Ref. Ares(2026)5114853 - 20/05/2026

PRODUCT SPECIFICATION

GEOGRAPHICAL INDICATION PROTECTION SOCIETY OF KAKAO BERAU *(MPIG Kakao Berau)* BERAU REGENCY

ABSTRACT

Cacao (Theobroma cacao L.) is one of flagship plantation commodities in Berau Regency, East Kalimantan Province, having a strategic role in public economy. The development of cacao plants was initiated in Merasa hamlet, Kelay District circa 1987. It then expanded to Teluk Bayur, Sambaliung, Gunung Tabur, Segah, and Tabalar Districts in Berau Regency. Cacao clones mostly cultivated by communities in the central area are Sulawesi-1 and Sulawesi-2 clones, constituting the results of side grafting or top grafting on old plants which mostly originate from hybrid seedlings planted in 1980s. These clones are national flagship clones designated by the Minister of Agriculture under Decisions Number: 695/Kpts/SR.120/12/2008 and 1695/Kpts/SR.120/12/2008. Soil in Berau Regency is generally dominated by red-yellow podzolic (Ultisol) type. In general, the soil types consist of Regosol (Inceptisol), Alluvial (Entisol), Peat/Organosol (Histosol), Podzolic (Ultisol), Latosol (Oxisol), Lithosol (Entisol), Mediterranean (Alfisol), and Rendzina (Mollisol). The average year-round daily air temperature ranges between 25.92 - 28.01 °C, with the highest one at 33.34 °C and lowest one at 22.48 °C.

'Kakao Berau' powder has a rich, characteristic cocoa aroma and flavour, free from any foreign odours or tastes. The powder retains the sensory profile of Berau cocoa, characterised by a strong cocoa aroma (score 6–7), moderate bitterness (4.5–6.0), balanced acidity (2.0–4.25), moderate astringency (3.0–4.5), and subtle roasted, nutty, and light fresh-fruit notes. Off-flavours such as woody, smoky, or putrid notes are absent or negligible (scores 0 to –1), reflecting clean post-harvest practices. These organoleptic scores are obtained through cocoa cupping carried out by the Indonesian Coffee and Cocoa Research Institute (Puslitkoka) using the internationally recognised ICCO cocoa sensory evaluation protocol.

'Kakao Berau' exhibits a fine texture, with a maximum shell content of 1.75% (weight/weight). Its colour ranges from deep brown to other natural cocoa shades, reflecting the inherent characteristics of Berau cocoa beans and the processing methods applied locally. 'Kakao Berau' powder maintains a balanced water content of no more than 5% and contains of ≥20% cocoa butter using local hydraulic machine presser with maximum capacity of 1kg/batch, derived from the naturally high cocoa butter content found in Berau cocoa beans. After pressing, the butter content of 'Kakao Berau' resulting in around 53,36%. Additionally, the product meets strict contamination limits, ensuring low levels of metal contaminants such as lead, cadmium, tin, and arsenic, while being free from harmful microbes like Escherichia coli and Salmonella.

In order to protect the quality and characteristics of ‘Kakao Berau’ from name misuse by another party, the eographical Indication Protection Society (MPIG) of Kakao Berau is applying for the Geographical Indication protection of ‘Kakao Berau’ as PDO (Protected Designation of Origin) to the European Commission.

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INTRODUCTION

The development of global cacao consumption continues to increase, in line with the increase in global populations, while the influence of economic improvement or public well-being also contributes to an increase in the consumption of cacao and its processed products. Increased consumption constitutes an opportunity for the cacao industry in Indonesia. The cacao industry is greatly affected by several factors starting from raw materials, processing process at a plant, and human resources.

The cacao plant is one of the flagship plantation commodities playing a relatively critical role in the national economy, especially in providing an employment opportunity, a source of income and foreign exchange for the state. In addition, cacao also plays a role in boosting regional development and agroindustry development.

It is estimated that in 2010, about 1,372,705 ha or 93 % of 1,475,344 ha of Indonesian cacao area is smallholder cacao plantation. Indonesia's cacao area and production spiked in the last decade, with the rate of areal increase of about 5.99% per year. Indonesia's cacao production is mostly attributed to people's plantations spread in South Sulawesi, East Kalimantan, and Irian Jaya. Their products are mostly exported, especially to the Netherlands, Germany, the United States, and Singapore, in the form of dry beans. This indicates the important role of cacao whether as a source of employment opportunity or income for farmers and foreign exchange for the state.

East Kalimantan constitutes a cacao plant development area, among others Berau Regency, and Kutai Timur Regency, with the cacao planting area in 2020 reaching 1,253,05 ha with dry cacao production of 787.6 tons. East Kalimantan has great potential for cacao plantation despite its relatively small area compared to South Sulawesi and Central Sulawesi Provinces. However, such potential can increase added value for increasing farmers' standard of living.

The registration of the products will give added value and competitiveness as well as benefits to stakeholders contributing to the quality of cacao beans, among others, farmers, and exporters. The registered Geographical Indication of dry cacao bean products include the history of cacao plant spread and development area in Berau Regency and its processing area, thus its ownership status is of communal or collective nature.

The registration of 'Kakao Berau' PDO products is very potential for ensuring that economic benefits of such products can still be enjoyed by producers/farmers, product managers, traders, exporters and the government from which the products originate. PDO protection for 'Kakao Berau' is expected to give the following benefits, among others:

1. Protecting producers/farmers and cacao products from fraud, misuse, and product falsification.
2. Increasing the bargaining value of dry cacao bean products and having competitive advantage, thus they can compete in the national and international markets.
3. Increasing the added value of 'Kakao Berau' products, opening up employment opportunities, increasing production and product quality.
4. Giving information to consumers on the quality and origin of 'Kakao Berau' products.
5. Guaranteeing the promotion and reputation of 'Kakao Berau' products.
6. Improving the well-being of cacao farmers and business players.
7. Improving regional economy and expediting development in cacao plant development centers in Berau Regency.
8. Maintaining environmental preservation, because the quality of 'Kakao Berau' products results from the interaction of environmental, plant (genotype) and human factors.

In the context of obtaining acknowledgement of the quality and uniqueness of 'Kakao Berau' products, the Geographical Indication Protection Society *(MPIG)* of 'Kakao Berau' proposes to obtain legal protection for the cacao products.

APPLICANT

1. Applicant : Geographical Indication Protection Society of Kakao Berau *(Masyarakat Perlindungan Indikasi Geografis (MPIG) Kakao Berau)*

Address : Geographical Indication Protection Society of Kakao Berau *(Masyarakat Perlindungan Indikasi Geografis (MPIG) Kakao Berau)* **with the address of Plantation Service Office of Berau Regency** Jl. Dr. Murjani I No.82, Karang Ambun, Tj. Redeb District, Berau Regency, East Kalimantan 77315, **Tanjung Redeb, Berau, East Kalimantan**

The application is made by the Geographical Indication Protection Society of 'Kakao Berau' (*Masyarakat Perlindungan Indikasi Geografis (MPIG) Kakao Berau*). This organization constitutes the realization of cacao farmer community institution originating from 6 districts, namely: Sambaliung, Kelay, Segah, Gunung Tabur, Teluk Bayur and Tabalar, Berau Regency, East Kalimantan Province designated under Decision of Berau Regent No. 5 of 2019 Dated 27 November 2019.

1.1 Organizational Structure of MPIG of *Kakao Berau*

Counsellors :
- Regent of Berau Regency
- Spokesperson of Regional House of Representatives of Berau Regency
- Chief of Regency/City Police of Berau Regency
- Head of the Regional Office of Law and Human Rights of East Kalimantan Province
- Dean of the Agricultural Faculty of Mulawarman University

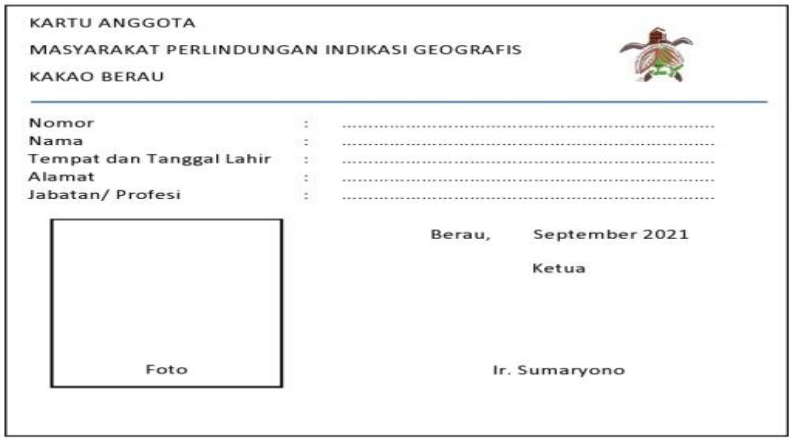
Patrons :
- Head of the Planning and Development Agency of Berau Regency
- Head of the Plantation Service Office of East Kalimantan Province
- Head of the Plantation Service Office of Berau Regency
- Head of the Industry and Trade Service Office of East Kalimantan Province
- Head of the Industry and Trade Service Office of Berau
- Food Resilience Service Office of Berau Regency
- Culture and Tourism Service Office of Berau Regency
- Regional Office of Law and Human Rights of East Kalimantan Province
- Cooperative and Small, Medium Enterprise Service Office of Berau Regency
- Head of Kelay Sub-district
- Head of Talisayan Sub-district
- Head of Sambaliung Sub-district

- Head of Gunung Tabur Sub-district
- Head of Teluk Bayur Sub-district
- Head of Tabalar Sub-district

Board of Experts:
- Dr. Ir. Soetanto Abdoellah, SU
- Ir. Rudarmono, MP.
- Ir. H. Dahniar Ratnawati, M.Si.

1.2 Member Card

As a proof of membership of MPIG Kakao Berau, every member has the following card:


KARTU ANGGOTA
MASYARAKAT PERLINDUNGAN INDIKASI GEOGRAFIS
KAKAO BERAU

Nomor :
Nama :
Tempat dan Tanggal Lahir :
Alamat :
Jabatan/ Profesi :

Foto

Berau, September 2021
Ketua

Ir. Sumaryono

1.3 Verification of Compliance

The body verifying compliance with the provisions of the product specification:

Name: CSQA Certificazioni Srl

Address: Via S. Gaetano, 74, 36016 Thiene (VI)

2. Name of Protected Designation of Origin

'Kakao Berau'

3. Type of Product

The type of Product applied is **Cacao Powder.**

Class 1.8. Other products listed in Annex I to the Treaty (spices etc.). CN Code: 1805 00 00 – Cocoa powder, not containing added sugar or other sweetening matter.

4. Description of Characteristics and Quality

4.1 Physical Properties of ‘Kakao Berau’

‘Kakao Berau’ is derived from Berau dry beans from Sulawesi-1 and Sulawesi-2 clones. ‘Kakao Berau’ has a rich, characteristic cocoa aroma and flavour, free from any foreign odours or tastes. The powder retains the sensory profile of Berau cocoa, characterised by a strong cocoa aroma (score 6–7), moderate bitterness (4.5–6.0), balanced acidity (2.0–4.25), moderate astringency (3.0–4.5), and subtle roasted, nutty, and light fresh-fruit notes. Off-flavours such as woody, smoky, or putrid notes are absent or negligible (scores 0 to –1), reflecting clean post-harvest practices. These organoleptic scores are obtained through cocoa cupping carried out by the Indonesian Coffee and Cocoa Research Institute (Puslitkoka) using the internationally recognised ICCO cocoa sensory evaluation protocol.

‘Kakao Berau’ exhibits a fine texture, with a maximum shell content of 1.75% (weight/weight). Its colour ranges from deep brown to other natural cocoa shades, reflecting the inherent characteristics of Berau cocoa beans and the processing methods applied locally.



Figure 4.1. ‘Kakao Berau’ Beans

4.2 Characteristics of Chemical Quality and Taste

Chemical Content of ‘Kakao Berau’.

‘Kakao Berau’ powder maintains a balanced water content of no more than 5% and contains of ≥20% cocoa butter using local machine presser with maximum capacity of 1kg/batch, particularly having butter content of around 53,36% derived from the naturally high cocoa butter content found in Berau cocoa beans.

Additionally, the product meets strict contamination limits, ensuring low levels of metal contaminants such as lead, cadmium, tin, and arsenic, while being free from harmful microbes like *Escherichia coli* and *Salmonella*.

5. Description of Geographical Environmental Influence

5.1 Natural Factors

A. Administration of Berau Regency

Berau Regency has an area of 34,127 km^2, consisting of 13 districts namely Kelay, Tabalar, Talisayan, Biduk-biduk, Pulau Derawan, Maratua, Sambaliung, Tanjung Redeb, Gunung Tabur, Segah, Teluk Bayur, Batu Putih and Biatan Districts, including 100 hamlets and 13 sub-districts.

Berau Regency is located between 1^0 to 2^033" North Latitude (N) and 166^0 to 119^0 East Longitude (E).

Table 5.1 Area and Number of Hamlets in Berau Regency.

District	Area (km^2)	Hamlet	District	Area (km^2)	Hamlet
1. Kelay	6,134.60	14	8. Tj. Redeb	23.76	6
2. Talisayan	1,798.00	9	9. Gn. Tabur	1,987.02	11
3. Tabalar	2,373.45	6	10. Segah	5,166.40	11
4. Biduk-Biduk	3,002.99	6	11. Teluk Bayur	175.70	6
5. P. Derawan	3,858.80	5	12. Biatan	1,432.04	8
6. Maratua	4,118.80	4	13. Batu Putih	1,651.42	7
7. Sambaliung	2,403.86	14			

Source: Berau Dalam Angka, 2020.

As a regency directly bordering North Kalimantan Province, Berau Regency plays a strategic role in relation to goods and services distribution and flow in the development of regional economy.



Figure 5.1 Administrative Area Map of Berau Regency

B. Topography

Berau Regency has a strategic geographical position in the northern area of East Kalimantan Province, namely in the form of coastal area directly facing Sulawesi Sea constituting a domestic and international shipping line. The land area of Berau regency agreed and used in the document of space/area arrangement plan *(Rencana Tata Ruang dan Wilayah/RTRW)* is 2,203,081 ha with the water area amounting to 1,222,988 ha.

The general topography of Berau Regency varies from lowlands (38%) and middle land (42%) with generally varying conditions from flat, undulating to steep at varying elevation between 0 – 1500 meters above sea level.

The area of Berau Regency by elevation above sea level is differentiated to elevation of 0 – 7 meters of 79,544.37 ha or 3.28 %. Elevation between 7 – 25 meters accounts for 175,629.40 ha or 7.26 %. Elevation between 25 – 100 meters accounts for 561,534.34 ha or 23.20 %. Elevation between 100 – 500 meters accounts for 345,550.50 ha (14.28%). Meanwhile, elevation more than 1000 meters above sea level accounts for 63,860.44 ha or 2.64 %. Table 5.2 presents elevation above sea level and their respective spread in more detail.

The topographical condition of Berau Regency has varying shape by relief, slope inclination and elevation from sea level. The land area of Berau Regency is dominated by a cluster of hills which are mostly not inhabited thus districts in Berau Regency averagely have a spacious area with varying population density.

Table 5.2 Area According to Elevation of Each District (Ha).

No.	District	Elevation Class Area (m asl)				
		0 - 7	8 – 25	26 - 100	101 - 500	501 – 1000
1	Talisayan	14,541.66	20,730.57	140,081.77	149,317.08	-
2	Biduk-Biduk	9,040.70	22,601.75	11,300.87	47,463.88	-
3	Kelay	-	3,658.20	68,238.10	250,036.53	37,500.00
4	Segah	-	30,781.52	83,725.74	339,613.00	14,500.00
5	Gunung Tabur	7,216.99	24,788.34	131,274.03	38,971.96	-
6	Teluk Bayur	-	-	-	-	-
7	Sambaliung	4,533.47	56,633.05	75,725.14	17,944.57	-
8	Tanjung Redeb	-	3,776.94	2,943.06	-	-
9	P. Derawan	44,191.55	12,669.01	48,245.63	2,533.81	-
10	Tubaan	-	-	-	-	-
11	Tabalar	-	-	-	-	-
12	Biatan	-	-	-	-	-
13	Batu Putih	-	-	-	-	-
T o t a l		79,524.37	175,629.38	561,543.34	845,880.63	52,000.00

Source: Regency Planning Board (BAPPEDA) of Berau Regency 2020.

The land area consists of hills spread nearly across the area, especially Kelay District where limestone hills extend nearly 100 km^2. Subsequently, Talisayan District has hills known as Padai Hill and Karst area “Sangkulirang Mangkalihat” extending to Kutai Timur Regency with the total area of 1,867,676 ha or 12 % of the total karst area in Indonesia (15.4 million/ha). This karst area plays an important role in the hydrological cycle, namely Berau Regency and Kutai Timur Regency River Basin, because the area constitutes the upstream area of 5 (five) main rivers in Berau and Kutai Timur Regencies (Dumaring, Tabalar, Menubar, Karangan and Bengalon) and is the source of water for communities in 100 villages.

C. Soil Type and Elevation.

The land utilization system constitutes a combination of variables influencing the land condition, namely soil type, parent material, morphology, drainage, and topographic condition.

Land resources constitute natural resources potential in managing the agricultural sector. Berau Regency having wet tropical climate has sediment rocks with relatively old formations, thus affecting the soil type and fertility. Soil in Berau Regency is mostly dominated by the red-yellow podzolic type (Ultisol). In general, the soil types consist of Regosol (Inceptisol), Alluvial (Entisol), Peat/Organosol (Histosol), Podzolic (Ultisol),

Latosol (Oxisol), Lithosol (Entisol), Mediterranean (Alfisol), and Rendzina (Mollisol). Table 5.3 shows the soil type and area in Berau Regency in detail.

Table 5.3 Soil Type and Area in Berau Regency.

No	Soil Type	Area (Ha)	Percent (%)
1.	Regosol (Incepstisol)	5,278.2	0.15
2.	Alluvial (Entisol)	81,056.4	2.38
3.	Peat/Organosol (Histosol)	17,594.9	0.52
4.	Podzolic (Ultisol)	850,085.6	24.03
5.	Latosol (Oxisol)	438,198.3	12.84
6.	Lithosol (Entisol)	1,669.7	0.05
7.	Mediterranean (Alfisol)	134,236.7	3.93
8.	Rendzina (Mollisol)	66,467.4	1.95

Source: Regency Planning Board **(**BAPPEDA) of Berau Regency, 2020.

The supporting data for agricultural commodity development is land resources (soil resources). This potential is related to the soil capability and other limiting factors, including physical, chemical, and biological soil fertility. Soil texture is among others physical properties of soil supporting soil fertility. Table 5.4 presents the general spread and area of soil texture class in Berau Regency.

Table 5.4. Spread and Area of Soil Texture Class in Berau Regency.

No	District	Texture Group Class (Ha)			Total Area
		Fine	Medium	Coarse	
1.	Tj. Redeb	6,461.00	0	0	6,461.00
2.	Gn. Tabur	194,712.00	0	0	194,712
3.	Sambaliung	208,375.27	31,936.73	0	240,312
4.	Talisayan	709,725.62	3,383.38	0	713,109
5.	Biduk-Biduk	360,473.00	0	0	360,473
6.	P. Derawan	790,824.22	2,906.78	0	793,731
7.	Segah	432,272.52	64,425.48	0	496,698
8.	Kelay	309,877.28	279,902.72	0	589,780
9.	Tel. Bayur	17,471.00	0	0	17,471.
10.	Tubaan	-	-	-	-
11.	Tabalar	-	-	-	-
12.	Biatan	-	-	-	-
13.	Batu Putih	-	-	-	-
T o t a l		3,030,191.91	282,555.09	0	3,412.747
Percentage (%)		88.79	11.21	0	100

Source: Regency Planning Board **(***BAPPEDA)* of Berau Regency, 2020.

Agricultural development in various land types always has limiting factors greatly affecting plant growth, among others soil drainage. Table 5.5 presents the spread and area of each soil drainage class in Berau Regency.

Table 5.5 Spread and Area of Soil Drainage Class in Berau Regency.

No	District	Area (Ha)	Soil Drainage Class		Peat	No-Data
			Never Inundated	Periodically Inundated		
1.	Tj. Redeb	6,461	3,157.07	3,259.63	0	623
2.	Gn. Tabur	194,712	177,950.50	12,695.73	69,568.93	686,091
3.	Sambaliung	240,312	180,970.21	51,112.29	42,044.72	8,230
4.	Talisayan	713,109	409,458.85	22,541.25	25,832.21	281,109
5.	Biduk-Biduk	360,473	273,358	87,114.58	0	0
6.	P. Derawan	793,731	65,799.82	41,840.18	25,709.99	0
7.	Segah	496,698	216,120	158,173.4	207,999.35	122,405
8.	Kelay	589,780	586,780	0	193,455.69	0
9.	Tel. Bayur	17,471	20,471.6	0	0	0
Total		3,412,747	1,934,066	373,737	564,611	1,098,501
Percentage (%)		100	56.67	11.04	16.54	32.19

Source: Main Data on Berau Regency Development in 2020.

Table 5.6 presents soil fertility in the cacao plantation center of Gurimbang Hamlet and Birang Hamlet based on the results of (physical and chemical) soil analysis.

Table 5.6 Soil Analysis Results in Gurimbang and Birang Hamlets

Origin of Soil Sample	Against 100 gr of dry example at 105°C						Against 1 kg of dry soil example				P2O5	pH	
	Pipette method texture			C Walkley & Black	N Kjeldhal	C/N	NH4OAc Extract. 1M pH 7				Bray 1 Ext	KCl	H2O
	Sand	Silt	Clay				K	Ca	Mg	CEC			
	%			gram			C mol						
Gurimbang	4	50	46	1.01	0.14	7	0.74	4.07	1.84	15.05	1	4.67	5.0
Birang	10	52	38	0.79	0.08	10	0.12	2.79	1.28	8.31	4	3.10	5.1

Source: Lab. of *Puslitkoka*, 2019.

Based on the results of soil analysis in several cacao plant centers in Berau Regency, it is concluded that the two locations based on the physical properties are included in the Silty Clay until Silty Clay Loam texture class, with the soil acidity level included in the relatively acid category, low organic material content, and low to medium macronutrient content. To optimize cacao plant growth in some centers, the use of balanced fertilizers between inorganic and organic fertilizers is recommended. The balanced fertilization approach is based on the principle of nutrient deficiency prevention, soil nutrient balance, and nutrient transfer by plants and soil erosion.

Table 5.7 Recommendation for Cacao Plant Fertilization in several Growth Stadia per Tree

Age	Urea	Superphosphate-36	KCl	Organic fertilizer
< 1 Year	25 – 30 gr	25 - 30 gr	20 - 30 gr	2 – 3 kg
1 – 2 Years	45 – 30 gr	45 – 50 gr	35 – 40 gr	3 – 5 kg
2 - 3 Years	90 – 100 gr	90 – 100 gr	70 – 80 gr	5 – 6 kg
3 – 4 Years	180 – 200 gr	180 -200 gr	125 – 150 gr	7 – 8 kg
>4 Years	220 – 230 gr	180 – 200 gr	170 – 180 gr	7 – 8 kg

Source: Primary Data (processed) Based on Cacao Plant Nutrient Need, 2021.

'Kakao Berau' are grown mostly on Ultisol (podzolic), Oxisol (Latosol), and Alfisol (Mediterranean) soil types, with a texture class of silty clay and silty clay loam and silt content that predominates, with a soil pH around 5. These soil types are unique to the region and have a high silt fraction that facilitates the absorption of essential nutrients. This contributes to the development of high cocoa butter levels (around 53,36%) and elevated polyphenol content (10.49–21.23%). These chemical traits are fundamental precursors to the strong cocoa aroma, moderate bitterness, balanced acidity and flavour complexity that characterise ‘Kakao Berau’.

D. Climate

Berau Regency has a climate type with relatively high rainfall spread nearly throughout the year thus there is no clear difference between the dry season and the rainy season. The climate type of Berau Regency based on Oldeman (1980) classification is divided into 4 types, namely types A, B, C and D. (Table 5.8).

Table 5.8 Climate and Regional Type in Berau Regency.

No	Climate Type	Spread Area
1.	A	Most of Kelay District to the border of Kutai Timur Regency and most of Segah District.
2.	B	Most of the western part of Tanjung Redeb District, Gunung Tabur District and Hinterland of Sambaliung District.
3.	C	Most of Pulau Derawan District, Talisayan District, Biduk-Biduk District.
4.	D	Most of Biduk-Biduk District area to Tanjung Mangkaliat.

Source: Bappeda of Berau Regency 2020.

The spread of Rainfall in Berau Regency in the last five years varies between 48.40 mm per month with the number of rainy days of 7 days to 267.20 mm per month with the number of rainy days of 24 days. The 2015 – 2019 rainfall ranges between 1,500 – 4,000

mm per year. The area of each Rainfall class in Berau Regency area is divided into five rainfall classes, as shown in Table 5.9.

Table 5.9 Rainfall and Area

No	Rainfall (mm/year)	Area (Ha)	Percentage (%)
1.	0 – 2,000	434,903.15	17.97
2.	2,000 – 2,500	906,366.44	37.45
3.	2,500 – 3,000	619,524.78	25.60
4.	3,000 – 3,500	109,844.33	4.54
5.	3,500 – 4,000	53,361.30	2.20

Source: Meteorology Agency of Berau Regency. 2020.

Meanwhile, table 5.10 and table 5.11 show the monthly rainfall and rainy days for the last five years (2015-2019).

Table 5.10 Data on Rainfall in Berau Regency

Year	JAN (mm)	FEB (mm)	MAR (mm)	APR (mm)	MAY (mm)	JUN (mm)	JUL (mm)	AUG (mm)	SEP (mm)	OCT (mm)	NOV (mm)	DEC (mm)	TOTAL (mm)
2015	154.94	50.52	167.64	65.24	119.38	104.14	22.86	27.94	50.8	111.76	144.78	127	1147
2016	215.9	190.5	175.26	93.98	152.4	68.58	50.8	43.18	259.08	202.26	121.92	86.86	1660.22
2017	83.82	296.22	203.2	124.46	63.5	58.42	20.32	73.55	93.98	195.58	149.86	68.58	1371.6
2018	215.2	65.5	100.24	85.8	55.56	25.86	154.94	48.18	77.78	83.82	65.88	167.64	1131.4
2019	220.1	62.3	148.3	158.3	184.3	115	220.7	49.5	134.6	84.5	157.8	280.1	1790.5

Source: *Meteorological dan Geophysical Agency of Berau Regency. 2020*

Table 5.11 Data on the Number of Rainy Days in Berau Regency.

Year	JAN (day)	FEB (day)	MAR (day)	APR (day)	MAY (day)	JUN (day)	JUL (day)	AUG (day)	SEP (day)	OCT (day)	NOV (day)	DEC (day)	TOTAL (day)
2015	10	3	13	4	9	6	2	2	4	9	10	9	81
2016	14	15	8	6	10	6	2	7	8	13	7	8	105
2017	6	12	14	10	7	7	3	8	7	5	11	7	97
2018	5	3	6	2	4	3	8	4	3	8	6	16	68
2019	5	4	7	4	3	3	2	4	3	4	6	6	51

Source: Meteorological dan Geophysical Agency of Berau Regency. 2020

The average year-round monthly air temperature ranges between 26.74 ºC and 27.24 ºC. The highest average air temperature is 33.34 ºC while the lowest one is 22.48 ºC. The wind condition in Berau Regency indicates that wind speed ranges between 5 knots and 24 knots.

Table 5.12 Data on Average Temperature (°C) in Berau Regency.

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL	Average
2015	25.92	25.98	26.09	27.11	27.17	27.25	27.56	27.63	27.66	27.23	26.99	27.37	323.96	27.00
2016	26.93	26.8	27.49	27.19	27.52	27.22	27.21	27.41	27.09	27.3	27.58	27.17	326.91	27.24
2017	26.94	26.57	26.47	26.99	27.52	26.93	27.35	26.98	27.44	27.65	27.09	27.55	325.48	27.12
2018	26.07	26.06	27.39	26.75	26.69	27.09	27.34	27.46	27.52	27.01	27.04	26.72	323.74	26.98
2019	26.32	26.42	26.21	26.33	26.89	26.87	26.65	27.23	27.35	27.34	26.77	26.45	320.83	26.74

Source: Meteorological dan Geophysical Agency of Berau Regency. 2020

Air humidity in Berau Regency ranges between 63–99%. The lowest air humidity occurs in May at 63%. Meanwhile, the highest humidity occurs in February, March, April and August at 99%.

These climatic conditions especially the combination of high humidity (63–99%), warm temperatures (26.7–27.2°C), and frequent rainfall, create an ideal environment for the development of local microbial communities on the surface of the surrounding farm ecosystem.

Because the composition and activity of fermentation microbes are shaped directly by Berau's climate and soil environment, the resulting flavour precursors, and the final sensory attributes of the powder, are intrinsically linked to the geographical area.

5.2 Human Factors

The characteristics of 'Kakao Berau' cocoa powder are also directly shaped by the traditional knowledge and established processing practices of the farmers and processors of Berau Regency.

a. Fruit and Seed Selection

Farmers in Berau apply strict selection practices, harvesting only healthy, ripe fruits that are free from pests and diseases. This ensures that the beans entering fermentation are optimal. Clean, ripe pods enhance the efficiency of spontaneous fermentation and prevent the development of undesirable off-flavours. This early stage determines the purity and consistency of the precursors that later contribute to the cocoa aroma and flavour of the final powder.

b. Traditional 5-Day Fermentation Method

The fermentation method practiced in Berau uses wooden boxes with drainage holes (0.7 cm in diameter, spaced 10 cm apart), allowing liquid pulp (sweatings) to escape. Fermentation lasts five days with two turnings, which supports the natural progression of microbial populations. This method enables the controlled formation of catechins and procyanidins (reported at 2,616 mg/kg and 3,327 mg/kg respectively).

c. Sun-Drying Technique

After fermentation, beans are sun-dried for 5–7 days, a practice that preserves key volatile compounds while avoiding the smoky or burnt flavours associated with artificial drying. Sun-drying reduces moisture gradually, which can contributes to the clean flavour profile of the powder, characterised by negligible off-notes (woody, smoky, putrid). The drying method also produces beans with low slaty, mouldy, broken, germinated and waste content, ensuring high-quality raw material with minimal contamination. This directly influences the microbiological purity of the final powder

d. Roasting and Grinding Performed by Local Processors

Berau processors roast the beans to a level that optimally develops flavour precursors into fully formed aromatic compounds. This roasting stage enhances the strong cocoa aroma, roasted notes, subtle nutty character and balanced acidity that appear in the powder. Once roasted, beans are deshelled and ground into cocoa, concentrating the sensory attributes shaped by earlier stages.

e. Pressing and Powdering

Local processors in Berau press the cocoa using low intensity pressure with local hydraulic machine in room temperature, resulting in cocoa cake retains ≥20% cocoa butter after pressing. This is also made possible by the naturally high cocoa butter content of Berau beans.

The cake is then milled into a fine powder, producing a consistent texture. This fineness is a result of both the inherent composition of Berau beans and the established expertise of local processors in handling high-butter cocoa. After pressing, the butter content of ‘Kakao Berau’ resulting in around 53,36%.

6. Description of Regional Boundaries

6.1 Cacao Fruit Production Area

Cacao Plant Cultivation is spread in 9 (Nine) District areas, but the areas constituting the cacao plant centers and proposed as the PDO area are only spread in 6 (six) district areas, namely Sambaliung, Gunung Tabur, Teluk Bayur, Segah, Kelay and Tabalar Districts; Berau Regency, East Kalimantan Province. Table 6.1 presents the area of cacao planting, wet bean production and dry bean production in each cacao production center in Berau Regency from 2015 – 2019.

The areal development of cacao planting and wet cacao as well as dry cacao bean production from 2015 to 2019 is presented below.

Table 6.1 Development of Planting Area and Wet Cacao Bean Production as well as Dry Cacao Bean Production in Sambaliung and Teluk Bayur Districts, in 2015.

No.	District	Hamlet	Total Area (Ha)	Cacao Bean Production (kg)	
				Wet	Dry
1.	Sambaliung	Tumbit Dayak Suaran Long Lanuq	370.3	70,167 42,168 30,069	23,389 14,056 10,023
2.	Teluk Bayur	Nasding Sri Makmur Meraang	798.5	41,292 24,862 19,143	13,764 8,321 6,381
T o t a l				227,802	75,934

Source: Berau Cocoa, 2019.

Table 6.2. Development of Planting Area and Wet Cacao Bean Production as well as Dry Cacao Bean Production in Berau Regency, in 2016.

No	District	Hamlet	Total Area (Ha)	Cacao Bean Production (kg)	
				Wet	Dry
1.	Sambaliung	Bena Baru Inaran Long Lanuq Nyapa Indah Suaran Tumbit Dayak	370.3	3,000 210 3,646 22,017 16,101 21,489	1,000 70 1,215 7,639 5,367 7,163
2.	Teluk Bayur	Labanan Nasding Tumbit Melayu Meraang	798.5	4,838 23,050 47,141 72,814	1,613 7,638 15,714 24,271
3.	Gunung Tabur	Gn. Tabur	72.0	3,498	1,188
4.	Kelay	Merasa	472.75	3,454	1,151
5.	Segah	Batu Rajang	250.0	25,707	8,596

T o t a l			206,619	82,648

Source: Berau Cocoa, 2019.

Table 6.3 Development of Planting Area and Wet Cacao Bean Production as well as Dry Cacao Bean Production in Berau Regency, in 2017.

No	District	Hamlet	Total Area (Ha)	Cacao Bean Production (kg)	
				Wet	Dry
1.	Sambaliung	Long Lanuq Nyapa Indah Suaran Tumbit Dayak	370.3	662 719 59,633 17,288	147 160 13,252 3,842
2.	Teluk Bayur	Labanan Nasding Tumbit Melayu Meraang	798.5	4,959 11,111 4,641 18,888	1,102 2,469 1,031 4,197
3.	Gunung Tabur	Gn. Tabur	72.0	5,469	1,215
5.	Kelay	Merasa	472.75		
6.	Segah	Batu Rajang	250.0	4,959	1,653
T o t a l				128,327	29,068

Source: Berau Cocoa, 2019.

Table 6.4 Development of Planting Area and Wet Cacao Bean Production as well as Dry Cacao Bean Production in Berau Regency, in 2018.

No	District	Hamlet	Total Area (Ha)	Cacao Bean Production (kg)	
				Wet	Dry
1.	Sambaliung	Gurimbang Nyapa Indah Suaran Tumbit Dayak	370.3	15,200 2,187 50,952 16,805	5,067 729 16,984 5,602
2.	Teluk Bayur	Labanan Meraang Nasding Tumbit Melayu	798.5	4,644 21,504 9,465 10,987	1,548 7,168 3,155 3,662
3.	Gunung Tabur	Gn. Tabur	72.0	9,472	3,157
5.	Kelay	Merasa	472.75	36,760	12,253
6.	Segah	Batu Rajang	250.0	15,020	5,007
T o t a l				192,997	64,332

Source: Berau Cocoa, 2019.

Table 6.5 Development of Planting Area and Wet Cacao Bean Production as well as Dry Cacao Bean Production in Berau Regency, in 2019.

No	District	Hamlet	Total Area (Ha)	Cacao Bean Production (kg)	
				Wet	Dry

1.	Sambaliung	Gurimbang Nyapa Indah Suaran Tumbit Dayak	370.3	13,468 4,874 45,549 14,549	4,495 1,625 15,183 4,850
2.	Teluk Bayur	Labanan Meraang Nasding Tumbit Melayu	798.5	1,378 19,910 12,410 11,536	459 6,637 4,137 3,845
3.	Gunung Tabur	Gn. Tabur	72.0	14,785	4,928
5.	Kelay	Merasa	472.75	34,714	11,571
6.	Segah	Batu Rajang	250.0	33,693	11,231
T o t a l				206,884	68,961

Source: Berau Cocoa, 2019

6.2 Dry Cacao Bean Processing Area

Out of 9 district areas in Berau Regency, the current 'Kakao Berau' PDO areas only include 6 (six) district areas, namely Sambaliung, Gunung Tabur, Teluk Bayur, Segah, Kelay and Tabalar Districts; Berau Regency, East Kalimantan Province, as presented in the following map:

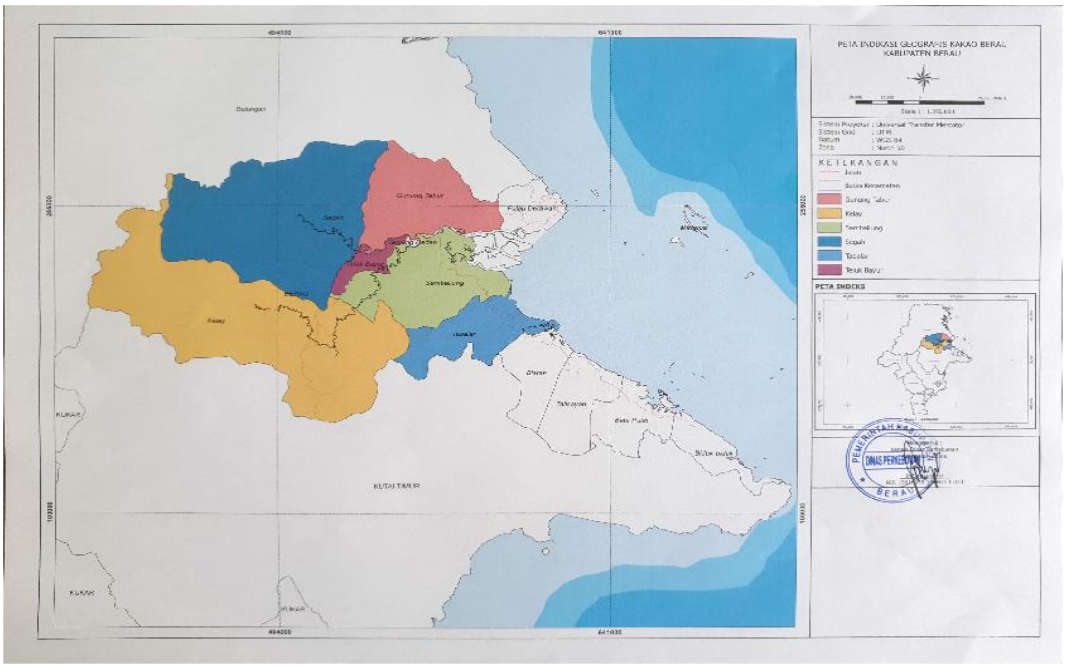


Figure 6.1 Map of Kakao Berau Geographical Indication

The current 'Kakao Berau' Geographical Indication areas include 6 (six) District areas, namely:

1. Gunung Tabur District

2. Sambaliung District
3. Teluk Bayur District
4. Kelay District
5. Segah District
6. Tabalar District

7. History and Customs

7.1 History

It is estimated that Cacao Plants have started to be cultivated by farmers in Berau Regency since 1987 with the initiation of Mr. Puyung Langgeng and Mr. Minami (WNI from Japan who has assimilated with the community) in Merasa Hamlet, Kelay District. According to the current information, Cacao plants contain good nutrition as a food and beverage ingredient. The two cacao plant pioneers cultivated cacao in the downstream area of Merasa Hamlet, by cultivating coca plantation at Kelay riverbank in an area of 12 ha. The source of cacao plant seeds originated from varying clones, from several areas, among others Kutai Barat and Kutai Kartanegara areas (PT. Hasfarm, Jahab).

Thanks to care and treatment carried out by the two pioneers, cacao plants started to produce in 1991, and then the cacao beans were managed in a simple manner. Dry cacao bean products were subsequently sold to collectors from Nunukan, to be sold further to Tawau city (East Malaysia State).

In 1992, cacao production continued to increase. In addition to Cacao grown by the two pioneers, at the beginning of 1991, Berau Regency received Cacao seedling aid from the Plantation Service Office of East Kalimantan Province, through the Special Area Plantation Development Project (*P2WK*) allocated to Bina Baru and Inaran Hamlets. In 1992, cacao aid was given in Tumbit Melayu, Tumbit Dayak to Gurimbang Hamlets. Since then, counseling from the Government whether sourced from State Budget, Regional Budget of East Kalimantan Province and Berau Regency and Third Parties for the development of cacao commodity aimed at improving production, through the provision of cacao seedlings, continues to date.

Increased cacao production in 1992 was not balanced by the capability of collectors from Nunukan who only bought dry cacao beans in a limited quantity, thus production accumulated. Subsequently, a part of dry cacao production was accommodated by an interinsular trader (H. Hapit) to be marketed in Makassar city at a price of about Rp 500.- – Rp 600.- per kilogram. The market condition and low price of cacao beans developed by

Mr. Minami and Mr. Puyung Langgeng continued until 1995 – 1996. In those years, the price of Dry Cacao beans reached Rp. 1,000,- to Rp. 1,500.-. per kilogram.

In time, the price of dry cacao beans continued to increase thus making a positive impact on the increased price of dry cacao beans which had a bearing on the surrounding farmers and communities to cultivate cacao plants. It reached its peak with the national designation of Berau Regency as a Cacao Commodity development area in 2010-2012 through the program of National Movement (*Gernas*) for Cacao sourced from the National Budget fund and then continued to expand to several district areas in Berau Regency to date.

Several years later, 'Kakao Berau' formed a standardized processing unit (PU) of cacao beans to accommodate farmers' cacao fruit at a standard and synergistic price. Berau Cocoa also carried out counseling, assistance, and development for cacao farmers, especially in the selection of superior clone types. Subsequently, 'Kakao Berau' carried out the processing process by referring to the Standard Operating Procedure for cacao bean processing, thus producing Dry Cacao Beans of quality and specific characteristics and taste.

In 2017, 'Kakao Berau' made the first delivery of 25 tons of dry cacao beans to Cargill through Gresik port and Mars Symbioscience Indonesia in Makassar.

Cacao plants in Berau Regency initially used varying and diverse varieties/clones resulting in relatively low fruit productivity. With counseling, assistance, and development by Berau Cocoa and Plantation Service Office of Berau Regency and Plantation Service Office of Kaltim Province, intensification, rejuvenation and rehabilitation of low productivity cacao plants were carried out using superior clones, namely Sulawesi – 1 and Sulawesi – 2 clones by the budding, side grafting, and top grafting methods. With the application of good agroforestry practices (GAP) including clone improvement, standard care and treatment, cacao plants in Berau Regency produce quality and highly productive cacao fruit.

The results of Intensification, Rehabilitation, and rejuvenation of people's Cacao plantations, as well as increased economic value of cacao fruit have been currently enjoyed by farmers in six (6) districts in Berau Regency, namely Kelay, Segah, Teluk Bayur, Sambaliung, Gunung Tabur and Tabalar Districts. The area of independently managed cacao plantations has reached more than 1,253.05 hectares with production of more than 787.6 tons of dry cacao beans. It is believed that the production of these cacao plantations will continue to increase in line with the implementation of cacao plantation intensification, rehabilitation, and rejuvenation program in several districts through the Agribusiness Development Movement (*Gemari*) for cacao in Berau Regency.

7.2 Customs

The development of cacao plants in Berau Regency has positive impacts on public economic, sociocultural changes especially cacao farmers. Cacao plants may be used as one of the sources of life support and other activities requiring a relatively high cost. thus, good cacao plant management can improve farmers' well-being and standard of living.

8. Description of Production and Processing Process

8.1 Cacao Fruit Production Method

The developed cultivation technology of cacao plants (*Theobroma cacao* L.) is an environmentally friendly and sustainable technology by utilizing organic materials maximally and minimizing the use of inorganic materials. The implemented activity stages are as follows:

A. Land Preparation

The prospective land for cacao planting area is cleared from remaining wood, branches, leaves and weeds and then utilized as organic materials/fertilizers.

There are 3 (three) land statuses legally allowed for Cacao planting in Berau Regency. The first land status is Other Use Area *(APL)* status. *APL* is an area outside the State forest area allocated for development outside the field of forestry (such as settlement). *APL* also usually constitutes a Title of the community.

The next land status is Social Forestry, being a sustainable forest management system implemented in a state forest or customary forest area by the local communities to improve their well-being. Social forestry may be divided into 5 (five) schemes, namely Village forest, community forest, people's plantation forest, Customary forest, and Forestry partnership. Social forestry has strict regulations, among others may not use any chemicals, only certain commodities are allowed (including cacao), must apply Good Agroforestry Practices, must be carried out by local communities, and obtain approval from the relevant authorities.

The next land status is Land for Agrarian Reform Objects or TORA. TORA is land controlled by the state and/or land which is already owned by the community for legalization. TORA is generally sourced from derelict state land. Therefore, this land is delegated to the surrounding communities for settling land dispute conflicts and land status overlap.

Regional division based on this status refers to the official map of the Ministry of Environment of the Republic of Indonesia, while cacao plantation opening by

illegal logging is prohibited. The planting process must refer to the principles of Conservation.

a. Areal Clearing

In this stage, work performance includes the setting of areal boundaries to be planted, and clearing of bushes and small trees, which are then cut into small pieces. The next step is proceeded with areal clearing from scattered wood cuts. The area used is an area that is not included in Protected Forests and National Parks. However, if it is located in a protected forest, it must be part of the Social Forestry Program.

b. Soil Tilling

Cacao farmers in Berau Regency do not generally till soil, but only make planting holes together with stake installation and planting distance determination.

c. Planting Distance

The ideal planting distance for cacao is the distance appropriate for the development of plant's canopy and relatively available space for rooting. The selection of planting distance is closely related to the nature of plant growth, source of planting material and soil fertility.

Cloned cacao from top grafting seedlings usually requires smaller canopy growth space compared to cacao from hybrid seedlings/non-grafting seeds. On land with low nutrition (fertility), the used planting distance is shorter, while on fertile soil, the planting distance may be widened. The following table presents various planting distances with the number of plant population per hectare.

Table 8.1 Planting Distance and Number of Cacao Trees per Hectare

No.	Planting distance (m x m)	Number of trees per hectare
1.	3.0 x 3.0	1,100
2.	4.0 x 4.0	625
3.	5.0 x 4.0	500
4.	4.0 x 3.0	830

Source: Farmer Groups' Experience in Berau Regency. 2019.

d. Planting Hole

The purpose of making a planting hole is to provide an optimum environmental condition for cacao seedling rooting, physically, chemically, and biologically. The size of planting hole is generally 40 x 40 x 40 cm. This planting distance is considered

sufficient to support the adaptation of seedling rooting with the field condition. However, the size of planting holes on soil with firmer texture needs to be extended so that seedling rooting has better root growing media.

A planting hole should not be made when soil is in a very wet condition, especially on firm texture soil, because the hole wall tends to be muddy when dug and solidify when dry. This condition causes the formation of an impermeable layer which can obstruct the growth of seedling rooting. In addition, excessive stormwater seepage exists from planting holes thus there is inundation in the planting holes while soil aeration decreases.

Planting holes are made 3 – 4 months before planting by placing excavated soil next to holes, aimed at changing reductive condition of the soil to oxidative and reducing poisonous elements (oxidative process). At least one month before planting, excavated soil is returned into the holes so that the soil condition is balanced against the environmental condition around the planting holes.



Figure 8.1 Making a Cacao Seedling Planting Hole

e. Making a Trench

A trench is excavation made next to the plant's main organs for placing organic fertilizers and serving as a drainage hole as well as containing eroded soil sediment. A trench is aimed at managing organic materials, soil, and water conservation efforts in a cacao plantation. A trench is filled with cacao plant waste or pruning and weed remains until it is full. After a trench is full, a new trench is made. A trench can also serve as a drainage hole to expedite absorption (infiltration) of stormwater inundating soil surface.

On land with sloping topography, the making of trenches can prevent erosion, because they can reduce surface flows. A typical trench made in a cacao plantation has the length of 100 cm, width of 30 cm, and depth of 30 cm.

B. Seeding and Plant Propagation

Good and healthy seedlings (superior clones) will produce quality cacao fruit. Cacao seeding place planning needs to consider costs, purpose of use and number of seedlings required. Good seeding management will yield good (fertile) quality seedlings, with faster growth if they have been relocated to the plantation.

Seeding needs to take into account the following:

a. **Seeding Location**: close to a road to facilitate transportation, close to a water source and planting location as well as covered by a plastic roof and or shade net (60 %) thus reducing the risk of diseases.




Figure 8.2 Cacao Seeding Location

b. **Cacao Seed Selection**

- Good cacao seeds (Lower Stem) originate from the chosen hybrid/F-1, while for the upper stem (scion) uses Sul 01 and 02 clones as well as other superior clones. Subsequently, the top grafting process is carried out.
- Cacao seeds should be prepared during the cacao harvest season, so that healthy seeds can be selected.
- Seeds are added by 20 %. For example, one ha of flat land with a planting distance of 3x3 m needs 1,300 cacao seedlings, consisting of 1,111 seedlings and 20 % of replanting supply of 222 seedlings. Therefore, it needs 1,898 beans (with the formula 1.46 x 1,300).

For sloping land, the used planting distance is 4 x 2.5 m. The total seedling needs amounts to 1,200 seedlings, comprising 1,000 seedlings and 20 % of backup of 200 seedlings. Thus, it needs 1,752 beans (with the formula 1.46 x 1,200).





Figure 8.3 Cacao Seed Sowing and Seed Planting

c. Seeding preparation in a polybag

- The size of polybag depends on the seedling age. A seedling of 5-6 months needs a polybag of 20 x 25cm. Subsequently, polybag filling is carried out two weeks before sowing.
- To add nutrients in the seeding media, organic fertilizers in the form of compost or manure are added.
- The seeding media (polybags) are left for 1 (one) week before being planted with seeds. The planting media are then given liquid fertilizers and continuous watering. The watering is aimed at dissolving fertilizers and ensuring good soil structure for cacao seedling root growth.



Figure 8.4 Seeding preparation in a polybag

d. Bean Germination and Planting

- Cacao fruit are broken by using a blunt object. The seed located at the center of fruit (large and healthy bean) is used as a source of seedling. Beans are then separated from the placenta.
- They are cleaned and shelled to expedite the germination process.
- Seeds are sowed on a jute sack, which is placed in an open space (good air circulation), and maintained to be always moist during the germination period.
- Beans will germinate within 1-7 days, and then planted with the sprout facing downward and about ½ of the beans must be covered by soil.
- A cotyledon will appear 1 week after sowing.



Figure 8.5 Bean Germination and Planting

e. Seedling and Shade

A cacao seedling seedbed prefers 70 – 75 % of shade (using UV plastic or shade net) with the required height of 2 (two) meters from the surface. This is aimed at facilitating the cacao seedling care process.

f. Pest and Disease Control on a Seedbed

- Pathogen attacks on cacao seedlings may be controlled using Fungicides with the concentration of 0.5-1 gram per liter of water.
- Pest attacks on Cacao seedlings may be controlled using insecticides with the concentration of 0.5-1 ml per liter of water.

C. Vegetative Propagation

The material used for vegetative propagation is a stem or branch referred to as a scion. The characteristics of a good scion are among others cacao plant bud which is not too young or old, scion size, which is relatively similar to the lower stem, not subject to a stem borer disease, and still fresh.

Cacao plants resulting from vegetative propagation have growth in accordance with the scion used. If the scion is derived from a plagiotropic branch, the growth of the resulting plant will be like a plagiotropic branch.

Vegetative propagation will produce a plant which is genetically the same as its parent thus yielding cacao plants having uniform productivity and quality. Therefore, the use of vegetative planting materials originating from cacao clones with tested superiority will better ensure productivity and quality of the resulting cacao beans.



Figure 8.6 Vegetative Propagation

a. Side Grafting on a mature plant (rehabilitation)

To carry out side grafting, a cacao plant should have a height of 45-75 cm from the stem base. The scion used should have a brownish-green color and 3- 5 buds. The bottom part of scion is cut on a slant of about 3-5 cm. The scion is then put into the grafting point by peeling the bark. Ensure that the long incision of scion faces the wood. The scion is then covered with plastic and bound with PP raffia so that stormwater does not seep into the grafting section.

The plastic is removed within 21 days after the grafting process. The bottom part tie is left so that grafting can attach strongly. To prevent pest and disease attacks, new shoots should be sprayed using insecticides and fungicides with a dose of 2 ml/liter of water. After the grafting reaches 3 months or shoot length reaches 45 cm, the grafting bud is cut by leaving 3 – 5 buds for the formation of main stem. Fertilization is carried out after grafting reaches 4-6 months, proceeded with follow-up fertilization 2 (two) times in a year at the beginning and end of the rainy season.

When grafting reaches 9 months, the main stem is cut on a slant of 45^{o}. Cutting is made 45-60 cm above the grafting point. The cut section is applied with TAR to prevent stem decay. Maintenance pruning is carried out every month or adjusted to the shoot condition and growth.



Figure 8.7 Side Grafting Method

b. Top Grafting

Top grafting is one of the methods in vegetative plant rejuvenation by planting superior clones when seedlings reach three (3) months. It is aimed at producing new seedlings having high superiority and productivity, resistant to pests and diseases as well as easy to treat.



Figure 8.8 Top Grafting Method 1

Top grafting is carried out when seedlings have reached 3 months, by grafting a leaf shoot incision with a lower stem. 3 – 4 shots are left under the grafting point. Buds originating from the selected clones are taken by making a cut along ± 10 cm or having 2-3 buds. Buds are then ready to graft from the top to the bottom with a distance of 4-5 cm or following the size of bud grafting incision. The bud scion is inserted into the division on the cut lower stem. The bud is then tied using a small plastic string, given a plastic hood and tied at the bottom.

After 10–15 days, the grafting plastic hood is opened, and then the grafting seedling is ready to be moved to the seedbed plantation (seeding). The arrangements of branch growth form are subsequently carried out, aimed at arranging productive branch growth. The arrangements of branching form in seeding are carried out with the following methods: when a seedling reaches one (1) month after grafting, it is tied to ensure that the seedling can grow straight until it reaches four (4) months.



Figure 8.9 Top Grafting Method

D. Planting

Cacao seedlings can be moved after reaching 5 – 6 months in the seedbed. The

prepared planting holes are given organic fertilizers (manure or compost) of 1-2 kg per hole and are then covered with soil excavated from the holes. The provision of organic fertilizers is aimed at improving the soil structure and providing nutrients for the seedlings to be planted. The newly planted seedlings in the field are vulnerable to sunlight, thus they need temporary shades.

E. Plant Care

a. Replanting

To optimize cacao plant population, seedling backups are needed for replanting. The purpose of replanting is to replace cacao seedlings which have been planted in the field but have abnormal growth or wither. 1 ha of land needs seedling backups for replanting of 4-5 percent of the total seedling need per hectare.

b. Weed Control

Farmers in Berau Regency generally carry out manual weed control in the cacao plant area. However, for the control of weed growth which has disturbed the main planting, farmers use herbicides. Therefore, it can be said that weed control in the cacao plant area is carried out with the combination of those two technical methods.

c. Fertilization

Fertilization is carried out after cacao plants reach 2 (two) months in the field. Fertilization on non-producing plants (*TBM*) is carried out with a distance of about 15– 50 cm (for the age of 2 – 10 months) and 50–75 cm (for the age of 14–20 months) from the main stem. For producing plants (*TM*), fertilizers are given with a distance of 50–75 cm from the stem. The annual fertilizer dose required for 1 ha of land, is presented in the following table:

Table 8.2 Needs for Inorganic Fertilizers and Organic Fertilizers of Cacao Plants by Planting Age per Plant

Plant age (year)	Urea (g/plant)	SP-36 (g/plant)	KCl (g/plant)	Organic (Kg/plant)
1	-	-	-	2 - 3
2	20	20	25	3 - 5
3	40	40	50	5 – 6
4	80	80	100	7 – 8
5	150	100	200	7 – 8
6	200	200	300	7 – 8

Source: Primary Data (processed) based on the cacao plant need. 2021

d. Pruning

As long as cacao plants have not produced, the main care is carried out by balanced branch formation and vegetative growth arrangements.



Figure 8.10 Branch Maintenance Pruning of a Cacao Plant

In cacao plant cultivation, pruning treatment is an effort which must be made to form a canopy and eventually to improve production and maintain a plant's economic age. In general, pruning on cacao plants is aimed at:

- Obtaining balanced and strong canopy growth.
- Reducing moisture, thus preventing pest and disease attacks.
- Facilitating harvest and plant care.
- Obtaining a high production level.

e. Shape Pruning

Non-producing cacao plants (*TBM*) reaching 8 months need to be subject to shape pruning. Main stems or 5 – 6 primary branches are reduced to only 3 – 4 branches. The selected/maintained branches are branches symmetrical against the main stem and not attacked by pests or diseases; thus, all parts of the plant are exposed to sunlight.

Pruning on primary branches is carried out on branches with a length of not more than 150 cm from the main stem. It is aimed at stimulating the growth of secondary branches. Shape pruning is carried out at an interval of 2 (two) while the plant has not been productive (*TBM*).

f. Production Pruning

Production pruning is carried out on unproductive branches, namely branches growing inward (closing the main stem), hanging branches or dry branches, because those branches will increase moisture and reduce sunlight intensity.

g. Maintenance Pruning

Maintenance pruning is carried out by cutting secondary and tertiary branches with a distance of less than 40 cm, so that branching is not too tight and does not reduce aeration.

F. Pest and disease control

A Plant-Disturbing Organism (*OPT*) is one of the important factors hampering the productivity and quality of cacao fruit. Pest and Disease Control on cacao plants refers to the concept of Integrated Pest Control (PHT), namely integrating various types of control techniques to minimize pest and disease disturbance / attacks. This Control Technique has been implemented by members of MPIG Kakao Berau through the Integrated Pest Control Field School (SL-PHT) facilitated by the Plantation Service Office of Berau Regency, Plantation Service Office of East Kalimantan Province, and some other stakeholders.

Main pests and diseases attacking cacao plants in Berau Regency are among others:

a. Cocoa Pod Borer (CPB) *(Conopomorpha cramerella)*

CPB is the main pest of cacao plants leading to losses to farmers. It is spread in nearly all cacao producing areas in Indonesia. The stage of CPB resulting in damage is larvae which attack cacao fruit from the size of 8 cm to pre-mature. The caterpillars damage cacao fruit by boring the fruit, feeding the pulp, and making a channel to beans, thus the beans are attached to each other, have a black color, are difficult to separate and have a smaller size.

CPB eggs are laid on the surface of rind (on the fruit groove), have an oval shape with a length of 0.4-0.5 mm and width of 0.2-0.3 mm, and orange color. The CPB egg stage lasts for 2 - 7 days. After hatching, larvae enter the fruit.

CPB larvae (caterpillars) have a yellowish-white (transparent) color with a maximum length of 11 mm, with the larva stage duration of 14-18 days, consisting of 4 instars. Before forming a pupa, caterpillars exit the fruit and gather on the surface of fruit or on young leaf and waste. The CPB pupa (cocoon) has a transparent appearance, brown color and is water-resistant. The imago (adult) will be active at night, while during the day, they shelter in a place not exposed to sunlight (shady). The moth has a length of 7 mm, with the moth stage duration of between 7-8 days. A female moth is able to lay up to 50- 100 eggs throughout its life.

An attack on fruit is marked by the fading of rind color, appearance of yellowish-

green or orange stripy color, no sound if the fruit is shaken, and black as well as interlocking cacao beans. This pest can be controlled by cacao plantation sanitation, pruning, short harvest interval, fertilization, sheathing and pruning.

Plantation sanitation is carried out simultaneously with the time of healthy cacao fruit harvest. Cacao fruit are subsequently split (broken), while fruit attacked by CPB, pod rot disease, rind, placenta, and decayed fruit are put into a hole covered with soil (heaped) with a thickness of l20 cm.

Prevention efforts are made by pruning cacao plants and shade plants (if any). The cacao plant's canopy is pruned to the maximum height of 3.5 meters. Branch pruning is carried out on upward branches, namely higher than 3.5 m. The used cutting tools are saw, pole pruner, and pruner shears with a pole. The control efforts made are among others:

- CPB control by: Frequent harvest, Pruning, Fertilization and Sanitation.
- In addition, Control by a technical culture System has also been carried out by selecting clones tolerant to CPB attacks, namely Sulawesi I, Sulawesi II, MCC 01, MCC 02, ICCRI 06 and ICCRI 08.

b. Tea Mosquito Bug *(Helopeltis spp.).*

This bug is the main pest ranking second after CPB. The nymph and imago attack cacao plants' canopy and unripe fruit by injection into the tissue and then sucking the fruit's liquid. Along with the injection, the bug releases a toxic liquid which can kill the plant tissue around the injection.



Figure 8.11 Pest Helopeltis spp. Tea Mosquito Bug

Attacks on ripe fruit are marked by the appearance of light brown concave patches, which will turn blackish. Serious attacks on unripe fruit cause the surface of rind to crack and deform thus hampering bean development. Attacks on the shoot or branch led to withering, dry and then death, falling leaves as well as plant's branches looking like a stick. Attacks by such pests result in a 50–60% decrease in fruit production.

c. Pod Rot Disease *(Phytopthora palmivora)*

The pod rot disease constitutes the most important disease because it attacks nearly the entire area of cacao planting. This disease is caused by the fungus Phytopthora palmivora which can survive underground.

The spread of fungi from one fruit to another fruit is caused by stormwater splash, contact between infected fruit and healthy fruit, and carrier animals such as rats, squirrels, or snails. The loss caused by this disease reaches 30–50%.

The symptoms of this disease occur from unripe fruit to ripe fruit. Infected fruit will rot along with blackish-brown patches with clear boundaries, starting from the end or base of fruit. This is caused by indentation on the base of fruit where water inundates thus spores can grow on such part.

The control of this disease is carried out by combining sanitation, pruning and fertilization according to the suggested dose, picking rotten fruit and burying them underground with the depth of 30 cm.



Figure 8.12 Symptoms of Cacao Fruit Rot Disease

d. Vascular Streak Dieback (VSD) Disease (*Oncobasidium theobromae*)

This disease attacks all plant stages, starting from seeding to productive stages. This disease spreads between cacao trees through spores with wind as the carrier media. On young leaves, spore sprouts enter the xylem tissue. After 3-5 months, the noticeable symptom is that leaves turn yellow with green patches and fall easily.

A VSD attack is categorized as light if the number of attacked branches is <10 % and the fungi only attack up to the tertiary branches. Medium attack intensity occurs if fungi attack up to the secondary branches and the number of attacked branches ranges 10 – 30 %. If the attack intensity exceeds > 30 %, it is categorized as a heavy attack.

The control of this disease can be carried out by continuous plantation sanitation, pruning and fertilization as well as selection of tolerant clones.

8.2 Cacao Bean Processing Method

Processing method of 'Kakao Berau' beans are the process of selecting fruits and seeds, fermentation, and drying. Only healthy fruit and seeds that are not attacked by pests and diseases are fermented. The fermentation process of 'Kakao Berau' uses a wooden box with a height of 40 cm, with width and length adjusted according to the number of beans and has holes with a diameter of 0.7 mm with a distance of 10 cm between the holes on the bottom and sides. This hole functions to remove liquid or mucus from inside the box during the fermentation process. Fermentation lasted for five days with two turnings. After the 5th day of the fermentation process, 'Kakao Berau' is naturally dried in the sun for 5-7 days. This natural drying process allows the formation of compounds such as catechins (catechin + epicatechin) of 2616,00 mg per kilo grams of beans, and procyanidyns (oligomers A2-B1-B2-C1) of 3327,00. These compounds might provide ‘Kakao Berau’ aroma and taste such as nutty taste and fresh fruit notes with weak acidity.

a. Fruit Picking and Sorting

Ready-to-harvest and physiologically ripe cacao fruit are signified by the change of rind color from violet to orange, or from green to yellow, depending on the variety or clone. In 1 (one) year, great harvest occurs one or two times at an interval of 5-6 months.



Figure 8.13 Sulawesi -1 and Sulawesi – 2 Clone Fruit

Picked fruit is sorted between healthy fruit and disease-infected fruit. The harvest frequency is determined by the quantity of ripe fruit in one harvest period. Farmers usually harvest 5 - 6 times in the great harvest season at an interval of one week.

b. Fruit Breaking and Ripening (Fermentation)

Cacao fruit breaking is carried out by using a wooden blunt object, proceeded with cacao bean sorting to separate defective beans. Healthy beans are then put into a fermentation box.

Fermentation is carried out for 5 days by using a container made of wooden box and then covered with banana leaves and jutty sacks or tarpaulins thereon. During the fermentation process, beans are stirred on the second and third days so that fermentation occurs perfectly.

Fermentation is carried out to obtain cacao beans of good quality and have cocoa aroma as well as taste.



Figure 8.14 Cacao Fruit Breaking and Fermentation

c. Drying

After being fermented, cacao beans are immediately dried with the aim of reducing the water content of beans to 6–7% thus they are safe during storage, packing, transportation, and distribution. Drying is carried out by sun drying, dryer or combination of both.

Drying on a drying rack is carried out with the capacity per square meter of 15 kg, thus cacao beans will dry after 5-7 days in normal sunlight intensity (no rain). During the sun drying process, beans are turned every 1-2 hours. During the sun drying process, beans are sorted by disposing rind fractions, placenta, foreign materials, and defective beans.

The Processing Unit (PU) 'Kakao Berau' carries out sun drying with the combination of conventional drying and machine drying. Conventional drying uses a plastic roof and is carried out for 5 days while machine drying is carried out for 12 effective hours, at a temperature of about 60^{o}C for obtaining the water content of beans between 6-7 %.



Figure 8.15 Manual Cacao Bean Drying and Heater

d. Sorting

After drying, dry cacao beans are then sorted with the aim of separating cacao beans from attached dirt, grouping beans based on physical appearance and bean size. Sorting is carried out mechanically and manually.





Figure 8.16 Dry Cacao Bean Sorting

e. Powder

The dried cacao beans are roasted at a temperature of around 130 degrees Celsius for 15 minutes. Once cooled, the beans are shelled to separate the nibs from the outer skin (shell). The nibs are then ground into a paste.

Local processors in Berau press the paste using low intensity pressure with local hydraulic machine in room temperature, resulting in cocoa cake retains ≥20% cocoa butter after pressing, of around 53,36%. This is also made possible by the naturally high cocoa butter content of Berau beans.

The cake is then milled into a fine powder, producing a consistent texture. This fineness is a result of both the inherent composition of Berau beans and the established expertise of local processors in handling high-butter cocoa.

f. Packing and Storage





Figure 8.17 Cacao Bean Storage and Packing

'Kakao Berau' in the form of powder are packaged with plastic packaging of 250, 300, 500 and 1000 grams. Storage warehouses must be free from chemicals, strong odor materials, and warehouse pests (rats and insects) which may influence the quality of the product.

9. Control Method and Traceability

9.1 Control of compliance with rules in the Document of Description

Control starting from cultivation to processing consists of the following:

A. Planting (Cultivation) Control:

- Independent control: Each Cacao fruit producer must always examine and implement cultivation and plantation management standards which comply with the cultivation rules and standards in accordance with the Product Specification of 'Kakao Berau' GI.
- Control by Farmer Groups: Every year, the chairman of Farmer Groups (management of Farmer Group) must ensure that the Document of Description constitutes the minimum standard which must be implemented by their members and must report its development to the Geographical Indication Protection Society (MPIG Kakao Berau)
- Control by MPIG: in 1 (one) Month per year. MPIG Kakao Berau randomly picks 5 (five) Farmer Groups (KT) and examines compliance with the Document of Description on farmers' plantations.

B. Processing Control:

- Control by the Plantation Service Office and other relevant institutions in the processing unit (PU) of dry cacao beans because the processing unit is an independent institution, thus the control system is implemented by an independent institution.
- Control by MPIG: during harvest and processing. MPIG randomly picks 5 PU (processing unit) and examines the process based on compliance with the Document of Description. MPIG also examines the processes of sorting and preparation for sales to the market against dry cacao bean labeling or packaging. To ensure the ease of

control of plantation and dry cacao bean processing place, it must be coordinated and communicated by MPIG conducting the above-mentioned activities.

9.2 Traceability

The traceability system consists of:

A. Member Registration:

- All farmers are registered and given a GI card. This list is updated every year.
- Processing Units (PU) must be registered as a "GI Processor". To facilitate control in each stage of Dry Cacao Bean processing, Processing Units must set out the processing and storage places.

B. Control of Wet Cacao Bean Origin:

- Every farmer sells Wet Cacao Beans to a Processing Unit (PU), thus PU must check the card and record the names of Farmers, quantity bought and transaction dates.
- For Processing Units (PU) distributing dry cacao bean processing yields to the next processor / trader, they must record the names, buyer numbers, quantity bought and transaction dates.
- PU must send the list of buyers to MPIG at least 2 (two) times in a year, namely: July and September. MPIG will examine the quantity of dry cacao bean products sold to buyers.

C. Dry Cacao Bean Traceability Order

- After the processing process, PU must identify each sack using a lot code. This code includes: Processing Unit Code (01), production year (YYYY) and Farmer group number / farmer group area (ZZ). This code consists of 8 numbers: XX-YYYY –ZZ.
- The code is kept up to the stage of dry Cacao Bean sales and allows for comprehensive traceability.

D. Control of dry Cacao Bean Sales and Wet Cacao Bean Purchases:

In 1 (one) year, the production data of each PU must be sent to the secretariat of MPIG Kakao Berau, which then examines transactions and conformity of the quantity of Dry Cacao beans sold to producers/ buyers.

9.3 Quality and Uniqueness Control

'Kakao Berau' GI will provide a Certificate to Processing Units. The certificate may be given after two months from the processing of wet cacao beans to the storage of dry cacao beans, with quality in accordance with the quality standard.

- MPIG Kakao Berau will examine the requirements of yield/product taste, chemical and traceability.
- In taste and chemical testing, the quality of dry cacao bean will be tested by MPIG Kakao Berau. The taste testing will be carried out by a team consisting of 5 people and a panelist who is trained and will be responsible for the quality and uniqueness control of dry 'Kakao Berau' bean. Meanwhile, the chemical testing is carried out by a competent laboratory.
- After recording the value of elements (free from contamination, free from main taste defect and chemical testing value), the overall quality is evaluated and a decision to accept or reject the dry cacao beans is made.
- If accepted, the dry cacao beans can receive a certificate. If rejected, Processing Units have an opportunity to present the quality of dry cacao bean for the second time by another panelist. If the next team still rejects them, the cacao beans cannot receive any certificate and thereby, may not be sold under the name of 'Kakao Berau'.

10. Logo

Products marketed under the PDO 'Kakao Berau' shall bear the 'Kakao Berau' logo as well as the Indonesian National Geographical Indication logo below:

10.1 'Kakao Berau' Logo

Figure 10.1 presents the 'Kakao Berau' logo.



Figure 10.1 Kakao Berau Logo

The ‘Kakao Berau’ logo has the following meaning or philosophy:

A. **IMAGE OF TURTLE** illustrates the identity of Berau Regency with a dark brown color constituting an animal having a high adaptability and having existed from time immemorial like cacao plants which have existed for a long time in Berau Regency.

B. **COCOA BAR ON THE TURTLE HEAD** means that innovation will be carried out continuously to produce processed products made of Cacao.

C. **DARK BROWN COLOR ON CACAO FRUIT** indicates superior clones among others Sul-1 and Sul-2 planted a lot by Berau communities.

D. **GREEN COLOR ON CACAO LEAVES** means that Cacao can thrive in Berau Regency

E. **DRY CACAO BEAN CLAMPED BY TWO TURTLE LEGS** means Mentoring and development for farmers producing superior products made of Cacao will continue to be carried out.

F. **KAKAO BERAU WRITING** is a brand with green color meaning the development of plantations which is in harmony and in line with sustainable environmental preservation.

10.2 National Logo

The National Geographical Indication Logo is as follows:



Figure 10.2 Indonesian National Geographical Indication Logo

10.3 Labelling

The labeling provisions are divided into several sections according to product stages.

Product Stages	Labelling Provisions
Cacao powder	Only cacao powder that have the characteristics mentioned above and are produced in the geographical area specified in this document can bear the name 'Kakao Berau', the 'Kakao Berau' logo, and the National Geographical Indication Logo.
'Kakao Berau' used as ingredient	- 'Kakao Berau' name on the front of packaging must be verified to have cocoa powder content originating from only 'Kakao Berau' powder. - The name must be used, and the percentage of the existing cocoa powder content MUST be set out. - The name may not be used on the front of packaging, if the cocoa powder content is less than 35%. - If the cocoa powder content is less than 35%, the name may ONLY be used on the composition section, INSTEAD of the front. For example: This cocoa is made of "**15% of *Kakao Berau* Powder**, 35% of Coconut Sugar, 30% of Milk and 20% of other ingredients".

CONCLUSION

Superior cacao commodity plantations in Berau Regency have the potential to be exploited and developed to meet domestic and international (export) market demands, in the form of cacao powder. It is expected that cacao products produced by farmers, which for decades, were only traded casually (traditional market scope) with low quality (without fermentation) and underwent fluctuating area and production, can increase added value for farmers' and regional income. With this geographical indication protection, 'Kakao Berau' products are believed to become the flagship trading commodity of Berau Regency.

'Kakao Berau' from Berau Regency now have standardized processing units, thus producing cacao powder of prime quality and processing standard as well as having a competitive export market share opportunity. Therefore, the protection for 'Kakao Berau' from Berau Regency, East Kalimantan Province is greatly needed because it is traded under the tradename 'Kakao Berau'. 'Kakao Berau' has been known as one of good quality cacao products in Indonesia. Therefore, the Geographical Indication Protection Society of 'Kakao Berau' *(MPIG Kakao Berau)* formed in 2019, with members consisting of various communities concerned about the quality of Cacao powder and their processed products in Berau Regency, filed an application for Geographical Indication under the name 'Kakao Berau'**.**

APPENDICES

Appendix 1. Results of *Kakao Berau* Taste Test

LABORATORIUM PENGUJI
(Laboratory for Testing)
PUSAT PENELITIAN KOPI DAN KAKAO INDONESIA
(Indonesian Coffee And Cocoa Research Institute)
"LP PUSLITKOKA"

FR-LP. 5.10.01.02.02-C

LAPORAN HASIL UJI CITARASA
(Report of Analysis/Testing)

02.19.2.067

No. 02.19.2.067 - C

Nomer Pengujian (Number of Testing) : 02.19.2.067
Tanggal terima contoh (Sample recieved) : 30-09-2019
Tanggal Pengujian (Date of Testing) : 22-10-2019 — 22-10-2019
Jenis contoh (Kind of sample) : Biji Kakao Lindak
Identitas contoh (Sample Identity) : Biji Kakao Gunung Tabur.

Karakteristik (Characteristic)	Skor Citarasa * (Organoleptic Score)	Karakteristik (Characteristic)	Skor Citarasa * (Organoleptic Score)
Cokelat/Cocoa	7.00	Manis/Sweet	0.00
Asam/Acidity	4.25	Sangrai/Roasted	5.00
Pahit/Bitterness	4.50	Kayu / Woody	1.50
Sepat /Astringency	4.50	Cacat Lain/Other Off	
Buah Segar/Fresh Fruit	3.00		
Buah Kering/Browned Fruit	1.00		
Bunga/Floral	2.00		
Rempah/Spicy	0.00		
Kacang / Nutty	1.00	Nilai global:	7.00
Comments:			

*) Keterangan skor (Score notes)
Nilai untuk rasa dan intensitas/Notation for Taste and Intensity: 0=Tidak ada/Non; 1-2= Sangat lemah/Very weak; 3-5= Lemah-Sedang/weak to moderate; 6-8= Kuat/Strong; 9-10= Dominan/Dominant.

Jember, 22-10-2019
Manajer Teknis

Andi Dharma Wahyudi

Catatan (Notes):
1. Hasil analisis ini hanya berdasarkan contoh yang diuji (This results based on the tested sample only).
2. Hasil analisis ini hanya berlaku selama 3 bulan (This results valid within 3 months).

ORIGINAL

LABORATORIUM PENGUJI
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PUSAT PENELITIAN KOPI DAN KAKAO INDONESIA
(Indonesian Coffee And Cocoa Research Institute)
"LP PUSLITKOKA"

LAPORAN HASIL UJI CITARASA
(Report of Analysis/Testing)

FR-LP. 5.10.01.02.02-C

No. 02.19.2.066 - C

02.19.2.066

Nomer Pengujian (Number of Testing) : 02.19.2.066
Tanggal terima contoh (Sample recieved) : 30-09-2019
Tanggal Pengujian (Date of Testing) : 22-10-2019 — 22-10-2019
Jenis contoh (Kind of sample) : Biji Kakao Lindak
Identitas contoh (Sample Identity) : Biji Kakao Tumbit.

Karakteristik (Characteristic)	Skor Citarasa * (Organoleptic Score)	Karakteristik (Characteristic)	Skor Citarasa * (Organoleptic Score)
Cokelat/Cocoa	6.00	Manis/Sweet	0.00
Asam/Acidity	2.00	Sangrai/Roasted	4.25
Pahit/Bitterness	6.00	Kayu / Woody	0.00
Sepat /Astringency	6.00	Cacat Lain/Other Off	
Buah Segar/Fresh Fruit	1.00	Busuk/Putrid	-1.00
Buah Kering/Browned Fruit	0.00		
Bunga/Floral	0.00		
Rempah/Spicy	0.00		
Kacang / Nutty	3.00	Nilai global:	6.00
Comments:			

*) Keterangan skor (Score notes)
Nilai untuk rasa dan intensitas/Notation for Taste and Intensity: 0=Tidak ada/Non; 1-2= Sangat lemah/Very weak; 3-5= Lemah-Sedang/weak to moderate; 6-8= Kuat/Strong; 9-10= Dominan/Dominant.

Jember, 22-10-2019
Manajer Teknis

Andi Dharmawan, S.TP

Catatan (Notes):
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Appendix 2. Results of *Kakao Berau* Chemical Content Test

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LAPORAN HASIL ANALISIS/PENGUJIAN
(Report of Analysis/Testing)
No. 02.25.2.0051 - M

FR-LP. 7.8.01.02.02-M

02.25.2.0051

Nomer Analisis(Number of Analysis) : 02.25.2.0051
Tanggal Terima Contoh (Sample received) : 08-12-2025
Tanggal analisis/pengujian (Date of analysis/testing) : 08-12-2025 — 10-12-2025
Jenis contoh (Kind of sample) : Kakao bubuk
jenis analisis/pengujian (Kind of analysis/testing) : Lemak Total
Identitas contoh (Sample identity) : Kakao bubuk

HASIL ANALISIS/PENGUJIAN (Result of Analysis/Testing)

Karakteristik (Characteristic)	Hasil analisis * (Result of analysis)	Metode Analisis (Method of analysis)
Kadar air (Moisture content)	N.A	SNI 2323-2008; 7.2
Serangga hidup (Life insects)	N.A	SNI 2323-2008; 7.1
Biji berbau asap/abnormal/asing (Beans' smell smoky/abnormal/other tains)	N.A	SNI 2323-2008; 7.3
Jumlah biji per 100g (Number of beans /100 g)	N.A	SNI 2323-2008; 7.6
Kadar Biji Pecah (Broken Beans)	N.A	SNI 2323-2008; 7.5
Kadar benda asing (Foreign matters)	N.A	SNI 2323-2008; 7.3
Kadar biji berjamur (Mouldy beans content)	N.A	SNI 2323-2008; 7.7
Kadar biji slaty (Slaty beans content)	N.A	SNI 2323-2008; 7.7
Kadar biji berserangga (Insect demaged beans content)	N.A	SNI 2323-2008; 7.7
Kadar kotoran (Waste contents)	N.A	SNI 2323-2008; 7.4
Kadar biji berkecambah (Sprouted beans content)	N.A	SNI 2323-2008; 7.7
Kadar kulit dan keping biji (Shell content and Nib content)*	N.A	SNI 2323-2008; L-A
pH Keping biji (pH value of nib)*	N.A	SNI 2323-2008; L-D
Kadar lemak total (Total fat content)*	53.36 %	SNI 2323-2008; L-B
Kadar asam lemak bebas (Free fatty acid content)*	N.A	SNI 2323-2008; L-C
Kadar logam berat (Heavy metals) Cd / Pb *	N.A / N.A	SNI 2323-2008; L-E, G
Analisis lain * N.A	N.A	

Kesimpulan Mutu Biji:
(Conclusion of quality)

Jember, 10-12-2025
Manajer Teknis

Ninik Kusmiarsih, SE

Catatan (Notes):
N.A.= tidak dianalisis (not analyzed), *) Tidak termasuk lingkup Akreditasi, **) Subkontrak Pengujian
(N.C.) = Kata dan angka diikuti huruf N.C. tidak sesuai dengan (Word and values followed by N.C. are not conform to) SNI 2323-2008
1. Hasil analisis ini hanya berdasarkan contoh yang diuji (This results based on the tested sample only).
2. Hasil analisis ini hanya berlaku selama 3 bulan (This results valid within 3 months).
3. Tidak melakukan pengambilan contoh (Do not take samples).

Page 2 of 2

ORIGINAL

LABORATORIUM PENGUJI
(Laboratory for Testing)
PUSAT PENELITIAN KOPI DAN KAKAO INDONESIA
(Indonesian Coffee And Cocoa Research Institute)
"LP PUSLITKOKA"

Accredited KAN Komite Akreditasi Nasional LP-592-IDN

LAPORAN HASIL ANALISIS/PENGUJIAN
(Report of Analysis/Testing)

FR-LP. 5.10.01.02.02-M

No. 02.19.2.067 - M

02 . 19 . 2 . 067

Nomer Analisis(Number of Analysis)	: 02.19.2.067
Tanggal Terima Contoh (Sample received)	: 30-09-2019
Tanggal analisis/pengujian (Date of analysis/testing)	: 22-10-2019 — 22-10-2019
Jenis contoh (Kind of sample)	: Biji Kakao Lindak
jenis analisis/pengujian (Kind of analysis/testing)	: Lemak Total, Citarasa, Polyphenol, pH.
Identitas contoh (Sample identity)	: Biji Kakao Gunung Tabur.

HASIL ANALISIS/PENGUJIAN (Result of Analysis/Testing)

Karakteristik (Characteristic)	Hasil analisis * (Result of analysis)	Metode Analisis (Method of analysis)
Kadar air (Moisture content)	N.A	SNI 2323-2008; 7.2
Serangga hidup (Life insects)	N.A	SNI 2323-2008; 7.1
Biji berbau asap/abnormal/asing (Beans' smell smoky/abnormal/other tains)	N.A	SNI 2323-2008; 7.3
Jumlah biji per 100g (Number of beans /100 g)	N.A	SNI 2323-2008; 7.6
Kadar Biji Pecah (Broken Beans)	N.A	SNI 2323-2008; 7.5
Kadar benda asing (Foreign matters)	N.A	SNI 2323-2008; 7.3
Kadar biji berjamur (Mouldy beans content)	N.A	SNI 2323-2008; 7.7
Kadar biji slaty (Slaty beans content)	N.A	SNI 2323-2008; 7.7
Kadar biji berserangga (Insect demaged beans content)	N.A	SNI 2323-2008; 7.7
Kadar kotoran (Waste contents)	N.A	SNI 2323-2008; 7.4
Kadar biji berkecambah (Sprouted beans content)	N.A	SNI 2323-2008; 7.7
Kadar kulit dan keping biji (Shell content and Nib content)	N.A	SNI 2323-2008; L-A
pH Keping biji (pH value of nib)	5.77	SNI 2323-2008; L-D
Kadar lemak total (Total fat content)	51.30 %	SNI 2323-2008; L-B
Kadar asam lemak bebas (Free fatty acid content)	N.A	SNI 2323-2008; L-C
Kadar logam berat (Heavy metals) Cd / Pb	N.A / N.A	SNI 2323-2008; L-E,
Analisis lain * Polyphenol	21.23 %	

Kesimpulan Mutu Biji:
(Conclusion of quality)

Jember, 22-10-2019
Manajer Teknis

Andi Dharmawan, STP

Catatan (Notes):
N.A.= tidak dianalisis (not analyzed), *= Tidak termasuk lingkup Akreditasi
(N.C.) = Kata dan angka diikuti huruf N.C. tidak sesuai dengan (Word and values followed by N.C. are not conform to) SNI 2323-2008
1. Hasil analisis ini hanya berdasarkan contoh yang diuji (This results based on the tested sample only).
2. Hasil analisis ini hanya berlaku selama 3 bulan (This results valid within 3 months).

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LAPORAN HASIL ANALISIS/PENGUJIAN
(Report of Analysis/Testing)

FR-LP. 5.10.01.02.02-M

No. 02.19.2.066 - M

02-19-2-066

Nomer Analisis(Number of Analysis)	: 02.19.2.066
Tanggal Terima Contoh (Sample received)	: 30-09-2019
Tanggal analisis/pengujian (Date of analysis/testing)	: 22-10-2019 — 22-10-2019
Jenis contoh (Kind of sample)	: Biji Kakao Lindak
jenis analisis/pengujian (Kind of analysis/testing)	: Lemak Total, Citarasa, Polyphenol, pH.
Identitas contoh (Sample identity)	: Biji Kakao Tumbit.

HASIL ANALISIS/PENGUJIAN (Result of Analysis/Testing)

Karakteristik (Characteristic)	Hasil analisis * (Result of analysis)	Metode Analisis (Method of analysis)
Kadar air (Moisture content)	N.A	SNI 2323-2008; 7.2
Serangga hidup (Life insects)	N.A	SNI 2323-2008; 7.1
Biji berbau asap/abnormal/asing (Beans' smell smoky/abnormal/other tains)	N.A	SNI 2323-2008; 7.3
Jumlah biji per 100g (Number of beans /100 g)	N.A	SNI 2323-2008; 7.6
Kadar Biji Pecah (Broken Beans)	N.A	SNI 2323-2008; 7.5
Kadar benda asing (Foreign matters)	N.A	SNI 2323-2008; 7.3
Kadar biji berjamur (Mouldy beans content)	N.A	SNI 2323-2008; 7.7
Kadar biji slaty (Slaty beans content)	N.A	SNI 2323-2008; 7.7
Kadar biji berserangga (Insect demaged beans content)	N.A	SNI 2323-2008; 7.7
Kadar kotoran (Waste contents)	N.A	SNI 2323-2008; 7.4
Kadar biji berkecambah (Sprouted beans content)	N.A	SNI 2323-2008; 7.7
Kadar kulit dan keping biji (Shell content and Nib content)	N.A	SNI 2323-2008; L-A
pH Keping biji (pH value of nib)	6.07	SNI 2323-2008; L-D
Kadar lemak total (Total fat content)	52.92 %	SNI 2323-2008; L-B
Kadar asam lemak bebas (Free fatty acid content)	N.A	SNI 2323-2008; L-C
Kadar logam berat (Heavy metals) Cd / Pb	N.A / N.A	SNI 2323-2008; L-E,
Analisis lain * Polyphenol	10.49 %	

Kesimpulan Mutu Biji:
(Conclusion of quality)

Jember, 22-10-2019

Manajer Teknis

Andi Dharmawan, S.TP

Catatan (Notes):
N.A.= tidak dianalisis (not analyzed), *= Tidak termasuk lingkup Akreditasi
(N.C.) = Kata dan angka diikuti huruf N.C. tidak sesuai dengan (Word and values followed by N.C. are not conform to SNI 2323-2008
1. Hasil analisis ini hanya berdasarkan contoh yang diuji (This results based on the tested sample only).
2. Hasil analisis ini hanya berlaku selama 3 bulan (This results valid within 3 months).

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Appendix 3. Results of *Kakao Berau* Soil Sample Test



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FR-LP. 5.10.01.01.01-T

HASIL ANALISIS *(Result of Analysis)* :

Identitas Contoh		Terhadap 100 g contoh kering 105°C										Terhadap 1 kg contoh kering 105°C																		pH (1:5)	
		Tekstur Cara Pipet			C	N		Ekstrak HCl 25% *)				Ekstrak NH_4-OAc. 1 M pH 7							P_2O_5 *)		Ekst. NH_4-OAc pH 4,8 *)			HCl 25 % *)	Mn Total	Ekst. HCl 0,1 N *)		KCl 1N *)	H_2O	KCl 1 N
Nomor Analisis	Kode Pengirim	Pasir	Debu	Liat	Walkley & Black	Kjeldahl	C/N	P_2O_5	K_2O	CaO	MgO	Na	K *)	Ca	Mg	Nilai Kation	KTK	KB	Ekst. Olsen	Ekst. Bray I	S	Fe	Cl	B	Destruksi Camp Asam Kuat *)	Cu	Zn	Al-dd		
		%			gram			mg				c mol *						%	mg						mg			c mol *		
	Kode contoh																														
11910262	Gurimbang	4	50	46	1,01	0,14	7	-	-	-	-	-	0,74	4,02	1,84	-	15,06	-	-	1	-	-	-	-	-	-	-	4,67	5,0	-
11910263	Birang	10	52	38	0,79	0,08	10	-	-	-	-	-	0,12	2,79	1,28	-	8,31	-	-	4	-	-	-	-	-	-	-	3,10	5,1	-

Catatan (*Notes*) :

1. Hasil analisis ini hanya berdasarkan contoh yang diuji
   (*This result based on the tested sample only*)
2. Hasil analisis ini hanya berlaku enam bulan
   (*This result is valid within six months*)
3. Semua hasil analisis kecuali kadar air di hitung atas dasar contoh kering
   (*All analytical results except the moisture was calculated on the basis of dry sample*)
4. *Pengambilan contoh di lakukan oleh pelanggan*
   (*Sampling have been done by customer*)
5. (*) Tidak termasuk ruang lingkup akreditasi
   (*Not included in the scope of accreditation*)

Jember, 16 Oktober 2019
Manajer Teknis,
(*Technical Manager*),

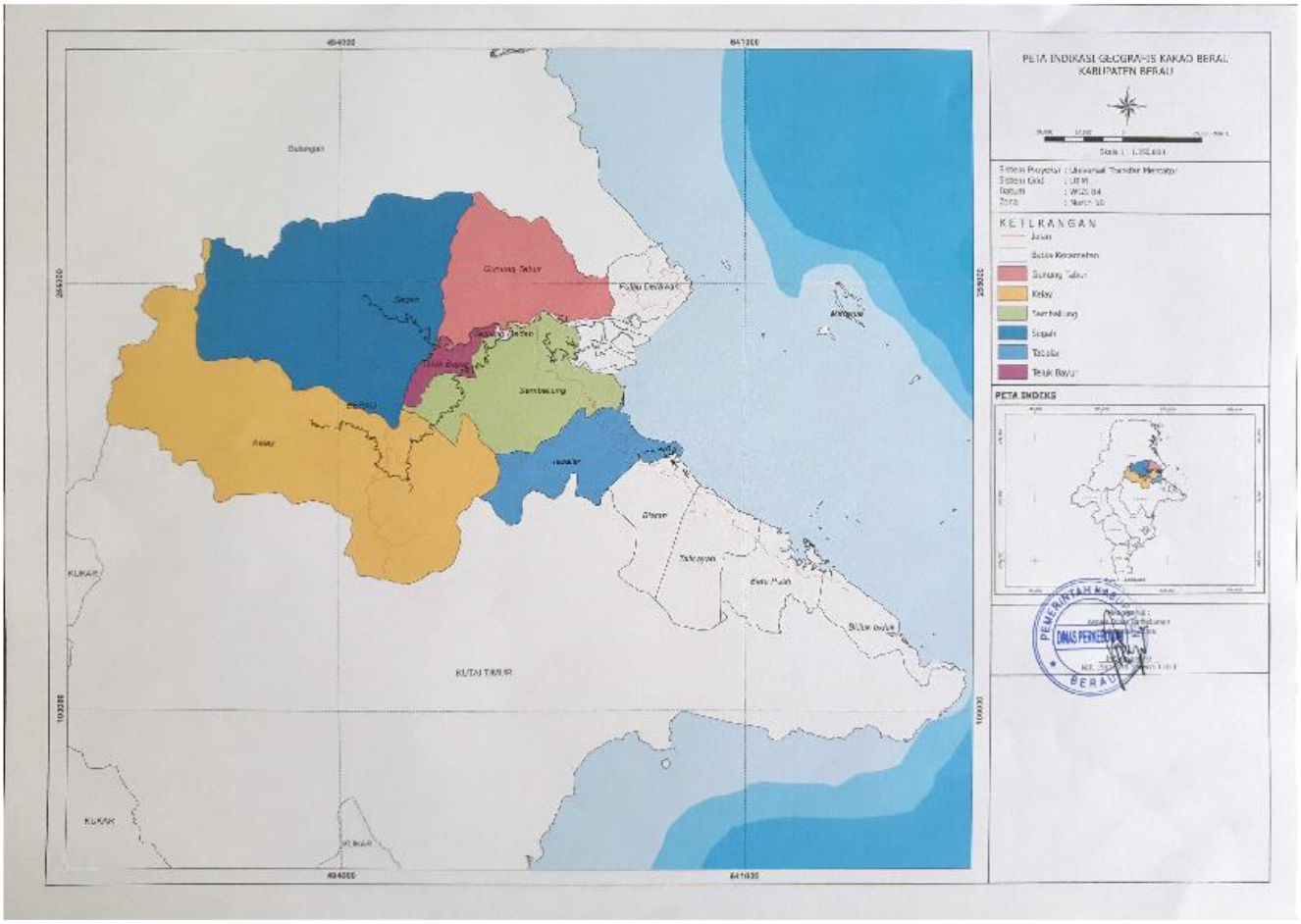
Tri Adityanto

ORIGINAL

bun Kaltim-01.19.1.0262 - 01.19.1.0263-T

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Appendix 4. Map of *Kakao Berau* Geographical Indication



Appendix 5. Description of Sulawesi 01 and Sulawesi 02 Clone Cacao Plant.

DESCRIPTION OF
CACAO PLANT

1. Sulawesi 01 Clone

Decision Number	:	**1694/Kpts/SR.120/12/2008**
Dated	:	**12 December 2008**
Origin	:	Morphologically looks like PBC 123 clone, exploration result from the plantation of PT Hasfarm Product, in Pinang Manis, Tenggarong East Kalimantan which was later assigned a germplasm accession number KW 162. Morphologically also looks like the exploration result collection of the Indonesian and Central Sulawesi Coffee and Cocoa Research Institutes which was later assigned a clone accession number KW 215.
Habit	:	Medium, intensive branching thus looks thick
Growth Rate	:	Fast
Branching Property	:	Relatively straight (semi-vertical)
Leaf		
Leaf Shape	:	Obovate, medium size
Leaf Color	:	Young leaves have a bright red color
	:	Old leaves have a dark green color, wavy surface and apparent leaf veins
Flower		
Color of Flower Stem	:	Pink, open staminode
Pollination	:	Self-compatible and capable of cross-compatible
Fruit		
Shape	:	Oblong, large size
Length (cm)	:	20.5
Arc (cm)	:	25.8
Rind Thickness (mm)	:	16.3
Number of Fruit/Tree	:	49.6*
Fruit Score	:	23.0

Color	:	Unripe fruit have a dark red color while ripe fruit have a reddish-yellow color
Fertilization Property	:	Continuously bear fruit along the year

Bean

Shape	:	Ovate
Dry Bean Weight (gram)	:	1.10
Epicarp Content (5)	:	11.3
Number of Beans/100gram	:	104
Number of Fruit/Cob	:	41.5
Production Potential	:	1.8-2.5 tons/ha (population of 1,100 trees/ha)

Resistance to Main Pests and Diseases

VSD	:	Resistant
Oncobasidium theobromae	:	Resistant
CPB	:	Vulnerable
Development Area Compatibility	:	Regional environmental condition of South Sulawesi, West Sulawesi, Central Sulawesi and Southeast Sulawesi Provinces at the maximum elevation of 900 m asl. Type B, C or D climate (according to Schmidt & Ferguson classification)
Clone Proposer/Owner	:	Governments of South Sulawesi, West Sulawesi, Central Sulawesi and Southeast Sulawesi Provinces

2. Sulawesi 02 Clone

Decision Number	:	**1695/Kpts/SR.120/12/2008, Dated: 12 December 2008**
Origin	:	Morphologically looks like BR 25 clone saved by the Indonesian Coffee and Cocoa Research Institute from the plantation of PT. Hasfarm Product, in Pinang Manis, Tenggarong East Kalimantan which was then become one of the germplasm collection assigned an accession number KW 163.
Canopy habit	:	Medium, semi-intensive branching
Growth rate	:	Fast
Branching property	:	Straight (Vertical)

Leaf

Leaf shape	:	Obovate, large size
Leaf color	:	Young leaves have a reddish-brown color, while old leaves have a green color, wavy surface and apparent leaf veins

Flower

Color of flower stem	:	Pink, open staminode
Pollination	:	Self-compatible and capable of cross-compatible

Bean

Shape	:	Ellipse
Dry Bean Weight (gram)	:	1.00
Epicarp content (%)	:	11.64
Number of Beans/100 grams	:	103
Number of beans/cob	:	37

Production potential (Ton/Ha/Year): 1.8-2.75 tons/ha (population of 1,100 trees/ha)

Resistance to Main Pests & Diseases:

VSD	:	Relatively resistant
Oncobasidium theobromae	:	Relatively resistant
PCB	:	Resistant
Regional Compatibility	:	Regional environmental condition of South Sulawesi, West Sulawesi, Central Sulawesi and Southeast Sulawesi Provinces at the maximum elevation of 900 m asl. Type B, C or D

		climate according to Schmidt & Ferguson classification.
Variety Proposer/Owner	:	Governments of South Sulawesi, West Sulawesi, Central Sulawesi and Southeast Sulawesi Provinces.