Verification of Coffee Product Form and Determination of Conversion Rate From Coffee Dried Berries to Green Coffee Beans (GCB)[1]

Dennis S. Mapa, Ph.D., Divina Gracia L. Del Prado, Ph.D., Vivian R. Ilarina,
Rachel C. Lacsa[2], Manuela S. Nalugon, Abella A. Regala,
Marivic C. De Luna, and Ray Francis B. De Castro

Philippine Statistics Authority

ABSTRACT

The Philippine Statistics Authority (PSA) collects, generates, and releases production data on coffee in the form of dried berries from the results of the Crops Production Survey. In the computation of the Supply Utilization Accounts and Food Balance Sheet for coffee, the coffee form used is green coffee beans (GCB), using a conversion rate of 28 percent from dried berries to GCB. However, the Food and Agriculture Organization of the United Nations (FAO) and International Coffee Organization (ICO) use a 50 percent conversion rate from dried berries to GCB.

The common form of coffee traded by farmers and the conversion rate from dried berries to GCB were investigated through consultations with traders, processors, and other stakeholders; and surveys with coffee farmers and traders as respondents. The results of this study show that the common form of coffee traded by farmers is GCB, and the average conversion rate from dried berries to GCB is 50 percent.

Keywords: *fresh berries, field visits, survey, processors, experiment, percent recovery*

I. INTRODUCTION

The Philippine Statistics Authority (PSA) collects, generates, and releases production data on coffee in the form of dried berries. The data are based on the Crops Production Survey (CrPS) results. Meanwhile, in the computation of the Supply Utilization Accounts and Food Balance Sheet for coffee, the PSA has been releasing production data on coffee in green coffee beans (GCB) by using the 28 percent conversion rate from dried berries to GCB.

Coffee dried berries refer to the dried coffee fruit, which includes the bean, mucilage, and pulp. Meanwhile, GCB refers to unroasted coffee beans that are dried up to 12 percent moisture content without the pulp and mucilage of the fruit.

It was noted that other coffee-producing countries use GCB in reporting coffee production. In terms of the conversion rate from dried berries to GCB, the International Coffee Organization (ICO) and Food and Agriculture Organization (FAO) both use 50 percent as the conversion rate.

[1] Presented at the 15th National Convention on Statistics, 03-5 October, 2022, Crowne Plaza Manila Galleria, Ortigas Center, Quezon City and published in this issue as a *Technical Note*.

[2] Corresponding Author's Email Address: r.lacsa@psa.gov.ph

II. OBJECTIVES

This study aims to verify the product form of coffee that is most traded by farmers. Also, it seeks to establish the conversion rate for coffee from dried berries to GCB to be comparable with the international standards, thus, making statistics on coffee more relevant.

III. METHODOLOGY

To verify the product form of coffee that farmers most trade and to establish the conversion rate for coffee from dried berries to GCB, the PSA conducted several initiatives such as the inquiry to Cavite State University, various surveys, and field visits. Figure 1 shows a summary of the steps and the timeline of the methododology which were discussed in detail in the succeeding paragraphs.

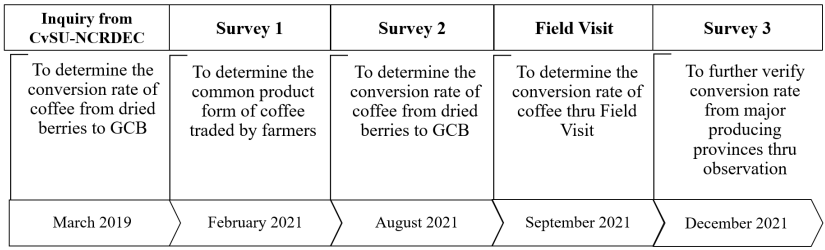


Figure 1. Steps and timeline of the methodology.

A. Inquiry to Cavite State University-National Coffee Research, Development and Extension Center (CvSU-NCRDEC)

Results of the experiment conducted by the CvSU-NCRDEC in 2019 to obtain the conversion rates of coffee to GCB from other product forms of coffee were among the sources of information for this study.

B. Survey on the Verification of Product Form of Coffee Traded by Farmers (Survey 1)

Through its Provincial Statistical Offices (PSOs), the PSA conducted the field verification of the product form of coffee traded by the farmers during the conduct of the first quarter 2021 survey round of the CrPS, with January to March 2021 as reference period. A data collection form, separate from the survey questionnaire of the CrPS, was used to collect data on the product forms of coffee sold by the farmer-producer from January to March 2021 and when they started selling/trading the coffee in that form.

C. Survey on the Verification of Product Form of Coffee Traded by Farmers and Coffee Conversion Rate from Dried Berries to GCB (Survey 2)

Another coffee field verification was conducted as a rider to the third quarter round of the CrPS, with July to September 2021 as the reference period. The items collected in the survey were the product form of coffee sold by farmers during the quarter, and the time they started trading the coffee in that form. It was also asked if the farmer-producer was aware of the conversion factor from dried berries to GCB, the conversion factor they used, and the method used by the farmer in processing the dried berries to GCB.

D. Field Visits to Selected Coffee Growers and Processing Establishments (Field Visit)

The PSA conducted field visits to selected coffee growers and processing establishments in Batangas and Cavite in September 2021. The field visits gathered information on the percent recoveries of coffee from dried berries to GCB.

A second field visit was conducted in Benguet. The 2020 Updated List of Establishments (ULE) was used to determine the coffee manufacturing and processing establishments to be visited. Coffee growers as key informants were also interviewed aside from the list obtained from the ULE. During the field visit in Benguet, an actual de-husking operation was observed in addition to the face-to-face interview with the selected key informants.

In February 2022, Undersecretary Dennis Mapa did the third field visit to Sultan Kudarat, the top coffee-producing province in the country. During the visit, he observed the actual demonstration of coffee processing, which included solar drying, de-pulping/milling of dried coffee berries, roasting and grinding, and the packaging of the final product.

E. Survey on the Determination of the Conversion Factor from Dried Berries to Green Coffee Beans from Traders/Processors in the Top Coffee-Producing Regions (Survey 3)

The results of the two surveys showed that most farmers now trade coffee in the form of GCB. However, there is still a need to firmly establish the conversion rate from dried berries to GCB. Thus, determining the percent recovery of GCB from dried berries at 12 percent moisture content was conducted in the top-producing provinces of the top coffee-producing regions in December 2021.

The four top coffee-producing regions that conducted the field verification survey were Northern Mindanao, Davao Region, SOCCSKSARGEN, and Bangsamoro Autonomous Region in Muslim Mindanao (BARMM). Specifically, the survey was conducted in the provinces of Bukidnon, Davao del Norte, Davao del Sur, Davao de Oro, Davao Occidental, Davao Oriental, City of Davao, Cotabato, Sultan Kudarat, South Cotabato, Basilan, Maguindanao, and Sulu.

The collected data were the type of coffee variety/ies processed from dried berries to GCB, the initial weight (in kilograms) of dried berries at 12 percent moisture content, and the final weight after processing to GCB. The percent recovery or conversion rate from dried berries to GCB was computed by getting the ratio of the final weight to the initial weight multiplied by 100. That is,

$$\%\, recovery = \frac{GCB\ weight\ (final\ weight)}{Dried\ Berries\ weight\ (initial\ weight)} \times 100 \qquad (1)$$

IV. RESULTS AND FINDINGS

From the results of the experiment conducted by CvSU-NCRDEC in 2019, the percent recovery of fresh berries to green beans of coffee arabica is 20.4 percent using wet processing, while for coffee excelsa, it is 16.4 percent and 16.7 percent using wet and dry processing, respectively. Deriving from the results of the CvSU-NCRDEC experiment, the percent recovery of coffee from dried berries to green coffee beans is 41.3 percent using dry processing (see Table 1). More detailed results of the experiment are shown in Appendices A and B.

Table 1. Results of the Material Balance Experiment of CvSU-NCRDEC conducted in 2019.

Variety	Process	Product Form	Percent Recovery
Arabica-Red Bourbon	Wet	Fresh Berries to GCB (10–12 MC)	20.4
Coffee Excelsa	Wet	Fresh Berries to GCB (11.20% MC)	16.4
	Dry	Fresh Berries to GCB (11.54% MC)	16.7
Coffee Excelsa	Dry	Dried Berries to GCB (derived)	41.3

MC – Moisture Content; GCB – Green Coffee Beans

From the results of Survey 1 and 2, which covered the first and third quarter survey rounds of CrPS, GCB was the most traded coffee product form with an average percent share of 45.1 percent. This was followed by dried and fresh berries, with 43.2 percent and 11.7 percent, respectively (Table 2).

Table 2. Coffee product form traded by farmers, January to March and July to September, 2021.

Product Form Sold	Jan to Mar 2021		Jul to Sep 2021		Average Percent Share (Jan to Mar 2021 and Jul to Sep 2021)
	No. of Responses	Percent Share	No. of Responses	Percent Share	
Total	**998**	**100**	**609**	**100**	**100**
Fresh Berries	119	11.9	70	11.5	11.7
Dried Berries	413	41.4	274	45.0	43.2
Green Coffee Beans (GCB)	466	46.7	265	43.5	45.1

On the other hand, from the field visits done to the four provinces, Table 3 shows the percent recoveries from dried berries to GCB ranged from 43.2 percent (Cavite) to 59.2 percent (Sultan Kudarat) while Table 4 shows the results of Survey 3, which was conducted in December 2021 that the average percent recovery from dried berries to GCB was 54.6 percent. Likewise, it was also observed that the overall average percent recovery from dried berries to GCB from various sources was 51.5 percent, which is near the 50 percent conversion rate being used by the International Coffee Organization and Food and Agriculture Organization as shown in Table 5.

Table 3. Percent recovery of coffee from dried berries to GCB as observed in the top coffee-producing provinces.

Province	Percent Recovery		
	Average	Minimum	Maximum
Batangas	52.5	20.0	60.0
Cavite	43.2	25.0	76.5
Benguet	58.3	50.0	65.0
Sultan Kudarat	59.2	58.3	60.1

Table 4. Percent recovery of coffee from dried berries to GCB as observed in the top coffee-producing provinces in Mindanao Regions.

Region/Province	Percent Recovery		
	Average	Minimum	Maximum
PHILIPPINES	**54.6**	**15.0**	**95.6**
Northern Mindanao	**55.5**	**52.3**	**58.8**
Bukidnon	55.5	52.3	58.8
Davao Region	**53.0**	**15.0**	**95.6**
Davao de Oro	81.7	32.8	95.6
Davao del Norte	75.0	75.0	75.0
Davao del Sur	41.8	15.0	75.0
City of Davao	40.8	25.0	56.9
Davao Oriental	59.0	48.0	75.0
Davao Occidental	42.1	20.0	80.0
SOCCSKSARGEN	**52.1**	**33.3**	**67.0**
Cotabato	48.3	33.3	60.0
South Cotabato	47.4	40.5	50.0
Sultan Kudarat	59.3	47.1	67.0
BARMM	**60.7**	**15.0**	**87.4**
Basilan	24.5	15.0	32.0
Maguindanao	75.6	69.0	83.0
Sulu	74.5	60.8	87.4

Table 5. Summary of percent recoveries of coffee from dried berries to GCB.

Source	Percent Recovery
CvSU-NCRDEC	
Excelsa (dry processing)	41.3
Field Visits	
Batangas	52.5
Cavite	43.2
Benguet	58.3
Sultan Kudarat	59.2
Survey 3	54.6
Average	**51.5**

V. SUMMARY AND CONCLUSIONS:

Based on the results of the surveys and field visits, the PSA recommends changing the coffee product form from dried berries to GCB in the data collection of the CrPS starting on the third quarter of 2022 and adopting the ICO and FAO's 50 percent conversion rate from dried berries to GCB equivalent.

The results of the coffee surveys and field visits were presented to the Technical Working Group on Crops Statistics and Interagency Committee on Agriculture and Fishery Statistics (IACAFS), where the results and recommendations were approved and endorsed for approval by the PSA Board.

The results of the study and recommendations were presented to the PSA Board on 13 May 2022, where recommendations were approved through PSA Board Resolution No. 05 Series of 2022 entitled "Approving and Adopting the Use of Green Coffee Bean (GCB) as the Coffee Product Form in the Crops Production Survey and the Conversion Rate of Fifty Percent from Coffee Dried Berries to GCB Equivalent."

VI. LITERATURE CITED:

Development and Extension Center, Cavite State University (CSU-NCRDEC), and DOST-PCAARRD. n.d. "National Coffee Research."

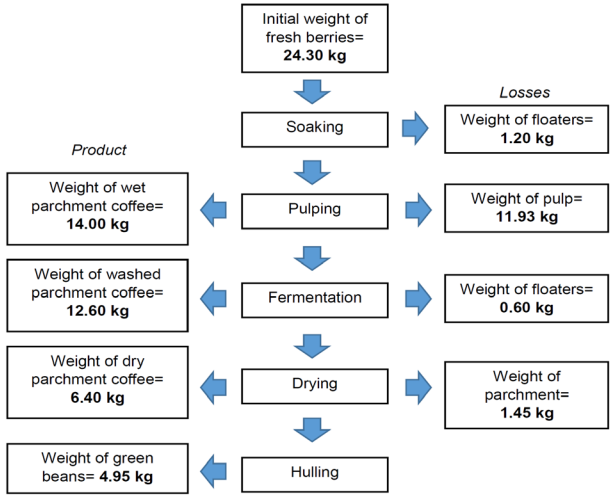
ESCOBAR, M. AND TORRES, A. n.d. "Standardized Evaluation of Philippine Specialty Coffee for Domestic and Export Markets."

International Coffee Council. 2009. "ICO Documents." International Coffee Organization. March 18–20. http://www.ico.org/documents/icc-102-10e-rules-statistical-reports.pdf.

Appendix A: Material Balance Sheet for Coffee Arabica-Red Bourbon

MATERIAL BALANCE

C. arabica- Red Bourbon



Percent recovery (fresh berries to green beans @10-12% MC)

$= 100 - [(\frac{weight\ of\ fresh\ berries - weight\ of\ green\ beans}{weight\ of\ fresh\ berries})X100)]$

$= 100 - [(\frac{24.30 - 4.95}{24.30})X100)]$

=20.37%

Note:

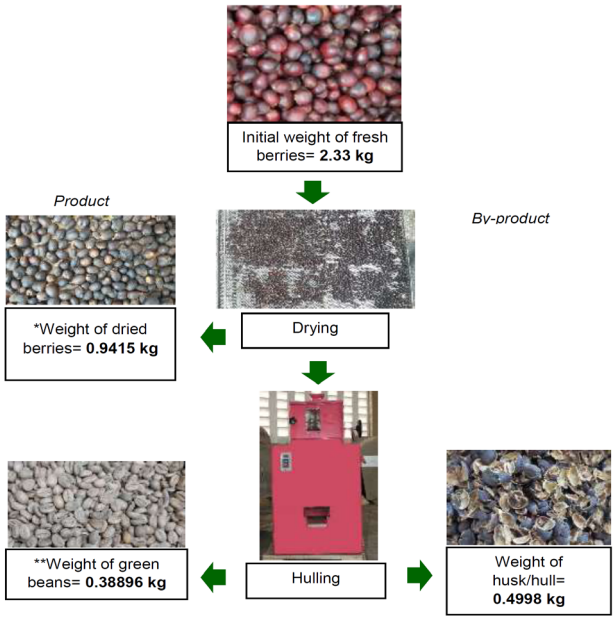
This is part of the results of the project on "Standardization of Cup Profiles of Coffee for Domestic and Export Markets" funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD).

Please ask permission from the investigators (Dr. Marilyn Escobar and Engr. Al-Eugene L. Torres) before using this data in your publication, presentation and others. Please email your queries to ncrdec@cvsu.edu.ph or ncrdec.cvsu@gmail.com

Appendix B: Material Balance Sheet of Wet and Dry Processed Coffee Excelsa

MATERIAL BALANCE

Species: ***Coffea excelsa***
Accession Number: **EA2C4**
Processing Method: **Dry processing**



Percent recovery (fresh berries to green beans)

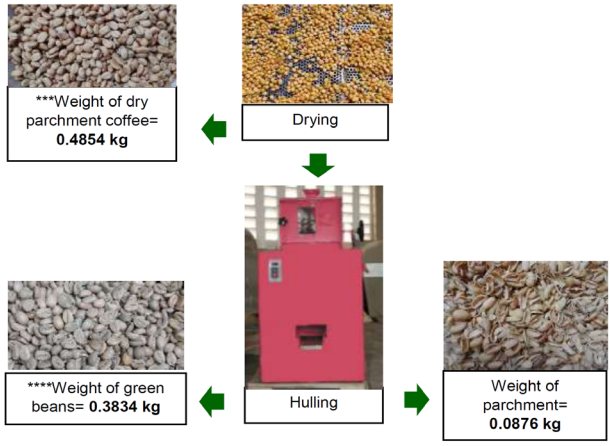
$= 100 - [(\frac{weight\ of\ fresh\ berries - weight\ of\ green\ beans}{weight\ of\ fresh\ berries})X100)]$

$= 100 - [(\frac{2.33 - 0.38896}{2.33})X100)]$

=16.66%

Notes:
*12.56% moisture content
**11.54% moisture content, unsorted

Appendix B: Material Balance Sheet of Wet and Dry Processed Coffee Excelsa (continued)



Percent recovery (fresh berries to green beans)

$= 100 - [(\frac{weight\ of\ fresh\ berries - weight\ of\ green\ beans}{weight\ of\ fresh\ berries})X100)]$

$= 100 - [(\frac{2.33 - 0.3834}{2.33})X100)]$

=16.43%

Notes:
*soaked for 24hrs with 30L of water
**fermented for 18hrs with 30L of water
*** 8% moisture content
****11.20% moisture content, unsorted