Cassava (*kamoteng-kahoy*) is the third largest source of carbohydrates in the world next to wheat and rice. Among crop plants, the cassava plant provides the highest yield of food energy and is a

staple food for more than one billion people in 105 countries. It is the staple food, preferred over rice by a number of tribes in Mindanao. Cassava root is very rich in starch and contains significant amounts of calcium, dietary fiber, iron, manganese, phosphorus, potassium, vitamin B6 and vitamin C.

Cassava is usually grown as a monocrop in many areas in Mindanao. It can, however, be intercropped with coconut, oil palm and rubber during the early stages of these tree crops. Moreover, cassava can be used as a nursery crop of cacao. The key to productive cassava production is the selection of recommended varieties and the use of recommended cultural management practices. Another positive aspect of cassava production is the simple set of procedures involved e.g., preparation of planting materials, planting, cultivation, harvesting, chipping, drying and storage (Fig. 6).

Fig. 6. Steps in the production of cassava.

Cassava can play an important role in meeting the immediate food supply needs of residents in the BBC area. As a staple food crop, cassava matures in as early as six months, just two months longer than rice and corn. Unlike rice and corn, cassava is much easier to grow and can be produced year-round. Various preparations of cassava for human consumption are shown in Fig. 6a. **See *Annex A*** for more information on Cassava production and application.

Fig. 6a. Various preparation of cassava as human food.

Other than vegetables, rice, corn and cassava, banana particularly the *cardaba* and *latundan* varieties can be used to supplement rice. Banana can be eaten raw. Moreover, there are several food preparation options for *cardaba*- boiled, sweetened, barbecue and others. This makes banana a potential crop to address immediate food supply needs.

6.2 Crops with Current High Demand to Provide High Income

A careful evaluation of crops suitable to the agro-climatic conditions of BBC shows several long-duration crops with great potential to augment the income of famers. Moreover, these crops also show added productivity when intercropped with short-term crops. These crops, when grown alone or mixed with other crops, can potentially provide farmers with returns that are higher than the government's poverty threshold level of PhP 70,000 per year.

Table 13. Investment cost, duration to maturity and projected income of selected long duration crops.

CROP	INVESTMENT COST (PhP)		DURATION TO MATURITY (Yrs)	NET INCOME RANGE AT MATURITY (PhP/YR)
	ESTABLISHMENT	FIRST THREE YRS		
1a. Coconut[1/] for copra	30,000	125,000	4.5 – 6.0	25,000 – 40,000
1b. Coconut for special use[2/]	90,000		3.0 – 4.0	90,000– 150,000
1. Oil palm	35,460	110,000	2.2 – 3.0	80,000 – 140,000
2. Natural Rubber	32,450	77,500	4.5 – 6.0	60,000 – 160,000
3. Banana *(Cardaba)*	35,000	80,000	1.5 – 2.0	45,000 – 60,000
5. Cacao	40,000	95,000	3.0 – 3.5	35,000 – 80,000
6. Coffee[1/]	40,000	95,000	2.5 – 3.5	20,000 – 40,000
7. Abaca [3/]	40,000	75,000	3.0 – 4.0	40,000 – 60,000
4.0 Fruit trees[4/]	35,000	80,000	3.0 – 4.0	40,000 – 80,000

1/ Using modern farming practices.
2/ Coconut for young fruits, sweet juice, sweet aromatic juice and coco sugar.
3/ Recommended to be intercropped with other HY crops for added farm productivity and income.
4/ Include durian, mangosteen, lanzones, rambutan, etc.

The agro-climatic requirements of these crops and where they are suited in the BBC are shown in Table 14.

Table 14.The agro-climatic suitability of crops with current high income.

CROPS	AGRO-CLIMATIC REQUIREMENTS	WHERE TO PLANT IN BBC
1. Coconut	Drained plains to sloping field; slope of 25° and below, elevation of 700 masl and below; preferably not above 30° slope.	From coastal drained plains to hilly fields of not more than 700 masl.
2. Oil palm	Deep moderately to highly fertile soil, plains to slope of not more than 18° in slope,; rainfall of not less than 1800 mm evenly distributed/year.	From plains up to 18° slope below 600 masl. BBC have more than 50,000 ha under this category.

CROPS	AGRO-CLIMATIC REQUIREMENTS	WHERE TO PLANT IN BBC
3. Rubber	Plains to sloping fields and mountain moderately highly fertile soil up to 700 masl with no extensive mist formation; annual rainfall of 1400 and above.	From plains to hilly (less than 25° slope). Fields for reforestation of not more than 700 masl.
4. Banana	Drained plains to hilly (18° slope) of not more than 800 masl, rainfall of not more than 2000 mm, evenly distributed.	From plains to hilly (< 25° slope) areas; elevation of not more than 700 masl.
5. Cacao	Rainfall of 1250 to 3000 evenly distributed; altitude = 300 – 1200 masl need shade for first four year old reduce sunlight; 75% of sunlight – reduce 25% as it mature. Both crops and shade can be planted at 3 x 6 m.	Flat plains to hilly areas as intercrop to coconut and other tree crops at low elevation, or as monocrop in high elevation.
6. Coffee	Well-drained soil, high organic soil, high and well-distributed rainfall, daily sunshine of six hours and above, planting of mist and moderate wind.	From plains to hilly land of over 700 masl as intercrop to coconut, falcata, rubber and other timber plantations. Arabica at 800 masl and above.
7. Abaca	Well-drained soil high in organic soils; well distributed rainfall and no strong winds; otherwise wind-breaker trees shall be provided.	From 300 to 1000 masl; in low to moderately high elevation as intercrop to coconut, rubber, falcate and other crops
8. Fruit trees	From plain to sloping field of not more than 18° well-drain and fertile soil	From plains to 700 masl

6.2.1 COCONUT USING MODERN FARMING PRACTICES

6.2.1.1 The Demand

Before Typhoon Pablo, coconut provided BBC farmers with low yield, productivity and income. It was primarily due to a few of factors - lack of government support and poor farming practices. Majority of the coconut trees were old and unfertilized, and provided very low productivity.

Coconut has immense national and international market due to its multiple uses. Its main product, coconut oil (CNO), is used in food preparation as vegetable oil, industrial materials, and biofuel. Fresh nuts are raw materials for desiccated coconut, coconut milk and coconut water. By-products include geo-textiles, soil conditioner, medium for vegetable/cutflower production and charcoal which have a growing market.

Philippine statistics indicate that the average yield of coconut in the country is only 1,200 kg of copra/ha per year. In the BBC, average yield is marginally highest at 1,250 kg/ha per year (Bureau of Agricultural Statistics (BAS), 2012). Considering the coconut farm size of smallholders in the country of 2.5 ha and the price of copra of PhP 20/kg, the income of a coconut farmer is only PhP 60,000/farm per year - below the poverty threshold level of PhP 72,000/ha per year. Hence, poverty is common in areas where coconut is grown as a monocrop. Few coconut farmers integrate other crops like *cardaba* banana, lanzones, cacao and mangosteen to supplement the low income from coconut.

6.2.1.2 Modern Production Practices

Many innovative practices can increase coconut yield and/or productivity to three or more times than the current yield level in the country. This will enable farmers to earn income above the poverty threshold level. Among these are the application of Mykovam, salt, multi-nutrient fertilization (MNF), and the replanting of old unproductive trees with hybrid coconut varieties. Mykovam is an environment-friendly microbial application discovered at the University of the Philippines, Los Banos (UPLB). It allows coconut trees to generate parts of their nutrient needs from the air through microorganisms. These are techniques that are applicable in BBC but have not been promoted aggressively.

a. Salt application. Most farmers do not fertilize their coconut trees. Consequently the yield of good varieties stagnate at 10 kg of copra/tree or 1,230 kg/ha per year at a population of 123 plants/ha. According to Philippine Coconut Authority (PCA) researchers Magat and Canja (2009), the application of salt at the rate of three kg/tree in year one, two kg/tree in year two and one kg/tree in year three and onward, increases the yield of coconut from 10 kg/tree per year to 12.5 kg/tree in year one and 15 kg/tree in year two and onward. The increase in yield provides the farmer an additional net income of PhP 12,000/ha per year, after deducting the cost of salt application.

b._Multi-nutrient fertilization (MNF). Magat and Canja (2009) noted that the yield of coconut without MNF stagnate to 100 kg of copra/tree per year. The application of MNF or 14-5-20 of NPK plus chloride, sulfur and boron at the rate of three kg in year one, two kg in year two, and one kg in year three and onward increases the yield/tree of 15 kg or copra in year one, 20 kg in year two and 25 kg in year three and onward. This provides the farmer an increase net income of PhP26,400/ha in year 2 and PhP 50,200/ha in year 3 and onward.

c. Planting /Replanting of hybrid coconut seedlings. More than 50% of coconut trees in the Philippines including Davao Oriental are old and senile. This is the major reason behind the low yield of only 1200 kg/ha per year. One way to increase the yield is to replant old trees with high yielding varieties. The PCA has developed 15 high yielding hybrids of coconut under the World Bank-financed loan implemented in the 1980-1990s. Hybrid plants become productive early, about four years after planting compared to seven years for the tall selections. Hybrids also generate yields of 150 to 200 nuts/tree per year versus the traditional varieties which produce only 60 nuts/tree per year. Unfortunately, the PCA has abandoned hybrid seed production, citing the high cost of seed production as the reason. The difference in the cost of production of hybrid seeds and traditional seeds is only P20.00 but the benefits are tremendous – three times more yield for 30 years. Malaysia found out that while the cost of producing hybrid seeds is high, the high yield of the hybrid plants more than justifies the investment for the production of hybrid seed nuts (Fig. 7). Malaysia is currently producing hybrid seed nuts using the parent materials and technology developed by PCA as a tool to help increase the yield and income of smallholders in their country. Hybrid seeds are distributed to smallholders on a plant-now-pay later basis. In view of this Malaysian experience, the PCA is now considering the revival of the hybrid seed production. It is recommended that BBC be selected as a pilot area.

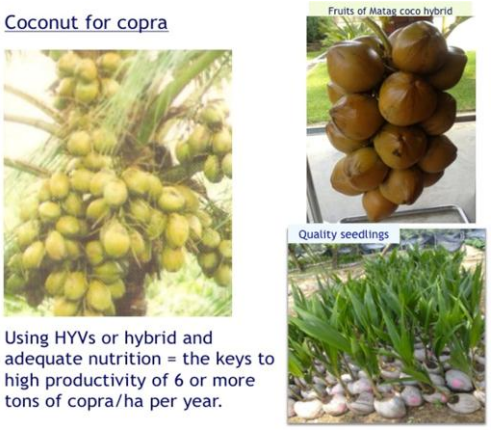


Fig. 7. A productive coconut tree planted from a hybrid seed nut.

d. Planting of special coconut varieties for high income. While coconut is grown largely for copra, cultivation of special coconut varieties can double the income of smallholder coconut growers as in the case of Thailand. The special coconut varieties occupy almost 100,000 ha in Thailand. Malaysia has followed by distributing 50,000 seed nuts annually to farmers. These special coconut varieties include the following:

- *NamWam*. A selection of dwarf variety producing small nuts with sweet water and with tender meat. This selection is commercialized to cater to the tourism industry.
- *Nam Hom*. Produces sweet and aromatic juice and tender meat. It is commercially grown for both the domestic and export markets in Thailand and has reached Europe and USA as health food.

- *Maphrass Tan*. A group of coconut selections with soft and long inflorescence high sap yield and high concentration of sugar. It is used in commercial coco sugar production. This is being used in Thailand's special food industry.
- *Maphran/Kathi*. A coconut selection where all nuts produce the *macapuno* type and is commercially grown for confectionaries.
- *Nam Hom x Maphran/Kathi hybrid*. A high yield producing aromatic *macapuno* which became very popular but expensive in Thailand's supermarkets. It is now being exported to many countries.

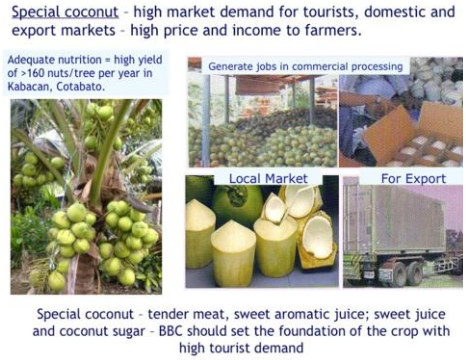


Fig. 8.A prolific sweet and aromatic juice coconut; preparation for local and global export market.

Since *Nam Wan*, *Nam Hom* and *Maphrass Tan* are available in the Philippines, they may be multiplied and grown in the BBC in preparation for the positioning of Davao Oriental as a major tourist destination, for the domestic and export markets (Fig. 8).

e. Intercropping of coconut. Another strategy to increase the productivity of coconut farms is to intercrop with other high value crops. The productivity of the intercrop depends on the kind of crop, the age, population density of both coconut and the intercrop and the level of cultural management being carried out.

Crops like cacao, banana and fruit trees such as lanzones and mangosteen perform well as intercrops when coconut is grown at a population of 70 to 80 plants/ha. Higher coconut density may become too shady for these crops.

The application of modern farming practices to increase the yield and productivity of coconut can provide farmers in the BBC with higher income. Empowering farmers to use these practices may require a multi-agency approach involving the national government, LGUs and NGOs.

Multi-storey coco-based farm. Situated at Baguio District, Calinan, Davao City, 500 MASL, the farm (a) of Mr. Marcos M. Dumandan is planted to hybrid coconut at 100 trees/ha with durian and lanzones. These tall coconut and fruit trees created below a favorable environment for productive growth of hybrid cacao Arabica coffee and pepper.

Fig. 8a. Multiple storey coconut farm with intercrops (Fruit Trees, Coffee, Cacao & Coffee)

6.2.2 OIL PALM

6.2.2.1 High demand – globally and domestically

Oil palm is a tree from which palm oil is derived as its main product. This is primarily used as vegetable oil and is highly demanded in both the global and domestic markets for various reasons as shown in Figures 9, 10 and 11.

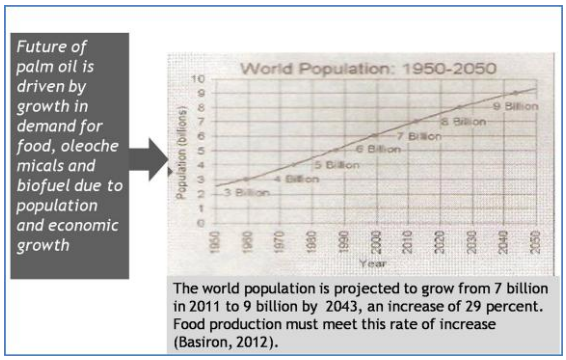


Fig. 9.The high and increasing demand of palm oil due to increasing population.

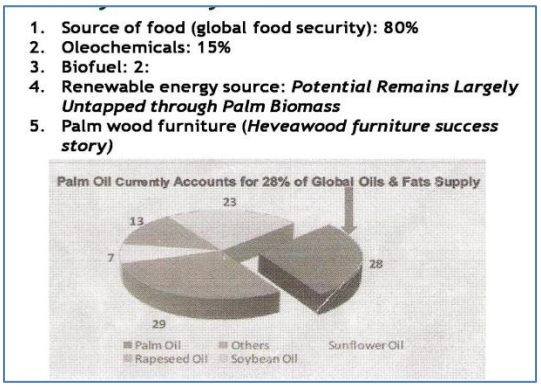


Fig. 10.The high and increasing demand of palm oil due to the discovery of many uses.

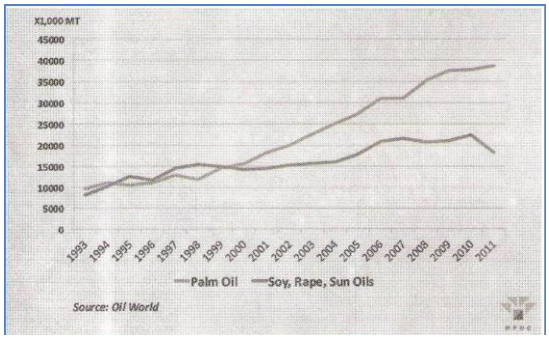


Fig. 11.The high and increasing demand of palm oil due to increasing dependence as vegetable oil, replacing other vegetable oils.

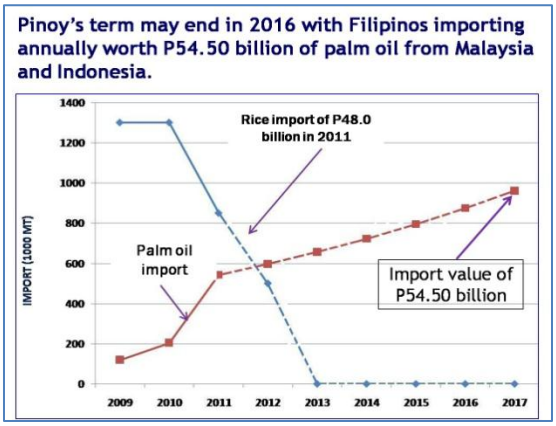


Fig. 12.Philippine importation of palm oil and rice since 2009 and projected till 2017.

Oil palm became the most important vegetable oil globally with consumption doubling in the last 30 years, and projected to double in the next 10 years. China and India are the largest consumers of palm oil importing 40% of global production.

Domestically, there is increasing demand for palm oil as vegetable oil. Since 2009, the Philippines' importation of oil palm has increased. In 2012, the Philippines imported from Malaysia 500,720 MT of palm oil valued at PhP 27.52 billion. This is expected to double to PhP 54.5 billion by 2017.

6.2.2.2 Becoming an Important Crop in Mindanao

Due to high demand for palm oil, a once neglected product in the country, the oil palm tree is becoming an important crop in the Philippines which many farmers would like to plant. Oil palm is highly competitive and provides one of the highest incomes compared to other vegetable oil crops (Table 15).

Table 15. Percent share of palm oil compared to other vegetable oil of the world.

Crops	Oil Yield/ha	% Share of World Production
1. Palm Oil	6.20	35
2. Soybean	0.40	27
1. Rapeseed	1.50	15
2. Sunflower	1.20	8
3. Others (coconut 3%)	-	15
TOTAL		100

Moreover, oil palm is one of the easiest crops to plant; easier than planting and maintaining coconut or fruit trees. Oil palm can be successfully planted in fields which are difficult to farm with traditional Philippine crops including reforestation crops. It has exhibited high productivity even in occasionally flooded fields, reclaimed marshlands, cogonal or grass and brushlands, second growth forest lands and left-over timber farms. It provides farmers with regular bi-weekly income from the 3rd to the 25th year. The features of oil palm trees compared with coconut are shown in Table 16. The oil palm tree matures early, has high vegetable oil yield and can provide farmers with four times more income than coconut. Moreover, the post-harvest handling of oil palm fruits, known as fresh fruit bunch (FFB) is easier than coconut. All that farmers need to do is to harvest and bring the FFB to milling plants where they are paid the price of the FFB. In the case of coconut, farmers need to go through a tedious process of copra meat extracting and drying, which is laboriously expensive and difficult during rainy days.

Table 16. Comparative growth and productivity of coconut and oil palm.

PARAMETERS	COCONUT	OIL PALM
1. Duration to first fruit harvest (yr)	5.5	2.2
2. Duration to maximum productivity (yr)	7.5	5.0
3. Oil yield (t/ha)	1.2	4.5
4. Est. Farmers net income PhP/ha per year	>18,000	>80,000
5. Productive life-span (yr)	>25	>25
6. Area planted in the Philippines	3,560,000	73,460

Both Coconut and Oil Palm are covered by the mandate of PCA under the law (PD 232).

Small landholders with 2-3 ha who apply the standard production technology can generate a fairly decent income of at least P 7,000 per month as shown in Table 17. With this income, a small-hold farmer crosses the government's poverty threshold level of P70,000 annually.

Table 17. Projected income of oil palm farming among smallholders at 6 to 25 years at a price of PhP 6.00/kg of FFB.

PARAMETERS	PRODUCTION LEVEL		
	HIGH	MEDIUM	LOW
Production f FFB (t/ha/yr)	35	25	20
Price /ton (PhP)	6,000	6,000	6,000
Gross Income	210,000	150,000	120,000
Less Expenses	42,000	35,000	32,000
Net Income:			
Yearly (PhP)	168,000	115,000	88,000
Monthly (PhP)	14,000	9,583	7,333

Table 18. Projected income of oil palm farmer at a price of PhP 3.50/kg of FFB.

PARAMETERS	PRODUCTION LEVEL		
	HIGH	MEDIUM	LOW
Production f FFB (t/ha/yr)	35	25	20
Price /ton (PhP)	3,500	3,500	3,500
Gross Income	122,500	87,500	70,000
Less Expenses*	34,000	25,000	8,000
Net Income:			
Yearly (PhP)	88,500	62,500	52,000
Monthly (PhP)	7,375	5,208	4,333

* Assuming no land rental and interest on loan.

At present, the Philippines has only 73,000 ha planted to oil palm compared to over five million ha in Malaysia, ten million ha in Indonesia and almost one million ha in Thailand. Small landholders in these countries obtain high income to overcome poverty, create prosperous rural communities, send their children to college and construct good houses as shown in Fig. 13. Indonesia is now ahead of the Philippines in overcoming poverty using oil palm farming as one its key agribusiness strategies.

Fig. 13. Typical house of small landholders in Indonesia before and after engaging in oil palm farming. *From: *Janurianto, A. 2011. Paper presented during the International Conference and Exhibition of Palm oil, Jakarta, Indonesia, May 11 to 13, 2011.*

6.2.2.3 Wide Area Suited at BBC

BBC has wide areas suitable for oil palm farming. The suitable areas are limited only by elevation and slope but not by rainfall and soil. Oil palm is productive in plains where evenly distributed rainfall is 1,800 mm and above. It can also thrive in deep and moderate fertile soils from sea level of up to 600 masl. Oil palm performs better than coconut in swampy but drainable lands and in cogonal fields. It performs best in flat lands or plains, although high yield is obtained in slightly sloping land of 18° slope and lower.

6.2.2.4 Investment Consideration

The cost of investment in oil palm farming is at PhP 127,000/ha covering the cost of land preparation, planting and maintenance for three years. Return on investment is achieved in seven years. Among smallholders whose farms need no extensive land preparation for plantings, associated expenses may just be the purchase of planting materials. At current prices, this is approximately PhP 28,000/ha. Farmers can also use the areas between rows of oil palm for the production of various food and cash crops while waiting for the oil palm trees to mature. Half of the oil palm plantations in the world are grown by small-holder farmers.

6.2.3 NATURAL RUBBER

Currently, natural rubber (NR) enjoys high demand and high prices in both domestic and world market. The demand for NR is projected by Rubber Asia to reach 36 million tons by 2020 (Fig. 14). Smit (2005) projected an increase in demand for traditional rubber consuming countries such as the United States, Japan and the BRICs(Brazil, Russia, India and China) (Fig. 15).

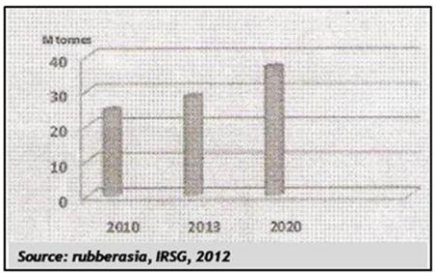


Fig. 14. Past, present and projected demand of NR.

The high demand for natural rubber is expected to provide farmers with high income. More than 90% of the rubber plantations in the world are in the hands of smallholders, providing them with revenues above poverty threshold levels.

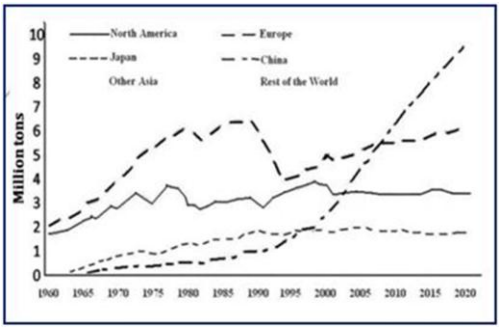


Fig. 15.Past, present and projected consumption of rubber in major

6.2.3.1 Problem of expansion besets rubber producing countries in Asia but not in the Philippines

The five leading countries in NR production shown below can no longer substantially expand their NR production to meet global demand due to the shortage of land and/or manpower for harvesting rubber latex known as tapping (Table 19). Indonesia has available wide areas that are suitable for NR production and an abundance of labor but its farmers prefer to plant oil palm. Vietnam will reduce its area from 850,000 ha to 800,000 ha to give way to the establishment of rubber-based industrial zones. Malaysia is limiting its rubber production area to1,200,000 ha due to labor shortage.

The Philippines has a unique opportunity. It has more than one million ha of vacant grass and brushlands suitable for rubber cultivation. It has an ample supply of labor as it currently has one of the highest unemployment rates in the ASEAN region. In BBC, the impact of Typhoon Pablo resulted in wide open areas suitable for rubber farming. This can provide high farm income of three to four times the income from coconut in the pre-Typhoon Pablo scenario.

Table 19. Area and production of rubber among the five leading producers and the Philippines (compiled by Pamplona, 2012).

COUNTRY	AREA('000 ha)	PRODUCTION ('000 MT)
1. Thailand	2,434	3,056
2. Indonesia	3,414	2,755
3. Malaysia	1,248	1,200
4. Vietnam	850	930
5. India	635	920
6. Philippines	165	153

6.2.3.2 Recent major technological breakthroughs in rubber

There are new technologies in rubber production which can push the income of farmers much higher and make rubber farming very competitive. Among these technologies are:

a. **Discovery of high yielding – latex-timber clones (HY-LTC) hybrids**. These hybrid varieties increase yield by two to three times over the yield of traditional clones – RRIM 600 (Table 20). Other than providing high latex yield, the trees provide substantial lumber when they are no longer productive. These clones are now available in the country and are currently being subjected to performance trials in Cotabato and Agusan del Sur and are reportedly showing very promising results.

Table 20. Comparative latex and timber yields of a traditional clone, RRIM 600 and some HY-LTC recommended by the Malaysian Rubber Board for planting (2012 to 2020).

CLONE	DRY RUBBER YIELD (kg/ha/yr)	WOOD VOLUME YIELD AT 14 YEARS OLD(M2/tree)
1. RRIM 600	1,344	0.43
2. PB 350	1,862	1.20
3. RRIM 2023	2,822	0.81
4. RRIM 2025	2,700	1.87
5. RRIM 2027	3,036	1.30
6. RRIM 3001	>3,000	0.84

b. Component technologies – for shorter immaturity period from 7 to 4 years or less.

- This means earlier and higher income for farmers and investors as shown in Table21.
- The component technologies for early maturity include using HY-LTC, quality planting materials (QPM), employing good cultural management practices, and providing plants with adequate fertilization (Fig. 16).

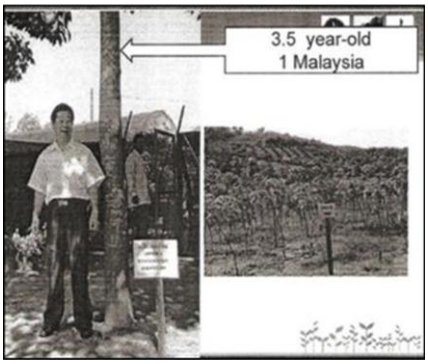


Fig. 16. Photo from a Malaysian newspaper featuring a rubber clone which is "tappable" within 3.5 years from planting.

Table 21. Yield and income from a hectare of adequately managed rubber farm using component technologies for early maturity and high yield.

YEARS AFTER PLANTING	DRY RUBBER YIELD (kg/ha per year)	ESTIMATED GROSS ANNUAL INCOME (PhP)
1 – 4	-	-
5	1,200	96,000
6	1,300	104,000
7	1,500	120,000
8	2,400	192,000
8 to 25	3,000	240,000

Fig. 17.Commercial trial of latex-timber clones in Carmen, Cotabato.

6.2.3.3 Improved intercropping scheme. This allows farmers to produce staple/cash crops between the rubber rows without affecting the growth and productivity of rubber trees. As demonstrated in Fig.18 – rubber trees can be intercropped with corn *(left)*, banana *(right)* and many other crops.

Fig. 18.Some crops which can be intercropped profitably between the rows of rubber.

6.2.3.4 Component technologies for wind fastness. The component technologies developed in the plains of Vietnam include the use of suitable clones, use of plants with well-developed root system, basal fertilization of rock phosphate, planting in silt-pit bed, pruning and guying.

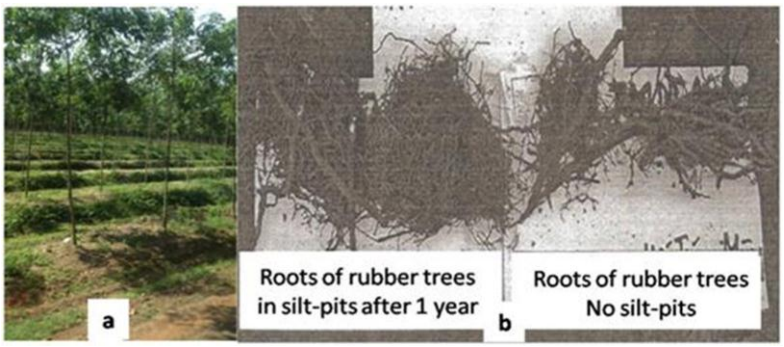


Fig. 19.Providing silt-pit in rubber farms promotes extensive and deeper rooting and the rapid growth of sturdy plants which are resistant to strong winds.

Fig. 20.Formative pruning is carried out at immaturity stage and regular top pruning at maturity stage as a mitigation measure against strong winds.

Fig. 21.Rainguard allows all-weather tapping of trees.

6.2.3.5 All-Weather tapping technology thru rainguard. This allows all-weather tapping, even on rainy days, increasing yield by as much as 20% (Fig. 21). This technology will be useful in BBC given its high annual rainfall of 4,300 mm/year.

6.2.3.6 Competitive advantages of rubber

Fig. 22.Dr. M. Supriadi of IRR presented during the IRTEC '12 – some evidences of how rubber farming improved the lives of small landholders in Indonesia – farmers constructing new concrete houses, owning cars, motorcycles and sending their children to college.

Rubber provides higher income than most crops. Income from two to three ha can provide a farmer money enough to buy nutritious food for his family, build a good concrete house, buy basic household needs, like a TV and refrigerator, a four-wheel vehicle and support the cost of the education of his children in college (Fig 22). Rubber provides high timber yield at the end of its life-span. A rubber plantation with HY-LTC can generate as much as 600 cu. m/ha of good timber in 14 to 20 years with a market value of at least PhP500,000. It is also labor intensive (Fig. 23), needing one farm laborer for every two hectares. Jobs are also created in nursery, primary processing and manufacturing (Fig. 24). Rubber has shown its capacity to overcome poverty and bring about prosperity.

Fig. 24. In Vietnam, upstream and downstream rubber industries provide jobs to thousands of women.

Fig. 23. Job Generation at rubber farms. As a reforestation crop, rubber provides employment from (a) land preparation, (b) planting and cutting of trees (c) for rubber wood. The biggest employment comes from rubber latex extraction when the trees are at 5 to 25 years old.

6.2.3.7 Financial requirement and farming techniques

The cost of establishing a hectare of rubber plantation during the first year in grassland and fields previously grown to upland crops is PhP 32,450. About PhP 20,000 of this amount goes to the purchase of good-quality planting materials. The maintenance cost from the first to the sixth year averages PhP 14,000 per year for a total of PhP 116,450.

In situations where a farmer plants rubber in an area planted to corn, banana and other crops, his major expenses in shifting to rubber farming would only be the cost of planting materials, estimated at P20,000/ha.

6.2.3.8 Where to plant in BBC

The largest portion of the BBC's total available agricultural land is most suitable for rubber cultivation. It is not limited by the agro-climatic parameters in BBC, soils and rainfall. It can be planted at not more than 700 masl. It can be planted at high slope. It can also be used for agro-reforestation in sloping areas. In places of moderately fertile soil or even in eroded soils not suitable for other commercial crops, rubber can still deliver high yield provided it is adequately fertilized.

6.2.3.9 A possible model for the BBC: The Makilala rubber expansion program

Makilala is an upland municipality in North Cotabato with a highly rugged terrain at the foothills of Mt. Apo along the North Cotabato border. In this town, most farmers are tilling crops in grasslands and brushlands. The rich volcanic soil, however, enabled a few enterprising farmers to plant rubber. To help farmers improve their income, the Makilala local government implemented an integrated rubber development project which sought to transform at least 10,000 ha of rugged grass and brushlands into rubber plantations by planting five million rubber trees. To implement the project, the local government allocated PhP 25 million for the purchase of approximately one million rubber seedlings for distribution to interested small landholders with ready areas for planting.

6.2.3.10 Financial Risk Analysis

As an international commodity, the price of rubber is affected by the world economy and changing world prices. Evolving rates may lead to lower values than what is quoted in this study. The use of inferior production technology can also result yield that is lower than the level this study has projected.

6.2.4 BANANA

Banana is the country's most important fruit crop in terms of area, production output and exports. It is the country's second biggest agricultural export after coconut oil. The bulk of the country's banana exports are produced in the Davao Region including Davao Oriental.

The common varieties of banana include cavendish for export market, *saba* or *cardaba* as supplemental staple food or raw material for banana chips. Other varieties such as *lakatan*, *latundan* and *seniorita* are also becoming prominent due to their high demand in the local market.

Banana can be raised as a monocrop and as a component of intercropping system. Monocropping is generally practiced in large-scale when the primary purpose is the production of high quality fruit for export. Intercropping is practiced in small farms where household labor and other resources are utilized. An example is the intercropping of banana between the rows of coconut trees planted at a distance of 3.5 x 7.0 m. Banana is also used as a nurse crop of coffee, cacao and fruit crops like durian and mangosteen.

Banana is a potential alternative crop in the BBC since it is easy to grow and has a short gestation period. It also commands high demand as food and as raw material for banana chips for export. The agro-climatic condition of the BBC is highly suitable for *cardaba* production. It can be grown in plains with good drainage and even in hilly areas sloping below 20°. It is planted using suckers, corms or tissue culture plantlets. Tissue cultured planting materials are recommended as they are free from pests and diseases like corn borer, nematode, and viral diseases such as Bunchy top and fusarium wilt.

Introduction of cavendish banana in BBC may face some challenges due to the high rainfall in the area which is highly favorable to the spread of Sigatoka disease. Other varieties such as *lakatan* or *latundan* may be less susceptible to this disease and can be propagated in the area.

6.2.5 CACAO

6.2.5.1 Demand

Fig. 25.A highly productive cacao tree from an outstanding variety.

Cacao has a high demand in both the domestic and global markets. It is projected that by 2020, there will be a 1,000,000 MT shortage of cacao. The Philippines may overcome this shortage by expanding

existing local cacao production. The Philippines consumes about 30,000 to 40,000 tons of beans which is about eight times the local production of 10,000 tons. The Philippine is a minor producer of cacao in spite of wide areas suitable for the production of this crop.

6.2.5.2 Production

The technology in cacao production is well-developed. The occurrence of pests and diseases make the cacao production more challenging than other crops. The crop is largely intercropped with coconut. In 2009, the Philippines harvested an area of 9,500 ha compared to Malaysia's 21,000 ha; Papua New Guinea's 128,000 ha and Indonesia's one million ha. There Isa big potential for the Philippines to expand its existing cacao production. Among the strategies to increase cacao production is to promote the intercropping of cacao in coconut areas. The coconut-cacao crop mix is presently being done in many areas in Mindanao including the western part of Davao Oriental. This intercropping system is also viable in the BBC.

The key to success in cacao production is the use of good quality and disease- free planting materials. Budded hybrid such as UF 18, BR 25, PB 123, K2 and K9 are recommended. These are readily available in commercial nurseries. Proper shading at the time of planting and the immature stage of the plant is necessary. It is important that before planting materials are secured, the field for planting is prepared and the shade plants established six months ahead. The shade plants include cassava, *madre de cacao*, banana and coconut. Recommended plant density is 1,000 plants when intercropped with coconut, and 1,600 as monocrop. Many asexually propagated cacao are available in commercial nurseries in Davao City.

The trees mature in two years but with limited yield of up to four years. The pods are harvested, opened and placed in fermentation boxes. The key to a quality bean is fermentation. Fermented and dried beans are sold to traders.

6.2.5.3 Investment consideration

The initial investment cost is about PhP 35,000/ha. Yield at four years and beyond can average three to four tons of wet beans/ha. At existing prices, this can generate a gross income of PhP 100,000/ha and a net income of PhP 35,000/ha.

6.2.5.4 Financial risk analysis

Low yield can result from low level of fertilization and occurrence of pests and diseases. To overcome these risks, good-quality planting materials should be provided to growers with corresponding technical assistance in basic farm management, pest and

disease management, post-harvest handling and proper harvesting techniques.

6.2.6 COFFEE

This crop is grown worldwide by small landholders, providing moderately high income with relatively short gestation period. The major varieties include robusta, arabica, excelsa and liberica. The first two account for the bulk of production, contributing 70% and 20% respectively, of the Philippines' output. It has wide range of adaptability including high elevation of over 1000 masl.

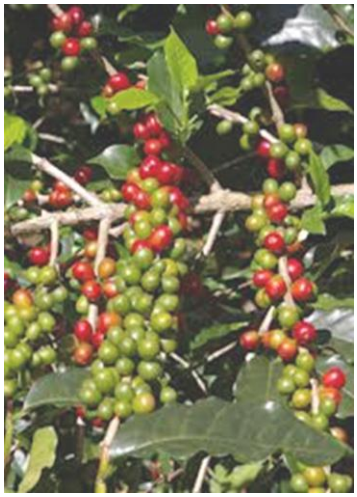


Fig 26.A prolific Arabica coffee suitable for cultivation in higher elevation.

National production is low, much below the local requirement, thereby making the country a net importer of coffee. The national yield of almost a ton of green beans/ha per year is below the normal yield potential of the crop and can be improved by using high yielding varieties and adoption of modern production practices. Robusta is mainly grown in lowland areas while Arabica -- which produces an aromatic coffee that commands a premium price -- is suited to higher elevations.

The Philippines, once a major exporter of coffee, is now a major importer of this commodity which has a huge demand in the export market. In 2010, the Philippines consumed 65,000 tons of coffee beans of which only 20,000 was sourced locally. Half of this volume came from Mindanao. Nestle promotes the planting of coffee through a buy-back scheme. The company also provides training for farmers and technicians, and sells good-quality and reasonably-priced seedlings to coffee growers.

6.2.6.1 Production

The production technology of coffee is well-developed. The crop is commonly grown as a monocrop in the lowlands or as intercrop to coconut, rubber, banana in the highlands. Two years after planting, the first harvest occurs at minimal yields and increases to higher yields in four to five years. Yields can vary from 500 to 2,000 kg/ha with an average of 1,000 kg/ha per year.

6.2.6.2 Investment consideration

The investment cost is about P50,000/ha. This covers the cost of seedlings and land

preparation. The use of quality planting materials is one of the keys to higher productivity.

6.2.6.3 Financial risk analysis

Major risks to profitability include the use of low quality planting materials, low seedling survival and low fertilization. To overcome these risks, propagation of good quality planting materials from accredited nurseries and provision of techno-training to growers on basic farm management and pest and disease management should be undertaken.

6.2.7 ABACA

It is one of the crops introduced in the BBC before Typhoon Pablo which farmers found easy and profitable to grow. Based on interviews with farmers, many are interested to plant this crop or expand existing abaca production sites. According to provincial agricultural data (2012), at least 3,000 ha were planted to abaca in the BBC just before Typhoon Pablo hit the area. Pre-Typhoon Pablo total abaca production hectarage in the three BBC municipalities are: 1,279 ha in Baganga, 737 ha in Boston, and 869 ha in Cateel.

Fig. 27.(a) A healthy and productive abaca plantation, (b) the stripping of abaca manually and (c) the use of machine.

All these municipalities have vast potential areas for the expansion of abaca cultivation as a monocrop or as an intercrop to other crops, including falcata. Abaca can also be intercropped with coconut, rubber and other tree crops. Shading at planting is important to prevent excessive heat as the crop cannot tolerate high light intensity during its early establishment stage. Partial shade to reduce sunlight is needed at the maturity stage. This makes abaca a perfect intercrop to increase land productivity and add to the income generated from tree crops such as coconut, rubber, falcata, fruit trees and others.

The key to successful abaca production for sustainable high yield is the use of disease-free planting materials. Cultural practices should also include efforts to control the disease particularly bunchy top and abaca mosaic (Fig. 27).

The Fiber Industry Development Authority (FIDA) is recommending a distance of 2.5 x 2.5 m in planting using either sucker, corm or tissue culture seedlings for a population of 1,600 hills/ha. Lower population is expected when abaca is intercropped with tree crops like coconut, rubber and falcata. The first harvest is expected at six to seven months after planting. Thereafter, harvesting is carried out at least twice a year. Value-adding offers much potential to increase income from abaca farming. Farm or village-level value-added processing can be done to produce handicraft, ropes, specialty paper and furniture (Fig.28).

Fig. 28.Some commercial uses of abaca.

6.2.8 BAMBOO

Bamboo is a special crop for a special purpose. It can be used as a wind-breaker and can reduce soil erosion when planted in hilly areas and along river banks. It can be produced as slats with many building applications for poles, for propping banana and for aquaculture. The shoots can also be consumed as vegetable.

There are different species of bamboo with may be commercialized in the BBC. Emphasis should be placed on:

- *Giant bamboo.* This grows to a height of 20 m, internodes of 20-40 cm and a diameter of 12-19 cm. Poles from this species are being used as posts, bridges, scaffolding, fish cages, etc. Slats are suitable for housing needs, furniture, and other aquaculture and agriculture applications.
- *Kawayan tinik*. Grows to about 25 m, diameter of 10-20 cm and intercrop of 40-60 cm. It is used in house construction, for fencing and in aquaculture.
- *Boho.* Grows to a height of 20 m, internodes of 1440 cm and 8-10 cm in diameter. Its commercial uses include utilization as propping poles in banana plantations.

The most common method of propagating bamboo is by nodal cuttings for which a simple nursery facility such as shade, plastic bags and source of water are needed. Otherwise, planting materials are available in commercial nurseries from PhP 20-30 per

seedling. Bamboo can be grown in difference elevations, from sea level to 1500 masl, in well drained, seed loam to clay loam soil. It is planted at a distance of 7 x7 m. Bamboo stems mature within three to five years.

The cost of establishment could range from PhP 18,000 – PhP 25,500. The estimated annual gross income from a plantation of 1,500 to 2,000 poles ranges from PhP 75,000 to PhP 225,000. This is based on the assumption of 150 plants or mat/ha. Aside from its high income potential, bamboo is commonly planted as a boundary crop along the river, curbs or hilly areas that are prone to erosion.

6.2.9 Other Crops.

Aside from these major long-duration crops, there are other crops that are also suitable for cultivation in BBC. These include other fruit trees such as durian, lanzones, mangosteen and rambutan which can provide potentially high income as these have high demand in the local and regional markets. These crops are discussed in detail in ***Annex B***.

6.3 Risk factors involving production of medium to long-duration crops

While market opportunities are abundant, the production of these medium to long-duration crop alternatives can be affected by a number of internal and external risk factors, which may affect overall income and profitability. Some of these risk factors include:

6.3.1 Market – Most of these crops are globally-traded commodities and local production competes with similar products from other countries. Thus, market prices are subject to a wide range of influences, including prevailing global demand-supply situations.

6.3.2 Pests and diseases – Pest and disease infestation, if not controlled properly, could significantly affect production levels. For example coco-scale insects (*Aspidiotus destructor sign.*)are damaging coco trees in South Luzon Region. Sigatoka and fusarium viruses are destroying banana farms in Compostela Valley, Davao Norte and Caraga Region.

6.3.3 Climate and weather – Typhoon Pablo may have changed the rainfall pattern in the BBC and could affect crop establishment, production and management. Climate changed-induced weather extremes could also substantially alter farm productivity levels.

6.3.4 Political and social – Strong local political will is needed to counteract aggressive lobbying from militant organizations. For instance, anti-oil palm lobby groups are actively disrupting plantation expansion in other regions.

6.3.5 Technology – Traditional farming practices in coconut production (e.g., use of inferior planting materials, no fertilization) are not applicable and should not be applied to these high-value crops. Application of appropriate technologies are required for these crops (i.e. oil palm, rubber, banana, cacao, coffee, abaca) to achieve high productivity levels and compete in the global marketplace.

6.4 Crop Suitability by Municipality

6.4.1 **Baganga** has wide plain areas below 3° slope previously planted to coconut with an estimated total area of 6,000 ha. These areas are best suited for many crops like lowland rice, corn, cassava, oil palm, bananas and vegetables. It also has wide areas (about 8,980 ha) within 3 to 8° slope which are suited for many crops like corn, cassava, oil palm, rubber, coconut and pineapple. The municipality has 17,712 ha between 8 to 18° slope suitable for cultivation of tree crops like rubber, coffee, cacao, coconut, oil palm, abaca, fruit trees, etc. The wide areas of 42,457 ha are between 18 to 33° slope and are suited to crops which would require zero or minimum tillage. These include rubber for agro-reforestation, abaca, fruit trees such as mangosteen, durian, lanzones and coconut. It is not suitable for intensive cultivation of corn, upland rice and oil palm.

6.4.2 **Boston** has a small area of plain (761 ha) suited for lowland rice. It has more than 10,000 ha between 3-18°slope that are highly suitable for cassava, banana, oil palm, rubber, abaca, banana and fruit trees. The municipality as a wide area of 8,695 ha between 8 to18^{o}slope which are suited to coconut, oil palm, rubber, coffee, cacao, and fruit trees. Areas from 18 to 30° slope can be planted, under zero or minimum tillage, to coffee, cacao, fruit trees and rubber. It is not suited to oil palm.

6.4.3 **Cateel** has wide plain of 4,000 ha between 0 to 3° slope suitable for lowland rice, corn, oil palm, banana, cassava and fruit trees. The area of almost 5,000 ha found between the 8 to18^{o} slope are suitable for such crops as corn, cassava, coconut, oil palm, rubber, banana, coffee and cacao. Some of the wide areas between 30 to 50° slope may be selectively grown to zero tillage cultivation of rubber for agro-reforestation, coffee, coconut, abaca and some fruit trees. It is not suited to oil palm and coconut.

The following table (Table 22) is a quick reference for crop suitability in the BBC.

Table 22. Suitable Crops per Municipality

Gestation/Elev	Boston	Baganga	Cateel
Short term, -up to 1000 MASL	Rice, corn, tropical vegetables, root crops, legumes	Rice, corn, tropical vegetables, root crops, legumes	Rice, corn, tropical vegetables (including chili), root crops, legumes
- above 1000 MASL	Subtropical vegetables	Subtropical vegetables	
Long term, -up to 1000 MASL	Coconut, rubber, oil palm, cacao, fruit trees, abaca, banana	Coconut, rubber, oil palm, cacao, fruit trees, abaca, banana, pineapple	Coconut, rubber, oil palm, cacao, fruit trees, abaca, banana
-above 1000 MASL	Arabica coffee, abaca, forest trees, sweet banana	Arabica coffee, abaca, forest trees, sweet banana	Arabica coffee, abaca, forest trees, sweet banana

Chapter 7

MARKET OPPORTUNITIES

As discussed in the earlier sections of this study, the impact of recommended short- and long-term crops in addressing immediate food requirements and farmers' incomes have been evaluated. This section presents a rapid scan of existing market conditions for these crops in the BBC as well as neighboring demand centers in adjacent regions. It also provides an overview of market opportunities in selected local (within Mindanao) and export markets.

7.1. Over-all market conditions for each suitable crop

7.1.1 Short-duration crops (below 9 months)

7.1.1.1 Rice. Being the main staple food in the country, there will always be a high demand for good quality rice to help supply the requirements of the province and neighboring areas such as Bislig in Surigao del Sur. A number of municipalities in the western part of Davao Oriental notably Banay-banay and Lupon are widely known as the major sources of rice in the province, which are being marketed in the region as the Banay-banay variety. Consumers are generally unaware that BBC has larger tracts devoted to rice production than Lupon and Banay-banay combined. Upland rice production through an upland variety called *Peria* can be expanded and promoted to niche markets in the Davao Region. With the increasing popularity of health products, this upland unpolished rice variety can be marketed as such.

7.1.1.2 Corn. BBC has traditionally produced yellow corn in limited scale and is practically devoid of white corn. Open pollinated white corn can be introduced in the area to supplement short-term food requirements. With expanded production, white corn can be sold in neighboring Bislig and other areas in Surigao del Sur and Agusan Norte.

7.1.1.3 Cassava. Cassava can be grown to augment short-term food requirements. Other varieties can also be introduced for different markets or uses. Cassava as raw material for feeds and alcohol can be explored under direct marketing tie-ups with feedmillers and consolidators.

7.1.1.4 Vegetables. Prior to Typhoon Pablo, vegetable production in the BBC was limited and a lot of the area's vegetables were sourced from Mati, Compostela Valley or Davao Norte. Shortly after the typhoon, vegetable production was introduced in the BBC as a short-term food sufficiency initiative. In the short-term, existing vegetable production in the area will supply its own requirements. Excess

production can be sold to neighboring areas such as Bislig and other towns in Surigao del Sur.

7.1.1.5 Others (Gabi/Taro, Ube/Purple Yam, Citronella, Chili). In the short-term, these crops particularly *gabi* and *ube* can supplement as staple food. Expanded production of these crops can be pursued with excess production meant for neighboring markets. Other crops such as chili can be sold as niche products to regional buyers and consolidators. Processed chili powder from Cateel was introduced in a recent food fair in Manila.

Fig. 29 Chili plant, fruits and finished product

7.1.2 Long-duration crops

7.1.2.1 Bananas. *Cardaba* and *latundan* are the leading banana varieties grown in the area. In the immediate term, production of these varieties can supply local demand. With good-quality and sustainable volume, these fruits can be marketed in nearby demand areas like Mati and Bislig. Excess supply of *cardaba* banana can also be sold to banana chip processors in Mati and San Isidro towns.

7.1.2.2 Other Fruits (Durian, Mangosteen, Rambutan, Lanzones) When commercially produced in the area, these can substitute procurements from the region, and even supply the table fruit requirements of Mati, Bislig in Surigao del Sur and Nabunturan in Compostela Valley and other neighboring towns.

7.1.2.3 Sugarcane. High-quality muscuvado sugar is highly coveted in the local and export markets for its health benefits. A group in Sultan Kudarat Province (Sultan Kudarat Muscovado Farmers and Millers Corporation or SKMFMC) currently produces muscovado sugar which it sells in the domestic and international markets.

7.1.2.4 Coconut. Called the tree of life, this palm contributes the widest range of end products, from fruits, sap, water, leaves, midribs, husk, shell, and trunk: fresh fruit, juice, toddy, sugar, cream/milk, vegetable, feeds, health drink, copra, oil, food wraps, brooms, head gear, buttons, kitchen utensils, charcoal, activated carbon for filters, lumber, etc. Scientific studies reveal that with appropriate cultural practices, yields could be increased significantly. Planting the variety for a specified end product is also significant in attaining efficiency in harvesting, processing and product quality. A variety may be good for copra and oil production, but may not be suitable for fresh fruits, sugar production or toddy. The domestic and international markets for majority of the products are highly lucrative, but demands careful consideration for planning and implementation. ***See Annex C*** for list of products derived from coconut tree.

7.1.2.5 Oil Palm. According to the RAFPID report, close to 70,000 ha are highly suitable for cultivation of oil palm in the BBC cluster. The group of prominent businessman Manuel Pangilinan in partnership with Indonesia's Indofood conglomerate has made initial discussions with the provincial government, and has scanned the area for a possible large scale oil palm plantation investment project. Plans include establishment of plantation and processing plants. In the neighboring province of Agusan del Sur, Agumil Corporation and Filipinas Palm Oil Plantation (FPOP) have been developing plantations and putting up processing plants in the Visayas and Mindanao the past two decades. In 2012, the Philippines imported 500,720 tons of palm oil valued at PhP 27.5 billion. This is projected to reach 1 million tons or PhP 54.5 billion by 2017. Domestic needs alone clearly indicate the huge market for oil palm.

7.1.2.6 Coffee. The Philippines, once an exporter of coffee, is now a major importer of this commodity which has a high demand in the export market. In 2010, the Philippines consumed 65,000 tons of beans, of which only 20,000 was sourced locally with half coming from Mindanao. Nestle, which imports 60% of its requirements encourages the planting of coffee with a buy-back assurance. It also provides training and seedlings to coffee growers.

7.1.2.7 Cacao. Currently, cacao has high demand both in the domestic and global markets. The Philippines consumes about 30,000 to 40,000 tons of beans, about eight times the local production of 5,000 to 10,000 tons. Among the key buyers in Mindanao are Nestle Philippines, Commonwealth Foods, Kennemer Foods and US-based Mars Chocolate, one of the world's leading chocolate manufacturers.

Mars is sourcing a substantial part of its cacao requirement from the Philippines and has existing supply agreements with members of Davao City-based Cacao Industry Development Association of Mindanao, Inc. (CIDAMI) which was established with the support of the U.S. Department of Agriculture (USDA). CIDAMI's membership is composed of farmers, cooperatives, marketers, traders, entrepreneurs and nursery operators. Mars Chocolate established the Mars Cacao Development Center (MCDC) in Davao City and provides training on production of planting materials, nursery management, field cultural practices, and post-harvest processing in order to produce cacao beans that meet its strict quality standards.

Dutch company Kennemer Foods International (KFI) also supplies cacao beans to Mars Chocolate and is also keen on developing the cacao industry in Mindanao. Kennemer has partnered with TVI Resource Development Philippines Inc. (TVIRD)for the establishment of a joint agri-enterprise for cacao production in Zamboanga del Norte. KFI president Simon Bakker recently expressed the company's long-term commitment to develop the cacao industry in the Davao Region through contract growing arrangements with interested growers.

Kennemer Foods, in partnership with the Department of Agriculture (DA) and the local government of Davao Oriental is helping rehabilitate cacao-producing areas damaged

by Typhoon Pablo. The company has reportedly budgeted PhP 5.3 million for this project.

Davao-based agribusiness firm Puestespina Farms is also supporting cacao production in the province by providing good-quality planting materials and establishing market linkages with local growers.

7.1.2.8 Natural Rubber. There is currently high demand of natural rubber (NR) consequently high price in both the domestic and world markets. The demand for NR is projected by Rubber Asia at 36 million tons by 2020 with higher demand projected in the traditional rubber consuming countries such as USA and Japan and emerging markets in the BRICs- Brazil, Russia, India and China.

Thailand, Indonesia, Malaysia, Vietnam and India, the five leading countries in NR production, can no longer substantially expand their NR production to meet global demand due to the shortage of area and/or manpower for harvesting rubber latex, or tapping, except for Indonesia, which still has wide areas suitable for NR production and abundant availability of labor. This presents a unique opportunity for the Philippines which has more than one million hectares of idle grass and brushlands suitable for rubber cultivation, ample supply of labor but has one of the highest unemployment rates in the ASEAN. The BBC in particular has wide open land suitable for rubber farming. This is expected to promote high farm income of four times the income from coconut before Typhoon Pablo.

7.1.2.9 Abaca. There are 14 fiber processors spread across Mindanao. One of the biggest processors is the Davao Rope Factory based in Agdao, Davao City. Local fiber trading is aggressively carried out by three grading/baling establishments, six buying stations and 153 abaca traders. All these industry participants are registered, licensed and monitored by the Fiber Industry Development Authority (FIDA). Philippine abaca is exported to major markets such as the United States, United Kingdom, Germany, Canada, Netherlands, France, Japan, India, Malaysia, China, Taiwan and others. Abaca production in Davao Oriental is currently sold to local traders in Davao City. Mindanao hosts the biggest pulping plant in the world, the Newtech Pulp Inc. located in Balo-i, Lanao del Norte with a rated capacity of 75 MT a day. Local production cannot fully supply all of this plant's raw materials and the company imports abaca fiber from Ecuador at an annual average of 400 MT.

7.1.2.10 Bamboo is highly valued for its wide applications in agriculture, construction, furniture and aquaculture. A Japanese firm is setting up a bamboo processing facility in North Cotabato to produce tiles, boards and other building materials. Already, the local business chamber is spearheading the production of planting materials to supply the plant's poles requirement. Bamboo is also preferred for propping poles in banana plantations and fish cages. Both activities are currently programmed for the BBC. Typhoon Pablo has demonstrated another need for bamboo in the BBC- wind breaks. Further studies should review the varieties and planting methods appropriate for this application.

7.2 Indicative markets

Short-duration food crops will mostly be for local consumption, especially initial harvests. As production volumes increase, these can be consolidated and traded to neighboring municipalities and regional urban centers. Large processors of cassava are expected to have their own post-harvest facilities in the area. For fruit trees, fresh produce are expected to be consumed locally, replacing in-shipments from Davao, Mati and Bislig. Investors in rubber, cacao and coffee will be interested to establish post-harvest facilities, even processing plants in BBC. Oil palm fresh fruit harvests will initially be processed in existing mills in Agusan. As the area planted reaches 3,500 hectares, processors will seriously consider setting up milling operations in BBC. The recent declaration to develop Davao Oriental as tourist destination opens vast opportunities for special coconut varieties. As for traditional varieties, the local copra market for processors within the Davao Region remains viable. Competitiveness can be maintained through increase in yield and improved post-harvest facilities. Specific markets and indicative buyers for each crop are discussed further in ***Annexes D and E***.

Chapter 8

PROMOTING CROP DIVERSIFICATION AND MODERN FARMING PRACTICES

8.1 Information Dissemination for a Paradigm Shift

Typhoon Pablo has shed light on many new opportunities that are now bringing hope for better socio-economic conditions in the BBC for the following reasons:

1. The rich agro-climatic resources are still intact and provide a platform for crop diversification and integration for high yield, productivity and income.
2. The uprooting of damaged coconut trees facilitates crop diversification to include crops with higher potential income than coconut such as oil palm, banana, coffee, cacao and rubber.
3. In case a farmer decides to plant coconut, higher yielding varieties or hybrids should be recommended.
4. Crop diversification through intercropping could enhance land efficiency, productivity, income and food security when staple food crops such as corn, cassava, vegetables are integrated with coconut, oil palm, rubber and other tree crops.

Greater opportunities are open for BBC farmers to complement crop diversification with modern farming practices for much higher yield, productivity and income. Experiences in advanced agricultural countries and other regions of the Philippines shows that crop diversification coupled with the application of modern agricultural practices maximize the benefits of crops with high potential yields.

To apply modern agricultural practices, there is a need to prepare the mindset of farmers towards entrepreneurship development and technical skills training and in the long-term, possible facilitation for financial assistance. There is a need to correct and overcome serious misconceptions about agriculture that is prevailing among farmers and technicians in the BBC:

1. That fertilization and/or salt application of coconut trees will make the plant dependent on these inputs and the coco plants will no longer be productive than before once the input application is stopped. Plants require proper nutrition for higher crop yields and productivity. In most cases, the benefits of high yielding varieties or hybrids can only be maximized with adequate nutrition.

2. That oil palm and other commercial crops make the soil infertile in the long run. This is not true as application of adequate fertilization in oil palm and other

crops like corn and banana for decades did not reduce soil fertility. High rates of fertilization of cavendish banana in Davao del Sur of over 42 bags/ha per year made the soil fertile for the sustainable production of this crop. Adequate fertilization and irrigation of coconut hybrids in Brazil resulted in very high productivity of 400 nuts/year compared to only 60 nuts/year in the BBC.

Therefore, it is very important that farmers and local technicians in the BBC have the correct understanding of the growth behavior, nutritional and climatic requirements, and the practices needed for high productivity farming activities.

8.2 Scheme for Introducing the Alternative Crops for Diversification

Seeds of most vegetable crops, rice, corn and banana can be accessed through the DA's regular seed distribution program. It is important that local technicians gain access to these inputs and provide intensive training to farmers on proper farming practices for these crops. The succeeding discussions focus on four major long-duration crops proposed for the diversification program: Coconut, Oil Palm, Natural Rubber, and Cacao.

8.2.1 COCONUT

8.2.1.1 Coconut for copra

Information through its Regional Manager indicates that the Philippine Coconut Authority (PCA) shall make available to Davao Oriental 10,000 seed nuts within 2013.These are seed nuts of tall coconut for copra which becomes productive in seven years. No early maturing varieties or hybrids are available with PCA. Starting 2014 and onward, PCA has programmed 20,000 nuts for Davao Oriental, the bulk of which will be for BBC. The current program of PCA is no different from the program before Typhoon Pablo.

Fig. 30. Seedlings of coconut hybrid for distribution to small landholders in Malaysia.

The BBC LGUs should convince PCA that starting 2014, it should supply farmers with high yielding and early maturing varieties like the *Tacunan Green Dwarf* which matures in 3.5 years and produces yields of two to four times higher than the traditional variety (Fig. 29). PCA needs to revive the production and distribution of these hybrid seed nuts by reinstating hybrid seed nut production activities in its stations in Zamboanga City and Carmen, Cotabato.

The LGUs may also consider generating funds to purchase hybrid seed nuts to augment the limited supply of PCA. Hybrid seed nut production from private farms such as Hijo Plantation and Ayala seed farm may be contracted for this purpose.

8.2.1.2 Coconut for special purposes

It is suggested that each of the three municipalities endeavor to secure and establish a parent seed farm of coconut for special purposes. These include coconut for aromatic sweet juice with tender meat and for coconut sugar production. The tender meat sweet juice coconut is available at PCA in Zamboanga City and some farm private growers in Central Mindanao. The sweet juice coconut and the coconut for sugar production may be purchased from private nurseries. These will lay the foundation for the production of special coconut varieties that can cater to the expected high demand of tourists and health conscious individuals. Each municipality may begin with a seed nut garden of one hectare for each of three kinds of special coconut varieties.

8.2.1.3 Promoting high coconut yield and income

In addition to the planting of early maturing, high yielding coconut hybrid, two complimentary strategies should be promoted to attain high coconut yield. These are applications of salt and multi-nutrient fertilizer (MNF). In some discussion with technicians and farmers, there appears to be a misconception on the use of salt and MNF. Technicians and farmers believe that the application of these inputs will make the coconut dependent on their application so that when application of these inputs is stopped, the tree will no longer produce nuts. This misconception should be overcome through information dissemination, establishment of production demo in government land or farmers' model farm in strategic areas. Localized and annual field day should be carried out to view the demo. The PCA and or the LGUs should spearhead the demo. Farmers in the community and surrounding barangay should hold annual farmers' harvest festivals to view the positive effects of proper input application. Prizes and awards should be given to best performing adopters.

Strategies to allow farmers to readily access inputs like salt and MNF should be put in place by the LGUs. Local technicians also need to monitor whether these farmers are applying the correct and right amount of inputs.

Integration of other crops with coconut should be promoted through techno-training and techno-demo activities. These include intercropping of high value

crops such as cacao, coffee, cassava, banana, as well as cash crops like corn, cassava and vegetables.

8.2.2 OIL PALM

8.2.2.1 Adoption of the Central Mindanao LGU Model. The successful promotion of the cultivation of oil palm by LGUs in Central Mindanao may serve as model for the province of Davao Oriental, the BBC in particular, in promoting oil palm farming.

The LGUs in Central Mindanao which include many municipal governments and the provincial governments of Cotabato, Maguindanao and Sultan Kudarat successfully promoted the expansion of oil palm production among smallholders. The LGUs assisted small landholders to plant their idle lands or convert low income crops to oil palm through a plant-now-pay later program. This was part of the LGUs' strategy to help small farmers shift from traditional farming to high-value crop production.

Funds to purchase F1 hybrid oil palm seedlings were sourced from the LGU budget allocation, grants from DA and other government agencies including the Priority Development Assistance Fund (PDAF) of congressmen and others. Seedlings were purchased from accredited nursery operators who were also required to provide pre-planting training to farmers. Only farmers who underwent proper training and prepared his area for planting were given seedlings.

8.2.2.2 The Case of North Cotabato LGU Oil Palm Expansion. The province has been successfully conducting its oil palm seedling distribution program for eight years. In 2012 it budgeted P30 M to buy 140,000 OP seedlings and distributed these to small landholders who planted in over 1,000 ha. Other municipal LGUs replicated this approach and distributed seedlings to smallhold farmers covering a total area of 2,500 ha.

A Provincial Palm Oil Technical Working Group was organized to advise the provincial government on the technical aspects of oil palm farming. Incentives were also provided to successful farmers. The provincial LGU also facilitated marketing arrangements with existing palm oil mills in Sultan Kudarat and Maguindanao.

With the continuing expansion of production areas in the province, a local entrepreneur partnered with a Thai investor (Univanich Group) to put up a milling plant in Carmen town. The plant, which will be operational by next year, is

expected to provide hundreds of jobs and generate more economic activities in the province.

8.2.2.3 Readily available Market for Would-be Oil Palm Growers in BBC. In a meeting with Mr. S.K. Tan, Chief Executive Officer of Filipinas Palm Oil Plantation (FPOP) in Rosario, Agusan del Sur, he expressed that the company welcomes prospects of buying and milling of FFBs from BBC in the next four to six years. Currently, Filipinas oil is replanting many old oil palm trees and in the process, the company's milling capacity is low allowing the buying and milling of FFBs from other sources such as the BBC. Agumil Plantation in nearby Trento town in Agusan del Sur will operate on wider capacity for the next ten years. Another Canadian group of investors is reportedly putting up an oil palm plantation and an oil mill in La Paz, Agusan del Sur. This may likewise be a potential market for prospective oil palm growers in the BBC.

8.2.3 NATURAL RUBBER

The excellent agro-climatic conditions of the BBC coupled with a focused strategy for high rubber yield and productivity can bring high income to farmers and create prosperous communities in the area. The successful strategies in Malaysia, Indonesia, Thailand and Vietnam in promoting highly-productive rubber production could serve as models that could be replicated in the BBC:

1. Procurement of quality high yielding planting materials – the hybrid-latex timber clones;
2. Training and dissemination for adoption of superior production management techniques – this include planting in properly drained fields, adequate weeding, pruning, correct tapping techniques, proper collection of latex and primary processing;
3. Training of farmers and technicians in crop integration particularly at the immature stage to provide the farmers with income during the immature stage and added income during the mature stage;
4. Training of tappers to ensure proper tapping for high latex yield and for long years of the productive life-span of the rubber trees.

8.2.3.1 Securing Good-Quality Planting Materials. It is recommended that procurement of quality planting materials of high yielding clones like PB 260, USM 1 and the Malaysian recommended clones (PB 350, RRIM 2025, RRIM 3001) be done in nurseries with scion groves of these clones.

8.2.3.2 Training of Would-be Nursery Operators. The LGU should source and allocate funds to train nursery operators who should be encouraged to put up rubber nurseries in the different communities of BBC. The training should give emphasis on the knowledge and skills in producing quality seedlings, budding and after care of budded plants.

8.2.3.3 Training of Farmers on Production Management and Latex Harvesting. The training should equip the farmers and tappers with applicable knowledge and skills in production management particularly latex harvesting or tapping and primary processing.

8.2.4 CACAO

The ideal site for cacao production is an area with well-drained soil. The soil and rainfall conditions in the BBC are favorable for cacao production. Most cacao growing areas are located in sites within 300 masl, although cacao production can be found in higher elevations.

Farmers should be trained on the proper management of the crop particularly on the aspects of adequate fertilization, pest and disease control. Proper post- harvest handling is also needed to produce good-quality beans which are required in the market.

8.3 Strategies for Accessing Good Quality Planting Materials

An important element to effectively promote any crop diversification effort is the introduction of good quality planting materials for the recommended alternative crops. The following table presents appropriate strategies to help ensure that good quality planting materials for each crop are successfully obtained for distribution to growers.

CROP	STRATEGIES
a. Coconut	- Procure seed nuts from Philippine Coconut Authority (PCA) - Contract private coconut seed nut farms to produce hybrid planting materials (e.g. Hijo and Ayala farms) - Put up BBC (LGU) coconut nurseries in strategic areas - Procure seed nuts of special coconut varieties and establish LGU seed nut farm in BBC - Link with private seed nut farms re: seed-nut production for BBC -

CROP	STRATEGIES
b. Oil Palm	- Buy from private/accredited commercial nurseries in Central Mindanao/or Agusan and distribute to farmers thru Plant Now Pay Later (PNPL) schemes - Encourage private nursery operators to establish satellite facilities at BBC for easier access to seedlings and technical support - Encourage private investors to carry out out-growership with technical support and buy back production
c. Rubber Coffee Cacao Fruit trees	- Buy from private accredited commercial nursery and distribute through PNPL schemes - Establish LGU (Municipal/Barangay) nurseries with corresponding budwood gardens nursery - Encourage private commercial nurseries to establish satellite nurseries in BBC.
d. Banana Pineapple Abaca	- Procure from private nurseries or existing plantations - Request FIDA to provide abaca planting materials - Establish LGU (Municipal/Barangay) nurseries
e. Short duration grains, root crops and vegetable	- Source out from DA, state universities and other government agencies - Establish of LGU nurseries for specific crops - Buy from and/or establish partnerships with private input suppliers

Chapter 9

CONCLUSIONS AND RECOMMENDATIONS:

As discussed in the previous sections of this study, Typhoon Pablo completely devastated BBC's agricultural production areas and cut off most of the areas' main source of livelihood - monocrop coconut farming. In the aftermath of the typhoon, the residents and LGUs of the BBC were confronted with two difficult challenges – (1) in the short term, the need to provide food and immediate income for early post-disaster recovery; (2) in the medium- to long-term, the need to rehabilitate damaged production areas and restore sources of income by introducing alternative crops. This paper examines various options to address these major challenges and recommends a holistic crop diversification approach that meets the immediate needs of affected growers and builds a platform for the long-term rehabilitation and development of the BBC's agricultural sector.

Given this crop diversification framework, the following important strategies are strongly recommended:

(1) In the immediate term, crop diversification efforts should focus on introducing short-term food crops to address urgent food supply and income requirements. Rice, corn, cassava and vegetables are the easiest and most viable crops to plant. Provincial and municipal LGUs should, therefore, work closely with and maximize existing government, foreign donor and NGO initiatives to initiate production of these food crops to provide livelihood to affected growers.

(2) To rehabilitate damaged coconut areas, LGUs are encouraged to work closely with the PCA to prioritize the distribution of high-yielding or hybrid seed nuts for coconut replanting. Since hybrid seed nuts are in limited quantities, the LGUs in partnership with the PCA, should explore innovative options to access more of these improved coconut varieties through tie-ups with private seed farms.

(3) For remaining coconut trees, fertilization using salt and multi-nutrient fertilizer (MNF) and/or Mykovam should be promoted to growers. Intercropping existing coconut trees with short-term crops such as corn, vegetables or cassava as well as other commercial crops like cacao, coffee and banana should be introduced to provide growers with additional income.

(4) Alternative commercial crops such as rubber, oil palm, *cardaba* banana, other fruit trees, abaca should be introduced to growers. To effectively introduce these alternative crops, access to good-quality planting materials should be made available to growers through the establishment of LGU nurseries or partnerships with private nursery operators or tissue-culture laboratories.

(5) The provincial and municipal LGUs should undertake an extensive information dissemination campaign to promote these alternative crops to growers. This campaign includes conduct of technology transfer training, establishment of techo-demo sites in strategic areas, cross-visits by growers to other production sites and capability building of local technicians.

(6) LGUs should also support existing and prospective private investors undertaking or planning major agribusiness projects in the BBC. Existing investors include the Kennemer Group and Puentespina Farms (cacao) and Dizon Farms (banana) while prospective investors include the Manuel Pangilinan-Indofood Group (oil palm). LGUs could assist these private investors in identifying potential production sites and prospective contract growers or suppliers.

(7) The provincial and municipal LGUs should also formulate an integrated multi-year-crop development program building on Davao Oriental's Rapid Agriculture & Fishery Production Integrated Development (RAFPID) Framework as a long-term rehabilitation and diversification framework. This would entail soliciting funding commitments from national government agencies such as the Departments of Agriculture (DA) and Agrarian Reform (DAR) and possible funding and technical assistance from international donor agencies and NGOs.

The crop diversification program should also be presented to the private sector for possible support and to attract potential investments. For effective implementation, a full-time professional management team may have to be organized to undertake the various components of the program.

(8) Other important recommendations include:

a. Completion of the Cateel-Compostela-Montevista national road (approx. 65 kms) and improvement of the peace and order situation along the route to provide faster transport access between the BBC and the Davao Region;

b. Immediate repair of damaged bridges connecting BBC to Mati to facilitate normal transportation access within the province;

c. Complete rehabilitation of the Cateel Irrigation System to support rice production and expansion;

d. Rehabilitation of damaged farm support infrastructure such as farm to market road, small irrigation system, post-harvest facilities and trading centers and markets;

e. Continuous clearing of debris, especially of damaged and fallen coconut trees to prepare land for agricultural production as well as provide materials for housing (re)construction;