

# Status of Mungbean Production in Central Luzon, Philippines

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## Abstract

Mungbean is the major field legume produced by farmers in Central Luzon after harvesting rice in the wet season. It requires minimal to zero tillage and less irrigation so it is best planted in the rainfed rice areas during dry season. Being the second top mungbean producer among all regions in the Philippines, Central Luzon needs to address the challenges in its mungbean industry to identify relative interventions toward increasing the production volume. This paper analyzed the status of the region's mungbean production through profiling of farms and farmers, examining cost and returns in the whole value chain and identification of market chains, constraints, interventions, and current research programs. The lack of available quality seeds, trainings, extension support and fund allocation for research limit the potential of mungbean industry to increase production areas and yield. The proximity of Central Luzon to Greater Manila Area where most trading and processing occur, indicates a greater potential to expand market opportunities. The concerns of farmers on manual harvesting of mungbean pose a major challenge to the agricultural and mechanical engineers in designing machineries for small farm landholdings.

**Keywords:** Mungbam production, cost and returns, marketing, legumes, Central Luzon

## 1. Introduction

Mungbean is known as “poor man’s meat” due to its lower price and high protein content. It is usually planted after rice from January to May. It can fix nitrogen between 64% and 87%, which corresponds to 43-85 kg/ha (Rosales et al., 1995). This lessens the cost of nitrogen fertilizer for rice in the wet season. The Philippine mungbean production was estimated at 22,740 mt in the second quarter of 2023 with Ilocos, Central Luzon and Cagayan Valley as the top-producing regions with 91.4% share to the country’s output (PSA, 2024). From 2018 to 2022, the country’s performance on mungbean remained in terms of area planted, production volume and yield per hectare. Price fluctuations ranged from P55/kg to P95/kg. In terms of area planted and volume of production in Central Luzon, the provinces of Tarlac, Pampanga and Bataan are the top producers, which comprise around 83% of the total volume produced in 2023 (DA-RFO3, 2024). There are 33 mungbean varieties in the Philippines from 1975 to 2019 (NSIC, 2024). The 12 varieties were bred by University of the Philippines-Institute of Plant Breeding (UPLB-IPB) while the rest (21) were bred by the Department of Agriculture- Bureau of Plant Industry (DA-BPI). The varieties of DA-BPI Luntian 1, 2 and 3 have high stickiness and resistant to cercospora leaf spot and rust. Most of UPLB-IPB’s varieties Pagasa 1, 2, 7, 9, 11, 13, 15, 17, 19, 21 have 58 to 65 days maturity, glossy green color and average yield of 1.2 mt/ha (NSIC, 2024). The most planted variety of farmers in Central Luzon is kulabo, which is commonly called *labo* by farmers. It was developed by DA-BPI in 2004 with dull green seed color, 80 days maturity and yields 1.09-1.17 mt/ha (Gatan and Gatan, 2019). Since Central Luzon is the second largest mungbean producer in the country and with very few research studies conducted related to mungbean, the authors examined the status of the region’s mungbean production and identified policy recommendation and Research for Development program and projects to increase area and production volume. The status of mungbean production in Central Luzon was assessed through: characterization of the socio-demographic profile of mungbean

stakeholders such as farmers, wholesalers, and retailers; cost and return analysis on farm production, wholesaling and retailing; identification of market chains; identification of constraints and recommended interventions of farmers; and identification of research for development program and projects conducted on mungbean.

## **2. Method**

The study used a quantitative research design through survey interviews from the largest provincial and municipal mungbean producers in Central Luzon. The interviewees were purposively selected by the researchers based on their extensive experience in mungbean production. The researchers obtained informed consent from the interviewees and local government units (LGUs) before conducting the interviews and gathering other pertinent documents like written records and reports. The structured survey forms for farmers, wholesalers and retailers were pre-tested and improved before the survey proper.

### *2.1 Location and Participants*

The total area harvested for mungbean in Central Luzon last 2023 was 1,587.67 has with 1,050 farmers (DA-RFO3, 2024). The top provinces were Bataan, Pampanga and Tarlac which comprised around 83% of the total area. Among these provinces, the top five municipalities are Hermosa in Bataan, Lubao and Apalit in Pampanga, and La Paz and Concepcion in Tarlac. The researchers have chosen the top five municipalities to be the location of the study due to extensive experience of the mungbean farmers on production and in gathering adequate information. Based on the survey studies conducted by other researchers like Singh and Masuku (2014) and Torres et al. (2021), if the population is homogenous, any percentage would be enough to represent the population and if the data gathered are almost the same, the data are already valid due to data saturation and lesser variations. Mungbean farmers in Central Luzon are homogenous since most of them are producing mungbean after rice, which is from January to May, for family consumption, and for income opportunity of adult women and teenagers specially during the second and third harvest. For this study, the researchers purposively interviewed five mungbean farmers for each municipality, three wholesalers and five retailers. Due to busy schedule of other invited farmers in Tarlac, only three farmers from La Paz and four farmers from Concepcion came for the interview. The researchers have interviewed a total of 22 mungbean farmers, which can already represent the Central Luzon because of their homogeneity with the rest of the mungbean farmers in terms of production season, seeds source and area used.

### *2.2 Data Gathering Tools and Procedure*

The researchers have prepared and finalized four types of survey questionnaires to each of the stakeholders in the mungbean industry like farmers, wholesalers, retailers and local government units. The questionnaire for the farmers composed of three parts – socio-demographic profile, farm profile and cost and returns. Meanwhile, the questionnaire for retailers and wholesalers are focused on their mungbean sources, price agreement, types of consumers and market requirements. The researchers directly gathered the information from mungbean farmers, wholesalers and retailers. Municipal agricultural office heads and extension workers were also interviewed on the LGU profile on mungbean. The survey was conducted in September 2024 using face-to-face interviews to all the identified participants. The interviews were conducted in the municipal agricultural offices and barangay halls. The researchers prioritized the market outlets of farmers such as wholesalers and retailers in the public markets for the gathering of information to represent the actors in the market channels. The researchers have personally administered the interviews with the farmers, sellers and LGUs.

### *2.3 Data Analysis and Interpretation*

The data entries on each questionnaire were validated to ensure accuracy, correctness and uniformity before coding them for tabulation. The data were coded using letters and numbers up to eight characters for ease of encoding in the table using the MS excel program. Researchers have reviewed the data entries and run them to check for errors and fill up missing entries. The final data entries were analyzed using averages, frequencies and percentages to generate the profile summary of farmers and farms. Analysis of cost and returns for mungbean production was measured in terms of return on cost, break-even price and break-even yield. Return on cost was computed by dividing the net income by the production cost (Table 2). Break-even analysis is a financial assessment tool to determine where total revenue from sales equal costs in producing a product, resulting in no profit or loss (EBSCO, 2021). The break-even point is the basis of analysis on how many units must be sold at certain prices in order to cover the costs incurred. This also helps the companies in projecting estimated profits in the succeeding operations. For this study, the break-even point for price and yield of mungbean was calculated by dividing each price and yield from the production cost. The value of mungbean along the market chain was analyzed based on the average price offered per market channel (Table 3).

### 3. Results

#### 3.1 Socio-Demographic Profile of Mungbean Stakeholders

A large majority of mungbean farmers are male, which comprised around 91% of the total sample. Most of them are beyond 45 years old (81%) with an average age of 55.67 years. Male usually dominates the farming sector and even mungbean production not only in the Philippines but also in other countries (Aung & Lee, 2021; Assefa, et al., 2022). Mungbean farmers in Myanmar (52.2), Ethiopia (42.12) and Bangladesh (<40) are younger compared with Filipino farmers (Aung & Lee, 2021; Assefa et al., 2022; Hajong et al., 2021). These figures show that there are more young individuals in other countries that venture in mungbean farming compared in the Philippines. Most sons and daughters of Filipino farmers do not want to pursue farming and other agriculture-related business ventures due to laborious farm activities. Farmers have varied educational background. Some have finished elementary, high school, vocational and even college degrees, which are not agriculture-related courses. Education enables farmers to easily understand and adopt new practices learned from various media platform and co-farmers. Their major source of income is farming business particularly rice and vegetable production. Few farmers from Tarlac source their major income from mungbean production. Tarlac province is one of the largest mungbean producer in Region 03. Most of respondents are members of farmers' associations, which help them access various support interventions like seeds, fertilizers and farm machineries from DA and LGU programs. The average years of experience in mungbean farming is 9.68 years, which is comparable to the farmers in Bangladesh with 9.31 years of experience (Hajong et al., 2021). Conversely, farmers in Myanmar have 14 years of experience in mungbean farming (Aung & Lee, 2021). Mungbean in Myanmar is one of the most important major export-earning crops which creates many opportunities for small farmers and rainfed areas. Most farmers have not attended any training on mungbean. Based from the interviews, farmers have learned the techniques in mungbean production from their forefathers and co-farmers. Majority of farmers sell their harvest to consolidators and public markets, which for them is the easiest way to dispose the volume harvested, convert it to cash and avoid storing large volume in their households.

Table 1 illustrates the farm profile of farmers in terms of area used, yield, distance to market, seed class and irrigation facilities. Most farmers devote 1.0 to 2.0 has for mungbean production with an average of 1.32 has. The areas planted for mungbeans are part of their rice farm areas cultivated during the wet season, which falls between June and October. All farmers obtained yield using kulabo variety between 0.5 mt and 1.0 mt per ha while very few yielded below 0.5 mt and above 1.0 mt. The average yield is computed around 0.75 mt. This is below the potential yield of the variety which could reach up to 1.09 - 1.17 mt/ha. The average yield of mungbean farmers in Cuyapo, Nueva Ecija was only 0.7 mt but it can give an average net income of P22,600 when sold for P70/kg or P70,000/mt (Domingo, 2023). The average yields of mungbean in other countries like Bangladesh (0.946 mt), Cambodia (0.8-2.4 mt) and Myanmar (1.29 mt) were higher (Islam et al., 2011; Martin et al., 2015; Aung & Lee, 2021). Farmers from these countries use rhizobium inoculants to achieve the maximum potential yield while most Filipino mungbean farmers are not yet aware about this technology. The national average yield for mungbean in 2023 was 881 kg/ha. The mungbean yield in Central Luzon can still be increased if the right quantity and quality of inputs and better cultural practices will be used by the farmers. Farmers can also gain more profits if they have stable market network with prices beyond P60/kg or P60,000/mt. Data shows that majority of farmers are sourcing good seeds from the public market. Most of the areas cultivated for mungbean are owned by farmers and their relatives, which is a good indicator that they have the discretion to decide in practicing latest technologies.

Table 1. Farm profile of mungbean farmers in Central Luzon, n=22

| Variable                       | %  | mean |
|--------------------------------|----|------|
| Area (ha)                      |    | 1.32 |
| <1.0                           | 18 |      |
| 1.0-2.0                        | 68 |      |
| 2.1-4.0                        | 14 |      |
| Average yield per hectare (mt) |    | 0.75 |
| <0.5                           | 27 |      |
| 0.5-1.0                        | 59 |      |
| 1.0+                           | 14 |      |
| Distance to Main Road (km)     |    | 0.59 |
| <1.0                           | 59 |      |
| 1.0                            | 32 |      |

|   |     |      |
|---|-----|------|
| 1.0+                                    | 9   |      |
| Distance to Market (km)                 |     | 6.09 |
| 1.1-5.0                                 | 59  |      |
| 5.0+                                    | 41  |      |
| Land Ownership                          |     |      |
| self-owned                              | 41  |      |
| parents, relatives                      | 45  |      |
| rented, tenanted                        | 14  |      |
| Varieties used                          |     |      |
| Kulabo                                  | 100 |      |
| Seed Class                              |     |      |
| good                                    | 86  |      |
| certified                               | 14  |      |
| Seed Source                             |     |      |
| LGU                                     | 32  |      |
| own                                     | 36  |      |
| public market                           | 59  |      |
| Irrigation Facilities                   |     |      |
| national/ communal<br>irrigation system | 13  |      |
| shallow tube well                       | 77  |      |
| deepwell                                | 4   |      |
| small farm reservoir                    | 4   |      |

Farmers usually sell their mungbean harvest to wholesalers, which are also known as dealers and consolidators. Wholesalers source mungbean directly from farms and trading posts. They regularly purchase 1.0-2.0 mt per week and pay P60,000/mt. They sell it to the public market at a retail price of around 65-P70/kg (1.0 mt = 1,000 kg) to farmers and household members. Farmers do not commonly set aside mungbean seeds for the succeeding planting season due to unavailability of storage facilities. This compels them to source seeds from the public market every planting season. Retailers also buy mungbeans from trading posts twice a month with a volume of 2.5 mt per purchase. They pay P68,000/mt and sell it to household members at P90/kg and P20/200g using simple plastics. There are no well-known mungbean processors in Central Luzon that buy large volume from farmers or public market. Most women in the farming community process mungbean into sweet delicacies like *buchi* or sesame ball with mungbean paste, rice cakes toppings and use as flavoring for *hopia* (good pastry). Most bakeries in the surveyed municipalities use mungbean paste that is usually sourced from Manila as their ingredient for *hopia* production. Mungbean is commonly prepared as viand and soup by most rural households in Central Luzon every Friday and during occasions.

### 3.2 Cost and Return Analysis

The average yield of mungbean farmers was 750 kg or 0.75 mt per ha, which they sell at P60.00/kg and get around P45,000 gross income. Labor cost is almost twice the input cost. This is consistent with the findings of Pal et al. (2021) where human labor was the major component of cost in mungbean production. Labor for harvesting had the highest cost followed by fertilizer and land preparation, which account for 25.34%, 13.82% and 10.75% of the total production cost, respectively. Due to excessive farmwork and the tedious manual harvesting of mungbeans, most farmers opt to hire laborers to do the work (Domingo, 2023). Nevertheless, mungbean production represents an outstanding opportunity for farmers since the crop provides additional income while also enhancing soil fertility (Rakhimov et al., 2022). Mungbean farmers in Central Luzon had earned a net income of Php12,444.90 within only three months of production with a 38.23% return on cost (Table 2). To break-even or avoid losses, farmers must produce at least 542.58 kg (0.54 mt) per ha and sell it for a minimum price of P43.41/kg.

Table 2. Cost and returns on mungbean production in Central Luzon, 2024, 1.0 ha.

| Item/ Activity                        | Unit | Quantity       | Amount/ unit (P) | Total Amount (P) |
|---------------------------------------|------|----------------|------------------|------------------|
| Gross Income                          |      |                |                  | 45,000.00        |
| Yield per ha                          | kg   | 750*           | 60.00            |                  |
| <i>A. Farm Inputs</i>                 |      |                |                  | <i>10,555.10</i> |
| Mungbean Seeds                        | kg   | 25             | 75.00            | 1,875.00         |
| Fertilizer, 14-14-14                  | bag  | 3              | 1,500.00         | 4,500.00         |
| Insecticide                           | li   | 2              | 500.00           | 1,000.00         |
| Fungicide                             | kg   | 1              | 950.00           | 950.00           |
| Fuel                                  | li   | 30             | 57.67            | 1,730.10         |
| Sacks                                 | pc   | 50             | 10.00            | 500.00           |
| <i>B. Labor Cost</i>                  |      |                |                  | <i>22,000.00</i> |
| Land Preparation                      | MMD  | tractor rental | 3,500.00         | 3,500.00         |
| Planting                              | MD   | 3              | 550.00           | 1,650.00         |
| Fertilizer Application, 3 times       | MD   | 1              | 550.00           | 1,650.00         |
| Fungicide Application                 | MD   | 1              | 550.00           | 1,650.00         |
| Weeding, 2 times                      | MD   | 1              | 550.00           | 1,100.00         |
| Irrigation, 2 times                   | MD   | 1              | 550.00           | 1,100.00         |
| Harvesting, 3 priming, drying         | MD   | 15             | 550.00           | 8,250.00         |
| Seed cleaning                         | MD   | 2              | 550.00           | 1,100.00         |
| Contingency, 10% of labor cost        |      |                |                  | 2,000.00         |
| Production Cost (A+B)                 |      |                |                  | 32,555.10        |
| Net Income                            |      |                |                  | 12,444.90        |
| (Gross Income – Production Cost)      |      |                |                  |                  |
| Return on Cost (%)                    |      |                | 38.23            |                  |
| (Net Income / Production Cost x 100%) |      |                |                  |                  |
| Break-even Price (P)                  |      |                | 43.41            |                  |
| (Production Cost / Yield)             |      |                |                  |                  |
| Break-even yield (kg)                 |      |                | 542.58*          |                  |
| (Production Cost / Price per kg)      |      |                |                  |                  |

\* 1,000 kg = 1.0 mt (750 kg=0.75 mt, 542.58 kg=0.543 mt)

There are three forms of market chains for mungbean based from market observation and interviews conducted to different stakeholders (Figure 1). The most common form of market chain is from farmer to wholesaler, then to retailer and household consumers. The wholesaler is also called dealer and consolidator. Another chain is that farmer directly sells mungbeans to retailer then to household consumers. The third chain is that farmer directly sells it to the household consumers. This usually happens during the third or last harvesting time where volume obtained is very low. These market chains are not different with other agricultural commodities like rice, vegetables and fruits. The role of wholesalers is still dominant in agricultural marketing.

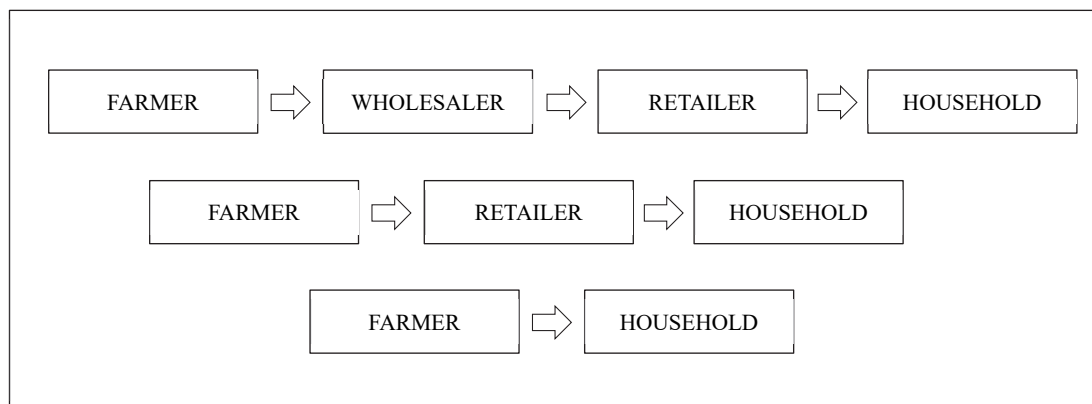


Figure 1. Different market chains of mungbean in Central Luzon

Using the most common market chain, which is from farmers to wholesalers, retailers and household consumers, the average markup per channel was computed. Farmers receive the highest markup at P16.60/kg followed by the retailers at P15.00 while the wholesalers get the lowest markup of P5.00/kg. Both farmers and retailers have limited volume of mungbeans in which disposal period takes longer days compared to wholesalers. These wholesalers have the capacity to buy large volume and can sell them in few days only. With these facts and figures, the study shows that all channels have fair share in the market. They can earn more profits if they will practice clustering and consolidation and have enough capital for storage and transportation facilities.

Table 3. Value of mungbean along the market chain

| Source/ Channel | Cost Incurred<br>(P/kg) | Price Sold<br>(P/kg) | Average Markup<br>(P/kg) |
|-----------------|-------------------------|----------------------|--------------------------|
| Farm/ farmer    | 43.40                   | 60.00                | 16.60                    |
| Wholesaler      | 65.00                   | 70.00                | 5.00                     |
| Retailer        | 75.00                   | 90.00                | 15.00                    |

### 3.3 Constraints on Mungbean Production and Farmers' Recommended Interventions

Mungbean has considerable importance in economic, food, fodder, and agricultural aspects because it is used as a green manure crop to improve soil fertility. However, despite the advantages, growing demand, and opportunities, farmers deal with various constraints limiting their overall production (Dikir, 2023). Harvest and postharvest losses constitute significant problems in mungbean production based from 15 farmers (68%) interviewed. Farmers in Central Luzon nowadays are still harvesting and drying mungbean manually. This is relative with Dikir (2023) findings that mungbean is highly vulnerable to shattering during harvesting. Therefore, it is imperative to improve postharvest activities such as collection, storage, and handling to improve mungbean seed quality. Moreover, pest infestation from borers and aphids is one of the challenges identified by farmers (52%) that contributes to yield losses. This is consistent to the findings of Domingo (2023) wherein pest infestation was the most significant problem that limits farmers to obtain higher yields. Farmers deal with these problems by applying pesticides to manage pests and prevent infestation in larger areas. In Pakistan, pests and diseases are also significant constraints, particularly pod borers and caterpillars, which were perceived as major pests by the farmers (Rani et al., 2018). Moreover, limited access to high-quality seeds (16%), fluctuating farm gate prices (12%), problems with weed management (8%), and unexpected heavy rainfall during the dry season, also contribute to the lower production of mungbean seeds (8%). These results correspond to the study of Sequeros et al. (2021), which revealed that production constraints generally included insect pests and plant diseases, unstable markets with low prices and low market demand, and the lack of quality seeds of suitable varieties. Furthermore, Haque et al. (2014) mentioned that although mungbean is a valuable crop, farmers deal with some challenges, including disease and pest infestation, an insufficient supply of high-quality seed, and a lack of information about technological advances. To cope with these pressing concerns, mungbean farmers recommended that they should be supported by the government agencies with free or subsidized inputs like quality seeds and fertilizers, financial assistance, market support, farm machineries and trainings.

### 3.4 Current Research for Development Program on Mungbean

Breeders from the Bureau of Plant Industry and UPLB – Institute of Plant Breeding have developed and registered 33 mungbean varieties from 1975 to 2019. Most of these are glossy green color which are used for vermicelli production while dull green color are preferred for home consumption. Breeders are still looking for best traits to improve the characteristics of existing varieties. DA-RFO3 Research Station for lowland development in Tarlac City has been conducting varietal trials since 2011 and other experimental studies on new varieties in partnership with BPI and SUCs. These varieties include Mg 14, 20 and 21. The station produces seeds and distribute it to the farmers in Tarlac. The research agenda of DA-RFO3 for mungbeans from 2022 to 2026 includes establishment of community seed system, field testing of improved varieties, and improvement of existing machines for harvesting. The high value commercial crops development program of DA-RFO3 provides seeds to LGUs for distribution to farmers. DA-RFO3 has no fund allocation for conducting research for development projects for mungbean or other legumes.

## 4. Conclusion

Overall, mungbean production in Central Luzon is generally produced by male farmers after rice from January to May in small-scale areas that is just enough to provide food for the households and additional income for pickers

like women and youth in the communities. Mungbean farmers in Central Luzon do not have access to quality seeds and they lack knowledge and practice on the proper cultivation and management. These are reflected by their average yield of 0.75 mt/ha and a net income of P12,444.90, which is far below than the average potential yield (Yap, 2016; Gutierrez, 2018) and net income in Isabela (Baccay, 2024). Farmers do not see mungbean farming as a business enterprise but an augmentation to nitrogen fertilizer requirement of rice in the wet season. The labor cost in mungbean production is twice the amount of input cost. The average cost per kg of mungbean is P43.41. The major market chain is from farmers to wholesalers then to retailers and household consumers. These market channels play very important role in the distribution of mungbeans from production to consumption. Wholesalers buy it at P60/kg and sell it for P70/kg while retailers offer it to individuals for P90/kg and beyond. All channels have fair share in the market and can earn more profits if there is enough capital, storage and transportation facilities.

To address the constraints on mungbean production, farmers recommend to develop new varieties, improve cultural practices and design machineries towards a one-time harvesting for mungbeans. They also want to be trained and assisted in practicing integrated pest management. There is lack of fund allotment to support the research and development activities on mungbean production as reflected in various government program accomplishments. This led to the slow progress in the development of new varieties and improved cultural management like the use of rhizobium inoculant. The laborious harvesting, lack of available quality seeds and trainings does not encourage farmers to maximize their areas for mungbean production.

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