



Blue Gold Program

Technical Note 05

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Benchmark Survey Report Mung Bean-MFS

December 2015

Blue Gold Program



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1. Introduction

The selection of Mung bean

The Blue Gold program is designed to ensure sustainable water management by forming water management groups in selected polders in Southern Bangladesh. The overall objective of the program is: “To reduce poverty by creating a safe living environment and a sustainable socio-economic development for 150,000 household living on the 160,000 ha of polders.” To achieve this, the Business Development Component of Blue Gold program is working to develop value chains that impact on the sustainable socio-economic development of polder dwellers by improving income and employment.

The Blue Gold program selected Polders 43/2D & 43/2F for the implementation of its activities alongside other polders. These Polders are part of the Sadar Upazilla in the Patuakhali district and partially under the Amtali upazila of the Barguna district.

Blue Gold prepares a Polder Development Plan (PDP) for each polder to define an integrated approach to polder development by its different components. The Business Development Component of Blue Gold has prepared a Value Chain Selection Matrix for the selection of value chains in polders 43/2D & 43/2F. Following an extensive set of criteria in a Value Chain Selection Matrix (Annex-2) Mung bean was identified as the appropriate crop for value chain development activities in these polders. This matrix facilitated unbiased selection following a scoring system aligned with the project objectives. It complies with the crop focus of Blue Gold and in particular stands to benefit from improved water resource management practices.

Mung bean scored highly due to a variety of reasons. About 70 percent of Mung bean production is concentrated in the four southern districts of Patuakhali, Barisal, Bhola, and Noakhali. Patuakhali alone accounts for 30 percent of the area under production. Mung bean is a very suitable and profitable field crop in these polders due to comparatively low production cost and relatively high profit potential. As a food crop Mung bean contributes to family nutrition. Farmers consider Mung bean highly and it is generally part of their cropping pattern following T-Aman. Mung bean has traditionally been cultivated in these polders over many years. It is considered a relatively safe cash crop with a reasonable profit and ensured demand.

Mung bean is produced across different production zones in Bangladesh and as such its market is less characterised by seasonality. While storage is easy, price variability is less an issue. It has potential local and international market demand. Moreover, there is an opportunity to meet a high price end-market demand (both domestic and international) by improving quality and production of Mung bean. Improved drainage and irrigation (as being implemented by the Infrastructure Component) can induce a substantial expansion of Mung bean cultivation and productivity in polder 43/2F and 43/2D. The Blue Gold program through its water resource management infrastructure development initiatives can also play a vital role in

improving water availability for irrigation. Not only more land can come under Mung bean cultivation, but there are also several opportunities to improve Mung bean productivity. Farmers can earn more by producing quality Mung beans for both the domestic and international market.

Mung bean offers female labour the opportunity to be employed in the cultivation process, particularly in harvesting and post-harvest processes. Mung bean expansion spreads labour demand into the Jan-April period, labour demand that is now converged in the T. Aman season (August-September and December-January). Mung bean provides an opportunity for collective actions and options for business development for producer and water managements groups. The presence of relevant actors, service providers and a Business Enabling Environment (BEE) devoid of major constraints supports Mung bean as a very good value chain development option compared to other (winter) crops. More information regarding the selection of Mung bean can be found in the PDP of polder 43/2F & 43/2D.

Methodology

In preparation of this Mung bean Value Chain Analysis report, information was collected from both secondary and primary sources. Information from secondary sources was used to identify key informants on the value chain including relevant researchers, key research organizations, as well as private and public actors. Information collection by meetings and field visits helped us to organize key informant interviews (KIIs) and focus group discussions (FGDs) and also to validate the information collected from secondary sources. This generally describes the information collection process for the preparation of the value chain analysis report. Table 1 below provides an overview of the process and the steps involved in the information gathering.

Table 1: Methods of Information Collection for Value Chain Analysis

	<i>Step-1</i>	<i>Step-2</i>	<i>Step-3</i>	<i>Step-4</i>	<i>Step-5</i>
<i>Process</i>	Literature Review	In depth Quality Interview	FGD	Field Validation and primary information and data collection	Information Compilation
<i>Tools</i>	Secondary Literature, Project document, Research papers	KII with Checklist, Questionnaire	Guideline	Field visit, Meetings	Rankings in value chain selection matrix, deduction, induction
<i>Output</i>	Checklist, guideline, identification KIIs	Analysis of value chain, constraints and opportunities	Validation of information from KIIs	Quantitative data on value chain actors, production and prospects	Analysis of findings for reporting

Secondary Literature Review

Information collected from different secondary sources like research papers published by research organizations, value chain reports, institutional publications, leaflets, workshop reports, and news items was used to generate preliminary insights and understanding about the end markets, market channels, market demand, quality preferences and market potential of the value chains. Literature reviews and studies helped with the identification of key informants on the value chain and of different market actors as well as different development stakeholders. The studies revealed key informants including researchers, key research organizations, government organizations and officers, private sector, NGOs and projects involved with Mung promotion.

In Depth Qualitative Study

A questionnaire was developed for conducting in depth interviews with key informants along with a guideline to conduct FGDs with stakeholders. Besides, extensive field visits were arranged to validate the collected information.

Key Informant Interviews (KIIs) with relevant stakeholders were organized involving Mung bean farmers (including female farmers), processor, exporter, researchers and extension service providers (DAE) in and outside the selected Polders. Through these KIIs, information was collected about problems and constraints in the Mung bean Value Chain and how to address these issues as part of Value Chain Analysis. Another set of KIIs took place with pulse processors, Mung bean seed suppliers to exporters and the exporters themselves.

Focus Group Discussions (FGDs) a series of FGDs were conducted involving Mung bean farmers (including female farmers) of Polders 43/2F & 43/2D using a guideline. Through the FGDs, information was collected about cultivation practices, problems and constraints in the Mung bean Value Chain and how to address these issues.

2. Mung bean Value Chain and Market System

End Market and Market Level Analysis

International Market for Mung bean

There is a large international trade in Mung bean. Bangladesh barely participates in this trade but there is a JICA project that produces for the bean sprout market in Japan which presently solely relies on China to supply it. Bangladesh is in fact an importer of Mung bean to compensate for the annual shortfall in production. The total national demand for Mung bean is estimated at 2.6 million MT per year against the total annual production of 2.18 million MT¹.

National Market

Most of the production in Bangladesh finds its way to the national end-consumer market either through pulse traders or food processors. The former take the smaller, said to be tastier, beans and the latter the larger sized beans.

The large pulse traders in the national market are mostly found in Munshigonj, Dhaka or Chittagong. From these large traders the pulse moves into the distribution channels (regional traders, small traders, grocery shops) to pulse end-consumers.

End-consumers are also reached by the food processors. A wide variety of processed food items require Mung bean, including dal vaja, chanachur, different types of mixes, etc. in (fried) bean and flour form. The demand for Mung bean from these processors is growing every year and includes companies such as Ruchi, BD Foods, PRAN, Square, Akij etc. Besides these large national food processors there are also some smaller regional ones.

Both large pulse traders and food processors draw their supply from the millers. Millers arrange for the de-hulling, drying, cleaning, grading, packaging and often crushing of the seeds (into splits). These millers are located in Baneshwar of Rajshahi, Munshigonj, Natore, or Banaripara of Pabna or surrounding areas of Dhaka city. In turn the millers are supplied from the regional market level.

Regional Market

The regional market level for the South Western area is defined by large beparies and arotdars mainly based in Patuakhali and also at Golachipa, Komlaghat and Boga. There are only a few large arotdars collecting Mung bean seed from large paikars/beparies. Sometimes large collectors (beparies or paikars) send Mung bean directly to millers.

Local Market - Polder 43/2d & 43/2F

¹ Market Strategies South (PROOFS report), page-26

Farmers in polder 43/2D & 43/2F sell their Mung bean crop in Badurabazar, Kalagachia, Hajirhat, Khasherhat, Boga, Chunakhali, Botolbunia, Khatashia markets.

Demand for Mung bean at household consumer level is good and despite being considered as one of the more expensive pulses, there is an indication that demand is increasing. The product is consumed as pulse or as flour and more often at somewhat special occasions.

Production

Production trend

The area of production of most pulses has continuously declined over the last ten years in Bangladesh. The total area under pulses reduced from 728 thousand ha in 1990-91 to 604 thousand ha in 2004-2005, but the production remained static around 525 thousand tons due to an increase in productivity. The main reasons for the decline are the expansion of irrigation facilities and increased crop competition in the winter season (mainly rice, wheat, maize, potato, vegetables) as well as the instability of the pulse yields due to inbreeding degeneration.

Bangladeshi farmers produce nearly a dozen of pulse crops but their yield and potential production vary enormously between species and across locations. All pulse crops suffer due to the increasing culture of rice, wheat and maize crops. Mung bean is generally only produced during the short interval of Rabi and Kharif-1 crop and must compete with alternative field crops in the winter season. Crops like lentil and chickpea registered a steady growth over the last few years. With the increase of cereal production, Mung bean production shows a promising and increasing trend benefiting from the availability of improved (short duration, location specific for different climatic conditions) varieties suitable for incorporation in the existing cropping pattern and not requiring a major adaptation to the system.

Production trend in Patuakhali

The cultivation of Mung bean is presently more prominent in Patuakhali and production is increasing. In case of a late Aman season farmers are better off producing Mung bean as it is a short duration crop. Trends show that, the cultivation of Mung bean has spurred in this area and farmers are increasingly shifting from cultivating Kheshari to Mung bean.

Low productivity of pulses

The productivity of pulses in Bangladesh is low and unstable compared to wheat or rice. Traditional farmer varieties or local varieties are inherently low yielding types, susceptible to diseases and insect pests, less branching and of low pod intensity. They do have a very small seed size though which is in demand in the area. The average production of rice is 4.0 t/ha and of wheat 5.0 t/ha whereas the production of Lentil is 0.8 t/ha and 1.2 t/ha for Mung bean.

Table 2: Comparative Productivity of Pulses and Cereal Crops

Rice	Wheat	Lentil	Mung bean
4.0 t/ ha	5.0 t/ha	0.8 t/ ha	1.2 t/ ha

The major constraint to productivity is that pulses in general have genetically low yield potential—particularly the indigenous varieties of pulses due to:

- The indigenous varieties of pulses are sensitive to too much water and fertilizer and often show negative response to these factors;
- These varieties have more disease and pest problems than cereals do;
- The varieties are more sensitive to climatic factors such as excess soil moisture, humidity and rainfall, terminal heat stress, and soil factors, when compared with cereals; and

- Pulse crops receive little attention from farmers with respect to appropriate land preparation, fertilization, sowing time, weeding, and plant protection.

Different apex research organizations are working on introducing new and improved varieties of Mung seed. For example, BARI Mung bean 2, 3, 4, 5 and 6 are better yielding and pest resistant varieties. The latter would also make a contribution to a reduction of the pesticide related environmental problems. A constraint is that only 30-40% of the Mung bean farmers in the polder are cultivating BARI varieties. It has also been noted that the varieties are not widely available. The distribution of the research institute varieties is in the hands of BADC.

Extensive production technology

It appears inherent to farming tradition that pulse crops including Mung bean can be grown with a minimum of care. Farmers put more effort into crops like rice, wheat and vegetables and give little attention to pulse cultivation. Farmers usually hire tillage services for land preparation. Two or three times tillage is used for land preparation based on soil type, followed by broadcasting of Mung seeds. Farmers usually do not apply any fertilizer, weeding or irrigation. Only a handful of farmers use fertilizer in the field and this is often limited to Urea only (resulting in strong green growth but not necessarily much yield improvement). Pests are a major problem for Mung Bean. Farmers usually take remedial action in case of a pest attack. Farmers purchase pesticide from local input traders on the backdrop that both farmers and providers might have limited knowledge about judicious use. There is also scope to improve harvest and post-harvest practices by the use of plastic nets. This simple change can ensure a better quality product with a higher price and reduce post-harvest losses.

One reason for the low investment in the crop could be the cash flow situation in the household. The income from the previous crop (T.Amam) has been utilised to pay off debts and immediate needs, while its revenue also has to allow the family to bridge the period till the next harvest. Overall, little cash might be available for this additional crop and risk taking with whatever that is available is minimised.

On the other hand, farmers do suffer from a lack of access to appropriate seeds, production and post-harvest technologies, market systems and credit facilities. Also, research and extension are poorly linked to farming communities.

Cramped cropping pattern

The duration of the winter season in Bangladesh is very short (75-90 days). Farmers generally do not sow Mung bean at the optimum time. As a result the crop has an even shorter period for vegetative growth, resulting in a poor yield. Farmers usually sow Mung bean after harvesting Rice, Wheat, Potato, Lentil, Oilseed, vegetables etc. Late harvesting of these crops causes late sowing of Mung bean and extends the harvesting into a period with risky weather conditions.

Harvesting

Harvesting happens in April in two to three cycles and is undertaken by women. They are often paid in kind. One payment system noted is the following; for a first cycle they receive one out of six kg, for the second one out of five kg and for the third, one out of four kg.

Adding value

Properly cleaned, graded and dried Mung bean can yield TK 50-80 more per mound than semi dried low quality Mung. Early in the harvesting season high moisture content can be a problem. Commercial crushing is not popular in the polder even though that at household level farmers crush small quantities of Mung for household consumption. Homestead level crushing is although not efficient compared with commercial crushers. Similarly, grading at farmer level is not attractive, as grading will reduce good quality product for individual farmers but overall will not increase much income. Farias and paikers also do not ask for graded Mung as they have to bulk their purchase for transportation to arots or to distance

mills. A bepari near Patuakhali received a grading (sieving in large, middle and small size) machine from the JICA project, instilling in another Bepari the desire to invest in a similar machine.

Millers for Mung bean are located mainly in Baneshwar, Puntia of Rajshahi, Naogaon and Ishwardi of Pabna districts. These millers ask for locally produced Mung bean that contained a mixture of large and small seeds. Usually millers clean, grade, dry the beans, mix these subsequently with oil, dry them again, then sieve and grind them to end with a de-hulled product. Millers store Mung in bags (60 to 85 kgs as per demand) for supplying to large buyers. The cost of millers is usually Tk. 2.50-3.00 per kg of Mung bean. However, profit comes from differentiated product that comes from segregation of different sizes of Mung seed. The thinner can yield Tk. 85-90 per kg (Gira Mung), while the medium quality can attract Tk. 65-75 per kg and the large size can attract a price of Tk. 50-60 per kg.

Adding value in the form of frying and sprouting is undertaken at higher levels for the high end consumer market frequenting super markets and chain stores. The market requirements of these products in terms of quality, hygiene, packaging, and branding are high. Few food companies sale fried Mung as consumer snack in small poly packets.

Marketing

High Transaction Costs

Transportation is a huge challenge in the whole project region. The wholesale markets are disconnected from the producers by river channels and poor roads. Due to the poor transportation network prices at local markets are low compared with important large markets. Farmers need to invest more time and money to reach important sales points where large paikers and beparies are available. The increase in transportation time brings along an opportunity cost.

Local Markets for Mung bean

Farmers sell Mung bean seed to Farias (often engaged by paikers), to Chotaya in local markets or directly to paikers/beparies or agents (engaged by mill owners) at nearby markets. The middlemen create value by transportation and access to the market. There are several traders in or nearby Patuakhali of which one has a grading machine. These traders buy the crop and arrange transport to the millers. The latter pay for the transport and pay a commission per truck of 19.5/20 tonnes. Their commission on Mung bean truck loads is substantially higher than for rice (e.g. 20.000 BDT versus 6.000 BDT). While the commissions appear the same on large sized and small sized Mung bean, it would appear that they have more difficulty to sell the larger sized ones. This is also reflected in the price difference between the sizes (table 5).

Profitability

Production Cost

Table 3; Cost of Production: Mung Bean (1 Acre)

Production Cost		With Limited Input	
Cost Item	Amount	Cost (in BDT)	Cost (In BDT)
Ploughing	3 ploughs	2000	2000
Seed	27 kg	2160	2000
Fertilizer	30 kg	1500	00
Pesticides & Insecticides	7 bottles	3000	1000
Labour	20 labour days	2000	1000

Total Production cost	10660	6000
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Yield

A farmer usually gets a yield of 4-5 kg per decimal while they reported that the maximum production that can be achieved is 8 kg per decimal. Productivity has gone down significantly due to increasing pest attacks and the use of low yielding and degenerated local varieties. Pests have increased in recent times mostly due to erratic rain fall but the major reason is that the farmers are not aware of proper pest management techniques. BARI Mung bean varieties are supposedly high yielding and pest resistant, but the seeds are not available in the local market. On the other hand farmers are used to broadcasting Mung seed. It is suggested that a small change in cultivation practice like line sowing instead of broadcasting can increase yield. Moreover, farmers are mostly not used to use fertilizer, to weed or apply irrigation in Mung cultivation. Proper use of fertilizer and irrigation has the potential to increase Mung production.

Table 4: Productivity of Mung bean-Current and Potential (1 acre)

Current (kg/ acre)	Potential (with intervention) (kg/ acre)
400-600	800

Table 5: Comparative Price at Different Levels (Tk/ Mound)

Crop	Price at farm gate	Faria	Arot
Local Mung Bean	TK 2500-3000	TK 2600-3200	TK 10-15
HYV Mung Bean	TK 1800-2400	TK 1900-2550	TK 10-15

Bulk sales and direct access to processor

Farmers mostly sell Mung bean at harvesting in the local market to 'Chotaya'. As a result farmers hardly have direct access to processors and there are a number of actors in between. The above table 5 summarizes the prices at different levels.

Margins and Profit

Despite the low productivity Mung bean cultivation is profitable. The production costs are low (Tk. 6000-10000/Acre) for the cultivation of the local variety Mung compared to other competitive crops. A farmer can produce 7-8 mound (336-384kg) per Acre resulting in a revenue of Tk. 22400 (sales price is envisaged to be Tk. 8 X 2800 = Tk. 22400) with very limited input for a local variety vis-à-vis a production of 11-12 mound (528-576 kg) per Acre for the same variety (with adequate inputs) resulting in a revenue of Tk. 34800 (Tk. 12 X 2900= Tk. 34800). Mung bean cultivation is a very profitable crop for the farmers with the added advantage that it has a yearlong demand. The price can vary suddenly though without apparent reason. The profit calculation is given in the table below:

Table 6: Profit Calculation –Mung bean (Tk/Acre)

Cost Item	Unit	Cost (in BDT)	Cost (in BDT)
Production cost		With Input	With limited Input
Ploughing	3 ploughs	2000	2000
Seed	27 kg	2160	2000
Fertilizer	30 kg	1500	00
Pesticides & Insecticides	7 bottles	3000	1000
Labour	10/20 labour days	2000	1000
Total Production cost		10660	6000
Yield	Mound/acre	11	8
Avg. Sales Price	Tk/Mound	2900	2800
Total Earning	Tk	31900	22400
Gross Profit	Tk	21240	16400

ROI		199%	273%
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Problems with the backward linkages

Weak seed distribution and promotion of quality seeds

Farmers in the project area use retained seeds and have the perception that these seeds are of good quality. Meanwhile, high yielding varieties like BARI Mung bean are not widely available in the polder area. Many farmers have not even heard of such varieties and their advantages in terms of yield, pest resistance and short growing season. The seeds are distributed through BADC and to a very limited extent by ACI. Until recently also Lal Teer distributed HYV Mung bean seeds but has withdrawn. There is little evidence of any type of promotional activities of quality seeds. The packaging, labelling and certification provide an extent of confidence in the quality.

Weak information on pesticide and insecticide management

Pulse crops, particularly Mung bean in our polder area are highly susceptible to diseases and pest attack. Mung seed also experiences fungal attack if proper drying is not done. Fungal attacks reduce the quality of the product dramatically and cause great loss in market value.

Farmers abundantly apply insecticides and pesticides without proper knowledge or training on what and how much to use. For instance, farmers use pesticide after flowering when the recommendation is to use pesticide before flowering, or do not adhere to the recommended dosages and interval periods. In addition, farmers apply pesticide at noon while the recommendation is to use pesticide in the early morning and evening when the pests are out. IPM practices are not applied by the farmers. Chemical input providers are not very knowledgeable and tend to give priority to personal gain above farmer result. Chemical companies have active marketing and sales forces in the district headquarter and at Upazilla level. Their distribution networks at union and village level are not significant and are largely in-active at promoting appropriate methods of pest and insect management.

Problems with the Forward linkages

Presence of a large number of middlemen

The pulse and oil crops value chains are characterised by the presence of a large number of middlemen. This erodes the price at the farm gate as has been shown in Table 5 above.

An approximate number of actors in these polders is listed in the table below:

Table 7: Market Actors –Polder 43/2D & 43/2F

Chotiaya (mat buyers)	Faria	Beparies/Paiker	Arot
300	100	20	3 / 4

This presence of the large number of middlemen can be attributed to the following:

Lack of local processing facilities and adding value opportunities

There are only two pulse crushing mills in greater Barisal. Pulses and oil crops produced in the project region are sold to arots in Patuakhali Pura Bazar, Kalapara and through bulking volume then transported to Kathpatti in Munshiganj, Narayanganj and Chandpur. The arots in these districts act as the link between the buyers at national level and the producers around the country.

The feasibility for crushing pulses at local level and marketing across the country has not been established. There are only a few places where grading of Mung bean is possible around the polder area. Large suppliers of Mung have categorically stated that if there is a demand supported by the right price

they can arrange for cleaning, grading and transportation of graded Mung seed. This kind of special demand seems generally very limited though. Meanwhile demand for HYV Mung seed is growing at food company level. Their demand is well met by millers in the northern region and also from other regions who can supply them graded pulses.

Due to many reasons female labour is not abundantly available to perform jobs like cleaning and grading at mills in the polder region. Moreover, there are large scale cleaning, grading, crushing mills in the North (Pabna & Rajshahi); they can meet the demand for graded Mung seed very efficiently. At farmer level in polder area, crushing is not efficient compared with large scale millers. Large mills can obtain 34/35 kgs of pulse from 40 kg Mung seed while farmers at household level can obtain only 28/29 kgs of low quality pulse. Also grading is not very lucrative at farmer level as it reduces the quantity of sellable produce. The increase in price will not cover the effort to grade individual farmer's production. Moreover, local level farias/beparies or paikars generally have to bulk the commodities to transport to mills. As a result, grading at this level, on a large scale, with some exception, will not be very profitable.

There are a few small scale poultry and fish feed manufacturers in Patuakhali and Barisal but the number is not large enough to increase the scope for local value addition. Usually at household level, there is a tradition of crushing Mung for consumption. The waste from crushing is given to poultry or fish pond. The quantity is very insignificant and it has little commercial value. The absence of local processing facilities has diminished the scope of value addition at local level in the feed sectors.

PRAN, ACI, BD-FOODS, SQUARE are the leading companies engaged in sales of fried Mung in small poly packets as snack item. They purchase Mung bean mainly from local markets. Millers located at Baneshwar, Putia and Ishwardi are good source of Mung bean for the private companies as well. The food companies purchase, clean, dry and grade Mung seeds to segregate large good quality seeds. PRAN alone collects 2500 MT of Mung seed per year and has a plan to expand its capacity up to 75000 MT within 3 years. PRAN is also engaged in contract farming through 13 lead farmers (LF) with approximately 76000 farmers. The contract farming arrangement is a bit informal, where PRAN facilitates with quality seed, information, supervision, training but the LFs mostly function as suppliers of seed that meets quality requirement of PRAN.

Extent of Collaboration

Absence of farmer's collaboration

Until recently there were no actual farmer cooperatives in the project area. RFLDC-DANIDA recently created community based organizations (CBOs) which have the potential to work as farmer cooperatives. So far no jointly organized activities could be identified. At present the DANIDA funded project Integrated Farm Management Component (IFMC) is piloting a "Farmers business school (FBS)" in Auliapur Union and Marichbunia Union of polder 43/2D.

Horizontal Coordination in the value chain:

Horizontal coordination in the Mung bean value chain can be defined as the accumulation of similar activities at a specific level in the value chain. Horizontal coordination can be inward (for example, input collection in bulk by several farmers to achieve economies of scale) or outward (for example, bulking of produce by several farmers to get a higher price) focused. Many more farmers could get involved or expand their lands if there is proper water resource management in the catchment area. While they are mostly small farmers they stand to benefit of some coordination and collaboration. This can bring higher efficiency in production, by scheduling of tillage services and of purchasing quality seeds and other inputs. Horizontal coordination allows farmers to share resources at that level e.g. transport. In Mung

bean cultivation farmers have an opportunity to harvest together, dry and crush together using a common dry yard, a crushing machine and grade & sort their produce to achieve a better price. Mung farmers or farmers in general have to schedule tillage due to limited supply of tillage services within a tight time window. Also some kind of coordination is required at the time of harvesting as this work is done by female in groups to optimise use of the available labour.

Horizontal coordination offers several advantages, including favourable economies of scale (large area tillage at one time results in reduced unit cost), economies of scope (market in group to get a better price), increased market power (bargaining power for better price), all generally leading to a reduction in the costs associated with production and marketing.

Vertical integration in the value chain:

Vertical integration in value chains can be expressed as combining the functions of more than one actor in a value chain or eliminating an actor or directly reaching a higher level actor bypassing a lower level actor. The objective is to get a better price (as it adds the margin of the eliminated actor and integrates its function) while maintaining or improving efficiency of operations. Considering the characteristics of the polder and its geographical location and production volume, vertical integration can be an option to realise benefits for the producers in the value chain.

Input actors for the Mung value chain are largely absent in the polder. Forward linkage actors (trading actors) are present in nearby Kolagachia, Hagirhat, Badura, Khasher hat, Boga and Khatasia. Organising their own supply of inputs from nearby markets will eliminate the local trader and through coordination their individual transportation cost will be reduced. Similarly, producers can decide to sell their produce collectively to nearby markets at least eliminating the faria. They can decide to transport their product collectively to Kolagachi or other nearby market on an agreed day and again their individual transportation cost could be reduced. The above provides several opportunities to the farmer producers in the polders for vertical integration in the Mung bean value chain which presently are not observed in polder region.

Preliminary opportunities to increase production of Mung bean

Opportunities for production expansion:

Yield Gap: Productivity of Mung bean is below the global standard. There is scope of increasing production (Table: 4).

Species/Variety Improvement: By introducing BARI, BINA varieties productivity can be increased. Introduce BARI Mung bean 5 or 6 through collaboration with BADC and other quality seed input providers.

Additional Land: At present on average only 50% of T. Aman land is covered under Mung bean cultivation. Much of the land which is presently left fallow in winter is suitable for Mung bean cultivation.

Availability of Mechanization: Mechanised farming has become possible due to the increased availability of power tillers and irrigation pumps in the polders. This is a result of the free distribution of these farm machineries by the FAO project. Farmers can now reduce turnaround time and can prepare land for Mung bean cultivation in a very short period of time.

Labour Available: Mung bean sowing begins in the month of Jan-February. At that time of the year labour should be available in the polder since labour demand is only high in the months of August-

September and December-January when farmers start T. Aman cultivation. Mung bean creates an opportunity to employ idle labour in another particular part of the year.

Water Resource Infrastructure: Blue Gold program is rehabilitating many water resource infrastructures of these polders. These can impact on agriculture by reducing water logging and improving the drainage system at catchment level. As a result more cultivable land can come under Mung cultivation. More area coverage will increase production of Mung and hence more income for the farmers. Similarly modest quantities of irrigation water become available and could allow some irrigation at critical stages in the growing season.

Improving cultivation practices: There is a lot of scope to improve the knowledge of IPM amongst the farmers avoiding unnecessary costs. Similarly there is scope to improve pest management by involving insecticide and pesticide marketing companies and the organisation of demonstration trials. The introduction of plastic nets in post-harvest processes can be of help in gaining good product quality.

Baseline Indicators:

Area of land under cultivation: At present only about 50% of T.Aman area is under Mung cultivation.

Use of HYV Varieties: Local variety is cultivated by 60%-70%.

Volume of production: According to a large arotdar² about 400 truck³ loads of Mung bean are collected from polder region or 8000 tonnes. Higher yields and more productive labour would contribute to the local economy.

Volume of business: There are few input traders and about 300 Chotaya, 100 Faria and 20 Beparies active in the collection of Mung bean. There are 2/3 large paikers in the polder regions and 3/4 large Arotdars in Pauakhali. More actors might not necessarily be better but an improved business volume would.

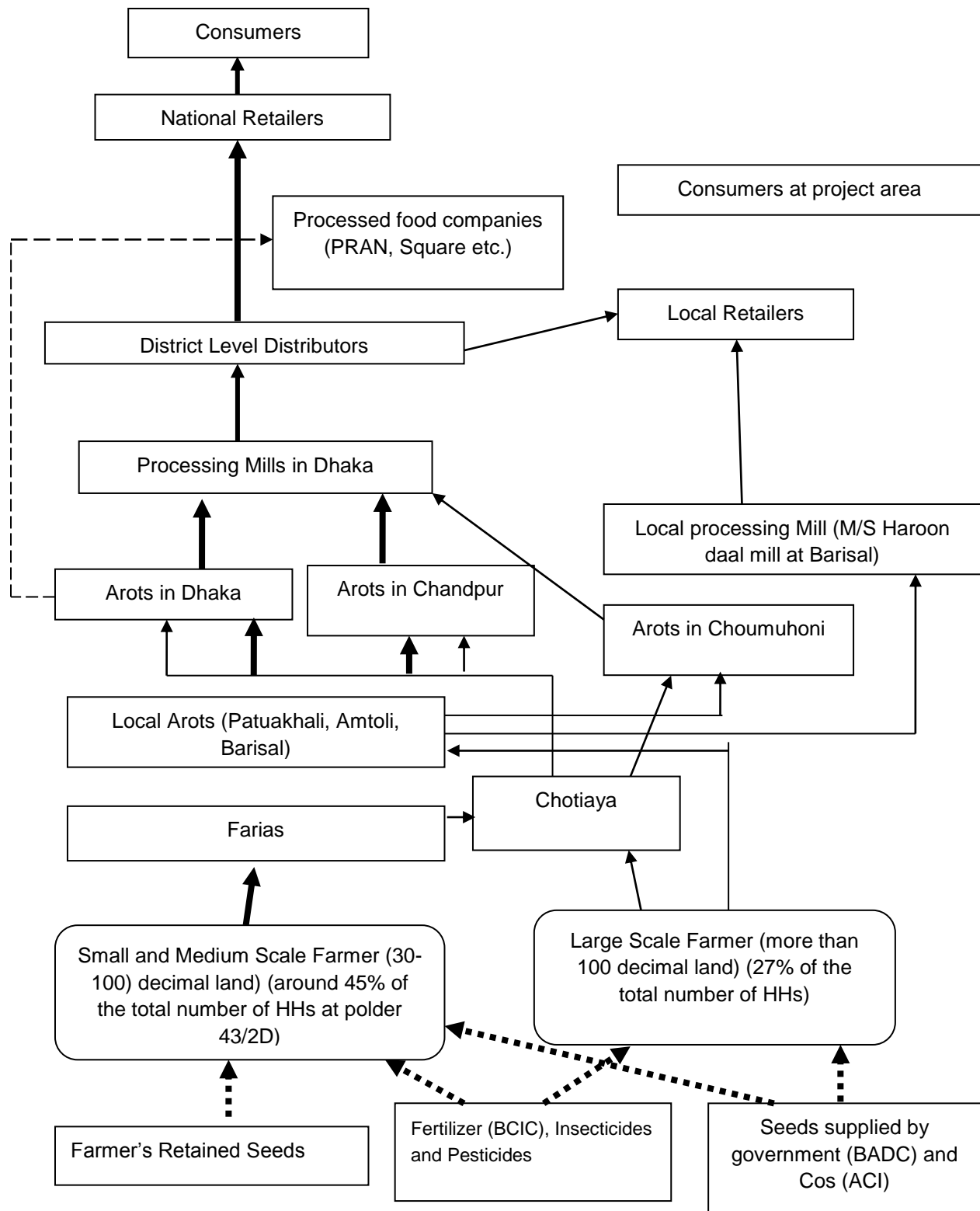
Collective actions: Examples of embryonic horizontal coordination and vertical integration.

Average price: The price (last year-2014) for the local variety (small seed) is Tk. 2500-3290 and Tk 1850-2400 for HYV Mung (large seed) per 48 kg in local market.

Profitability: Profitability levels of the farmers have improved from the baseline.

² Mr. Md. Abdur Rashid, M/s. Khandeker Traders, Pura Bazar, Patuakhali

³ 1 truck=19.5 MT of Mung bean (not crushed)



Note: The heavier arrows represent the strongest links. The dashed arrows represent links that require intervention.

Figure 1: Flow chart: Pulse (Mung bean) Value Chain

Mung Bean Actors, Functions, and Roles

Table 8: Summary of Mung bean Actor, Functions, and Roles

I.#	Actors	Functions	Roles	Cost / Price/Profit information
1	Consumer	Purchase and consume	Purchase from local shops	Tk. 80-120 per kg
2	Retailer	Purchase from Wholesalers, Store Bulk breaking	Sell to consumers	Tk. 80-120 per kg
3	Whole seller (Pulse Trader)	Bulk purchase and finance to procession mills,	Purchase Mung from mills. Finance mills & arotder for processing, grading and storage Mung bean.	5-7% net profit Tk. 65-105 per kg
4	Millers/ Processors	Transporting Processing, crushing, grading, cleaning, packaging, storing	Processes seeds to pulse, sometimes process through drying, cleaning, grading and bagging.	5-10% profit Tk. 50-60 (Large seed) Tk. 65-75 (Medium) Tk-85-90 (Fine-Zira) per kg
5	Arotder	Linkage, purchase on behalf of mill, arrange transport, financing	Work as commission agent for mill. Usually purchase on behalf of mill owners from big collectors (paikers, beparies)	Tk 40 -50/40 kg as commission
6	Bepari	Purchasing Mung Transporting	Purchase Mung at whole sale market or bulk amount and transport to processors.	Purchasing cost- BDT 1800-2400 (local) BDT 2500-3290 (HYV) Selling Price- BDT 20-80 profit per 48 kg Transport cost- BDT 18000-22000 (Baneshwar) Labour-BDT 17 (load unload)
7	Paiker	Purchasing Transporting	Purchase Mung at whole sale market or bulk amount and transport to arotdar and sometime to processors mills.	Purchasing cost [BDT 1800-2400 (HYV) BDT 2500-3290 (local)] Selling Price- BDT 40-120 profit per 48 kg Transport cost- BDT 18000-22000 (Baneshwar) for 19.5MT Labour-BDT 17 (load- unload)
8	Faria	Purchasing Transporting	Purchase Mung at farm gate and transports whole sale market.	Net profit Tk.15-35 per 48 kg
9	Chotaiya	Purchase	Purchase small quantity of Mung	Tk. 15-30 per 48 kg.

	(small paiker spreading a mat)	from farmers in small quantity	from farmers in local market	
10	Farmers	Growing of Mung Harvesting Drying and bagging	Cultivate land, Seed sowing, Fertilizer application ,pest control, Harvesting, cleaning, Drying, Bagging , storage, transport to nearest market or big market	Production costs –BDT 6000-8000 per 100 dec Selling price depends on variety, and quality (50-70 /kg for local, 40-50 for HYV) Normal profit = 200-300%
11	Input Providers/ Input retailer	Input retailing (seed, fertilizer, pesticide, herbicide and fungicide)	Purchase seeds from BADC, and some lead farmers and sale seeds. Purchase fertilizers from BADC & BCIC and other micro nutrient different companies and sale in retailing. Also trade in pesticide, herbicide and fungicide.	Chemical traders claim to take only 10% commission, reputed companies sell at fixed prices
12	Seed Producers	Seed supply	Seed production	100 BDT per kg (small packs), 80 BDT (in bulk)

Profit Taking by Different actors

Assuming market price for Mung at retail level is at Tk. 80/kg for large seed (HYV) and Tk. 105/kg for small (local) variety, a breakdown of profit taking by different actors is presented in the table below (based on actual findings, some assumptions and approximations). The production cost of Mung is calculated to be within a range of Tk. 25-30 per kg. Farmers make a profit of 200-275% over production cost.

Table 9: Profit Raking by different Actors in Mung VC
(Assuming market Price for Mung Tk. 80 & 105)

Actors	Tk/Kg.	Tk/Kg.
Pdn cost	25	30
Farmer	25	30
Chotia	0.5	0.5
Faria	0.5	0.5
Paiker	1	3
Bepari	0.5	1.5
Arot	1	1.5
Miller	16	20
Whole saler	3	6
Retailer	5	10
Total	77.5	103

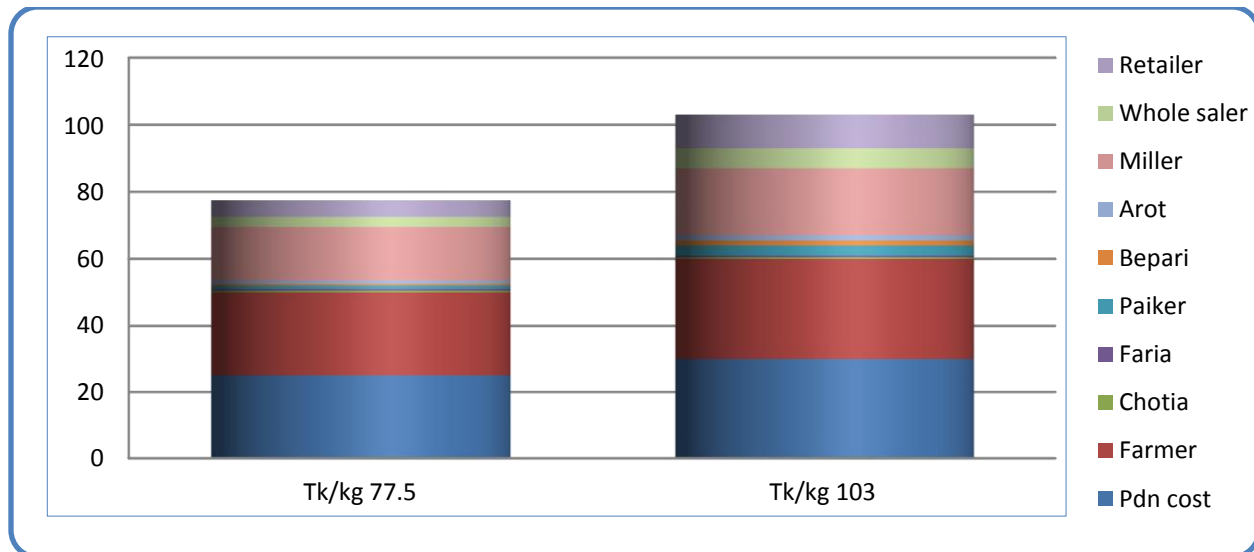


Figure 2: Share of profit in 1 kg of Mung bean by actors.

Support functions

Business Development Services

There are no dedicated services provided for Mung farmers. Farmers expect that information about cultivation should come from public extension service providers free of cost. Thus there might be limited scope to promote transacted extension services to the farmers. However, farmers do look for information on current market prices which can help them to decide in which market they should sell. Most of the farmers have access to mobile phones. As a result Community Information Centres (CIC) by Grameen Phone and Call centres by Bangla Link can be widely accessed by farmers for market information.

Embedded Business Services

Pulse crops are vulnerable to pests and insects. Most of the insecticide and pesticide manufacturing and marketing companies like Bayer crop science, Syngenta and ACI have their operations in the broader project area but not inside polder region. Farmers often lack reliable sources of information regarding improved cultivation practices from competent sources. None the less farmers have to rely on input traders for pesticide and medicine for supply and use. The input traders are generally aware of the environmental concerns but business objectives prevail. Pesticides for Mung bean constitute a very large share of their chemicals business. The larger knowledgeable input traders or dealers usually have a substantial number of retailers or sub-dealers (25 up to 100) who are less knowledgeable though.

Research

Bangladesh Agriculture Research Institute (BARI) has a Pulse Seed Division. They regularly introduce new high yielding Mung bean seed varieties and recommend improved production technologies. They so far promoted the BARI-1, 2, 3, 4, 5 & 6 varieties. Another institute promoting new Mung bean seeds is the Bangladesh Institute of Nuclear Agriculture (BINA). They have introduced the BINA 1, 2, 3, 4, 5, 6, 7 & 8 varieties. Finally there is also the BSMRAU University introducing the BU 1, 2, 3 & 4 varieties. All three work on developing Mung bean varieties to increase production under varying climatic conditions.

State Owned Enterprise Involvement – BADC and BCIC

Bangladesh Agriculture Development Corporation (BADC) is engaged in the supply of seeds at farmer level through its vast network of dealers. But its access to polder region is very limited. BADC markets

different HYV Mung varieties. In order to get seeds, local level dealers have to place the demand for HYV timely. Farmers are mostly used to cultivate with their own seed or seed procured locally. So, there is little demand for BADC seeds and hence local level input traders are not maintaining inventory of good quality seeds. As a result HYV seeds are often not available in local input selling shops.

A similar organisation is Bangladesh Chemical Industries Corporation (BCIC) that is responsible for the manufacturing and distribution of fertiliser to its selected dealers. Usually the businessmen who want to become BCIC dealer have to apply to Deputy Director (DD) office of DAE via UAO (Upazila Agriculture Officer). In a coordination meeting DD assess the application and sent to Deputy Commissioner (DC) for appointing dealer. Following the process dealers are appointed for BCIC and they become eligible to receive fertilizer upon making an advance payment and submission of request for fertilizer which is approved by UAO/AO of concerned upazila. BCIC allows one dealer per union. Under each dealer there can be nine sub-dealers per union (three sub-dealers per ward). Dealers generally are eligible to receive fertilizer at a fixed rate and they are allowed to make a profit of Taka 25 per 40 kg. But in reality, dealers are often observed to make more profit than they are allowed. Similarly sub-dealers are also allowed to make a profit of Taka 25 per 40 kgs while retailing fertilizer to farmers (government fixes per kg rate for each type of fertilizer). But here again, some over pricing is observed.

Training and Information on Technical Issues

Training and Information on technical issues regarding improved varieties of Mung bean seed, improved production practices, and post-harvest processing can be obtained from OFRD, BARI and BINA. In addition, university scientists are available to provide support.

DAE is supportive in the promotion of high yielding Mung bean varieties particularly in the Patuakhali region. Their upazilla level officials have shown interest and can provide technical support to Mung bean farmers with respect to good production practices. It will take additional efforts to bring them to the producer groups as they have a busy schedule and are often engaged with different (non-agricultural) activities.

Finally, several private sector actors (processors and exporters) are actively promoting and supporting the production in the area and are prepared to cooperate.

Presence of other projects in the region

The CSISA-BD project is promoting cereal systems (rice, maize, wheat and pulse) in this area. CSISA-MI is promoting conservation agricultural related machineries (PTOS, Bed Planter & harvester) and irrigation services (Axial flow pumps).

There is a Grameen Yukiguni Maitake Ltd (JICA supported) project facilitating good quality Mung production to export to Japan for selling in the Japanese market as bean sprout. There is another Ahsania Mission-CARE project and Wave Foundation effort in the area promoting Mung cultivation. iDE Bangladesh through PROOFS is also working on the value chain development of Mung bean to achieve their project objective in the Patuakhali and Barisal region.

Association of pulse seed processors

There is no association in this region to address Mung or pulse related issues.

Tillage services

Tillage services are very important for ensuring the timely tillage for Mung bean farmers in polder regions. Some WMGs have received power tillers (PTs). They are using these PTs to provide tillage services to farmers. But at the time of sowing, the demand for tillage service is very high. So, other service providers

also have a market. Due to a lack of supply, at the peak time, some farmers have to delay their tillage. In the peak season, some arrange heavy tractors from outside to meet the demand. However, the farmers prefer small power tillers over heavy tractors as for Mung bean cultivation only the top soil needs to be ploughed. However farmers sometimes complain about the quality of service provided by the tillers. Sometimes the tiller operators do not till the land as expected by the farmers due to their urgency to cover more acres and to make more money in a short period of time.

Irrigation and other related services

Transportation In the polder there are no specific irrigation service providers for Mung bean. Mung bean farmers usually do not apply irrigation. However, some farmers do possess low lift pumps (LLPs). These LLPs are generally used for fish ponds. Also some WMGs have received LLPs in the agricultural mechanisation package. Farmers usually prefer another crop over Mung beans if irrigation could be applied easily (e.g. Watermelon).

Other related services for Mung bean (e.g. drying yard, cleaning, grading etc..) are not present in the polders.

Transportation

Polder 43/2D & 43/2F are connected with Patuakhali city by road transportation and waterways while its communication with Barguna district head quarter is rather difficult. The roads from deep inside the polder to the main road that leads to Patuakhali are although often narrow, filled with potholes and most of the time unpaved. As a result transportation is not always easy and efficient. It can be concluded that, farmers have to sell their product in nearby markets to avoid transportation hassles and save time and money. On the other hand farias and paikers mainly maintain business relations with large beparies and arots in Patuakhali and Barisal. Different types of vehicles can be arranged for transporting human and agricultural commodities at varying rental rates.

Mung bean is transported both via roads and water ways. The transportation cost from Patuakhali arot to Baneshwar of Rajshahi where mills are situated, is Tk.18000-22000 based on the road condition, and traffic and political situations. From Boga and Komlagonj river ports, Mung beans are also transported by boat to Munshigonj and Dhaka.

Access to Finance

There are two bank branches and four post offices inside polders 43/2D & 43/2F, along with many B-Kash centres. Through all of these, cash transactions are possible. In addition, many national, regional and local Micro Finance Institute (MFIs) are operating inside these polders. People with limited income can become member of these MFIs to obtain credits.

BRAC BCUP is present in Patuakhali sadar upazila and Amtali upazila of the Barguna district. As BCUP's service area extends to 9 km from the BCUP-BRAC office, most farmers of polder 43/2D & 43/2F will have the opportunity to access its service. Negotiations are ongoing with BRAC to enable BCUP loan facilities up to a range of 20 km which would cover virtually all Blue Gold beneficiaries. BCUP offers a very attractive source of finance due to its low interest rate, i.e. 18% reducing (9% effective).

In addition, different government commercial banks (including Krishi bank) have an agri loan product. Rather theoretically, there is a possibility to receive a loan for lentil cultivation with government subsidised interest rate if the farmer is living within the banks service area. But in reality due to different practical problems, a normal farmer usually does not get encouraged to go for government loan.

Sometimes arots provide credit to beparies/paikers for purchasing Mung. If there is a big pull demand from the mill/arot with credit to purchase Mung in bulk quantity, farmers will be benefit.

Involvement of Women

In Mung bean cultivation, women play an important role along with all family members. A significant contribution from female members can be observed at the time of harvesting and post-harvest processing. Mung bean cultivation creates employment for women in the off-peak season for agricultural labour. Women are involved in collecting mature Mung bean pods, pod drying and sometimes in crushing. The latter is for home consumption.

Women collect Mung pods in a small basket locally called ‘Hazi’. One Hazi contains enough pods to realise 3.5-4 kg of Mung seed. The payment methods vary and are often results based. For example, in some systems female workers receive 1/6th of their collection as payment at the first harvest (first flush). They can get 1/3rd of the collection at the second flush and ½ for the third flush. Usually, women work in the early morning (6 to 9 am) and late afternoon (3 to 5 pm) to avoid both heat and sunshine. On any given working day women can collect 1-1.5 hazi of Mung bean pods resulting in an estimated wage of Tk. 100-150 per day (selective hours only). Once the Mung bean seeds come out from pods, they clean the seeds to remove dust and foreign particles. Then with the help of other family members, they put Mung bean seeds into bags and make arrangements for storage.

It is most often the women that take the initiative for seed preservation. For this purpose they collect Mung bean pods in the field from plants that are visibly well grown. This is a rather subjective selection process and they only select those plants that they perceive to be very healthy and not to have any defects. These pods are separately dried to remove any moisture. After proper drying they clean the seeds and apply a grading system to separate the mature, well- shaped, healthy seeds for next year’s cultivation. The seeds are preserved in earthen jars or bottles in a dry and cool place, and cover the mouths of the jars with cloths to avoid infestation from insects.

Assessment of Business Enabling Environment (BEE)

Quality and Grading

While processors are aware of quality differences, there is no formal industry standard and traders do not seem too concerned at present. There is a need to develop such quality standards to enable farmers to grow quality products for higher value markets. The effect will be that processors and traders will be able to offer higher prices in the local markets which in turn will result in more production of good quality Mung. Related to this there will be a need for a certification agency which can certify the quality of the product intended for export market (if permitted by government). This should not only be applied to Mung bean seed but also include value add products like refined Mung powder for the confectionery and cuisine industry.

Market practices

In polder 43/2D & 43/2F, farmers have to sell their Mung at the rate of 48 kg per mound instead of the prevailing national standard of 40 kg per mound. In a few places one mound is even equivalent to 46.5 kg. This practice creates confusion and frustration among producer farmers. They feel like they are being cheated by the chotiaya/farias/beparies/paikers/arotdars.

Interestingly, beparies/arotdars, on the other hand, have to supply Mung bean to millers as per national standard of 40 kg per mound. But beparies/arotdars have confirmed that the price per kg does not change. It means that if the purchasing price for Mung is Tk 50 per kg, than the sales price is also calculated on that basis. In fact it is irrelevant if a mound is equivalent to respectively 40 kg or 48 kg per

mound in case of the supply to the mills. So, if they purchase one mound (48 kg) of Mung from farmers at Tk. 2400, then they will supply one mound (40 kg) of Mung to millers at the base price of Tk. 2000 per mound plus additional commission per mound. As result, there is in fact no extra gain to the traders from this system anomaly.

Government Policies

A good and transparent government policy would support the expansion of Mung bean cultivation, processing and export marketing by the establishment of a good enabling environment and directed support.

Concerned government agencies (DAE-for extension/practice, BADC-seed/minor irrigation, DAM-market information/price) might get more effective to encourage production of Mung bean in order to meet at least local demand and possibly take advantage of export markets. There seems to be confusion regarding national production-demand data as there are demand and price fluctuations in the market due to seemingly random imports. Both import and export policies and actions may need to be re-examined. Government should play a vital role in promoting new varieties of Mung seed developed by BARI, BINA, BU and others for different climatic zones. This will enable farmers to choose the right kind of seed and technology to result in quality production. In this regard a more efficient distribution system and network is required (e.g. BADC distribution network).

Government should support the establishment of a commodity standard (fair and transparent) for different types of Mung bean. It might be of help to involve an association of the Pulse producers, traders and processors. Finally, Government can take an initiative to ensure that Mung farmers get fair access to appropriate agricultural loan products, preferably with low interest rates, for Mung cultivation. Thus effective, timely, comprehensive and forward looking policies can reduce the supply gap, contribute in nutrition uptake and generate more income for Mung producing farmers.

Market interventions

At present there are a few market interventions by the public sector:

- While there is a restriction on the export of Mung bean, the border with India is rather loosely controlled and illegal export occurs. The JICA project appears to be allowed to export their specially earmarked production for bean sprouts to Japan.
- The fertiliser industry is controlled by the public sector and the distribution is riddled with anomalies from untimely delivery, supply shortages, adulteration and retail pricing deviating from the official list prices.
- Extortion in the transport system along the major roads.

Pesticides

In order to conduct business of pesticide, insecticide and herbicide each input trader has to apply for trade licence to the Sub Assistant Plant Protection Officer (SAPPO) of local DAE. The interested trader has to apply by filling up a form available at SAPPO office. Generally, SAPPO has the responsibility to examine the application, visit physically the shop and be satisfied with the ability and experience of the interested trader. The SAPPO also needs to be sure that there is no grocery shop and food item business along with pesticide business. The application then is forwarded to Additional Director Plant Protection (ADPP). The ADPP has to arrange for three months training before issuance of trade licence. But due to many reasons (lack of available training schedule, less than adequate number of trainees, lack of trainers or others etc) the ADPP most of the time has to issue trading licence without training.

Input traders, when they become dealers of companies, usually receive training about the use of different product. Companies arrange training to promote their product and ensure effective use.

There is committee at DAE who prepares a list of items that are considered/observed having bad impact on agriculture by collecting information from different competent sources, usually from DAE field level staffs. Thus a list of banned items were prepared and sent to all Upazilla DAE offices. ADPP has the responsibility to supervise the situation in the market to stop selling of the banned item through input traders.

SWOT Analysis

S		O		S		O		S		O					
Increasing demand for HYV		New varieties exist		On-going cultivation of known crop, good production area		WRM infra, land area fallow		Existing Arot/ Beparies/ mills		Supply Gap, demand year round		Product qualities		Large unknown demand	
Input				Production				Trading/ Processing				Exporter			
W		T		W		T		W		T		W		T	
Farmers stick to own local varieties, limited market orientation		Not available locally and providers lack crop knowledge		Lack knowledge of improved practices		Limited sources of information, climate risks		No horizontal coordination amongst farmers		Perception of 48 vs 40 kg marketing practice		Lack of quality standard and policy		Import and Export ban policies	

Strength:

- Still huge amount of fallow/suitable land available in polder area.
- Farmers are cultivating Mung because of its profitability and cropping pattern fit
- Mung is a high value crop and easy to sell at local market around the year.
- Farmers already have basic knowledge of Mung production.

Opportunity:

- Unmet market demand in Regional, National and International markets.
- Water resources for irrigation are declining in the polders and there is insufficient interest in irrigation management, leading producers to look for crops requiring less irrigation water
- Mung has excellent potential in the polders as it grows well in this area, especially short duration varieties which overcome some of the weather risks.
- Mung can contribute in nitrogen fixing and enhancing organic matter in the soil.
- There is presently 50% of the area fallow, allowing an increase of Mung cultivation.
- Lead firms are available with established export channels, and involved in the promotion of Mung beans.

Weakness:

- Lack of knowledge of improved production technologies (fertilizer application, pest management and processing and drying) of Mung bean.
- Presence of flooding at sowing time and irrigation water shortages during production season.
- Perception of mound measurement practice (48kg taken as mound)

- Virtually no horizontal cooperation or coordination amongst farmers resulting in weak positions vis-à-vis input providers and market actors.
- Overall limited market orientation amongst farmers (i.e. eye for profitability, combined technical and economic efficiency of production) resulting of a lack of the underlying capacities.
- Traders do not seem overly concerned with product characteristics e.g. distinguishing on size, in the absence of industry standards.

Threats:

- Insufficient supply and insufficient quantity of quality seeds in the polder area.
- Early heavy rains and cyclones at the end of the season (April)
- No price seasonality but fluctuations of price on the basis of imports.
- Sudden heavy rains and temporary water logging situation in polder area.
- High tide in cultivation season
- Limited sources or providers of good information available.

3. Constraints, Findings, Problems and Interventions

Summary of Constraints and Findings

Improved and efficient water resource management can play an important role in the expansion of Mung cultivation in polder 43/2d & 43/2F. About 70 percent of Mung bean production is concentrated in the four southern districts of Patuakhali, Barisal, Bhola, and Noakhali. Patuakhali alone accounts for 30 percent of the area under production where polder 43/2D & 43/2F located. Irrigation facilities in this region are very limited.

Improved drainage and irrigation (as being implemented by the Infrastructure Component) can induce a substantial expansion of Mung bean cultivation and productivity in polder 43/2F and 43/2D. The Blue Gold program through its water resource management infrastructure development initiatives can also play a vital role in improving water availability for irrigation. Not only more land can come under Mung bean cultivation, but there are also several opportunities to improve Mung bean productivity. Farmers can earn more by producing quality Mung beans for both the domestic and international market.

Table 10: Area of Constraints its Analysis at a Glance

Area of Constraint	Findings	Resulting in
Water resource management	<ul style="list-style-type: none"> ■ land preparation and sowing is not taking place at optimal time due waterlogging 	⇒ more subject to climate than necessary => risk increases, => lower investment and productivity leading to reduced profitability
	<ul style="list-style-type: none"> ■ irrigation water lacks during production season to boost production 	
Sub-optimal use of finance	<ul style="list-style-type: none"> ■ extensive production of Mung bean with limited inputs apparently minimises risks ■ cash flow situation from households generally limits risk taking ■ experience high transaction costs at input procurement and output marketing side 	⇒ low investment into the production resulting in sub-optimal productivity and profit.
Sub-optimal cultivation practices (Technical efficiency)	<ul style="list-style-type: none"> ■ using own and purchased seeds of poor quality and of local variety ■ limited use of fertiliser due to traditional practice may be related with risk aversion and a believe that use of fertilizer impact negatively with local varieties. ■ inappropriate practices wrt fertiliser, pest 	⇒ low productivity leading to reduced profitability

	management, weeding and harvesting (e.g. product, dosage, timing, technology)	
Sub-optimal post-harvesting practices (marketing efficiency)	<ul style="list-style-type: none"> ■ market low quality Mung bean attacked by fungus due to moisture in early harvest period ■ farmers are not involved in value adding e.g. grading ■ farmers sell small quantities at farm gate or in local market leaving transport to market to others ■ farmers fail to cooperate and experience a weak position in the market 	⇒ lower price and profitability

Farmers of Mung, consider Mung as a low investment crop. But for producing good quality Mung on time land preparation and use of appropriate inputs is essential. So, making finance available is very important for expanding Mung cultivation. Since Mung is cultivated after harvesting of T.Aman, they can be cash starved as they have to pay back all loans incurred in T. Aman cultivation and family maintenance for the last four/five months. Investment is also required for land preparation services (like-tillage), sowing, seed purchase, seeding, weeding, pest control etc. Some farmers also need money for fertilizer and irrigation. Though farmers are usually not used to provide fertilizer and irrigation (some time due to lack of availability or just traditional practice). Thus linking farmers to MFIs and sources of fund is very important. Easy access to finance can help farmers plan for the expanded production area and ensure on time land preparation services. It can also help them to take decisions on the appropriate use of inputs. As a result farmers will be able to overcome their financial barrier and produce more quality Mung.

Farmers often use own and purchased seeds of poor quality and of local variety. Farmers usually do not use fertilizer. This limited use of fertiliser is mainly due to the traditional practice that can be related to risk aversion and a believe that the use of fertilizer impacts negatively with local varieties. On the other hand, inappropriate practices with respect to fertiliser use, pest management, weeding and harvesting (e.g. product, dosage, timing, technology) is also limiting the potential for increased productivity and higher incomes despite high market demand. Farmers thus need to be made aware about improved production practices.

Producer farmers of Mung, sometime market low quality Mung bean attacked by fungus due to moisture in the early harvest period. This poor quality product reduces their income from Mung considerably. On the other hand, farmers in the polder usually are not involved in value adding e.g. grading, as grading can reduce the sellable quantity without the offsetting benefit from a higher selling price. There is seemingly also no incentive for crushing at household level. Normally farmers sell small quantities at farm gate or in the local market.

Transportation is a huge challenge in the whole project region. The wholesale markets are disconnected from the producers by river channels and poor roads. Due to the poor transportation network prices at local markets are low compared with important large markets. Farmers need to invest more time and money to reach important sales point where large paikers and beparies are available. The increase in transportation time results in an opportunity cost.

Identification of interventions

The table below provides a summary of findings along with problem identification by analysing the findings and planned interventions to overcome the problems.

Table 11: Identifying Problems and planned Interventions

	Findings	Problem	Intervention
1.	land preparation and sowing is not taking place at optimal time due waterlogging	water resource management arrangement at catchment level fails	workable institutional arrangement to be established allowing for planning, conflict resolution and securing day-to-day operation and longer term maintenance
	irrigation water lacks during production season to boost production		
2.	extensive production of Mung bean with limited inputs apparently minimises risks	inappropriate financial products for crop production in the market	improving the understanding for the need for, planning and using of financing within a household perspective
	cash flow situation from households generally limits risk taking	inadequate understanding of financing (in the household)	Improving access to finance in general and to a more appropriate crop financing product in particular.
	experience high transaction costs at input procurement and output marketing side	individual procurement of inputs and marketing of small amounts	Stimulate coordination and/or cooperation with respect to input procurement and marketing activities
3	using own and purchased seeds of poor quality and of local variety	limited availability of good quality seed at local input providers, so preservation of seeds at home	Promote knowledge about improved seed preservation technology and linking farmers to quality seed providers and/or organising seed production
	limited use of fertiliser	lack of appropriate extension or knowledge providers about proper use of fertilizer	Training, field trials and linking farmers to a network of sources of information (public, private)
	inappropriate practices wrt fertiliser, pest management, weeding and harvesting (e.g. product, dosage, timing, technology)	lack of appropriate knowledge about inputs (seeds, chemicals) and overall cultivation practice	Setup field trials and transfer appropriate information (public, private) and arrange training programme for input providers and farmers on cultivation
4	market low quality Mung bean attacked by fungus due to moisture in early harvesting period	inadequate post-harvesting technology and quality consciousness	Transfer of improved post-harvesting technology and raising of quality/price relationships
	farmers are not involved in value adding e.g. grading	technology seems unknown, or unavailable or insufficient cooperation to start-up adding value by grading	Identification and introduction of crushing technology to producer group
	farmers sell small quantities at farm gate leaving transport to market to others	individual marketing at low price market level	Stimulate coordination and/or cooperation with respect to marketing activities linked to larger scale buyer
	farmers experience a weak position in the market	48 kg practice in the market is to the detriment of the small producer	Promote appropriate weight related practice

An effective water resource management arrangement at catchment can play an important role in expanding Mung cultivation in polder areas but it is not happening. To make it workable an institutional arrangement need to be established allowing for planning, conflict resolution and securing day-to-day operation and longer term maintenance by polder dwellers particularly by the Mung producing groups. The institutional process to achieve water resource management by the farmers is required.

There are inappropriate financial products for crop production in the market particularly if cultivation of Mung is considered. There is also wide spread inadequate understanding of financing (in the household) at farmer level. Due to lack of available funds and collective action by the farmers, often inputs are collected individually in small quantities and similarly small quantities are available for marketing.

To address the issue of finance, improved understanding about the need for, planning and using of financing within a household perspective is very essential. Improving access to finance in general and to a more appropriate crop financing product in particular (Mung) can help farmers to overcome financial barriers.

Stimulated coordination and/or cooperation with respect to input procurement and marketing activities by farmers both individually and as groups has to be pursued through MFS sessions among PG farmers.

In the polder the availability of good quality seed is limited at local input provider's level, so preservation of seeds at home has become an alternative option and a source of seed supply. Farmers also lack appropriate knowledge from extension provider about proper use of fertilizer. Farmers also lack of appropriate knowledge about inputs (seeds, chemicals) and overall cultivation practice.

We will teach farmers through MFS which inputs work, and create a linkage with an input trader giving him a better understanding of what inputs he should supply, and what advice he should give to farmers. For this we will facilitate trust between retailer and farmers, thereby improving both the retailer's business and the producer's farming. We will seek a win-win in this relationship or linkage through market oriented sessions in MFS.

Promoting knowledge about improved seed preservation technology and linking farmers to quality seed providers and/or organising seed production is absolutely vital to improve Mung production in the polder areas. Implementing training, establishing field trials and linking farmers to a network of sources of information (public, private) can help farmers to close the information gap about improved farm practices. Setting up of field trials and transferring appropriate information (public, private) and arrange a training programme for input providers and farmers on cultivation practices can improve cultivation practices of Mung farmers.

We can facilitate the improvement of the business of the producer farmers, of the traders and of the processor through a contractual delivery arrangement (like CF), by enhanced coordination, trust and creating a win-win situation.

There is an information gap about post-harvest technology at farmer level. Quality of the product and revenue earning opportunity is lost due to inadequate post-harvesting technology and quality consciousness among farmers. The relevant technology seems unknown, or unavailable or there is insufficient cooperation to supply to higher level buyers at the polder level. There is an urgent need for cooperation to start-up adding value by grading as an income opportunity. There is a traditional practice of taking 48 kg instead of 40 kg as mound from farmers. It creates confusion among small holder farmers.

It is very important to take some measures to transfer improved post-harvesting technology among farmers to ensure quality Mung. At the same time it is also important to raise consciousness about

quality/price relationships among farmers to encourage them to supply good quality product for a higher price. In addition the identification and introduction of crushing technology to producer groups can pave the path of employment generation and more income opportunity by targeting actors in upper value chain.

Stimulate coordination and/or cooperation with respect to marketing activities linked to a larger scale buyer at the same time promoting appropriate weight related practices e.g. ensuring 40 kg mounds are used instead of 48 kg mounds.

We can initiate discussions with the concerned committee to agree on 40 kg mound in all steps of the Mung sales process. We can support the farmers to take up the matter with the concerned committees and access also (local) authority support. Thus the problems related with weighing that hamper VC activities will be addressed to create a win-win situation from an improvement in the Business Enabling Environment.

Action planning of interventions

In the following table, different activities are listed with activities that can be covered under MFS.

Table 12: Planned Interventions with activities

	Intervention	MFS Activities	Other Activities
1.	workable institutional arrangement to be established allowing for planning, conflict resolution and securing day-to-day operation and longer term maintenance	<ul style="list-style-type: none"> -Session to discuss WRM for the benefit of Mung farmers -Irrigation need should be referred to WMA and reflected in WRM. - Create awareness of waterlogging and lack of irrigation water - Discuss catchment level cooperation with respect to efficient WRM for Mung producer groups in WMA 	-Discussion with BWDB about representation of PG at WMO level to address common need for efficient water use inside polder.
2.	improving the understanding for the need for planning and using of financing within a household perspective	<ul style="list-style-type: none"> -Crop budget comparisons -Discussion about financial requirement and planning in advance. -Session on financial product and sources -Production planning to estimate financial requirement -Discuss alternative sources of funding (BCUP) -Awareness building on loan product and sources of finance 	
	Improving access to finance in general and to a more appropriate crop financing product in particular.	<ul style="list-style-type: none"> -Invite representative from MFI -Explain procedures of microcredit -Linkage with MFIs based on production budget (increase outreach) - Attempt to define appropriate crop financing product with MFI 	-Initiate discussion with different MFI and commercial banks for creating collaboration and easy access to financial product.
	Stimulate coordination and/or cooperation with respect to input procurement and marketing activities	<ul style="list-style-type: none"> -Session for discussion about collective actions and benefits -Estimate demand for input and forecast production -Explain different ways of collective action - Linkage with network of input providers and buyers 	-Initiate discussion with potential private companies.
3	Promote knowledge about improved seed preservation technology and linking farmers to quality seed providers and/or organising seed production	<ul style="list-style-type: none"> -Discuss in MFS session -Field visit & linkage programs - Field trials on varieties and related crop budgets -Knowledge transfer about good seed preservation technology -Linkage with input provider - Clarify variety options, advantages and disadvantages - Assess feasibility of seed production 	-Search for technical support from public-private organizations.
	Training, field trials and linking farmers to a network of sources of information (public, private)	<ul style="list-style-type: none"> -Field trials -Crop budget comparisons - Session on cultivation information networking -Linkage with cultivation information -Hands on training in field trials 	
	Setup field trials and transfer appropriate information (public, private) and arrange training programme for input providers and	<ul style="list-style-type: none"> -Trail setting on good practices and with different input as basis for crop budget comparisons - Input provider training programme -Trial setting & demonstration on different practice 	

	farmers on cultivation	- Train input providers to improve their knowledge of appropriate cultivation practices	
4	Transfer of improved post-harvesting technology and raising of quality/price relationships	-Session with buyers about market requirements and relation to quality characteristics -Promote post- harvest practice to reduce moisture content -Awareness about quality of product with better post-harvest and high price - Address moisture content in harvested produce	-Search for appropriate technology and technical support from appropriate public-private organizations.
	Identification and introduction of grading technology to producer group	- Grading as business if feasible in PG. - Identify and assess feasibility of technology at farmer level - Assess farmer interest - Introduce appropriate technology	
	Stimulate coordination and/or cooperation with respect to marketing activities linked to larger scale buyer	-Session with PG to discuss opportunities for collective and coordinated actions towards market - Feasibility of such actions - Facilitate development of such action with interested farmer groups -Awareness about benefit of coordination and cooperation with forward actor -Linkage with buyers	
	Promote appropriate weight related practice	-Share ideas, create and promote opinion -Initiate discussion with all concerned to see if a standard weight can be agreed upon	

Annex 1.

Table 13: A brief Summaries of Problems, Interventions, and Implementation work

	Findings	Problem	Intervention	MFS activities	Other activities
1.	land preparation and sowing is not taking place at optimal time due water logging	water resource management arrangement at catchment level fails	workable institutional arrangement to be established allowing for planning, conflict resolution and securing day-to-day operation and longer term maintenance	-Session to discuss WRM for the benefit of Mung farmers -Irrigation need should be referred to WMA and reflected in WRM. - Create awareness of water logging and lack of irrigation water - Discuss catchment level cooperation with respect to efficient WRM for Mung producer groups in WMA	-Discussion with BWDB about representation of PG at WMO level to address common need for efficient water use inside polder.
	irrigation water lacks during production season to boost production				
2.	extensive production of Mung bean with limited inputs apparently minimises risks	inappropriate financial products for crop production in the market	improving the understanding for the need for, planning and using of financing within a household perspective	-Crop budget comparisons -Discussion about financial requirement and planning in advance. -Session on financial product and sources -Production planning to estimate financial requirement -Discuss alternative sources of funding (BCUP) -Awareness building on loan product and sources of finance	
	cash flow situation from households generally limits risk taking	inadequate understanding of financing (in the household)	Improving access to finance in general and to a more appropriate crop financing product in particular.	-Invite representative from MFI -Explain procedures of microcredit -Linkage with MFIs based on production budget (increase outreach) - Attempt to define appropriate crop financing product with MFI	-Initiate discussion with different MFI and commercial banks for creating collaboration and easy access to financial product.
	experience high transaction costs at input procurement and output marketing side	individual procurement of inputs and marketing of small amounts	Stimulate coordination and/or cooperation with respect to input procurement and marketing activities	-Session for discussion about collective actions and benefits with calculations - Stimulation of networking -Estimate demand for input and forecast production -Explain different ways of collective action - Linkage with network of input providers and buyers	-Initiate discussion with potential private companies.
3	using own and purchased seeds of poor quality and of local variety	limited availability of good quality seed at local input providers, so preservation of seeds at home	Promote knowledge about improved seed preservation technology and linking farmers to quality seed providers and/or organising seed production	-Discuss in MFS session -Field visit & linkage programs - Field trials on varieties and related crop budgets -Knowledge transfer about good seed preservation technology -Linkage with input provider - Clarify variety options, advantages and disadvantages	-Search for technical support from public-private organizations.

	limited use of fertiliser	lack of appropriate extension or knowledge providers about proper use of fertilizer	Training, field trials and linking farmers to a network of sources of information (public, private)	<ul style="list-style-type: none"> - Assess feasibility of seed production -Field trials -Crop budget comparisons - Session on cultivation information networking -Linkage with cultivation information -Hands on training in field trials 	
	inappropriate practices wrt fertiliser, pest management, weeding and harvesting (e.g. product, dosage, timing, technology)	lack of appropriate knowledge about inputs (seeds, chemicals) and overall cultivation practice	Setup field trials and transfer appropriate information (public, private) and arrange training programme for input providers and farmers on cultivation	<ul style="list-style-type: none"> -Trail setting on good practices and with different input as basis for crop budget comparisons - Input provider training programme -Trial setting & demonstration on different practice - Train input providers to improve their knowledge of appropriate cultivation practices 	
4	market low quality Mung bean attacked by fungus	inadequate post-harvesting technology and quality consciousness	Transfer of improved post-harvesting technology and raising of quality/price relationships	<ul style="list-style-type: none"> -Session with buyers about market requirements and relation to quality characteristics -Promote post- harvest practice to reduce moisture content -Awareness about quality of product with better post-harvest and high price - Address moisture content in harvested produce 	-Search for appropriate technology and technical support from appropriate public-private organizations.
	farmers are not involved in value adding e.g. crushing	technology seems unknown, or unavailable or insufficient cooperation to start-up adding value by crushing	Identification and introduction of crushing technology to individual farmer or group	<ul style="list-style-type: none"> - Grading as business if feasible in PG. - Identify and assess feasibility of technology at farmer level - Assess farmer interest - Introduce appropriate technology 	
	farmers sell small quantities at farm gate leaving transport to market to others	individual marketing at low price market level	Stimulate coordination and/or cooperation with respect to marketing activities linked to larger scale buyer	<ul style="list-style-type: none"> -Session with PG to discuss opportunities for collective and coordinated actions towards market - Feasibility of such actions - Facilitate development of such action with interested farmer groups -Awareness about benefit of coordination and cooperation with forward actor -Linkage with buyers 	
	farmers experience a weak position in the market	48 kg practice in the market is to the detriment of the small producer	Promote appropriate weight related practice	<ul style="list-style-type: none"> -Share ideas, create and promote opinion -Initiate discussion with all concerned to see if a standard weight can be agreed upon 	

Annex 2.

Blue Gold Program Matrix for Value Chain Selection Component-04																						
Criteria→	Indicate market level (Local, District, Regional, National, International)	Growth Potential (32)					Impact (32)					Structure of the Industry (15)				Gender & Employment		Collective Action(4)		Risk	Total Weighted Value	Rank
		Market Size	Unmet market demand	Potential productivity improvement	Expansion of area/capacity	Value adding to raw materials	Current production	Number of households involved	Contribution to HH income and wealth	Short or longer production/harvesting season	Food Security	Nutrition	Forward/backward linkages conducive to market based approach	Existence of service providers	Favourable business environment	Other programme interests	Involvement of women	Employment generation	Collective Action Opportunities			
Weight →		7%	6%	6%	7%	6%	5%	5%	6%	5%	6%	5%	4%	4%	4%	2%	6%	6%	4%		100%	
Food																						
Boro Rice	National																				0	
T Aman	National	3	1	1	0	1	3	3	1	3	1	1	1	3	3	0	1	1	0		1.89 7th	
T Aus	National	3	1	1	0	1	3	3	1	3	1	1	1	3	3	0	1	1	0		1.69 11th	
Betel leaf		3	1	1	1	1	3	3	3	3	0	0	0	1	1	0	0	0	1		1.31 13th	
Til (Sesame)		3	3	3	3	1	1	1	3	3	1	3	3	1	3	1	1	1	3		2.3 5th	
Mung bean	National/International	3	3	3	3	3	3	3	3	3	0	3	3	3	3	3	3	3	3		3.66 2nd	
Soybean																					0	
Chili	National	3	1	3	3	1	1	3	3	1	1	3	3	3	3	3	3	3	3		2.6 4th	
Bittergourd	District	3	1	3	1	1	1	1	3	0	3	3	3	1	1	3	1	1	3		1.95 6th	
Peanut	National	1	1	3	3	1	1	1	3	3	1	3	1	1	1	3	1	3	3		1.86 8th	
Bottlegourd	District	3	1	1	1	1	1	1	3	0	3	3	3	1	1	3	1	1	3		1.83 10th	
Sweetgourd	District	3	1	3	1	1	1	1	3	0	3	3	3	1	1	3	1	1	3		1.95 6th	
Countrybean	District	3	1	1	1	1	1	1	3	0	3	3	3	1	1	3	1	1	3		1.83 10th	
Sweet Potato	District	1	1	3	3	0	1	1	3	3	3	1	0	1	1	1	0	1	3		1.48 12th	
Khesari/Cowpea	Regional	1	1	3	3	1	1	3	3	3	0	1	1	1	3	1	1	3	3		1.84 9th	
Aquaculture																						
Tilapia	National	3	3	3	3	3	1	1	3	3	3	3	3	3	3	3	0	1	3		3.25 3rd	
Livestock																						
Native poultry	Regional	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	3		4.32 1st	