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# Cultivation of Environment Friendly Moong Dal (Green Gram) in Sundarban

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**Abstract:** ***Agriculture is the mainstay of livelihood for the community (80%) of Sundarban. With time agriculture practice has been changed. Farmers started boro paddy cultivation depending upon ground water which causes rapid depletion of ground water level. Traditional farming of moong dal (green gram) not only conserve water (151 ha.cm) but enhance the nitrogen content of soil (fix between 58-109 kg of atmospheric nitrogen per hectare).***

**Keywords:** Moong dal (green gram), boro paddy, water conservation, nitrogen fixing

## 1. Introduction

The World Heritage Site, Sundarban is not only a globally significant mangrove ecosystem and tiger habitat, but also the home of 4.4 million (World_Bank, 2014) people whose life and livelihoods are directly linked with nature. 80% households depend upon rain-fed monocrop agriculture (World_Bank, 2014), making them highly vulnerable to climate variability, salinity intrusion, extreme weather events and environmental degradation.

The effective area of agricultural land in Sundarban is 3,15,500 ha. Typically, the soils are deep fine textured, heavily structured and slow draining. Nearly 62% of total cultivable land of this region is low lying and suffers from elevated salinity during dry season, from intrusion of saline water, capillary action, and increasingly acid sulphate build up. Soil drainage is generally inadequate and deep-water stagnation occurs in monsoon season. At present nearing 20% of the agricultural land in this region is multi cropped. In this region 9% of the farmers are classified as small farmers and 35% as marginal farmers. Apart from this, the concentration of Bargadars, Patta-holders and landless agricultural labourers are very high. The farming community consisting of small and marginal framers and Bargadars are typically focused on subsistence production and their prime is food security (Department of Sundarban Affairs, GoWB, n.d.).

**Agriculture Practice of Sundarban**

Throughout Bengal, Aman (winter rice) varieties are grown from June to December, Boro (summer rice) varieties are grown from December to May, and Aus (autumn rice) varieties are grown from April to August (Deb, 2021).

Agriculture in the Indian Sundarbans is mainly mono-cropped with kharif (aman) rice grown in the monsoon season. Although the region receives high rainfall (about 1800 mm per annum), there is an acute shortage of irrigation water during the dry season as more than 80% of the rainfall occurs from July to September. Most of the croplands remain fallow during the post-monsoon period due to scarcity of fresh surface water for irrigation (Burman, et al., 2015).

An estimated 15,000 folk landraces are reported to have been cultivated in undivided Bengal in the 1940s in different seasons (Deb, 2021). Farmers of was Sundarban also dependent upon traditional varieties. With the advent of the Green Revolution, begun in 1965, a handful of high-yielding varieties (HYVs) replaced, and continue to replace, thousands of traditional landraces in South Asia (Deb, 2021). During 1980s - 1990s, HYVs were introduced in Sundarban, marking the starting point of regular dry-season (Boro) cropping in West Bengal's coastal regions (Basu, 2017). Till date in Sundaran the Aman cultivation mostly depend upon folk landraces and boro cultivation depend upon HYVs.

Before 1980s, farmers use to cultivate Moong dal (green gram) which is locally known as ‘choito mugh’ after amon paddy. But with the time the area under Boro paddy cultivation is increasing day by day. Therefore, farmers in the Sundarbans resort to pumping groundwater using shallow tube wells (STWs) for growing crops (mostly boro rice) during the post-monsoon period. Boro is the preferred crop as its yield (3 t ha-1) is higher than that of rice grown during the monsoon season (2 t ha-1) or during the pre-monsoon rains (aus, 2.5 t ha-1) (Burman, et al., 2015).

For increasing tendency of ground water dependent boro paddy cultivation the ground water level is depleting. Detailed study of STWs used for irrigating boro rice in 2003, 2009 and 2014 showed that the piezometric level decreased significantly from an average of 2.1 m bgl in January to 3.9 m bgl in May while the discharge rate decreased significantly from 10.8 to 7.2 ls-1. Over the same period, groundwater salinity increased significantly from an average of 2.0 to 3.7 dS m-1. Salinity (ECe) of the topsoil (0-15cm) in boro rice fields irrigated from STWs increased significantly from an average of 3.0 dS m-1 at sowing to 5.8 dS m-1 at harvest (Burman, et al., 2015).

**Moong dal (green gram)**

Scientific name: *Vigna radiata L.*
Local name: *Chaiti mung* or *Choito mugh*

In a country like India where a large population is vegetarians, the cheap and best sources of protein are still pulses. Besides being rich in protein, they sustain the

productivity of cropping system. Their ability to use atmospheric nitrogen through biological nitrogen fixation is economically sounder and ecologically acceptable (Chandar & Sagar, 2004).

**Table 1:** Share of pulses in nutritional supply (Chandar & Sagar, 2004)

| Per Capita/day | World | Asia | India |
|---|---|---|---|
| Energy (Kcal) | 56.00 | 51.90 | 117.40 |
| Protin (mg) | 3500 | 3100 | 6900 |
| Fat (mg) | 400 | 400 | 1000 |

Before 1980s almost all people cultivated Khesari which is locally known as tebre karai and Moong dal (green gram) which is locally known as 'choito mugh'. Moong dal (green gram) is sown during Falgun-Chaittro (February - March) months, grows in summer season and harvesting during Baisakh - Jaistha (April – May) (yield is 1000 -1200 kg/ha). Moong dal (green gram) are salt sensitive and are cultivated under low soil pH (4.5). It not only affects on farmer's income and also soil heath because these pulse varieties are help to nitrogen fixation which increase soil productivity (Mistri, 2022).

**Photograph 1:** Moong dal (green gram) field

The green gram crop requires only one irrigation during its whole life span. One special area of concern is an increase in net income of farmers after the introduction of green gram cultivation in this area. The net income in rupees/annum also includes the income coming from next paddy crop grown after the green gram crop, because the following paddy crop gets their nutrient supply through fixed nitrogen of preceding green gram crop. The replenishment of soil nutrient by the green gram crop always reduces the cost of cultivation of next paddy crop because of its stored nitrogen supply (Chandar & Sagar, 2004). Moong dal is an excellent, fast-growing cover crop and green manure. It suppresses weeds, prevents soil erosion, and can fix between 58-109 kg of atmospheric nitrogen per hectare (Mehandi, Quatadah, Misra, & Singh, 2018), greatly enriching your soil for succeeding crops. In Sundarban area the cover crop prevents the excessive evaporation from soil which restrict the increasing soil salinity through capillary movement.

**The Initiative:**

For environmental, ecological and economic benefit Lokamata Rani Rashmoni Mission (LRRM) motivated 70 farmers across several hamlets, including Naskar Gheri, Sahur Gheri, and Gayenbabur Gheri of Purba Gurguriya village, along with Uttar Debipur and Purba Debipur hamlets of Debipur village for cultivation of Moong dal (green gram) during 2025. The initiative covered a land area of 1296 katha (64.8 bigha / 8.6 hectare [1 Bigha is equal to approximately 0.134 Hectares (or 7.47 Bighas equal 1 Hectare)]). The entire cultivation cycle was completed within a duration of 90 to 100 days. Continuous technical support and hand holding support provided to every farmer. All the data provided by the farmers and collected by the field staff of LRRM.

At the same time the activity of 175 boro paddy farmers also monitored for comparative study. Field workers regularly interacted with farmers and collected field level data.

**Table 2:** Expenditure and production for green gram and boro paddy

| Particulars | Green Gram | Boro Paddy |
|---|---|---|
| | Cost/hectare (INR) | Cost/hectare (INR) |
| Seed | 2,607 | 2,600 |
| Power Tiller Operations | 2,984 | 6,768 |
| Water | 0 | 17,726 |
| Organic Manure & Plant Protection Chemicals | 705 | 0 |
| Chemical Fertilizer | 0 | 19,019 |
| Chemical Pesticide | 445 | 7,687 |
| Labour | 13,881 | 54,337 |
| Total Cost | 20,621 | 1,08,136 |
| Total Production (kg) | 924 | 6,865 |
| Gross Income (INR) | 60,740 | 1,78,488 |
| Net Profit (INR) | 40,119 | 70,352 |
| Benefit-Cost Ratio (BCR) (B/C) | 2 | 1 |

## 2. Discussion

**Water conservation**: In Sundarban boro paddy cultivation majorly dependent upon ground water. In normal situation the green gram cultivation in 01 hactare land is saving 151 ha.cm water or 1,51,00,000 liters of water in comparison with boro paddy (Konar & Dey, 2015). With our initiative in

8.6 hactare we conserved 12,98,60,000 liter of ground water. In the contest of 'global water bankruptcy' in Sundarban area cultivation of Green Gram in boro season is the best alternate for the community of Sundarban. In study area the farmers invested nil for water for green gram cultivation while Rs. 17,726/ha spent for water for boro paddy cultivation (Graph 1). During stydy year due to occasional rain, water requirement for green gram was nil but in other year small requirement may be there.

**Table 3:** Water requirement of different crops in West Bengal (Konar & Dey, 2015)

| Crops | Water Requirement (ha.cm[1]) |
|---|---|
| Boro Paddy | 175 |
| Green Gram | 24 |

[1]One hectare-centimetre (1ha.cm) of water is the volume required to cover an area of 1 hectare (10,000$m^2$) to a depth of 1 centimeter (0.01m) = 100$m^3$ = 1,00,000 litres

**Improved Soil health:** Green gram reduced the demand of chemical fertilizer for Nitrogen as it fix between 58-109 kg of atmospheric nitrogen per hectare. Cultivation of green gram reduce the input cost for next crop. Reduction of demand of chemical fertilizer make agriculture more climate friendly.

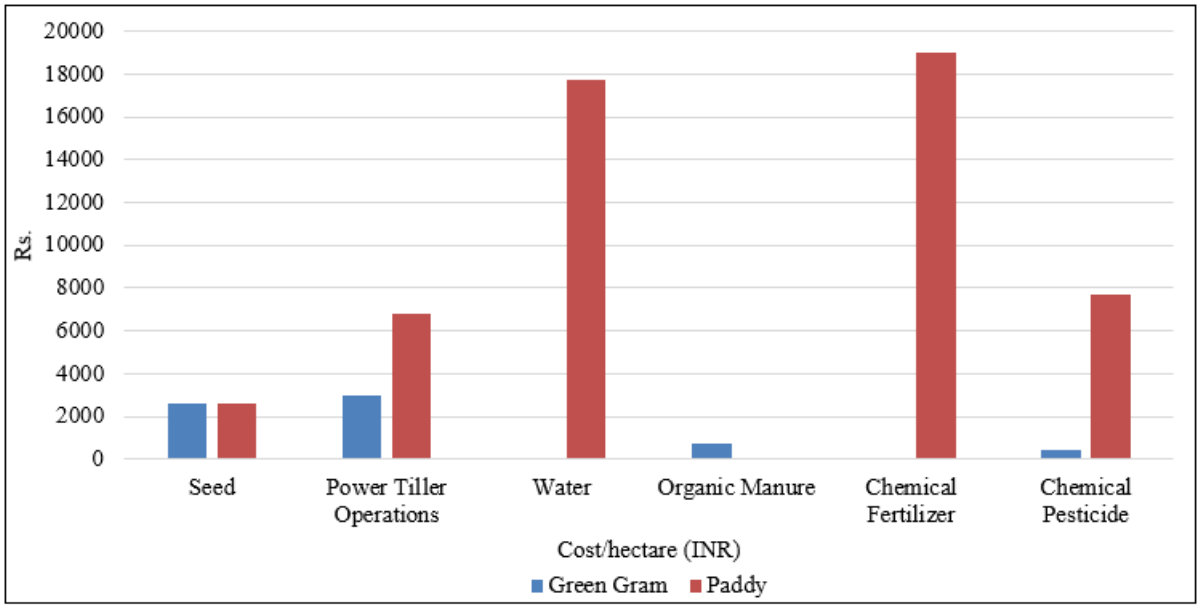
**Less Chemical Input**: Recommended dose of fertilizers for paddy - 60, 30 and 30 kg N, P and K ha-1 in wet season and 120, 60 and 60 kg N, P and K ha-1 in boro season (Banerjee & Pal, 2009). While green gram cultivation mainly dependent upon organic inputs. Very few farmers provided chemical inputs. Moreover, the amount of Nigrogen the green gram fix reduces the necessity of chemicals for next crops. Green gram farmers mostly used organic fertilizers produced by them and invested nil for chemical fertilizer while for boro paddy cultivation the farmers spent Rs.26,145/ha. Use of chemical pesticide 16 times more in boro paddy in comparison with green gram.

**Nutrition Value**: A seed of green gram (mung bean) is highly nutritious containing 24–28% protein, 1.0–1.5% fat, 3.5–4.5% fibre, 4.5–5.5% ash and 59–65% carbohydrates on dry weight basis and provide 334–344 kcal energy (Mehandi, Quatadah, Misra, & Singh, 2018). Considering the issue food security, wide cultivation of green gram in Sundarban is very essential.

**Soil Salinity**: In the post monsoon season fresh water layers become contaminated by the salt reaches from the saline groundwater and dominant clay complex at the soil surface also get polluted through capillary rise and makes the soil saline and unproductive for agriculture (Mandal, Das, Mondal, & Khoso, 2023).

**Benefit of Cover Crop**: Like other cover crop the green gram also provide various benefits including – soil erosion prevention, maintaining soil moisture, weed management, soil carbon sequestration, Nitrate leaching, increase in earthworm population and microbial population, better pest management, improved below and above soil biodiversity, improved soil and water quality (Sharma, et al., 2018).

**Benefit to Cost Ratio**: Initiative of LRRM shows that total input cost for green gram is Rs. 20,621/ha with a net profit of Rs. 40,119/ha and the benefit to cost ratio is 2. While in same villages the boro paddy farmers invested Rs. 1,18,474/ha and their net profit was Rs. 90,686/ha with the benefit to cost ratio is 1. Though the income from boro paddy is much higher but green gram is the best investment option.




**Graph 1:** Investment for water, organic fertilizer, chemical fertilizer and chemical pesticides per hacter for green gram and paddy

## 3. Conclusion

The Moong dal (green gram) cultivation in Purba Gurguriya and Debipur areas demonstrates that short-duration, low-water crops can generate moderate economic returns but enormous environmental and ecological returns. Similarly, in the Sundarbans, due to increasing salinity, groundwater depletion, and climate change impacts, Moong dal (green

gram) cultivation is a more sustainable and profitable alternative to large-scale paddy farming.


**Photograph 2:** Women cultivator of Moong dal (green gram)

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