

## Mung bean production as a source of livelihood among farmers in a municipality in the Philippines: Challenges and opportunities

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### ABSTRACT

This study explored the opportunities and challenges of mung bean production as a source of livelihood among farmers in the municipality of Cuyapo Nueva Ecija, where 223.4 hectares have been devoted to mung bean farming. The study used a descriptive research design and surveyed 214 mung bean farmers from 51 barangays in the municipality. The results of the study revealed that mung bean production provides income to farmers, having a 116.81% return on investment as shown in the cost and return analysis conducted. Mung bean production also provides additional income to local households as many laborers are needed, particularly during the harvesting period. However, mung bean farmers were challenged by the high cost of farm inputs, the low farmgate price of their mung bean harvest, farm destruction caused by stray farm animals, the threat of widespread pest infestation, and the low volume of production. To support the farmers in coping with these challenges, national and local government agencies might provide them with farm input subsidies, cash aid, marketing support, and technical assistance regarding proper crop management.

**Contribution/Originality:** This study presents the economic benefits of mung bean production to encourage more farmers to venture into mung bean production. This study may serve as a basis for concerned government agencies to develop a roadmap for improving mung bean production in the Philippines, which would benefit all stakeholders in this industry.

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## 1. INTRODUCTION

Mung bean (*Vigna radiata* L.) is one of the most significant pulses grown in various agro-ecological zones across the globe (Mota, Balla, & Doda, 2021). It originated in India (Amaral, Ferreira, Silva, Neves, & Demonte, 2017) and is now grown on around six million hectares globally (Chauhan & Williams, 2018). Mung beans are widely cultivated in the United States, Australia, China, and the South East Asian region, specifically in Thailand, the Philippines and Indonesia (Rahmianna, Basuki, Kote, Seran, & Rachaputi, 2021). According to the World Food Organization, 5.3 million tons of mung bean are cultivated each year globally, with Asian nations accounting for approximately 90% of the harvested crop (Astanakulov, Babaev, Eshankulov, & Turdibekov, 2022); it is regarded as an essential food and cash legume crop in the region (Nair et al., 2019).

Mung bean is a drought-resistant crop (Mota et al., 2021) that fits well as a component of cropping patterns in dry areas with a short rainy season and a prolonged dry season due to its superior characteristics, which include a short time to maturity and low input and minimal care requirements (Rahmianna et al., 2021; Schreinemachers et al., 2019). Mung bean is a significant leguminous crop, and its grain is one of the most nutrient-dense foods (Astanakulov et al., 2022). For centuries, the therapeutic qualities of this plant have been extensively recognized. The legume is a good source of protein for humans (Pataczek et al., 2018) and has antihypertensive, anticancer, hypolipidemic, antibacterial, antioxidant, anti-diabetic, and anti-inflammatory properties (Amaral et al., 2017). Legumes, such as mung bean, are increasingly recognized as important components of healthy diets, especially as a source of plant-based proteins that contribute to human health and environmental sustainability (Farnworth et al., 2020). Mung bean also enhances soil fertility (Rakhimov, Shodiev, & Rakhimov, 2022) and reduces the demand for increasingly costly synthetic nitrogen fertilizers because of its symbiotic nitrogen fixation (Mohammadzadeh et al., 2022). It has also been noted that incorporating legumes in crop rotations reduces greenhouse gas emissions (Farnworth et al., 2020).

Moreover, mung bean cultivation offers tremendous economic advantages (Assefa, Dinku, & Jemal, 2022). Mung bean farming is one important way of saving foreign exchange on food imports in various rice-producing nations (Cook, 1995). Mung bean cultivation generates money for farmers in a short period of time (Pataczek et al., 2018; Rakhimov et al., 2022). By maximizing resource utilization to fulfill the community's needs, smallholder production offers the financial and economic potential to alleviate rural poverty and enhance rural incomes (Aung & Lee, 2021; Burhansyah, Carolina, & Puspitasari, 2021). According to one study, mung bean cultivation may produce a return on investment of 132.66% per hectare (Yanos & Leal, 2020). Thus, increasing the profitability of mung bean production is critical to preserving and enhancing its position in local food and agricultural systems (Farnworth et al., 2020). In general, agricultural operations provide revenue to farmers and promote food and nutrition security by providing families with direct access to staples and supplementary food (Syafrial, Toiba, Retnoningsih, Purwanti, & Rahman, 2022).

Despite the advantages, mung bean growers are also confronted with the problems of mung bean farming. Among these challenges are insects, pests, plant diseases, and uncertain markets with low prices and little market demand (Sequeros et al., 2021). Inadequate crop management techniques and a lack of quality seeds of improved types (Nair et al., 2019), low soil fertility (Mota, Balla, & Doda, 2021), and insufficient fertilizer application are other significant issues (Kilmanun, Burhansyah, & Warman, 2021; Mota et al., 2021). Additional constraints with this crop include limited access to specific farm inputs, insufficient credit for mung bean farming, insufficient materials, the demand for intensive labor, and climate change (Aung & Lee, 2021).

In the Philippines, mung bean, locally known as "mongo," is one of the crops farmers grow along with rice. Mung bean production from July to September 2022 was 1.37 thousand metric tons. This was 0.7 percent higher than the 1.36 thousand metric tons produced during the same period in 2021. With 0.57 thousand metric tons, Cagayan Valley was the leading mung bean producer from June to September 2022, accounting for 41.5 percent of the country's overall output. Davao Region came second with a 12.3 percent share (Philippine Statistics Authority, 2023). The value of mung beans produced in the Philippines in 2021 was estimated to be about 2.27 billion Philippine pesos. Since 2017, the country's mung bean production value has been progressively expanding (Statista Research Department, 2022b). Also, about 42,000 hectares of land in the Philippines were utilized for mung bean farming in 2021. Except for modest drops in 2019 and 2021, the country's mung bean production output has been steadily expanding over the last five years (Statista Research Department, 2022a).

Mung bean has been subjected to research (Dahiya et al., 2015), yet little of its potential has been explored (Pataczek et al., 2018). Mung bean can be a valuable source of extra revenue for farmers in the municipality of Cuyapo, Nueva Ecija. It is a common legume planted by farmers in the municipality after the first cropping season in the region, owing to its resistance to the dry season. Through a cost-return analysis, this research illustrates the promising potential of this crop. Moreover, it highlights the production challenges that confront mung bean farmers and recommends solutions to address these concerns. Empirical knowledge of mung bean production is necessary to design interventions to increase the volume of production (Assefa et al., 2022). Therefore, the findings of this research may be utilized by government organizations to assist farmers in increasing their harvest. The results of this research may also make mung bean farming more appealing to farmers in other regions of the Philippines as a decent way to make additional income.

## 2. MATERIALS AND METHODS

This study utilized a descriptive research design, which is suitable if the study addresses "what" type of research questions (Borg & Gall, 1989, cited in Letchumanan, Husain, Ayub, Kamaruddin, and Zulkifli (2022)). A descriptive research design was used since the goal of the study was to describe the profile of farmers involved in mung bean cultivation and identify the challenges they encountered throughout production. The costs and returns of mung bean cultivation have been provided to illustrate the opportunity it may provide farmers as a source of extra income after the main rice cropping season. This research employed both quantitative and qualitative methods to acquire data from respondents. This research used a quantitative technique to gather data on the farmer-respondents' profile variables, their problems, and the cost and return analysis of mung bean production. Simultaneously, a qualitative approach was used to better understand the constraints and potential of mung bean cultivation as a source of livelihood among farmers in the municipality of Cuyapo, Nueva Ecija, a first-class municipality in the province. A total of 223.4 hectares of land area have been cultivated for mung bean production in the municipality.

The respondents of the study were selected using non-probability sampling. As per the records of the Municipal Agriculturist Office of the municipality of Cuyapo, Nueva Ecija, 477 farmers from 51 barangays are engaged in mung

bean production. Using Raosoft statistical software, the required sample size of respondents for this study was 214. The respondents were randomly chosen from various barangays in the municipality. The researcher considered individuals who were most available during the data-gathering period of the study until the sample reached the desired size.

The main data-gathering instrument was a checklist-type survey questionnaire. The validity of the questionnaire was established by asking five experts to examine the questionnaire and its items to determine whether it measured what it was supposed to measure. All suggestions and comments were incorporated into the instrument. For the cost and return analysis, the researcher focused on farmers who had planted at least 1 hectare of mung beans. They were asked to list their expenses, such as farm inputs, farm labor, and other operating expenses, their average production per hectare, and the farmgate price of their mung bean produce.

### 3. RESULTS AND DISCUSSION

#### 3.1. Profile of Mung Bean Farmers

Table 1 presents the number of years the farmer-respondents had been planting mung beans.

Table 1. Number of years cultivating mung beans.

Number of years cultivating mung beans	Frequency	Percentage
Less than 5 years	84	39.25%
6 to 10 years	75	35.05%
11 Years and above	55	25.70%
Total	214	100.00%

There were 84 respondents (39.25%) who had started to plant mung bean in the last five years, 75 (35.05%) who had engaged themselves in the production for 6 to 10 years, while 55 (25.70%) had extensive experience of 11 years and above. During the dry season in the municipality of Cuyapo, Nueva Ecija, farmers plant rice, mung bean, or other high-value crops. Since wide areas of rice fields in the municipality are not irrigated, planting mung beans is a good option because they do not need much water for irrigation, compared to rice crops. Thus, many farmers now plant mung bean as an alternative livelihood after the main rice cropping period. Farmers who have seen opportunities in mung bean production over the past years are expected to continue to include mung bean in their crop rotation.

Table 2 presents the land ownership of farmer-respondents who plant mung beans in Cuyapo, Nueva Ecija. Of the respondents, 140 farmers (65.42%) were merely tenants of the land they used to plant the legume, while 74 farmers (34.58%) wholly owned the land they tilled.

Table 2. Land ownership.

Land ownership	Frequency	Percentage
Own land	74	34.58%
Tenanted	140	65.42%
Total	214	100.00%

Due to the increasing value of land, even in rural areas, farmers have only a slim chance of ever owning their own land to cultivate, even in the distant future. Depending on their contract, some tenants have to give a percentage of their sales to their landlords. Meanwhile, other tenants do not have this requirement, particularly farmers who use only small areas for mung bean production. Moreover, regardless of land ownership, farmers must deal with farm needs such as seeds, fertilizers, and labor expenses.

Table 3 presents the farm area devoted to mung bean production. Eighty-two (82) farmer-respondents (38.32%) utilized a farm area of 7,501 to 10,000 square meters for planting mung beans, while 52 farmers (24.30%) planted this legume on more than 10,000 square meters of farmland. Meanwhile, a total of 80 farmers (37.39%) planted mung beans on a land area of 7,500 square meters and below. Some farmer-respondents said they allotted separate farm areas to the cultivation of rice and mung bean because they produced both crops.

Table 3. Farm area devoted to mung bean production.

Farm area	Frequency	Percentage
Less than 2,500 square meters	33	15.42%
2,501 square meters to 5,000 square meters	16	7.48%
5,001 square meters to 7,500 square meters	31	14.49%
7,501 square meters to 10,000 square meters	82	38.32%
10,000 square meters and above	52	24.30%
Total	214	100.00%

Some farmers who planted mung beans in larger areas wanted to take advantage of the high price of mung beans in the market. Meanwhile, some of the respondents opted to utilize smaller land areas because of high production expenses, limited time to tend their farms, and the fear of losing money due to uncertainties in the country's agriculture sector.

Table 4 presents the source of mung bean seeds planted by the farmer-respondents. Most farmers, 160 (74.77%), bought their seeds from private suppliers. According to the farmers, seeds bought from these suppliers have a high germination rate and are certified, which would guarantee a higher harvest volume. Meanwhile, 29 farmers (13.55%) utilized the seeds from their last harvests. The challenge of this practice is to maintain the quality of the seeds. Mung bean seeds must be properly stored since they are prone to insect infiltration, which would make them useless. On the other hand, only 25 farmers (11.68%) received seeds from the government in the form of a subsidy. The seed source is crucial in mung bean production; farmers would like to use affordable yet high-quality seeds to increase their chances of having a good harvest and income.

Table 4. Source of seeds.

Source	Frequency	Percentage
Government subsidy	25	11.68%
Last season's harvest	29	13.55%
Bought from private supplier	160	74.77%
Total	214	100.00%

Table 5 presents the sources of labor for planting mung beans. As most respondents utilized a farm area of 7,501 square meters to 10,000 square meters for planting mung beans, the large area means the farm owner or tenant cannot do the planting and farm maintenance alone. Thus, 168 farmer-respondents (78.50%) hired laborers to help them plant the legume. On the other hand, farmers planting mung beans on smaller land areas could handle the planting task together with their family members. Forty-six (46) farmer-respondents (21.50%) opted for this practice.

Table 5. Source of labor for planting mung bean and vegetation maintenance.

Source	Frequency	Percentage
Hired labor	168	78.50%
Family members	46	21.50%
Total	214	100.00%

Table 6 presents the source of labor for harvesting mung beans. One hundred and fifty-five (155) farmer-respondents (72.43%) hired laborers to pick the dry mung bean pods.

Table 6. Source of labor for harvesting and threshing mung bean.

Source	Frequency	Percentage
Hired labor	155	72.43%
Family members	59	27.57%
Total	214	100.00%

Harvesting mung beans is a tedious, manual job as laborers must look closely at the plant and ensure that all the dried mung beans are picked. One respondent reported that he hired 20 laborers to harvest one hectare of vegetation, who finished picking mung beans just in time to obtain a high price for mung beans in the market. Meanwhile, 59 farmer-respondents (27.57%) said their family members could harvest all the dried mung beans by themselves without paying laborers to perform the tedious task. In this way, they could save an amount of money that they could put towards their basic needs. One farmer said his family members would endure back pain to limit their expenses in mung bean production. Mung beans may be harvested up to 3 to 5 times, depending on the maturity of the pods.

Table 7 presents farmer-respondents' reasons for planting mung beans. All 214 farmer respondents (100%) said their primary motivation was to earn additional income during the dry season. Farmers who cannot afford to plant rice during the dry season see an opportunity to earn by planting mung bean and utilizing their farmlands again a few months after harvesting their rice crop. According to one farmer, the increasing prices of commodities caused by the high inflation rate required them to look for other sources of income to support their needs and send their children to school. This is why even with only a small farmland area devoted to mung bean production, they make the most of it, which is better than doing nothing. Farmer-respondents also disclosed that they sell their entire mung bean harvest if the selling price is high enough for them to recover their farm expenses and earn a net profit after almost three months of cultivating the beans.

Table 7. Reasons for planting mung bean.

Reasons for planting mung bean*	Frequency	Percentage
Additional income during dry season	214	100.00%
Source of food supply (For household consumption)	50	23.36%
Way to spend time after rice cropping season	20	9.35%

Note: \*Multiple responses.

Meanwhile, 50 farmer-respondents (23.36%) said they planted mung beans as a source of food for their household. Some farmers sell only part of their mung bean harvest and save a percentage for household consumption. According to one farmer, they cook mung beans to eat on ordinary days and whenever they want to. On the other

hand, 20 farmer-respondents (9.35%) disclosed that planting mung beans was a way for them to spend time wisely after the rice cropping season. Some farmers wanted to stay productive even after the rice harvesting season to stay fit and get rid of bad habits like gambling and other vices.

### 3.2. Cost and Return Analysis of Mung Bean Cultivation

Table 8 presents the cost and return analysis of mung bean cultivation for one hectare in the municipality of Cuyapo, Nueva Ecija.

**Table 8.** Cost and return analysis of mung bean for one (1) hectare (2022).

Details	Amount/Rate
Gross income (700 Kgs @ Php. 70.00/kgs)	Php. 49,000.00
Operating expenses:	
Labor cost	17,600.00
Material inputs	5,000.00
Total expenses	22,600.00
Net income	Php. 26,400.00
Return on investment	116.81%

The average harvest volume per hectare among farmer-respondents was 700 kilograms of mung bean, which they sold at Php. 70.00 per kilogram. Given these numbers, a farmer may earn a gross income of Php. 49,000.00 after selling all his mung bean produce. Among the operating expenses, the labor costs were recorded at Php. 17,600.00, which included payments to hired labor who performed farm work like planting, spraying, harvesting, and threshing. Human labor is thus a major component of the cost of mung bean production (Pal et al., 2021).

In addition, the material expenses amounted to Php. 5,000.00 for seeds, pesticides, and insecticides. After deducting the operating expense from the gross income, a farmer earned on average Php. 26,400.00 for almost three months of cultivating mung bean. This amount is of great help to farmers in feeding their families, sending their children to school, and buying necessities. The return on investment is recorded at 116.81%, which means farmers could fully recover the expenses incurred in mung bean production. The data analysis reveals that mung bean farming generates both income and employment. However, this scenario is not always the case because the farmer's income still depends on the volume of their harvest and the selling price of their produce. Farmers can only hope for good weather, no infestations, and no price drop of mung bean in the market during the harvesting season.

### 3.3. Common Problems Faced by Farmers in Mung Bean Production

Table 9 presents the common problems faced by the farmer-respondents in mung bean production. All the respondents were asked to check all the problems they had encountered on their farm in the survey questionnaire.

**Table 9.** Common problems faced by farmers in mung bean production.

Problems	Frequency	Percentage
High cost of farm inputs like seeds, insecticides, pesticides, fertilizers	175	81.78%
Low farmgate price of mung bean harvest in the market	164	76.64%
Invasion of stray farm animals on the farm	55	25.70%
Pest infestation	200	93.46%
Low volume of production	152	71.03%

The table shows that 200 out of 214 farmers (93.46%) claimed that pest infestation was the top problem hindering farmers from getting a good harvest. Common pests infesting mung bean plants include powdery mildew and powdery worms. Farmers deal with these problems by applying pesticides to eliminate pests and stop wider areas from getting infected. Another problem that challenged 175 out of 214 farmers (81.78%) was the high cost of farm inputs like seeds, pesticides, and fertilizers. To get a good harvest, farmers must take mung bean cultivation seriously by purchasing quality inputs, yet these are expensive. Some farmers borrowed money from various sources to cover the fertilizer and pesticide needs of their mung bean plants and increase their chance of high-volume harvest.

Meanwhile, 164 out of 214 farmers (76.64%) disclosed that the low farmgate price of mung beans in the market prevented them from earning better profits. One farmer said that despite his large harvest volume, he could not help but feel disappointed he did not have a higher income to support his family's needs. Another factor that causes the drop in farmgate price of mung bean is when the mung bean supply begins to peak in the local market, especially when most farmers have started harvesting their produce.

Moreover, 152 farmer-respondents (72.03%) disclosed that they were challenged by low production volumes. One farmer recalled that he had only harvested 300 kilograms of mung bean from one hectare due to low-yielding mung bean plants, pest infestation, and frequent rain during the plants' flowering period. In the Philippines, the average mung bean yield per hectare is 800 to 1,000 kilograms (Serquina, 2018). In other mung bean-producing countries such as Myanmar, the average harvest yield of mung bean is approximately 1290 kilograms per hectare (Aung & Lee, 2021).

Some 55 out of 214 farmers (25.70%) also claimed that the invasion of stray farm animals on their mung bean farm was a severe problem. Farm animals like goats, cows, and chickens may cause significant agricultural damage.

They may harm the plants by nibbling on plant components or simply trampling them. As a result, animals may cause considerable yield losses and financial problems.

#### 3.4. Proposed Interventions to Address Problems in Mung Bean Production

Based on the problems identified, Table 10 presents proposed interventions to address the pressing problems encountered by the respondents in mung bean production.

**Table 10.** Proposed interventions to address problems in mung bean production.

Problem	Intervention	Person/Agency involved
High cost of farm inputs like seeds, insecticides, pesticides, fertilizers	Farm input subsidy from the government	Department of Agriculture/ Municipal Agriculture Office
Low farmgate price of mung bean harvest in the market	Marketing support from the government	Department of Agriculture/ Municipal Agriculture Office/ local government unit
Invasion of stray farm animals on the farm	Municipality/Barangay ordinances to penalize owners of stray farm animals	Local government unit
Pest infestation	Proper pest management training for farmers	Department of Agriculture/ Municipal Agriculture Office
Low volume of production	Proper crop management training	Department of Agriculture/ Municipal Agriculture Office

With the increasing price of commodities due to inflation, prices of primary farm inputs for mung bean production are also increasing significantly. For farmers who usually borrow capital to finance their farm needs, the high cost of farm inputs is particularly damaging. After they sell their produce, only a small amount of profit remains because they have to pay back the loan they obtained to purchase high-priced farm inputs like seeds, pesticides, and fertilizers. Therefore, the government should provide either financial or material subsidies to farmers for their farm input needs to ease the financial burden of farmers in purchasing high-yielding seeds and effective fertilizers, pesticides, and insecticides. Regarding the low farmgate price of mung bean produce, the government could also help farmers find institutional buyers to buy their harvest directly and who could offer higher prices. According to some farmers, certain middlemen buyers control the farmgate price of their mung bean produce. They also believe that middlemen earn more than farmers who put so much labor into mung bean production. In addition, the municipal government, particularly at the barangay level, must pass ordinances to penalize the owners of stray farm animals that are caught destroying the mung bean vegetation of farmers. By doing this, farm animal owners are obliged to be more responsible and cautious when leashing their goats, cows, and carabaos in their grazing areas. As most farmers are confronted with pest infestations in their vegetation, the government, through the Department of Agriculture and or the Municipal Agriculture Office, should conduct proper pest management training for farmers, teaching farmers about the appropriate amount and proper use of chemicals to treat and control pests on their farms. In addition, these agencies may offer crop management training to educate farmers about the proper agricultural practices of planting mung beans and farm maintenance, which would further increase farmers' chances of a high production volume on their mung bean farm.

#### 4. CONCLUSION

Aside from planting rice, Filipino farmers pursue other opportunities for an additional livelihood. One option is to grow other crops after the rice cropping season. One popular crop in Cuyapo Nueva Ecija is the mung bean, known locally as "mongo," which is grown in the months after farmers harvest their rice. The legume is highly adaptive to the hot weather and only has minimal farm requirements. The study found that most farmers are tenants, have been cultivating mung bean for at least five years, and devote 7,501 to 10,000 square meters of their land to mung bean production. Due to copious farmwork and the tedious manual harvesting of mung bean, most farmers opt to hire laborers to do the work. To ensure a high-volume harvest, farmers also prefer to buy seeds from private suppliers in the market as only a few receive subsidized certified mung bean seeds from the government. The study also found that earning an additional income is farmers' primary reason for cultivating mung beans. The cost and return analysis presented in the study illustrates the attractive income a farmer may earn from each hectare for cultivating mung beans for a three-month period. This shows that mung bean production has a high economic impact as a source of livelihood for farmers, as well as for the hired laborers living nearby. However, farmers have to deal with certain challenges that may prevent them from making a good profit. These challenges include the high cost of farm inputs, the low farmgate price of their mung bean harvest, farm destruction by stray farm animals, the threat of widespread pest infestation, and low production volumes. To address these problems, relevant government agencies might offer assistance to mung bean farmers through material and cash subsidies, marketing support, and technical assistance that matches their needs. In addition, specialized training in processing mung beans into value-added food products is recommended for inclusion in the extension programs of universities and colleges in collaboration with other agencies. Such training may teach farmers different ways to earn more from their mung bean produce. Finally, as it is a profitable crop, farmers across the country may consider including mung bean in their crop rotation and benefit from the promising opportunities.

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