RAJASTHAN AGRICULTURAL COMPETITIVENESS PROJECT

Value Chain Analysis

Green Gram

Prepared by:

Grant Thornton
An instinct for growth™

AGRI BUSINESS PROMOTION FACILITY
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Executive Summary: Green Gram

Decorticated split cotyledon of whole seed of pulse is referred to as dal. A wide variety of processed pulses ranging from Green gram (moong), Bengal gram (chana), Red gram (tur) and Lentil (masoor dal) is consumed as dal in India. In addition, the by-product of seed coats, broken bits and powder from dal mills form a valuable source of protein for dairy animals.

Despite production of over 3.17 million MT of pulses, India is a large importer. Therefore, there is great opportunity to increase production as well as to reduce post-harvest losses. On the production front, the prices of pulses are high and even with low yield per acre as compared to other crops, pulses production is remunerative. India contributes to about 20% of global production of pulses.

Pulses are usually consumed in its processed form. They are used as dal in countries like India and Pakistan and as noodles in the east Asian region. Also, Pulse comprises of 11-14 percent seed coat (husk), 2-5 percent germ, and the remaining part is endosperm. In dal production, husk is removed and the bean is split. The maximum theoretical recovery from milling pulses is around 83-87%, however, in practice traditional milling recovers only 65-75%. Nevertheless, modern milling methods and processing of appropriate grades could recover even 72-82%. Thus, there is need for upgrading of dal mill as well as cropping of right varieties by producers. Notably, the by-products of dal milling such as broken grains, germ and powder, and husk are fed to poultry and cattle that fetch less than the dal price.

Importantly, India is the largest producer of green gram in the world. Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia and South China are other major producers. Africa, USA and Australia have recently introduced cultivation. Today, India produces about 1.5 million tonnes of green gram every year and yield hovers to around 5 quintals per hectare. Rajasthan, Maharashtra, Odisha, Karnataka, M.P. and Andhra Pradesh are leading states. Major green gram growing areas in Rajasthan are Nagaur and Jodhpur district. Jaipur, Jodhpur, Sikar and Jalore regions are also very important producing regions. Notably, in the cluster catchment area, the important regions include Nagaur, Tonk, Ajmer and Jaipur.

Green gram is an excellent source of high quality protein with easy digestibility, consumed as whole grains, dal and sprouted in variety of ways. As value addition, split and dehusked, fried in fat, fetch good value as snacks. After harvesting the pods, green plants are fed to the cattle. The husk of the seed also used as cattle feed.

Pusa, Baisakhi, Pant moong 3, Pusa 125 etc. are few of the major Green Gram varieties grown in Rajasthan. The Govt. of Rajasthan provides Rs 2500 for procurement of certified seeds and also 50% subsidy in micro nutrients and bio pesticides. Farmers are therefore got more inclined towards green gram cultivation than Guar (which absorbs a larger harvest cycle). Majority of green gram is being cultivated in a cereal- pulse cropping system and most activation falls in the Rabi season.

Some farmers in the key green gram producing regions store around 40-60% of their produce harvested for the period of 3 months to even 1 year in order to sell when prices are up-beat offered. Timely harvesting is necessary to avoid losses. Mung should be harvested when more than 80 per
cent pods mature. One or two rounds of picking of pods are also recommended to avoid losses due to shattering. The plants are cut with the sickle and dried on the threshing floor. These are then threshed by beating with sticks or by trampling with bullocks. The seed "cures" in early storage, and aeration assists this process. Therefore, aeration is strongly recommended even if the seed is harvested dry. Natural air drying or aeration is beneficial for curing.

Green gram is sown during July-August in Rajasthan and harvested during Sept-Oct. By adopting good management practices, an average yield of 15 q/ha can be obtained. However, in surveys it has been observed that the gross yield of gram in various clusters in Rajasthan is in range of 8 quintals per ha. The market rate of the seeds is about Rs. 45000 per ton or Rs. 45 per kg or Rs. 36000 per ha. The cost of cultivation is about Rs. 22110 per ha. Net realization (from sales of grains) per ha is about Rs. 13890 per ha.

Other than at the production stage, Good Agriculture Practices need to be introduced at the production, post-harvest stage and in operations like threshing, winnowing transportation, processing and storage to avoid losses. In fact, consultation at the field level indicates that post-harvest losses of about 2.5% occur (as per all-India estimates). Some important support institutions for Green Gram in Rajasthan are Department of Agriculture, Govt. of Rajasthan who provides extensive support through their team of State/District/ Tehsil and Panchayat level officials on; recommended package and practices for the crop, mini kits for crop demonstration and subsidy support on certified seed distribution to farmers. Other support structures of the Department of Agriculture are the Rajasthan State Seed and Organic Production Certification Agency, The Rajasthan State Seeds Corporation Ltd, the State Institute of Agriculture Management, Rajasthan State Warehousing Corporation, Department of Agriculture Marketing and Rajasthan State Agriculture Marketing Board who contribute to the productivity, storage and market linkage of the crop. Apart from this, there are various Krishi Vigyan Kendras around Jaipur, Alwar and Kota attached through State Agriculture Universities/ ICAR also contribute in terms of seed production, technology demonstration and post harvest management of the crop. RARI, Dungapura has also played a significant role in production of improved varieties of Green Gram contributing to both production and productivity in the State.

The price spread along with the share of stakeholders in consumer’s rupee spent at every stage of the value chain starting from the farm till the retailer is detailed out in the report. The price spread and values accrued to stakeholders across the chain reflects the profit margins accrued to different stakeholders. Farmer shares 60% of the consumer’s rupee while the shares of traders, processors, wholesalers and retailers are about 2.66%, 20.65%, 3.74% and 13.04% respectively. 37.43% of the value accruals are accrued to processors, wholesalers and retailers. Producers’ incomes are apparently dependent on yield as well as their dependency on the type of end product (eg. Dal, moong flour, etc.). Here in the existing value chain of Green gram, the price build up has been calculated for the important first channel where the target consumers are urban households and institutional buyers. The product considered is moong dal.

Typically farmers sell the raw green gram at about Rs 4500 per quintal to traders. In the local mandis, it was sold by traders to the processors at Rs 4700 per quintal (with commission about 3% and applicable mandi cess of 1.6%). The processors, upon primary and secondary value addition, sell it to wholesalers at Rs 6251 (gross margin about 33%). Thereafter the wholesale and retail prices are set up at Rs 6532 per quintal and 7512 per quintal with a gross margin of 4.5% and 15%

In this context, dall millers have some expenses related to bagging, transportation, weighing, etc. of their purchases from mandi. The net accruals on sale of main product dall and by-products chunni and bhusi is in the range of 2-3% (i.e. after considering processing cost, marketing, level of value addition, yield, storage costs, etc). Again, in this context, price movement of green gram in market crucially governs the net accruals as well.
Value Chain Analysis - Green Gram

respectively. Due to limited infrastructure facilities at the dispersal of various stakeholders, marketing efficiency is adversely affected.

The existence of a long chain of middle men including the APMC and related commission agents, producers share in consumers’ rupee is adversely affected. This mirrors the need for promotion of contract farming options as an alternate channel to APMC. However, the limitations in the contract farming policy & statutes merit correction. Rajasthan's population in rural and semi urban areas prefer properly cleaned and processed polished/unpolished dal (split/whole and with husk/without husk). In urban areas branded dal (polished/unpolished and color sorted) are more preferred. In some food retail centres in shopping malls in Jaipur, more prominent brands of dals like Tata 1-Shakti, Fortune, Reliance, Shakti bhog, Rajdhan, Patanjali etc were more visible on shelves. However, some local brands were also available in these retail chains and equally popular in small retail shops. Some of these brands included ‘AgroPure' promoted by AgroPure Group (NCR), ‘Shri Balaji’ promoted by Shri Balaji Dall Mill (Rajasthan). Some organic dal brands were also available.

A SWOT analysis of the green gram’s value chain highlights that India is the world’s largest producer as well as consumer of green gram. It produces about 1.5 to 2.0 million tons of Mung annually from about 3 to 4 million hectares of area, with an average productivity of 500 kg per hectare. Mung production in the country is largely concentrated in five states viz, Rajasthan, Maharashtra, Andhra Pradesh, Gujarat and Bihar which together contribute to about 70% of total Mung production in the country. As a matter of fact, Rajasthan and Maharashtra occupy the first two positions, contributing over 45% of green gram production in the country. In terms of advantages of cultivation, Mung contains about 20-25% protein. The plants are sometimes cut and ploughed into the soil to enrich soil nitrogen. The pulse provides scope to market various products like mung, mung dal chilka, mung dal whole etc. Mung flour is considered high in fiber and protein and is easy to digest and used in several recipes like mung chilka, etc. There is also large scope of innovation in terms of noodles/ pasta, RTE Dal Khichdi etc.

Green Gram also serves as energy and protein source in animal feed and thus making its demand high in the feed industry. But when it comes to its disposition in the target clusters of RACP, one finds that there is lack of knowledge of green gram production technologies among the local farmers. They also face the non-availability of improved & good quality seeds. There is lack of grading and storage facilities; and inadequate infrastructure/ facilities with producers, traders, millers at market level resulting in marketing inefficiencies. As a matter of fact, nearly 2.4 % of post-harvest losses are accounted in Green gram (merely till producer level storage). Almost no grading is being done at farm level (leading to price cuts due to foreign content/immature seeds over specifications/recommended tolerance level and also often due to some malpractices; and large number of intermediaries in the chain) leading to low income to producers. Lack of market information regarding prevailing prices, arrivals etc. force farmers to sell in the village itself. Also, there are limited processing units for green gram and its by-products such as dal mill units, roasted moong and flour units, etc. Also, obsolete techniques are being used in processing, which reduces output. Shortage/surplus production, coupled with imports level, make the prices of green gram unstable which obviously affects producers and consumers both.

These weaknesses can be removed with the intervention opportunities such as setting up a FPC in the cluster which would then have a scope for tie up of FPCs through FCSC with firms like Patanjali, Tata, Pulses processing units/ MSME firms, housing societies in urban areas and retail outlets. There is also scope for facilitation of start-ups from amongst FPOs or individual entrepreneurs, in secondary processing of value added products of green gram like flour, fried/roasted snacks, etc. There is also scope for establishment of quality sorting and grading facilities as part of FCSC, along with facilities for packaging and vehicle to facilitate transportation.
The FPC can then promote good agricultural practices with regard to planting, harvesting, use of inputs, disease management, pest control, etc. through FCSC. FPCs can also undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of CFC or FCSC as well as facilitate custom hiring services and hence lead farm mechanization through same.

**Pre and Proposed Post-Intervention Value Chain of Green Gram**

The pre and post intervention value chain for the commodity may be viewed as follows:

- **Existing Pre Intervention Value Chain: Green Gram**

The present pre-intervention or value chain for green gram may be viewed as one with two critical production-distribution or activity marketing channels. The farmers in the State produce green gram as Rabi crop and supply in institutional procurement done by NAFED etc. Also, farmers sell their produce to processors through village level aggregators and APMC commission agents. There are fifty odd dal mills in the state that process and market dal across the country. In this context, however many micro and small scale dal millers do not have pulses colour sorters machine which is essential to sell dal in premium retail markets. In order to penetrate and sell their product in these premium markets, dall millers get it colour sorted on ‘job work basis’. Alternatively, large dal millers too buy non-colour sorted dals from smaller firms in order to colour sort, pack in their brand and sell to premium markets. Value accruals to processors are subject to commodity price fluctuations by up to even 20%.

Post harvest losses occur at various stages of the existing value chain of green gram starting from post-harvest to mandi sales and processing. Such losses total up to a significant amount of 9.5% of the actual harvested output. The major reasons for such yield loss could be attributed to the poor storage, inefficient transportation and improper handling of the produce till mandi. At processor level, higher percentage of the yield loss may also occur due to the use of obsolete and inefficient technologies.

- **Proposed Post Intervention Value Chain: Green Gram**

The envisaged post intervention value chain map for Green Gram may be visualised as one with three production-distribution or activity-marketing channels: raw green gram, cleaned and graded green gram and value added products like dal, flour, etc. It is also envisaged that PCs of producers with FCSCs are evolved. Such FCSCs undertakes storage, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring, facilitating B2B connectivity etc. These could help in increasing net value accruals to farmers by about 5-15%. Farmers’ income from green gram cultivation may be enhanced. Presently, the gross average yield per acre is about 8 quintals per hectare. The average market rate of sale is about Rs. 4500 per quintal or Rs. 36000 per hectare. The average cost of cultivation is about Rs. 22110 per hectare. Other than good harvest practices, input facilitation (high seed prices during cropping season) needs to be provided/disseminated amongst farmers.

In the envisaged post- intervention re-structured value chain, channel 1 will have to be developed as alternate marketing channels where FCSCs play the role of an alternate private market yard and undertake basic primary processing (grading, sorting and packing) of green gram (apart from playing a role of facilitator to its members for institutional sales). In terms of other common infrastructure, Mini Dal mills, Mini flour plants or even mini Feed production plants may be pursed to provide ‘job work based’ services to members. In addition, an alternate marketing channel namely that of supplying to large distributors or retailers like Tata Rallis, Walmart, Patanjali may be developed.

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2 As per averages in discussion with respondents
3 As per averages in discussion with respondents
4 As per averages in discussion with respondents
In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of producer motivation. There is also need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors/Contract farming companies. There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field level. In this regard, it may be appropriate for ABPF to enable formation of FPCs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC like schemes, may be explored. The RACP and line departments need also work in coordination with NGO/service providers and the KVK etc. on high moisture content in harvested green gram, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage, cleaning and grading, and drying at farm level. The storage facility may be also therefore established as part of FCSC with assistance under the project. There is also need for awareness seminars and B2B meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri-marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

**Conclusion**

The report on the value chain analysis of green gram clearly brings out that unlike any other enterprises, agriculture is highly dependent on external factors like nature for its success. This perpetual environment of high risk and vulnerability has significantly lowered farmers’ confidence and suppressed their entrepreneurial instincts as was depicted in the discussions held at the cluster level meetings. In green gram value chain, farmers have not been able to gain higher remuneration/value for their produce due to lack of direct linkages with processors/consumer market. Thus RACP along with the market driven intervention of ABPF, aims to integration of farmers to join hands for a collective cause, help and even push them move up the agriculture value chains to actively participate in market functions, an unexplored lucrative territory for them so far. This would spur vertical business integration and diversify portfolios to reduce their vulnerabilities. The major role of ABPF- GT would be to carry out capacity building of the potential leaders (BoDs) of the FPC, NGO staff and PMU staff line, conducting value chain studies of the crops (market led), planning the interventions to improve the returns to the farmers in the 17 project clusters, developing the business plan for the registered producer companies of clusters, support and assist agri start-ups in the region and thus, develop overall market linkages. The formation of FPC, supported by RACP ABPF local NGOs and information centres like KVKs, provides much needed opportunity to farmers to change their destiny.
Chapter 1 - Introduction

Decorticated split cotyledon of whole seed of pulses is referred to as dal. A wide variety of processed pulses ranging from pigeon peas or red gram (tur), lentil (Masoor dal), green beans (Moong) and Bengal gram or chick peas (Chana) are consumed mainly as dal in India. In addition, the by-product of seed coats, broken bits and powder from dal mills form a valuable protein source for dairy animals.

Despite production of 3.17 million MT of pulses, India is a large importer. Therefore, there is a tremendous opportunity to increase production as well as reduce post-harvest losses. On the production front the prices of pulses are quite high and thus even with low productivity levels and yield levels per hectare as compared to other crops, pulses are remunerative. Importantly India contributes about 20% of the total global production of pulses.

Pulses are usually consumed in its processed form. Traditionally, pulses have been used as Dal in countries like India and Pakistan. It is also used as noodles in the East Asian region (e.g., in Myanmar). Pulses are 11-14 per cent seed coat (husk), 2-5 per cent germ, and the remaining is endosperm. In dal production, the husk is removed and the bean is split. The maximum theoretical recovery from milling pulses is around 83-87 per cent, however, in practice, traditional milling recovers only about 65-75 per cent. Nevertheless, notably modern milling methods can recover up to 78-82 per cent. Thus, there is a need for technology upgrading in traditional dal mills. Notably the by-products of pulse milling such as broken grains, germ and powder, and husk are fed to poultry and cattle and fetch that less than the dal price. (husks fetch barely about 15-20 per cent of the dal price)

Green gram is an excellent source of high quality protein with easy digestibility, consumed as whole grains, dal and sprouted in variety of ways. As value addition, split and dehusked, fried in fat, fetch good value as snacks. After harvesting the pods, green plants are fed to the cattle. The husk of the seed also used as cattle feed. Short duration and photo insensitive varieties fit well in many intensive cropping systems across the country. Summer green gram is especially help in sustaining the productivity levels of rice-wheat cropping system of Indo-Gangetic belt of northern India without any competition to rice or wheat, with additional yield of even up to 10-15 qtls/ha.

Origin
Green gram is one of the important pulse crops in India. It has been reported that Green gram has been cultivated in India since ancient times. It is widely cultivated throughout the Asia, including India, Pakistan, Bangladesh, Sri Lanka and Thailand.
## Importance

Green gram supplies protein requirement of vegetarian population of the country. It is a protein rich staple food. It contains about 25 percent protein, which is almost three times that of cereals. It is consumed in the form of split pulse as well as whole pulse. The Green gram Khichdi is recommended to the ill or aged person as it is easily digestible and considered as complete diet.

### 1.1. Global Scenario

#### 1.1.1. Continent Wise Production, Area and Yield of Green Gram

Asia is the major production source of green gram with an annual production of 11,161 thousand MT followed by the America with an annual production of 7943 thousand MT in the year 2014.

#### Table 1: Continent wise Production of Green gram

<table>
<thead>
<tr>
<th></th>
<th>World</th>
<th>Africa</th>
<th>Americas</th>
<th>Asia</th>
<th>Europe</th>
<th>Oceania</th>
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<td>Y2011</td>
<td>23,145</td>
<td>4,770</td>
<td>6,709</td>
<td>11,154</td>
<td>447</td>
<td>65</td>
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<tr>
<td>Y2012</td>
<td>24,271</td>
<td>5,874</td>
<td>7,276</td>
<td>10,612</td>
<td>464</td>
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<tr>
<td>Y2013</td>
<td>24,516</td>
<td>6,185</td>
<td>7,049</td>
<td>10,744</td>
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<tr>
<td>Y2014</td>
<td>26,530</td>
<td>6,193</td>
<td>7,943</td>
<td>11,661</td>
<td>701</td>
<td>32</td>
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Source: FAO statistical data, 2017

#### Figure 1: Green Gram production

The Asian region also comprises the largest region in terms of applied area.

#### Table 2: Continent wise Area of Green gram

<table>
<thead>
<tr>
<th>Area ('000 Ha)</th>
<th>World</th>
<th>Africa</th>
<th>Americas</th>
<th>Asia</th>
<th>Europe</th>
<th>Oceania</th>
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<tr>
<td>Y2011</td>
<td>30,885</td>
<td>7,325</td>
<td>6,902</td>
<td>16,338</td>
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<td>Y2012</td>
<td>29,160</td>
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<td>Y2013</td>
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<td>7,654</td>
<td>7,512</td>
<td>15,101</td>
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Figure 2: Green gram area wise data (in thousand hectares)

<table>
<thead>
<tr>
<th>Year</th>
<th>World</th>
<th>Africa</th>
<th>America</th>
<th>Asia</th>
<th>Europe</th>
<th>Oceania</th>
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</table>

Continent wise yield of green gram

The yield per hectare production of green gram is however highest in Europe

1.1.2. Green Gram producing countries

Green gram is widely cultivated throughout Asia. India is the largest producer of moong. Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia and South China are the other major producers. Africa, U.S.A. and Australia have recently introduced cultivation and the cultivation is spreading in many other countries. 

---

1.2. **Indian Scenario**

Rajasthan is the major producer of green gram in 2016 with 26% share in total production followed by Maharashtra, Andhra Pradesh, Gujarat, Bihar and Karnataka.

Figure 4: State wise share of green gram production

There have been a lot of fluctuations in the production of green gram in last 10 years mostly during kharif season. According to the 2nd advance estimates the production of green gram shows a certain hike in the year 2013-14 as compared to 2012-13. However, the production in Rabi has not shown much variation since last 10 years.
1.2.1. Production, Area and Yield of Green Gram in India

India is the world’s largest producer as well as consumer of green gram. It produces about 1.5 to 2.0 million tons of Moong annually from about 3 to 4 million hectares of area, with an average productivity of 500kg per hectare.

Figure 6: Trends in Area, Production and yield of green gram
A=Lakh ha, P=Lakh tonnes, Y=kg/ha

1.2.2. Major green gram producing states

The total area covered in 2014-15 under green gram in India was 30.59 lakh hectares with a total production of 15.087 lakh tonnes. During Twelfth plan (2012-2015) the coverage of total area and its production was maximum in Rajasthan (29.68 % & 25.51 % of the total area and production). Maharashtra ranked second in total area coverage (12.98 %) and third in total production (11.92 %). Andhra Pradesh ranked third in area (8.74 %) and second in production (12.43 %). The highest yield was recorded by the state of Punjab (838 kg/ha) followed by Jharkhand (680 kg/ha) and Tamil Nadu (675 kg/ha). The National average yield was 468 kg/ha. The lowest yield observed in the state of Karnataka (247 kg/ha) followed by Chhattisgarh (269 kg/ha) and Odisha (337 kg/ha). During the last three plan period, area under Green gram cultivation is fluctuating, however, production and productivity showed increasing trend.6

Figure 7: Major Green gram producing states

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>A 3.78</td>
<td>2.83</td>
<td>2.78</td>
<td>2.6</td>
<td>2.59</td>
</tr>
<tr>
<td></td>
<td>P 1.66</td>
<td>1.62</td>
<td>1.94</td>
<td>1.7</td>
<td>1.669</td>
</tr>
<tr>
<td></td>
<td>Y 439</td>
<td>572</td>
<td>698</td>
<td>654</td>
<td>645</td>
</tr>
<tr>
<td>Karnataka</td>
<td>A 4.02</td>
<td>2.93</td>
<td>1.75</td>
<td>3.2</td>
<td>2.63</td>
</tr>
<tr>
<td></td>
<td>P 1.11</td>
<td>0.73</td>
<td>0.52</td>
<td>0.81</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>Y 276</td>
<td>249</td>
<td>297</td>
<td>253</td>
<td>205</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>A 0.991</td>
<td>0.883</td>
<td>0.877</td>
<td>3.164</td>
<td>2.61</td>
</tr>
<tr>
<td></td>
<td>P 0.35</td>
<td>0.221</td>
<td>0.409</td>
<td>1.461</td>
<td>1.243</td>
</tr>
<tr>
<td></td>
<td>Y 353</td>
<td>250</td>
<td>466</td>
<td>462</td>
<td>476</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>A 5.58</td>
<td>4.361</td>
<td>4.345</td>
<td>4.31</td>
<td>3.19</td>
</tr>
<tr>
<td></td>
<td>P 3.74</td>
<td>2.554</td>
<td>2.124</td>
<td>2.08</td>
<td>0.89</td>
</tr>
<tr>
<td></td>
<td>Y 670</td>
<td>586</td>
<td>489</td>
<td>483</td>
<td>279</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>A 10.5</td>
<td>12.722</td>
<td>7.902</td>
<td>10.2</td>
<td>8.94</td>
</tr>
<tr>
<td></td>
<td>P 6.525</td>
<td>6.472</td>
<td>2.343</td>
<td>3.912</td>
<td>4.606</td>
</tr>
<tr>
<td></td>
<td>Y 621</td>
<td>509</td>
<td>297</td>
<td>384</td>
<td>515</td>
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<tr>
<td>Total</td>
<td>A 35.082</td>
<td>33.871</td>
<td>27.187</td>
<td>33.829</td>
<td>30.53</td>
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<td></td>
<td>Y 513</td>
<td>483</td>
<td>436</td>
<td>475</td>
<td>494</td>
</tr>
</tbody>
</table>

A=Lakh ha, P=Lakh tonnes, Y=kg/ha

1.2.3. Production VS Area

Rajasthan tops the production as well as area covered under green gram in the year 2012-2015. It produces more than one fourth of the total green gram produce in the country. The next major producing states are Maharashtra, Odisha, Andhra Pradesh, Karnataka and Madhya Pradesh.7

---

6 http://dpd.dacnet.nic.in/Mungbean.pdf
Figure 8: State wise share (in %) of area under green gram production

<table>
<thead>
<tr>
<th>State</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rajasthan</td>
<td>30%</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>13%</td>
</tr>
<tr>
<td>Odisha</td>
<td>9%</td>
</tr>
<tr>
<td>AP</td>
<td>9%</td>
</tr>
<tr>
<td>Karnatoka</td>
<td>8%</td>
</tr>
<tr>
<td>MP</td>
<td>7%</td>
</tr>
<tr>
<td>TN</td>
<td>6%</td>
</tr>
<tr>
<td>Bihar</td>
<td>5%</td>
</tr>
<tr>
<td>Gujarat</td>
<td>5%</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>1%</td>
</tr>
<tr>
<td>UP</td>
<td>3%</td>
</tr>
<tr>
<td>Others</td>
<td>4%</td>
</tr>
<tr>
<td>TN</td>
<td>6%</td>
</tr>
<tr>
<td>MP</td>
<td>7%</td>
</tr>
<tr>
<td>AP</td>
<td>9%</td>
</tr>
<tr>
<td>Karnatoka</td>
<td>8%</td>
</tr>
<tr>
<td>Odisha</td>
<td>9%</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>30%</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>13%</td>
</tr>
<tr>
<td>Odisha</td>
<td>9%</td>
</tr>
<tr>
<td>AP</td>
<td>9%</td>
</tr>
<tr>
<td>Karnatoka</td>
<td>8%</td>
</tr>
<tr>
<td>MP</td>
<td>7%</td>
</tr>
<tr>
<td>TN</td>
<td>6%</td>
</tr>
<tr>
<td>Bihar</td>
<td>5%</td>
</tr>
<tr>
<td>Gujarat</td>
<td>5%</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>1%</td>
</tr>
<tr>
<td>UP</td>
<td>3%</td>
</tr>
<tr>
<td>Others</td>
<td>4%</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>30%</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>13%</td>
</tr>
<tr>
<td>Odisha</td>
<td>9%</td>
</tr>
<tr>
<td>AP</td>
<td>9%</td>
</tr>
<tr>
<td>Karnatoka</td>
<td>8%</td>
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<tr>
<td>MP</td>
<td>7%</td>
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<tr>
<td>TN</td>
<td>6%</td>
</tr>
<tr>
<td>Bihar</td>
<td>5%</td>
</tr>
<tr>
<td>Gujarat</td>
<td>5%</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>1%</td>
</tr>
<tr>
<td>UP</td>
<td>3%</td>
</tr>
<tr>
<td>Others</td>
<td>4%</td>
</tr>
</tbody>
</table>
1.2.4. Indian Exports and Import

Export of pulses was banned in the year 2006 largely owing to the domestic shortages. On one hand India is the largest importer and consumer of pulses, on the other hand it is also the largest pulses processor. Major exporting nations like Australia, Canada etc. don’t have adequate processing facilities. India exports a considerable amount of pulses to other nations which was in the tune of over 6.39MT in 2015-16.

Table 4: India’s Export of major pulses

<table>
<thead>
<tr>
<th>HS Code</th>
<th>Pulses/Year</th>
<th>2014-15</th>
<th>Share in total pulses export (%)</th>
<th>2015-16</th>
<th>Share in total pulses export (%)</th>
<th>2016-17 (Apr-Dec)</th>
<th>Share in total pulses export (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07131000</td>
<td>Peas</td>
<td>3.91</td>
<td>1.76</td>
<td>6.44</td>
<td>2.52</td>
<td>6.43</td>
<td>6.53</td>
</tr>
<tr>
<td>07132000</td>
<td>Chickpea</td>
<td>190.23</td>
<td>85.64</td>
<td>216.93</td>
<td>84.87</td>
<td>61.21</td>
<td>62.16</td>
</tr>
<tr>
<td>07133100</td>
<td>Moong/Urad</td>
<td>4.25</td>
<td>1.91</td>
<td>6.39</td>
<td>2.5</td>
<td>7.88</td>
<td>8</td>
</tr>
<tr>
<td>07134000</td>
<td>Lentils/Masur</td>
<td>7.98</td>
<td>3.59</td>
<td>11.77</td>
<td>4.6</td>
<td>11.76</td>
<td>11.94</td>
</tr>
<tr>
<td>07136000</td>
<td>Pigeon peas</td>
<td>1.22</td>
<td>0.55</td>
<td>4.02</td>
<td>1.57</td>
<td>9.22</td>
<td>9.36</td>
</tr>
<tr>
<td>Total Pulses</td>
<td></td>
<td>207.59</td>
<td>245.55</td>
<td>96.5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Unit: In Thousand Tonnes)
Source: Department of Commerce

---

8 Pulses export is prohibited (until recently) except for chickpea (kabuli chana) and organic pulses including lentils up to 10,000 MT per annum. Hence, as can be seen in figure presented above, India’s larger portion of pulses exports was in chickpeas. Recently, DGFT India vide notification no.28/2015-202 dated 15th Sep 2017 has made export of tur dall, moong and urad ‘free’ for export till further orders.
Figure 10: India's Import of major pulses

<table>
<thead>
<tr>
<th>HS Code</th>
<th>Pulses/Year</th>
<th>2014-15 Share in total pulses export (%)</th>
<th>2015-16 Share in total pulses export (%)</th>
<th>2016-17 (Apr-Dec) Share in total pulses export (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>07131000</td>
<td>Peas</td>
<td>3.91</td>
<td>6.44</td>
<td>6.43</td>
</tr>
<tr>
<td>07132000</td>
<td>Chickpeas</td>
<td>190.23</td>
<td>85.64</td>
<td>216.93</td>
</tr>
<tr>
<td>07133100</td>
<td>Moong/urad</td>
<td>4.25</td>
<td>6.39</td>
<td>2.5</td>
</tr>
<tr>
<td>07134000</td>
<td>Lentils</td>
<td>7.98</td>
<td>3.59</td>
<td>11.77</td>
</tr>
<tr>
<td>07136000</td>
<td>Pigeon Peas</td>
<td>1.22</td>
<td>0.55</td>
<td>4.02</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>207.59</strong></td>
<td><strong>245.55</strong></td>
<td><strong>97.99</strong></td>
</tr>
</tbody>
</table>

(Unit: In Thousand Tonnes)
Source: Department of Commerce

Figure 11: Monthly arrivals (in '00 MT) and Average mandi prices (in Rs.) for Green gram in Bikaner Mandi

As can be seen from the above table, average prices in April 2014 were at Rs. 5833 level, which increased marginally to about Rs. 5972 per quintal in month of August 2014 and rose to Rs. 5972 per quintal in December 2014. Obviously, arrivals started rising in the same period. An increasing trend in prices can be seen from December 2014 to October 2015. As a matter of fact, prices in September 2015 were about Rs. 7500 per quintal. However, post October 2015, the prices saw a declining trend, even falling to Rs. 6160 per quintal in Month of March 2016. The prices again saw an uptrend April 2016 onwards till June 2016 reaching about Rs. 6516 per quintal. June 2016 to December 2016 saw regular downtrend reaching Rs. 4100 per quintal. The prices saw minor uptrend again post December 2016.

### MSP of pulses for last 5 years

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.3. State Scenario: Rajasthan

Major Districts Producing Green Gram in Rajasthan

Green Gram production in India is concentrated in five major states viz Rajasthan, Maharashtra, Andhra Pradesh, Gujarat and Bihar. These states together contribute to about 70% of moong production in the country. Rajasthan plays the lead role in this context.

Major Green gram growing areas in Rajasthan are Nagaur and Jodhpur district but productivity is highest in Jodhpur, Ganganagar, Ajmer and Bikaner districts. Jaipur, Jodhpur and Jalore regions are important in terms of production volumes in Rajasthan.

Table 5: District Wise Green gram Production in Rajasthan in Year 2015-16

<table>
<thead>
<tr>
<th>District</th>
<th>Area (in Ha)</th>
<th>Production (in tonnes)</th>
<th>Productivity (in T/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ajmer</td>
<td>89006</td>
<td>45988</td>
<td>517</td>
</tr>
<tr>
<td>Tonk</td>
<td>50520</td>
<td>24018</td>
<td>475</td>
</tr>
<tr>
<td>Jaipur</td>
<td>91751</td>
<td>43525</td>
<td>474</td>
</tr>
<tr>
<td>Dausa</td>
<td>39</td>
<td>17</td>
<td>436</td>
</tr>
<tr>
<td>Jaipur Region</td>
<td>231316</td>
<td>113548</td>
<td>475.5</td>
</tr>
<tr>
<td>Sikar</td>
<td>24806</td>
<td>7679</td>
<td>310</td>
</tr>
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<td>Nagaur</td>
<td>381622</td>
<td>194971</td>
<td>511</td>
</tr>
<tr>
<td>Jhunjhuru</td>
<td>27484</td>
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<td>446</td>
</tr>
<tr>
<td>Saikar Region</td>
<td>433912</td>
<td>214907</td>
<td>422.33</td>
</tr>
<tr>
<td>Alwar</td>
<td>6</td>
<td>3</td>
<td>500</td>
</tr>
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<td>Bharatpur</td>
<td>45</td>
<td>20</td>
<td>444</td>
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<td>Dholpur</td>
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<td>49</td>
<td>438</td>
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<td>S.Madhopur</td>
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<td>438</td>
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<td>Karoli</td>
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<td>6</td>
<td>462</td>
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<tr>
<td>Bharatpur Region</td>
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<td>Bikaner</td>
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<td>2287</td>
<td>509</td>
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<td>Churu</td>
<td>83060</td>
<td>18259</td>
<td>220</td>
</tr>
<tr>
<td>Jaisalmer</td>
<td>17034</td>
<td>8555</td>
<td>502</td>
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<td>Bikaner Region</td>
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<td>29101</td>
<td>410.33</td>
</tr>
<tr>
<td>Ganganagar</td>
<td>33055</td>
<td>17536</td>
<td>531</td>
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<td>Hanumangarh</td>
<td>18748</td>
<td>7777</td>
<td>415</td>
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<tr>
<td>Ganga Nagar Region</td>
<td>51803</td>
<td>25313</td>
<td>473</td>
</tr>
<tr>
<td>Jodhpur</td>
<td>173885</td>
<td>112932</td>
<td>649</td>
</tr>
<tr>
<td>Barmer</td>
<td>63974</td>
<td>4971</td>
<td>79</td>
</tr>
<tr>
<td>Jodhpur Region</td>
<td>237859</td>
<td>117903</td>
<td>364</td>
</tr>
<tr>
<td>Jalore</td>
<td>103300</td>
<td>24092</td>
<td>233</td>
</tr>
</tbody>
</table>
1.4. **District and cluster scenario**

The important Green gram producing districts of in Rajasthan includes Nagaur followed by Ajmer, Jaipur and Tonk.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>District in the Catchment Area</th>
<th>Production (In MT)</th>
<th>Rank of Catchment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nagaur</td>
<td>194,971.00</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Ajmer</td>
<td>45,988.00</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Jaipur</td>
<td>43,525.00</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Tonk</td>
<td>24,018.00</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Ganganagar</td>
<td>17,536.00</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>Jaisalmer</td>
<td>8,555.00</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>Bikaner</td>
<td>2,287.00</td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>Chittorgarh</td>
<td>204</td>
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<td>9</td>
<td>Baran</td>
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</tr>
<tr>
<td>10</td>
<td>Bundi</td>
<td>88</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>S. Madhopur</td>
<td>84</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>Kota</td>
<td>54</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>Jhalawar</td>
<td>52</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>Dholpur</td>
<td>49</td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>Pratapgarh</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>District in the Catchment Area</td>
<td>Production (In MT)</td>
<td>Rank of District in the Catchment Area</td>
</tr>
<tr>
<td>---------</td>
<td>---------------------------------</td>
<td>-------------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>16</td>
<td>Banswara</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>17</td>
<td>Alwar</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total Production in Catchment Area</strong></td>
<td></td>
<td><strong>337542</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Total Production in the catchment Area (2015-16)** 337,542

**Total Production in Rajasthan (2015-16)** 596,850

**Percentage share in the State Production** 57%

**Top Producing Districts in the catchment zone** Nagaur, Ajmer, Jaipur

### 1.5. Approach to Value Chain Analysis

In order to evaluate the value chain of Green gram, consultations were held with major stakeholders in the chain including farmers, Consumers, Processors, traders, supporting public and private service providers and institutions etc. in various parts of the state. Major Green gram producing clusters were considered for survey within Rajasthan.

**Table 7: Surveyed Major markets for Value chain Analysis of Green gram**

<table>
<thead>
<tr>
<th>Surveyed Markets for the Value Chain Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within and Outside Rajasthan</td>
</tr>
<tr>
<td>• Producers of different clusters (20)</td>
</tr>
<tr>
<td>• Traders (8)</td>
</tr>
<tr>
<td>• Processors (7)</td>
</tr>
<tr>
<td>• Government Agencies (8)</td>
</tr>
<tr>
<td>• Others (Experts, Association Representatives, etc) (5)</td>
</tr>
</tbody>
</table>

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Chapter 2- Pre Harvest Management

2.1. Major Commercial Varieties Grown in Rajasthan
A number of green gram varieties are grown in Rajasthan- Pusa, Baisakhi, Pant Moong3, Pusa105 etc. There are certain varieties recommended for different states. (Refer Annexure 4)

2.2. New initiatives and Practices
Rajasthan government provides Rs. 2500/qtl for the certified seeds besides 50% subsidy on micro nutrient and bio pesticides. Also, with remunerative trend in pulse price in recent times, farmers in Rajasthan prefer to cultivate more pulses particularly moong and moth as against the general trend of cultivating Guar. Guar, for that matter also has longer harvest cycle as against moong.

2.3. Seasonality Pattern
Green gram is a warm weather crop and comes up in areas receiving an annual rainfall ranging from 50 to 70 cm. It is mainly cultivated in a cereal-pulse cropping system primarily to conserve the soil nutrients and utilize the left over soil moisture particularly, after rice cultivation. Hence, although it can be grown in all the seasons, majority of green gram cultivation falls in either Rabi or late Rabi seasons particularly in peninsular India.

Optimum temperature range for growth is 27-30°C. A dry harvest period is desirable as this forces the crop to mature and also reduces the risk of weather damage. Notably, Green gram is less tolerant to water logging

Table 8: Seasonal Availability of green gram

<table>
<thead>
<tr>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sowing</td>
<td></td>
<td>Harvesting</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Commodity control

2.4. Land preparation
One deep ploughing followed by 2-3 harrowing and planking are considered optimum for green gram cultivation. Field should be well levelled and completely free from weeds.

In case of summer pulse, sowing is generally delayed till the harvesting of main crop. Green gram may be sown by broadcasting effectively, this would not only save time, but would also result in considerable saving of cost of land preparation, irrigation, layout development etc.
2.5. Sowing/Planting/Cultivation
Green gram is planted at the rate of 4-6kgs/acre in the spacing of 45 cm between rows and 15 cm between the plants. Depth for sowing is suggested to be 3-5cm. When using oxen plough for planting one must place the seed at the side of furrow. It is recommended to practice crop rotation because green gram has toxic residues and disease organisms that may affect the crop.

2.6. Climatic and Soil Requirement
Green gram is grown in zaid and kharif season in northern India. In southern India, it is also grown in rabi season. It requires hot climate and has the capacity to tolerate moisture stress. Areas with annual rainfall of 50-70 cm are considered best for Green gram cultivation. It can be grown successfully up to an elevation of 2000 metre from mean sea level. Green gram may be grown on a variety of soils ranging from red laterite in southern India to black cotton soils in Madhya Pradesh and sandy soils in Rajasthan. However, loam to sandy loam soil is considered ideal for green gram cultivation. Soil should be well drained as even temporary waterlogging may damage the crop. Saline-alkali and acidic soils are not suitable for Green gram cultivation.

Soil Requirement:
Green gram can be grown in all types of soils except saline, saline alkaline and soils with poor drainage. Where ever commercial crop of green gram is possible to produce well, such areas are also suitable to produce seed, provided isolation is taken care of and land is free from volunteer green gram plants.

Isolation requirement for seed production:
Green gram is classified as self-pollinated crop. Pollen shedding takes place long before petal opening. Isolation requirement for foundation seed is 10 metres and Isolation requirement for certified seed is 5 m from fields of other green gram varieties and of the same variety not confirming to varietal purity requirements of certification.

2.7. Nutrients Management

Nitrogen (N)
- Green gram is generally grown without application of fertilizers. However, experiments conducted at various places revealed that yield of Green gram can be increased to a great extent with the application of fertilizers
- Responses of Green gram to N is generally absent or negative
- In general, a starter dose of 10-20kg N/ha has been recommended
- Rhizobium Culture responses to application are quite variable. Responses are comparatively higher in summer season in comparison to Kharif.

Phosphorus (P)
- Responses of Green gram to phosphorous are quite conspicuous.
- Significant increase in the yield of Green gram due to application of 80 kg P2O5/ha. Higher response of Green gram on red soils followed by that on laterite soils.

Potassium (K)
- Responses of Green gram to potassium are negligible or absent content in most of the Indian soils owing to the high potassium content.

• Overall, application of 100 kg ammonium phosphate per hectare is generally recommended for Green gram. This fertilizer is comparatively cheaper in the context of nutrient basis and can supply required quantity of N and P to the crop.

2.8. Water management

Water management in green gram cultivation involves various practices.

It is important to irrigate the field immediately after sowing, followed by irrigation on the third day. And then irrigate at intervals of 7 to 10 days depending upon the soil and climatic conditions. Flowering and pod formation stages are critical periods when irrigation is a must. Notably, it is necessary to avoid water stagnation at all stages. Farmers also need to apply KCl at 0.5 per cent as foliar spray during vegetative stage if there is moisture stress.

In Kharif, Green gram does not require irrigation unless there is a prolonged dry spell. However, it is important to provide adequate drainage for proper disposal of excess water as crop is sensitive to water logging. In case of the failure of rains, 1-2 irrigations are required for good production for rabi and in case of zaid season, providing 5-6 irrigations is necessary. First irrigation at 20-25 days and subsequent irrigations at an interval of 12-15 days. Moisture deficiency at the time of pod filling stage badly effect the green gram production. Notably, flowering and pod formation stages are critical periods for irrigation.

Spraying of Di-ammonium Phosphate or urea, NA and Salicylic Acid

Recommended doses are as follows:

Foliar spray of NAA 40 mg/litre and Salicylic acid 100 mg/litre once at pre-flowering and another at 15 days thereafter

1) For Green gram, foliar spray of DAP 20 g/litre once at flowering and another at 15 days thereafter

2) For irrigated and rain fed crops foliar spray of DAP 20 g/litre or urea 20 g/litres once at flowering and another at 15 days thereafter.

2.9. Weed Management

Weed management and Inter-culture includes a range of practices.

Pre emergence application of Pendimethalin @ 3.3 litres per hectare under irrigated condition or 2.5 litres per hectare under rainfed condition on 3 days is required after sowing using Backpack/Knapsack/Rocker sprayer fitted with flat fan nozzle using 500 litres of water for spraying one ha. Thereafter, one hand weeding on 30th day after sowing gives weed free environment throughout the crop period or EPOE application of quinalofop ethyl @ 50 g ai/ha-1 and imazethapyr @ 50 g ai ha-1 on 15 – 20 days may be suggested. If herbicide is not applied farmer must give two hand weedicings on 15 and 30 days after sowing.

Inter-culture operations should be done at 20-25 days after sowing to keep the field weed free and to preserve soil moisture and to improve microbial activity. One or two weedicings or hoeings are to be done at about 20 and 25 days depending on weed growth. Spraying of chemical weedicide like Pendimethal in 30% @ 1.3 to 1.6 litres/Ac or Alachlor 50% @ 1 litre/Ac immediately after sowing or within 24 hrs after sowing is recommended.

Green gram being a dwarf statured crop suffers to great extent if the weeds are not controlled in time. The problem of weeds is more severe in kharif as compared to rabi and summer seasons. One hand weeding after 20-25 days of sowing followed by another after about 20 days may be sufficient. Weed can also be controlled with the use of herbicides i.e. pre-emergence application of 1 kg. a.i.
Lasso The maximum absolute yield of Green gram can be obtained from 'weed free' plots where the weed competition was 'zero.' Alachlor at higher concentrations reflect in lesser branches and pods per plant Fluchloralin, and pendimethalin both at 1.0 kg/ha applied alone and in combination with one hand weeding will result in effective weed control.

Weed control systems containing fluchloralin at 1.0 Kg plus one hand weeding and pendimethalin at 1.0 Kg/ha plus one hand weeding not only gives higher grain yield but also provided excellent control of carpet weed and barnyard grass up to crop harvest. Thus, the Flauzifopbutyl and senthoxydim at 0.75 Kg/ha can be successfully used for the control of barnyard grass in Green gram cultivation.

2.10. Pest & Disease management

Critically the insect/pest affecting green gram includes flea beetles, thrips, white flies and tobacco caterpillar (Spodoptera).

**Flea beetles:** This pest attacks Green gram at 2-leaf stage and make holes on leaves. If not controlled at the initial stage when there is a severe attack of this pest, about 80% of plants will die. Spraying @ 2.5 ml chlorpyriphos/litre water can be helpful.

**Thrips:** This pest sucks leaf sap from young leaves, which may lead to spread of leaf curl virus. About 15-20% damage to the crop may occur. For control, spray @ 1 g Acephate or 2 ml dimethoate/litre water. White flies: They will also suck sap from leaves along with spread of yellow mosaic virus for control there is need to spray @ 2 ml methyl-o-demeton or triazophos/litre water to control Thrips.

**Tobacco caterpillar (Spodoptera litura):** Leaves turn yellow along with holes when these insects scratch green matter and eat it formally. These insects eat away complete leaves. Or even flowers and pods. They feed more during nights and hide at plant base or in crevices of soil during day. To get rid of these insects, it is recommended to practice integrated Pest Management.

Most critical diseases include powdery mildew, cercospora leaf spot, bacterial blight, leaf curl virus and yellow mosaic virus.

**Powdery mildew:** At 30th-35th day when humidity is high, ash type powder will form on old leaves. It spreads to branches & pods.

**Cercospora leaf spot:** Light brown spots on leaves develop into big spots under favourable weather conditions and leaves dry up & fall down. This in turn lead to Poor seed development in pods.

**Bacterial blight:** Light brown spots on leaves.

**Leaf curl virus:** Spreads through thrips.

**Yellow mosaic virus:** Spreads through white flies.

2.11. Recommended Good Agriculture Practices

Seed Treatment with Biofertilizer

Treat the seeds with one packet (200 g/ha) of Rhizobial culture CRM 6 and one packet (200 g/ha) of Phosphobacteria along with one packet (200 g/ha) of PGPR developed at TNAU using rice kanji.

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as binder. If the seed treatment is not carried out apply 10 packets (2 kg) of Phosphobacteria and 10 packets (2 kg) of PGPR with 25 kg of FYM and 25 kg of soil before sowing.

**Fertilizer Application**
Apply fertilizers basally before sowing. Rainfed: 12.5 kg N + 25 kg P2O5 + 12.5 kg K2O + 10 kg S*/ha. Irrigated: 25 kg N + 50 kg P2O5 + 25 kg K2O + 20 kg S*/ha

*Note:* Applied in the form of gypsum, if Single Super Phosphate is not applied as a source of phosphorus
- Soil application of 25 kg ZnSO4/ha under irrigated condition
- Soil application of TNAU micronutrient mixture @ 5 kg/ha as Enriched FYM (Prepare enriched FYM at 1:10 ratio of MN mixture & FYM; mix at friable moisture & incubate for one month in shade).

**Multi-blooming technology for irrigated green gram in new delta region of Thanjavur**
For higher yield and income, apply 25:50:25:20 kg NPKS/ha.+25 kg N/ha. in 3 equal splits on 30, 45 and 60 days after sowing + 2% DAP spray on 45 and 60 days after sowing.

**Foliar spray of 1% urea for yield improvement in green gram**
For the yield improvement through increasing the physiological and biochemical attributes, foliar spray of urea 1% on 30th and 45th day after sowing is recommended. For rice fallow pulses in Delta area, the present recommendation of foliar spray of 2% DAP may be continued.

**Economizing the use of micronutrients through seed treatment for Green gram**
Seed coating with bio-fertilizers and micronutrients viz., Zn, Mo & Co @ 4,1,0.5 g/kg of seed is recommended.

**Multi Bloom Technology**
A special technology is being practiced in Pattukottai block of Tanjore district for Green gram. The soil is alluvial and rich in organic matter and nutrients. The crop is sown during early summer (Jan.-Feb.) as a normal crop and fertilizer is applied as per the recommendation for irrigated crop. In addition to that, top dressing of Nitrogen is done with an extra dose of 25 to 30 kg through urea. Since pulses have indeterminate growth habit and continue to produce new flushes, the top dressing will be done on 40-45 days after sowing.
The crop completes its first flushes of matured pods during 60-65th day and put further second new flush within 20-25 days. Therefore, two flushes of pods can be harvested at a time within the duration of 100 days.

**2.12. Harvesting**
During harvesting, proper care should be taken to minimize quantitative and qualitative losses.

**Following care should be taken during harvesting:**
Harvesting should be done at proper maturity to ensure optimum grain quality and consumer acceptance.

- Harvesting before the maturity of crop, usually result in lower yields, higher proportion of immature seeds, poor grain quality and more chances of infestation during storage
• Delay in harvesting of Green gram, results in shattering of pods and other losses caused by birds, rats, insects etc. The best time to harvest the crop is when 80 percent of the pods are fully matured
• Avoid harvesting during adverse weather condition i.e. rains and overcast weather
• Use right kind of harvest equipment (sickle)
• Avoid pest infestation prior to harvesting
• The harvested bundles should be kept in one direction in order to ascertain efficient threshing
• Keep the harvested bundles for drying in the field after cutting on the threshing floor, if weather permits
• The harvested produce should be stacked in a dry, clean place in cubical way to facilitate circulation of the air around
• Rogue out the admixtures prior to harvesting
• Keep the different harvested Green gram varieties separately to get true to type variety (grains)\textsuperscript{13}

2.13. Pre Harvest constraints of farmers

• Logistic Problems in Crop Protection
Logistic problems have been recognized as a major hindrance to a virile and effective crop protection programme. For instance, farmers may recognize a problem situation in the field but may not understand its causes. This calls for training of more extension workers and sending them to the rural suburbs to assist farmers.

Another logistic problem in crop protection is inadequate plant quarantine and sanitation programmes. At the national level, a system of quick response (within 48 hours) to a reported case of outbreak of pests and diseases should be adopted to salvage crops and prevent total failure and great loss to farmers.

• Social Problem
Plant protection problems have their social aspect. For instance, an individual farmer cannot take effective measures against pests which ravage over a large territory; in which case a joint action with his neighbours is necessary. An example is illustrated with grass hopper (\textit{Z. variegatus}) infestation. Preventive measures should be taken in the locations where the eggs are laid, such as burning old tree stumps, heaps of uprooted weeds and avoiding damp places in general. Eggs are most effectively destroyed by raking them out so that they dry in the sun. Nest sites are comparatively rare, usually one or two per hectare. (For effective control, the destruction of all nest sites over a large area by all farmers is necessary. One farmer acting alone will have limited effect, whereas joint action can reduce the succeeding population of grasshoppers by 70 – 80%.

Another social problem in the crop protection is inadequate price incentives to the farmers particularly when inclement weather strikes. Price incentive is necessary to guarantee farmers a good reward for their efforts. Also, excess produce should be purchased by the state governments and stored as strategic grain reserves. All these would encourage farmers to produce more so as to feed the teeming population in the country.\textsuperscript{14}

\textsuperscript{13} http://agmarknet.nic.in/Greengram_profile.pdf
\textsuperscript{14} http://www.sciencepub.net/nature/ns0712/02_1194_crop_ns0712_8_14.pdf
Chapter-3: Post-Harvest Management

3.1. Post - Harvest Losses, Harvesting Care and Post – Harvest Equipment

There is a sizeable quantitative and qualitative loss of pulses during different post-harvest operations like threshing, winnowing, transportation, processing and storage. Hence, it is important to give due emphasis to reduce the qualitative as well as quantitative losses of pulses during post-harvest operations. Notably, it has been reported that about 2.38 percent losses occurred during post-harvest operations at the producers’ level. This has been substantiated over consultation with stakeholders. The details are as under:

Table 9: Estimated post-harvest losses of Green gram at producer’s level

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Stages</th>
<th>Production loss (Percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Losses in transport from the field to threshing floor</td>
<td>0.67</td>
</tr>
<tr>
<td>2</td>
<td>Losses in threshing</td>
<td>0.63</td>
</tr>
<tr>
<td>3</td>
<td>Losses in winnowing</td>
<td>0.61</td>
</tr>
<tr>
<td>4</td>
<td>Losses in transport from threshing floor to storage</td>
<td>0.19</td>
</tr>
<tr>
<td>5</td>
<td>Losses in the storage at producers level</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td><strong>Total losses at producers level</strong></td>
<td><strong>2.38</strong></td>
</tr>
</tbody>
</table>


The post-harvest losses of Green gram may be minimised in the process of threshing, winnowing, storage, processing, handling and transportation.

**Threshing and Winnowing:**

Apparently, during threshing about 0.63 percent losses and during winnowing 0.61 percent losses are incurred. In order to reduce these losses, threshing and winnowing operations are required to be completed within a short period through improved equipment on a pucca platform.

**Transport Losses:**

About 0.67 percent losses are incurred in transporting the produce from the field to the threshing floor. Losses to the tune of about 0.19 percent are incurred for transporting the produce from threshing floor to storage are efficient and quick transportation supported by good packaging material is necessary to reduce the losses.

**Processing:**

Due to the use of old and outdated methods in processing, the loss at this stage has been reported to be upto 1 percent. To reduce the milling losses and to increase the output, it is suggested to improve dal milling by the use of upgraded technology eg. PLC controlled equipment may be used.
Storage:
Loss of about 7.5 percent (including loss of 0.29 per cent at immediate producer level) is estimated during storage due to improper and inefficient methods of storage; Quantitative losses mainly result from spoilage, driage or portion of produce, infestation by insects, rodents or birds. Improved scientific storage facilities may be adopted to reduce the losses

Following preventive measures may be adopted to avoid post-harvest losses

- Harvest at proper stage of maturity to reduce the losses.
- Use of proper method for harvesting.
- Adopt modern mechanical methods, to avoid losses in threshing and winnowing
- Use of improved technique of processing.
- Adoption of processes like cleaning and grading for remunerative prices inter-alia to avoid financial loss.
- Use of good packaging material for storage and in the transport i.e. B Twill Jute bags or HDPE bags.
- Adoption of proper techniques for storage.
- Application of pest control measures during storage.
- Proper handling i.e. (loading and unloading) of Green gram with good transportation facilities at farm and market level reduces losses.
- Avoid the use of hooks.\(^\text{15}\)

Harvesting Care:
Harvesting care as well as proper storage and transportation is very crucial. The major measures to be adapted to be

- Harvest at proper stage of maturity to reduce losses.
- Use of proper methods during harvesting.
- Adopt modern mechanical methods, to avoid the losses in threshing and winnowing
- Use good packaging materials for storage and in transport i.e. B-Twill Jute bags or HDPE bags.
- Adopt proper technique in storage.
- Apply pest control measures during storage.
- Proper handling i.e. (loading and unloading) of Green gram with good transportation facilities at farm and market level reduces losses.
- Avoid use of hooks during handling

3.2. Grade Specification & Grading at Producer level

Grading:
Grading implies to sorting of homogenous lots of the produce according to fixed grade standard. Produce is graded in accordance with various quality factors.

Benefits of grading:
Grading is beneficial to farmers, processors, traders as well as to consumers in the below mentioned ways:

- Grading of the produce before sale enables farmers to realize better price for their produce.

\(^{15}\) [http://agmarknet.nic.in/Greengram_profile.pdf](http://agmarknet.nic.in/Greengram_profile.pdf) (retrieved on April 7, 2017)
• Grading helps consumers secure standard quality produce at fair price.
• It facilitates consumers to compare prices of different qualities of a produce in the market.
• It also assures the quality of the produce and reduces the cost of marketing and transportation.

In the market, sale is generally on the basis of visual inspection of available samples and with local commercial name. Buyers offer price on visual examination of the whole lot considering quality factors like size of the grains, colour of the grains, moisture content, refraction and admixture with other varieties.

Grade Specifications:

1. Agmark

The Agricultural Produce (Grading and Marking) Act, 1937 was enacted to maintain the quality of agricultural produce in India. According to this Act, specifications have been drawn up for Green gram for various quality factors.

Green Gram shall:

• be the dried mature seeds of pulse green gram (Phaseolus aureus Roxb. or Phaseolus radiatus Rox: be sweet, clean, wholesome, uniform in size, shape, colour and in sound merchantable condition;
• be free from living and dead insects, fungus infestation, added colouring matter, moulds, obnoxious smell, discoulouration;
• be free from rodent hair and excreta;
• be free from toxic or noxious seeds viz. Crotolaria (Crotolaria spp.), Corn cockle (Agrostemma githago L.), Castor bean (Ricinus communis L.), Jimson weed (Dhatura spp.), Argemone mexicana, Khesari and other seeds that are commonly recognized as harmful to health;
• Uric acid and Aflatoxin shall not exceed 100 milligrams and 30 micrograms per kilogram respectively;
• Comply with the restrictions in regard to poisonous metals (rule-57), crop contaminants (rule 57-A) naturally occurring toxic substances (rule 57-B), use of insecticides (rule-65), and other provisions prescribed under the Prevention of Food Adulteration Rules, 1955, as amended from time to time.

Special characteristics:

Table 10: Maximum limits of tolerance (% by weight)

<table>
<thead>
<tr>
<th>Grade/Designation</th>
<th>Moisture</th>
<th>Foreign matter</th>
<th>Other edible grains</th>
<th>Damaged Grains</th>
<th>Weevilled grains percent by count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Organic</td>
<td>Inorganic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special</td>
<td>10</td>
<td>0.1</td>
<td>Nil</td>
<td>0.1</td>
<td>0.5</td>
</tr>
<tr>
<td>Standard</td>
<td>12</td>
<td>0.5</td>
<td>0.1</td>
<td>0.5</td>
<td>2</td>
</tr>
<tr>
<td>General</td>
<td>14</td>
<td>0.75</td>
<td>0.25</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Note: - In foreign matter, impurities of animal origin shall not be more than 0.10 percent by weight.

II) Grade specification of quality of Green gram split (Moong split husked)
A) General Characteristics:

Green gram split (Moong husked) pulse shall:

- Consist of husked and split seeds of pulse green gram (Phaseolus aureus Roxb. or Phaseolus radiatus Roxb.);
- be sweet, clean, wholesome, uniform in size, shape, colour and in sound merchantable condition;
- be free from living and dead insects, fungus infestation, added colouring matter, moulds, obnoxious smell, discolouration;
- be free from rodent hair and excreta;
- be free from toxic or noxious seeds viz. Crotolaria (Crotolaria spp.), Corn cockle (Agrostemma githago L.), Castor bean (Ricinus communis L.), Jimson weed (Dhatura spp.), Argemone mexicana, Khesari and other seeds that are commonly recognized as harmful to health;
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- Comply with the restrictions in regard to poisonous metals (rule-57), crop contaminants (rule 57-A), naturally occurring toxic substances (rule 57-B), use of insecticides (rule-65) and other provisions prescribed under the Prevention of Food Adulteration Rules, 1955, as amended from time to time.

B) Special Characteristics:

Table 11: Maximum limits of tolerance (% by weight)

<table>
<thead>
<tr>
<th>Grade/Designation</th>
<th>Moisture</th>
<th>Foreign matter</th>
<th>Other edible grains</th>
<th>Damaged grains</th>
<th>Broken Grains</th>
<th>Weevil led grain per cent by count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special</td>
<td>10</td>
<td>0.1</td>
<td>Nil</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Standard</td>
<td>12</td>
<td>0.5</td>
<td>0.1</td>
<td>0.5</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>General</td>
<td>14</td>
<td>0.75</td>
<td>0.25</td>
<td>3</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

Note: In foreign matter, impurities of animal origin shall not be more than 0.10 per cent by weight.

III) Grade specification of quality of Green Gram Split Moong split (Unhusked)

A) General Characteristics:

Green gram (Moong split-un-husked) shall be:

- The Green gram split (unhusked) pulse shall consist of unhusked and split seeds of pulse green gram (Phaseolus aureus Roxb. or Phaseolus radiatus Roxb.);
- be sweet, clean, wholesome, uniform in size, shape, colour and in sound merchantable condition;
- be free from living and dead insects, fungus infestation, added colouring matter, moulds, obnoxious smell, discolouration;
- be free from rodent hair and excreta;
- be free from toxic or noxious seeds viz. Crotolaria (Crotolaria spp.), Corn cockle (Agrostemma githago L.), Castor bean (Ricinus communis L.), Jimson weed (Dhatura spp.),
Argemone mexicana, Khesari and other seeds that are commonly recognized as harmful to health;

- Uric acid and aflatoxin shall not exceed 100 milligrams and 30 micrograms per kilogram respectively
- Comply with the restrictions in regard to poisonous metals (rule-57), crop contaminants (rule 57-A), naturally occurring toxic substances (rule 57-B), use of insecticides (rule-65) and other provisions prescribed under the Prevention of Food Adulteration Rules, 1955, as amended from time to time.

### B) Special Characteristics:

Table 12: Maximum limit of tolerance (% by weight)

<table>
<thead>
<tr>
<th>Grade/Designation</th>
<th>Moisture</th>
<th>Foreign matter</th>
<th>Other edible grains</th>
<th>Damaged Grains</th>
<th>Broken and Fragmented Grains</th>
<th>Weevilled grains percent by count</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Organic</td>
<td>Inorganic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special</td>
<td>10</td>
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<tr>
<td>General</td>
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<td>5</td>
</tr>
</tbody>
</table>

Note- In foreign matter, the impurities of animal origin shall not be more than 0.10 percent by weight.

Source: AGMARK Standards for Food grains and Allied Products under the Agricultural Produce (Grading and Marking), Act, 1937 Rules made up to 1st June, 2005, (Sixth Edition) Volume- VII and website of the Directorate of Marketing and Inspection “www.agmarknet.nic.in”

### Grading at producer’s level and under Agmark

There is an increasing recognition to the fact that producers need to be assisted in grading their produce before sale so that they may get better price. For securing adequate returns to the producer/seller, the scheme of “Grading at Producers’ Level” was introduced in 1962-63 by the Directorate of Marketing and Inspection. The main objective of this scheme is to subject the produce to simple test and assign a grade before it is offered for sale. After grading, the producers get prices commensurate with the quality of the produce.

**Benefits:**

- Grading of the produce at producers’ level enable farmers to get higher price for their produce. It also helps the consumers to get standard quality produce at fair price.
- Grading not only facilitates the dissemination of prices and market information but also assist the machinery of distribution at all stages.

Table 13: Progress of grading during the year 2011-2012 to 2015-16

<table>
<thead>
<tr>
<th>Year</th>
<th>At Producers’ Level</th>
<th>Under Agmark*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Quantity (in tonnes)</td>
<td>Value (in Rs. Lakh)</td>
</tr>
<tr>
<td>2011-12</td>
<td>42549**</td>
<td>6452.93**</td>
</tr>
<tr>
<td>2013-14</td>
<td>27793**</td>
<td>5056.14**</td>
</tr>
<tr>
<td>2015-16</td>
<td>17262**</td>
<td>2945.08**</td>
</tr>
</tbody>
</table>

**Quantity of Green gram**
3.3. **Major storage Disease and Pest and their Control Measure**

In India, post-harvest losses caused by unscientific storage, insects, rodents, microorganisms etc., account for about 10 per cent of total food grains. The major economic loss caused by grain infesting insects is not always the actual material they consume, but also the amount contaminated by them and their excreta which make food unfit for human consumption. About 500 species of insects have been associated with stored grain products. Nearly 100 species of insect pests of stored products cause economic losses. Storage insect pests are categorized into two types viz.

- **Primary storage pests:** Internal and External feeders
- **Secondary storage pests**

**Primary storage pests: Insects that damages sound grains are primary storage pests**

**Pulse beetle:** *Callosobruchus maculatus* (chinensis) (Bruchidae: Coleoptera)

The adult and grub feed on the grain by making a small hole. Infested stored seed can be recognized by the white eggs on the seed surface and the round exit holes with the ‘flap’ of seed coat.

**Red flour beetle:** *Tribolium castaneum* (Tenebrionidae: Coleoptera)

Both the larvae and adults cause damage. The greatest damage is during the hot and humid monsoon season. The larvae are always found hidden in the food. The adults, however, are active creatures, but mostly found concealed in flour. Adult construct tunnels as they move through flour and other granular food products. In severe infestation, the flour turns greyish and mouldy, and has a pungent, disagreeable odour making it unfit for human consumption.

**Khapra beetle:** *Trogoderma granarium* (Dermentidae: Coleoptera)

The greatest damage is done in summer from July to October. The grubs eat the grain near the embryo or at any other weak point and from there proceed inwards. They usually confine themselves to the upper 50 cm layer of grains in a heap or to the periphery in a sack of grains. They can reduce the grain to a mere frass. Since the larvae are positively thigmotactic, they can be collected by merely placing gunny bags on a heap of grain.

**Integrated Management of Stored Produce Pests**

The control methods of stored produce pests can be categorized into preventive and curative measures

**Preventive measures**

- Brush the cracks, crevices and corners to remove all debris in the godown.
- Clean and maintain the threshing floor/yard free from insect infection and away from the vicinity of villages.
- Clean the machines like harvester and thrasher before their use.
- Make the trucks, trolleys or bullock carts free from infestation.
- Clean the godowns/ storage structures before storing the newly harvested crop to eliminate various bio stages of pest hiding.
- Provide a metal sheet upto a height of 25 cm at the bottom of the wood in doors to arrest the entry of rats.
• Fix up wire meshes to windows, ventilators, gutters, drains etc., to prevent entry of rats, birds and squirrels
• Remove and destroy dirt, rubbish, sweepings and webbings etc from the stores
• Close all the rat burrows found in godown with a mixture of broken glass pieces and mud plastered with mud/ cement.
• Plaster the cracks, crevices, holes found on walls, and floors with mud or cement and white wash the stores before storing of grains.
• Provide dunnage leaving gangway or alleyway of 0.75 to 1 m all around to maintain good storage condition.
• Store the food grains in rat and moisture proof storage structures.
• Disinfect the storage structures receptacles by spraying malathion 50 EC @ 3 lit 100 m before their use.

Curative measures

1. Ecological methods
   a. Manipulate the ecological factors like temperature, moisture content and oxygen through design and construction of storage structures/ godown and storage to create ecological conditions unfavourable for attack by insects
   b. Temperature above 42° C and below 15° C retards reproduction and development of insect while prolonged temperature above 450 C and below 100 C may kill the insects.
   c. Dry the produce to have moisture content below 10% to prevent the build-up of pests.
   d. Kill the pests’ bio stages harboured in the storage bags, bins etc., by drying in the sunlight.
   e. Store the grains at around 10 % moisture content to escape from the insect’s attack.
   f. Manipulate and reduce oxygen level by 1% to increase the CO2 level automatically, which will be lethal to all the stages of insects.

2. Physical methods
   a. Provide a super heating system by infrared heaters in the flour mills and food processing plants to obtain effective control of pests since mostly the stored produce insects die at 55 –600 C in 10 – 20 minutes.
   b. Modify the storage atmosphere to generate low oxygen (2.4% and to develop high carbon dioxide (9.0 – 9.5) by adding CO2 to control the insects.
   c. Seed purpose: Mix 1 kg of activated kaolin (or) lindane 1.3 D (or) malathion 5 D for every 100 kg of seed and store/pack in gunny or polythene lined bags.
   d. Grain purpose: Mix 1 kg activated kaolin for every 100 kg of grain and store. To protect the pulse grains, mix activated kaolin at the above dosage or any one of the edible oils at 1 kg for every 100 kg of grain or mix 1 kg of neem seed kernel for every 100 kg of cereal / pulse and store.
   e. Do not mix synthetic insecticides with grains meant for consumption.
3. Cultural methods

a. Split and store pulses to escape from the attack by pulse beetle since it prefers to attack whole pulses and not split ones.

b. Store the food grains in air tight sealed structures to prevent the infestation by insects.

4. Mechanical methods

a. Sieve and remove all broken grains to eliminate the condition which favour storage pests.

b. Stitch all torn out bags before filling the grains.

5. Chemical methods

a. Treat the walls, dunnage materials and ceilings of empty godown with malathion 50 EC 10 ml/L (or) DDVP 76 WSC 7 ml/L1 at 3 L1 spray solution/10 sq.m.

b. Treat the alleyways and gangways with malathion 50 EC 10 ml/L or DDVP 76 WSC 7 ml/ L (1 L of spray fluid/270 m³).

c. Spray malathion 50 EC 10 ml/ L with @ 3 L of spray fluid / 100 m2 over the bags.

d. Do not spray the insecticides directly on food grains. • Use knock down chemicals like lindane smoke generator or fumigant strips pyrethrum spray to kill the flying insects and insects on surfaces, cracks and crevices.

e. Use seed protectants like pyrethrum dust, carbaryl dust to mix with grains meant for seed purposes only.

f. Decide the need for shed fumigation based on the intensity of infestation.

g. Check the black polythene sheets or rubberized aluminium covers for holes and get them ready for fumigation.

h. Use EDB ampoules (available in different sizes 3 ml, 6 ml, 10 ml, 15 ml and 30 ml) at 3 ml/quintal for wheat and pulses and 5 ml/ quintal for rice and paddy (Do not recommend EDB for fumigation of flour oil seeds and moist grains).

i. Use EDCT (available in tin containers of 500 ml, 1 liter and 5 litres) at 30 – 40 litres/ 100 cubic meter in large scale storage and 55 ml/quintal in small scale storage.

Fumigation

Use fumigants like ethylene dibromide (EDB), ethylene dichloride carbon tetra chloride (EDCT), aluminium phosphide (ALP) to control stored produce pests effectively. Apply aluminium phosphide (available in 0.6 g and 3 gram tablets) @ 3 tablets (3 gram each) per tonne of food grains lot with help of an applicator. Choose the fumigant and work out the requirement based on the following guidelines.

- 3 tablets of aluminium phosphide 3 g each per tonne of grain.
- 21 tablets of aluminium phosphide 3 g each for 28 cubic meters
- Period of fumigation is 5 days

Mix clay or red earth with water and make it into a paste form and keep it ready for plastering all-round the fumigation cover or keep ready sand snakes. Place the required number of aluminium phosphide tablets in between the bags in different layer. Cover the bags immediately with fumigation cover. Plaster the edges of cover all round with wet red earth or clay plaster or weigh down with sand snakes to make leaf proof. Keep the bags for a period of 5-7 days under fumigation based on fumigant chosen. Remove the mud plaster after specified fumigation periods and lift cover in the corner to allow the residual gas to escape. Lift the cover after few hours to allow aeration.
Chapter 4- Cost of production and Net value accruals to producers

A typical farmer in the region with about 1 hectare land under green gram cultivations as single harvest. The gross yield per acre is 8 quintal per ha. The market rate on sale is about Rs. 4500 per quintal or Rs. 45 kg or Rs. 36000 per ha. The cost of cultivation is about Rs 22110 per ha. Out of this about Rs. 6000 is cost of land preparation, seed cost is about Rs. 3600, fertilizer and pesticide cost is about Rs. 1500 per ha, weeding related (labour cost) is about Rs. 3600 and harvesting cost is and threshing cost is about Rs. 6600 per ha. Packing cost is about Rs. 500 per ha. Transportation cost to mandi is about Rs. 250 per ha- all totaling is around Rs 22110 per ha. Varieties available in green gram are Naugar, Ajmer and Jaipur variety. This farmer is largely into Jaipur variety (C grade). Jaipur variety also has A and B grades but presently no facility for grading exists. Also there is no storage facility for farmers. Bunding facility has been facilitated under RACP through which soil conservation and water level increase have been realized. The scope of shed net for seed cultivation for tomato, onion, hot pepper etc is an option. Seed facilitation services are also requested as seed rates are on the higher side @ Rs 200 per bag. Also cost of pesticides like phuladon, merathin, and parathin is at significant cost. The price fluctuation in output is between Rs. 4000-4800 in a single year or over 20 percent. Combine harvester are used @ Rs. 3000 per ha saves on labour cost. In periods of good harvest yield is even 9 quintal per ha and in worst case scenario even 6 quintal per ha – largely monsoon dependent.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moong Grown in (in ha)</td>
<td>1</td>
</tr>
<tr>
<td>Moong Productivity (qtl/ha)</td>
<td>8</td>
</tr>
<tr>
<td>Total Production (qtls)</td>
<td>8</td>
</tr>
<tr>
<td>Market Price on sale in mandi (per quintal)</td>
<td>4500</td>
</tr>
<tr>
<td>Total Gross Value Rlzd</td>
<td>36000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Costs (per ha)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Preparation</td>
<td>6000</td>
</tr>
<tr>
<td>Seed Cost</td>
<td>3600</td>
</tr>
<tr>
<td>Fertilizers &amp; Pesticides</td>
<td>1560</td>
</tr>
<tr>
<td>Sowing &amp; weeding related (labour cost)</td>
<td>3600</td>
</tr>
<tr>
<td>harvesting &amp; Threshing cost</td>
<td>6600</td>
</tr>
<tr>
<td>Packing cost</td>
<td>500</td>
</tr>
<tr>
<td>Transportation cost to mandi</td>
<td>250</td>
</tr>
<tr>
<td>Cost for 1 ha</td>
<td>22110</td>
</tr>
<tr>
<td>Net Realization (total)</td>
<td>13890</td>
</tr>
<tr>
<td>------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Per quintal net realization</td>
<td>1736.25</td>
</tr>
</tbody>
</table>

** Costs assumed are as per estimates given by respondents. The costs may vary in different zones, also based on cultivation practices of farmer. This particularly includes quality and type of inputs used.
Chapter 5- Supply Chain of the commodity

5.1. Seasonal Availability and Price Pattern

Seasonal Availability
Green gram is sown in Kharif season is harvested in the month of September and October in Rajasthan. It normally takes 2 months to arrive at maturity. Rajasthan being the major producer of green gram in India, Moong is available in market in the month of November. Hence the Peak period is considered to be from November where dal is available in surplus amount in the market. Also the rabi crop is available from January in market followed by late Rabi in April. The period from July to September where production is low is considered as Lean Period.

The following table represents the seasonal availability as well as price pattern of the commodity

<table>
<thead>
<tr>
<th>Crops</th>
<th>Jan</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Rabi</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Late Rabi</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Peak Period</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Lean period</td>
<td></td>
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</tbody>
</table>

5.2. Existing Marketing Channels

- Pre-Intervention Value Chain Map: Green Gram

The present pre-intervention or value chain for green gram may be viewed as one with two critical production-distribution or activity marketing channels. The farmers in the State produce green gram as Rabi crop and supply in institutional procurement done by NAFED etc. Also, farmers sell their produce to processors through village level aggregators and APMC commission agents. There are fifty odd dal mills in the state process and market dal across the country. In this context, however many micro and small scale dal millers donot have pulses colour sorters machine which is essential to sell dal in premium retail markets. In order to penetrate and sell their product in these premium markets, dall millers get it colour sorted on ‘job work basis’. Alternatively, large dal millers too buy non-colour sorted dals from smaller firms in order to colour sort, pack in their brand and sell to premium markets. Value accruals to processors are subject to commodity price fluctuations by up to even 20%.
Post harvest losses occur at various stages of the existing value chain of gram starting from post-harvest to mandi sales and processing. Such post harvest losses total up to a significant amount of 9.5% of the actual harvested output. The major reasons for such yield loss could be attributed to the poor storage, inefficient transportation and improper handling of the produce till mandi. At processor level, higher percentage of the yield loss could be attributed to the use of obsolete and inefficient technologies and improper storage.

In Channel 3, demand for premium colour sorted dal is met by millers (not having the required technology) by undertaking job work with other milling units possessing same. Alternatively, large millers buy non-colour sorted dal from small millers to further sort to sell the final product in premium markets.

**Institutional Marketing Channel:**
Notably, some institutions have been entrusted with marketing activities of Green gram like NAFED. NAFED is the nodal agency for procuring Green gram through providing minimum support prices to the farmers for their produce. The main institutional marketing channel for green gram is as under:

### 5.3 Alternative Systems of Marketing

#### 5.3.1 Direct Marketing

Direct marketing is an innovative concept, which involves marketing of produce by the farmers to the consumer/miller without any middlemen. It enables producer and miller and other bulk buyers to economise on transportation cost and to improve price realisation considerably. The price spread in direct marketing is considerably low. Direct marketing by farmers to the consumers has been experimented in the country through Apni Mandis in Punjab and Haryana. The concept of direct marketing with certain improvements has been popularised in Andhra Pradesh through Rythu Bazars. At present, small and marginal producers without the help of the middlemen are selling their produce in these markets. In these markets, mainly fruits and vegetables are marketed along with other commodities.

**Benefits:**
- It increases profit of the producers.
- It minimizes marketing cost.
- It increases distribution efficiency.
- It satisfies the consumers through better quality of produce at reasonable price. It provides better marketing techniques to producers.
- It encourages direct contact between producers and consumers.
- It minimizes the margin of the middlemen.
- It encourages the farmers to produce according to demand.

In this context, direct marketing linkages with SME Pulses processing industries could be developed. In similar arrangement, a model developed in the Vidarbha region of Maharashtra state could be followed, wherein millers and FPOs have started transacting directly. While millers benefit by way of quality cleaned and graded raw material being received from producers, also eliminating the costs of middlemen/agents services. The benefit to producer is higher value accruals as compared to market (mandi) price. As millers get desired quality at reduced cost of procurement, millers could easily share the benefit of same with producer which could be in range of 4.5%-5% at least.
5.3.2 Contract Farming

It is significant to note that Indian agriculture is not akin to Agri-business that is prevalent in US or Europe. It is a way of life in India. As a matter of fact, private sector participation in Indian Agriculture is imperative so as to provide much needed impetus for growth. Viewed in this context, contract farming in India is essential so as to promote rural self-reliance in general by pooling local available resources and expertise to meet new challenges. It will also reduce migrations from rural to urban areas and reduce load of procurement. It will promote processing and value addition.

Challenges in implementing contract farming are many as success stories in a classical mould are few. However, one cannot deny the accomplishments of a range of Indian contract farming models in India viz. Amul, NDDB, the Maharashtra sugarcane co-ops, the rapid spread of poultry projects etc. Few companies like Arvind Limited (Agri-business) have taken lead in contract farming of certain pulses in some states. Notably, small parcels of land of producers, speculative nature of prices, lack of confidence among private companies regarding compliance to contract by producers and vice versa, lack of defined contract farming framework/policy (until recent times) have been major reason for negligible progress on this front. This channel could, however, be developed by strong initiatives by producer companies having large producer base and hence large land bank. Initiatives could involve forming company’s own code of conduct and implementation, which may instil confidence in interested private companies. Notably, mutual trust and compliance of contract in all conditions shall create linkages for longer term. In fact, true success and rapid spread will come with deep seated changes in mindset and policy reform.

There is, therefore, need to enact laws of contract farming to facilitate activity between corporate and farmers. This is needed along with strengthening the overall legal frame work concerning agriculture. In general, the land holdings have gone down and the challenge for the nation lies in deriving direct benefit from R & D, scientific and technological innovations and knowledge infrastructure created by agriculture scientists and corporate houses for 2 acres of land. Diversification in agriculture to fisheries, horticulture, poultry are very important and hence participation of private sector is crucial. It is envisaged that private participation would create better technologies and improve marketability of agricultural produce.

In order to encourage this activity, Govt. fiscal support is a must as mentioned below.

- Food processors involved in contract farming should be exempted from all taxes.
- However, they should be encouraged and induced to invest in lieu in rural infrastructure and farmer’s upliftment to the extent of tax exempted.
- No taxes or duties on import of agriculture equipment should be levied.
- Abolish all fees, taxes, cess, duties, levy on procurement effected by a registered contract farming programme.

In order to ensure success of the concept not only contract farming be made legal with adequate institutional arrangement with forward & backward linkages to enable small farmers to participate in it. The contracts should be transparent & participatory and adequate bank finance for small and marginal farmers should be ensured. There should be contract farmer’s associations or cooperatives to safe guard their interest which should ensure sustainability of contract & higher income to farmers on stable basis. Above all, strong & adequate infrastructural facilities be provided to farmers and land use planning be suitably taken care of. Last but not the least; it may be stressed that the contract farming could prove counterproductive, unless organized markets
exist. In any case the contract farming approach has considerable potential in the light of preponderance of small and marginal farmers who can no longer be competitive without access to modern technology & support.

**Private-Community Grower Group-Farmer Model**

Ion Enviro undertakes contact farming with Community Grower Groups (CGG) having large acreage, on a profit-sharing basis. Farmers are trained in-house in scientific organic farm management and certification. Community Grower Groups are promoted through non-governmental-organisation or sell-help group or registered association. They follow fair trade practices wherein middlemen are eliminated, child labour is banned, men and women are given equal opportunity, and transparency in trade is maintained. In the process, they bring to rural areas the best of organic processes and water management techniques, thereby educating and empowering farmers. Production is executed in accordance with protocol requirements as per EEC 2092/91 standards. Written and documentary accounts are recorded to trace the origin, nature and quantities of raw materials procured and their usage (Ion exchange Enviro farms, 2005). The crops cultivated include Banana, Wheat, Cotton, Papaya, Pineapple, Basmati, Mango, Soybean, Tur, Black Gram, Green Gram, Tumeric, Grapes, Bengal Gram, Groundnut, Sesame and Cashew.

5.3.3 **Private market yard**

There are no private market yards in different clusters where green gram is significantly produced. However two major companies from Rajasthan like Star Agri Warehousing Ltd. and CGR Collateral Management Ltd. have taken licenses to operate their warehouses as Private market Yard. CGR is also a signatory of MoU with State Government of Rajasthan during GRAM, Kota and is keen to work with project farmers for offering their warehouses as Private market yard near to production centers from where farmers can store and sell their produce without going to Mandi. They are also offering 75% loan against warehouse receipt of green gram to farmers.

**Development of Mega Market**

An efficient agricultural marketing is essential for the development of the agricultural sector, as it provides outlets and incentives for increased production. A well-developed marketing system contributes greatly to the commercialization of subsistence farmers. Worldwide, Government have recognized the importance of liberalizing agricultural markets. Government's policy has to effectively address issues of marketing and help to overcome the constraints faced by various organizations including private sector involved in agri-marketing. The ever increasing production, spread of latest technologies, changing socio-economic environment, increasing demand for downsizing the distribution chain and reducing the margin between farmers and ultimate consumers as well as challenges emerging out of liberalization and globalization in the post WTO period requires a vibrant, dynamic and assimilative marketing structure and system.

In this context, it may be emphasized that on account of green revolution and other research in agricultural field, the agricultural production in the country has increased manifold and will continue to do so in the years ahead. There is therefore all the more need and justification for development of modern competitive marketing in the form of "Mega Markets" so that with the provision of scientific storage, infrastructure facilities, remunerative price for products could be ensured to the farmers. Thus production cost could be reduced, losses could be minimized and exports could be augmented. Given the comprehensive ultramodern marketing facilities for agricultural produce, the new concept of mega market can revolutionize the entire marketing system and give benefit of value addition to farmers.

It is significant to note that over Rs. 50,000 crore of agricultural produce are being currently wasted which is six times, that of the annual food subsidy of the nation. Besides agri-processing sector has
an employment elasticity of two to four times more than that of the manufacturing sector. It is therefore necessary to encourage and facilitate the industry to enter into direct contract with the farmers for the procurement of their raw material by taking measures on the following lines.
Chapter 6- Processing Infrastructure availability and utilization

6.1. Processing

1. Dal

- Pre cleaning and Fine cleaning
- Fitting
- Pre Treatment with Oil
- Drying and De husking
- Splitting
- Colour Sorting
- Packaging
1. **Moong Flour**

The process flow for preparing Moong Flour is a simple process which includes cleaning, splitting, and grinding of green gram to get the flour.

**Figure 12: Process flow for moong flour Preparation**

1. Raw Material From Warehouse
2. Cleaning And Conditioning
3. Splitting up of green gram into Dal
4. Roasting of splitted green Gram
5. Grinding (usually Khanda i.e. broken)
6. Sieving of grinded green gram
7. Fine Seaving of Flour
8. Packing of goods
9. Dispatch to Warehouse
2. Feed

The operation in the feed processing plant involves the receiving of raw materials in the plant premises. Feed ingredients arrive in sacks, or other small containers, and in bulk. Sacked ingredients are checked for identification and condition. They are then logged in after segregation of drugs and medications. Sacked ingredients is then stored in a dry location with proper protection from rodent and insect infestation. Sacked stocks are then rotated to minimize staleness, product degradation, and insect infestation.

Bulk ingredients are handled according to their physical form. Liquid ingredients, such as oils and molasses, are generally stored in bulk tanks. Proper storage temperature is maintained and the filter screens are checked periodically. Solid bulk ingredients such as grains, oil meals, etc., are cleaned with a scalper to remove foreign material prior to storage in bins. Bin temperatures are monitored to prevent heating due to grinning respiration.

Material flow during processing includes:
- particle size reduction,
- premixing,
- mixing,
- pelleting, and
- sacking

Coarse ingredients pass over a permanent magnet which removes tramp metal and then through a hammer mill which reduces particle size to the desired screen analysis. Ground material is monitored periodically to ensure size uniformity and to help detect wear of hammer mill screen and hammers. The ground material is then routed to ingredient holding the bins.

There are two mixing operations in feed milling. One is for the mixing of micro-nutrients, the operation is termed as pre-mixing. The other mixing operation involves the actual blending of all components of the diet.

Micro-nutrients, such as vitamins and trace minerals, are accurately weighed with carrier material which has a density approximating that of the predominant micro-ingredient. The materials are then mixed in a batch mixer for a period of time specified by the equipment manufacturer to ensure homogeneity. The premix is finally routed to the premix holding bin.

Diet mixing begins when augers are set in motion to deliver; the correct amounts of each ingredient including the premix, according to the formula, into the mixer. Where manual changing of the mixer is done, ingredients are weighed out in sacks or hopper carts. The mixing period is according to the equipment manufacturer's specifications, but final mix is checked periodically with a tracer to ensure homogeneity of the mix. If the mixed diet is to undergo pelleting, it is routed to the pelleting bin.
Mixed feed mash for pelleting is first conditioned with steam in the steam conditioner section of the pellet mill, after which it enters the die where it is finally extruded. Freshly extruded pellets are hot and contain excess moisture which is removed during passage through the cooler. Fines are then screened from the cooled pelleted feed and returned for repeating. Fish oil, if added, is now applied prior to the routing of the finished pellets into the packer bins.

6.2. Price build up & Marketing Efficiency Analysis

The price spread along with the share of stakeholders in consumer’s rupee spent at every stage of the value chain starting from the farm till the retailer is detailed out in the report. The price spread and values accrued to stakeholders across the chain reflects the profit margins accrued to different stakeholders. Farmer shares 60% of the consumer’s rupee while the shares of traders, processors, wholesalers and retailers are about 2.66%, 20.65%, 3.74% and 13.04% respectively. 37.43% of the value accruals are accrued to processors, wholesalers and retailers. Producers’ incomes are apparently dependent on yield as well as their dependency on the type of end product (eg. Dal, Flour, etc.). Here in the existing value chain of Green gram, the price build up has been calculated for the important first channel where the target consumers are urban households and institutional buyers. The product considered is moong dal.

Typically farmers sell the raw green gram at about Rs 4500 per quintal to traders. In the local mandis, it was sold by traders to the processors at Rs 4700 per quintal (with commission about 3% and cess of 1.6%). The processors, upon primary and secondary value addition, sell it to wholesalers at Rs 6251 (gross margin about 33%). Thereafter the wholesale and retail prices are set up at Rs 6532 per quintal and 7512 per quintal with a gross margin of 4.5% and 15% respectively. Due to limited infrastructure facilities at the dispersal of various stakeholders, marketing efficiency is adversely affected.

6.3. Stakeholder’s Share in Consumer Rupee

The price spread along with margin at every stage of value chain starting from the farmer till retailer is shown in the table given below.

Table 16 Price spread table

<table>
<thead>
<tr>
<th>Activity</th>
<th>Value per Quintal (Rs.)</th>
<th>Stakeholder’s share in Consumer’s Rupee (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retailing: Sale by retailer to consumer</td>
<td>About Rs. 7,512 per quintal which makes a profit margin of 15%</td>
<td>Retailers 13.04%</td>
</tr>
<tr>
<td>Wholesaling: Sale by wholesalers to retailers</td>
<td>Rs. 6,532 per quintal with a margin of 4.5%</td>
<td>Wholesalers 3.74%</td>
</tr>
<tr>
<td>Processing: Sale after processing to wholesalers</td>
<td>Rs. 6,251 per quintal (Gross value on sale with net profit margin in processing 2-3%)</td>
<td>Processors 20.65%</td>
</tr>
<tr>
<td>APMC: Sale upon trading at the mandi</td>
<td>Rs. 4,700 per quintal (Gross value on sale from Mandi)</td>
<td>Traders 2.66%</td>
</tr>
<tr>
<td>Production: Cost of production is Rs. 22110 per ha</td>
<td>Rs. 4,500 per quintal (Gross value on procurement at Rs. 4,500; gross value accrual to producers after cultivation costs is Rs. 1,736 per Quintal)</td>
<td>Farmers 60%</td>
</tr>
</tbody>
</table>
The existence of a long chain of middle men including the APMC and related commission agents, producers share in consumers’ rupee is adversely affected. This mirrors the need for promotion of contract farming options eliminating/minimising the role of the APMC. However, the limitations in contract farming policy & statutes merit correction.

6.4. Consumer preference Analysis

Rajasthan’s population in rural and semi urban areas prefer properly cleaned and processed unpolished dal – split/whole and with husk/without husk. In urban areas branded dal (polished/unpolished and color sorted) is more preferred. In some food retail centers in shopping malls in Jaipur, more prominent brands of dals and moong flour like Tata I-Shakti, Fortune, Reliance, Rajdhani, etc were more visible on shelves. However, some local brands were also available in these retail chains and equally popular in small retail shops. Some of these brands included ‘AgroPure’ promoted by AgroPure Group (NCR), ‘Shri Balaji’ promoted by Shri Balaji Dall Mill (Rajasthan). Some organic dal brands were also available.

Green gram after being processed into Flour or snacks as a value added product is an important product in the market segment. Brand equity is also critical in the market. Moong Mogar Dal, Moong chilka dal, Moong without chilka dal; basically various types of husked/ dehusked and whole split dal (clean, grade and sorted) are utilised for household consumption in Indian market.

Various advanced level innovations are also now being rolled out in market, which include Ready to eat Moong dal Khichdi, Pasta, Green gram Flour based Papad etc.

In terms of FPC’s marketing operations, targeted market could involve a mix of dal millers and other processors, large retailers, Institutional Sales (through NAFED, SFAC, etc), Flour Millers, Feed millers, Poultry farms, and also retail consumers.
Chapter 7- Existing Institutional support and Infrastructure facility

7.1. Support at cultivation stage

A range of support institutions support value chain activities as described below:

1. **KVK** - Application of technology/products through assessment, refinement and demonstration for adoption. To achieve the mandate effectively, the following activities are envisaged for each KVK:
   
   - On-farm testing to identify the location specificity of agricultural technologies under various farming systems.
   - Frontline demonstrations to establish its production potentials on the farmers’ fields.
   - Training of farmers and extension personnel to update their knowledge and skills in modern agricultural technologies.
   - Work as resource and knowledge centre of agricultural technologies for supporting initiatives of public, private and voluntary sector for improving the agricultural economy of the district.
   - Produce and make available technological products like seed, planting material, bio agents, young ones of livestock etc. to the farmers

Organize extension activities to create awareness about improved agricultural technologies to facilitate fast diffusion and adoption of technologies in agriculture and allied sectors.\(^{16}\)

**Krishi Vigyan Kendras (KVKs) Kota, Bundi, Baran and Jhalawar**

To realize their true potential, farmers must have access to the state-of-the-art technologies, necessary inputs and related information. In this context, the Government of India through Indian Council for Agricultural Research (ICAR) has established a large network of over 600 Krishi Vigyan Kendras (KVKs) across the country with an aim to conduct technology assessment and refinement, knowledge dissemination and provide critical input support for the farmers with a multidisciplinary approach.

Krishi Vigyan Kendras (Farm Science Centre), an innovative science based institutions, were established mainly to impart vocational training to the farmers and field level extension workers. The concept of vocational training in agriculture through KVK grew substantially due to greater demand for improved agricultural technology by the farmers. They not only required knowledge and understanding of the intricacy of technologies, but also progressively more and more skills in

\(^{16}\) [http://agritech.tnau.ac.in/kvk/kvk_intro.html](http://agritech.tnau.ac.in/kvk/kvk_intro.html) (retrieved on 6th April 2017)
various complex agricultural operations for adoption on their farms. The effectiveness of the KVK was further enhanced by adding the activities related to on-farm testing and Front-Line Demonstration on major agricultural technologies in order to make the training of farmers’ location specific, need based and resource-oriented.

KVKs are playing a proactive role in transferring new technology at field level with beneficial impacts. They have an edge in technology transfer over other service providers by virtue of their having better technical expertise and demonstration units.

7.1.1. Department of Agriculture, Govt. of Rajasthan:

The department has various verticals through which it supports production, productivity and market linkage in the state. It has a well-established structure and network of State/District and panchayat level officials to provide extension services to farmers. The department issues licenses to various agri-input marketing companies including seeds, fertilizers and insecticides and ensures quality assurance to farmers through regular reporting from suppliers and random quality checks of agri inputs. The licenses are issued first at the State level by registering input/service providers. The registered companies can only supply inputs to district and regional level distributors who in turn make availability of the products at the retailers. All handlers of agri inputs and produce have to take license from competent authority either at district or state level. Similarly, the department also issues mandi licenses for traders at different APMCs for trading in specific commodities. The same are described below.

A. Extension vertical:

- **Extension support**: The extension wing recommends good agricultural practices for various crops as per various agro-economic zones, promotes seed replacement through distribution of Minikits containing improved variety of seeds. It also provides grant support of upto 50 percent of the price of notified varieties of green gram of less than 10 years or Rs 1500 per quin whichever is less. For hybrid varieties subsidy is - 50% of the price of seeds notified for less than 10 years or Rs 5000 per quin whichever is less. The department also provides upto 50% subsidy on micro-nutrient (50% of total cost or upto Rs 500/ha) and bio-fertilizer application (50% of total cost or Rs 300/ha) under various schemes viz. National Agriculture Development Scheme/ National Composite Safety Mission/ National Food Security Mission. The application can be submitted to the office of Agriculture Supervisor-Ass. Agriculture Officer/ Asst. Director (Extn.)/ Dy. Director (Extension) by eligible farmers at Panchayat/Sub-district and District level respectively. Under the head “Subsidy on Crop Demonstrations”, subsidy upto Rs 5000/ha is available for green gram cultivation through flagship programs like State Plan/NFSM.

- **District level farmer help desk**: Under this head, farmer help line are established at district level with nominated district level officials from the office of Dy. Director, Agriculture Extension to support farmers on various farming related problems. Apart from this, a state level help desk is also maintained whose telephone no is 0141-5102578

- **Agriculture information dissemination**: At the state level, technical dissemination is being done through the daily newspapers, agricultural papers, monthly publication of "Kheti Ri Bataan" bulletin is also being done. Apart from this, information about advanced agricultural methods of major crops during crop season, publishing posters, agricultural guides on various topics, and Rabi / Kharif package of practice books at the block level and farmers, people’s representatives and farmers by producing farmer friendly literature. Is being distributed to the institutions related to. From day-to-day basis to all the radio stations of the
state, from 7.45 to 8.15, share the information related to farming and phone in these programs is being broadcast on Tuesday, Thursday and Saturday. The program is being sponsored by the Department of Agriculture on Monday, Tuesday and Wednesday for three days a week. "Farming" program on Doordarshan- produced by the Agriculture Department, is broadcast from Doordarshan Kendra, Jaipur on every Thursday from 7.30 am to 8.00 pm. In this program, information about departmental schemes / programs being executed by the Agriculture Department, discussions with experts, problem-solving, confusion-solving, fortnightly work, message, success stories, innovation, short films, eclipse etc. The tax program is made simple, interesting and farm-making. The technical information on agriculture and related subjects to the farmers has been done by the Indian government to provide "Kisan Call Centre" in the state through telephone. Farmers can get any kind of information related to farming by making free calls to phone number 1800 180 1551/1551, from basic / mobile telephone to 6.00 pm to 10.00 pm.

- **Water use efficiency promotion:** Under the Farm Pond Program, rain water harvesting is promoted with the provisioning of 50% subsidy or maximum amount of Rs 52,000/- on raw farm pond and Rs 75,000/- on farm pond with plastic lining whichever is less. This scheme is available under the Rashtriya Krishi Vikas Yojana.

For Dighi construction (under National Agriculture Development Scheme/RKVY), 50% of the unit cost or 350 / - per cubic meter filling capacity and 50% of the cost of the unit cost, on the construction of plastic lining (raw) diggings, by constructing a minimum of 4.00 lakh liters of Filler capacity and more than 50% of the unit cost. The amount of rupees 100 / - per cubic meter will be filled up or maximum Rs 2.00 lakh, whichever is less the grant will be payable.

For Water Houze construction under the national Agriculture Development Scheme, support is provided for areas where deep water is used for irrigation. For constructing a minimum of one lakh liters of Fill Capacity water shed Houz for all categories of farmers, 50 percent of the unit cost or Rs. 350 / - per cubic meter fill capacity or maximum Rs. 75000 / - whichever is less is the subsidy element.

Under the irrigation pipeline head (of National Agricultural Development Plan, National Food Security Mission, NMOP) water use efficiency is promoted for irrigation water. Under this scheme, PVC / HDPE of prescribed size for carrying water from source to farm on irrigation pipeline is supported. On the purchase of pipes, the farmers of all categories are given 50 percent of the cost or maximum amount Rs. 50 / - per meter on HDPE pipes or Rs. 35 / - per meter on PVC pipe or Rs. The maximum amount of Rs.15000 / - on the 20 / - per meter HDPE laminated le-flat tub pipe will be payable, whichever is less proportionate.

Under the Fountain Irrigation program through National Food Security Mission; Pulses and Wheat - Under the Fountain Irrigation Program, subsidy is 50% or the amount is Rs. 10000 / - per ha, whichever is less.

Under the Mobile Raingun support program, for irrigation of grains and pulses crops, subsidy of 50 percent of the cost under the Mobile Renganization program or Rs.15000 / - per unit whichever is less, grant is payable. This subsidy is available under the NFSM scheme.

- **Agricultural equipment grant distribution program:** Grants upto 40 to 50 per cent are given as per the category of farmers on the purchase of approved agricultural machinery viz. Seed cum Fertilizer Drill, Plow, Threser etc.
Value Chain Analysis - Green Gram

- **Gypsum distribution program**: 50% Subsidy is given to farmers on district wise rate of Gypsum for maximum area of 2 hectare. This support is for soil reclamation of alkali soils.

- **Plant protection inputs**: Segment, viz. Plant Protection Chemicals / Bio Agents / Bio Pesticides / Pheromone Trap / Liyos Distribution, including weeds in crops; 50% of the price or Rs. 500 any less per hectare is payable as subsidy.

- **Plan Protection equipments segment**: Human transport * (napsek, foot sprayer, duster etc.) are given 40-50 percent of the cost or maximum 600-800 / - Per device as subsidy. Under Power Drivesegment * (Nepasek Power Sprayer) are given 50-60 percent of the price or maximum 3000-3800 / - Per device. For tractor mounted sprayers, 50% of the price or Rs 10,000 per device is subsidized. These schemes are as per targets allotted for respective districts.

- **Assistance for area specific integrated farming systems** like livestock based, horticulture based and tree based farming systems: Assistance is provided for farmers of selected village/cluster having land from 0.25 to 2 ha area per farmer. It is implemented on cluster basis with 100 ha of land. Subsidy applicable is: 50% of cost or 52500/-for farm pond, 50% of cost or 468/-per SQM for green house, 50% of cost or 30/-per SQM for low tunnel, 40% of cost or 800/-per colony for bee keeping, 50% of cost or 15000/-for diesel pump, 50% of cost or 50000/-per HDPE vermi bed

- **Organic production**: Organic green gram also has a great potential. For support under the head, Promotion of Organic Farming, subsidies are available for heads like Conversion of land Cropping systems and organic seeds, traditional organic input production unit, botanical extracts production unit, use of phosphate rich organic manure, construction of vermin-compost pit, use of liquid bio fertilizer and support for packing labelling and branding material support are subsidized for consecutive two years at a rate specified in the manual.

- **Prime-minister Crop insurance scheme**: Farmer have to pay 2% of insured amount in Kharif, 1.5% of insured amount in Rabi and 5% of insured amount in horticulture & commercial crops, subject to maximum of 7 hectares per farmer. Rest of the premium amount will be borne by central and state government in equal ratio. Beyond 7 hectares, farmer has to pay whole premium amount, i.e. without any subsidy.

- **Soil health card**: Under this, component, district level soil and water testing labs support farmers on soil testing and providing soil health card for integrated nutrient management.

**B. Rajasthan State Seed Production and Certification agency** helps in ensuring production of certified seeds for farmers. The department is mandated to; Recognize varieties eligible for Seed Certification and annually publish lists indicating the names of such varieties, Maintain a list of sources of Breeder & Foundation seeds approved by the Central Seed Certification Board, Outline the procedure for submission of application for growing, harvesting, processing, labelling and tagging of seeds intended for certification, Undertake inspection of seed fields, seed processing plants and lots in accordance with the procedures outlined by the Central Seed Certification Board in accordance with Indian minimum seed certification standard (IMSCS), Regulate the processing of seeds at seed processing units and Ensure that the seeds certified by it conforms to the standards prescribed by the Central Seed Certification Board. Thus the department ensures availability of quality seeds for growers.
C. Rajasthan State Seeds Corporation helps availability of quality seeds at affordable prices through the cooperative network and private distributorship channel under the trade name “Raj Seeds”. During Rabi and Kharif seasons Rajseeds are made available at the door steps of the farmers through Beej raths operating at almost every panchayat samitee of the state.

D. Rajasthan Kisan aayog (Rajasthan State farmer Commission): It is mandated to Investigate and review of agriculture and allied sectors, keeping in mind the economic ecology and environment for sustainable development of agriculture and To inform the State Government for taking necessary measures to solve timely problems of agriculture, animal husbandry and fisheries, so that farmers can be protected against difficult situations, Talk to different farming organizations / associations to make the government aware of their demands and suggestions and To bring the difference in demand and supply to the attention of the State Government, so that its adverse effects are not on the peasantry.

E. State Agricultural Management institute (SIAM), Durgapura Jaipur: The institute is mandated to organize training programmes on functional areas of Agriculture and its allied sector namely; Induction courses on fresh recruits, Refresher courses for in service officials, Crop production technologies, Management of Technology and Input, Irrigation Management, Dry land Farming, Crop Economics, Extension technique, Communication skills, National Workshop / Seminars etc.

F. Agricultural Conservation Testing Centres (ATCs): The department of Agriculture has ten ATCs who are mandated to find out the usefulness of the research recommendations received from the agricultural research centres under the agricultural universities of the state in various agricultural and regional conditions and local conditions and to amend the tests in the research recommendations according to local conditions. On the basis of the tests, preparations of agricultural climatic package of practice and amendment of the advanced agricultural methods are amended. Apart from this, the agri-certified testing centres also solve the technical problems in the day-to-day work of the extension workers.

7.1.2. ICAR and allied institutions:

The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 101 ICAR institutes and 71 agricultural universities spread across the country this is one of the largest national agricultural systems in the world. The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has enabled the country to increase the production of food grains by 5 times, horticultural crops by 9.5 times, fish by 12.5 times, milk 7.8 times and eggs 39 times since 1951 to 2014, thus making a visible impact on the national food and nutritional security. It has played a major role in promoting excellence in higher education in agriculture. It is engaged in cutting edge areas of science and technology development and its scientists are internationally acknowledged in their fields.

State Agriculture Universities (SAUs):

The state four major Agriculture Universities namely;

The state four major Agriculture Universities namely;

1. Swami Keshwanand Rajasthan Agricultural University, Bikaner,
2. Maharana Pratap University of Agriculture and Technology, Udaipur,
3. Sri Karan Narendra Agriculture University, Jobner,
4. Agriculture University, Kota

and affiliated colleges who contribute to research, education, training and knowledge dissemination on agriculture technology.

The Agriculture Universities also provide research and extension support through attached Krishi Vigyan Kendras and Agriculture Research Stations.

**Agriculture Research Stations:**

Apart from the above, there are several agriculture research stations and sub-stations attached to the universities to undertake research/trial and demonstration of agriculture technologies.

**7.1.3. Credit facilities:**

Agricultural credit facilities in the state has both formal and informal sources. Under the formal sources, various banks are extending credit facility at subsidized interest rates under KCC schemes for farmers having land title. The Gram Seva Sahakari Samitis run by Cooperative Department also extends crop loans to farmers. However, as many farmers live in hindu-undivided families, i.e. land title is still with father and sons undertake farming in their share of land as mutually agreed in the village panchayat. In such cases, getting a formal source of crop loan is difficult. Hence many farmers resort to informal sources of loans from village level money lenders at exorbitant rates and exploit them later by forcing to supply the produce also through the money lenders.

**7.1.5. Agri input availability:**

A number of input service providers (in seeds, fertilisers and pesticides) operate in the important green gram producing clusters. They are registered through the office of Dy. Director, Agriculture Extn. of respective districts.

**7.2. Support at post-harvest stage**

Following are the major support institutions for post-harvest handling of agriculture produce in the state.

**A. Department of Agriculture marketing (DAM):** The department offers upto 50% subsidy on various sorting/grading machines as specified in the circular dated 19/07/2017.

**B. Post-harvest storage:** Department of Agriculture provides subsidy for metal storage bins to farmers. Apart from this, following storage infrastructure is available in the state.

- **Rural Godowns:** There are 139 rural godowns in Rajasthan which store mustard, gram, wheat, bajra, gaur, soybean, groundnut etc. The list of godowns in Rajasthan that store green gram is attached in Annexure-5

- **Central Warehousing Corporation:**
  The Central Warehousing Corporation (CWC) is the largest public sector warehouse operator with their godowns established in almost all the states of the country. At present, CWC have already established and operating more than 450 warehouses with a capacity of 93.25 lakh tonnes (as on 29/02/2004). These are scientifically constructed warehouses which facilitate the farmers to store their produce safely and to derive the benefit of pledge finance during the period of glut situation in the markets. (Annexure - 2 List out CWCs in Rajasthan)
• **State Warehousing Corporation**
  State Warehousing Corporations (SWCs) were established in different states under the purview of concerned state governments and constructed godowns at distant places. The total share capital of SWCs is contributed equally by CWC and concerned state governments and SWCs under dual control. The SWCs also provide storage facilities for green gram. (Annexure – 3 Lists of SWCs in Rajasthan)

C. **Market information through Agmarknet:**

The Directorate of Marketing and Inspection (DMI), an attached Office of the Department of Agriculture, Cooperation and Farmers Welfare under Ministry of Agriculture & Farmers Welfare, was set up in the year 1935 to implement the agricultural marketing policies and programmes for the integrated development of marketing of agricultural and other allied produce in the country with a view to safeguard the interests of farmers as well as the consumers. It maintains a close liaison between the Central and the State Governments.

The Directorate is headed by Agriculture Marketing Adviser to Government of India and has its Head Office at Faridabad (Haryana), Branch Head Office at Nagpur (Maharashtra) and 11 Regional Offices at Delhi, Mumbai, Chennai, Kolkata, Hyderabad, Chandigarh, Jaipur, Lucknow, Bhopal, Kochi and Guwahati and the Central Agmark Laboratory at Nagpur

D. **Support on Agri produce marketing through APMCs:**

The state has 136 Krishi upaz mandi samitis (KUMS) and 310 market sub yards for trade of agriculture commodities. These APMCs are intended to be responsible for:

- Ensuring transparency in pricing system and transactions taking place in market area;
- Providing market-led extension services to farmers;
- Ensuring payment for agricultural produce sold by farmers on the same day;
- Promoting agricultural processing including activities for value addition in agricultural produce;
- Publicizing data on arrivals and rates of agricultural produce brought into the market area for sale; and setup and promote public private partnership in the management of agricultural markets

E. **Support on post-harvest value addition:** The Farm Gate Agro processing and Agri-marketing scheme of Govt. of Rajasthan has provisioning for subsidy upto Rs 20 lakh for a sorting/grading/ value addition project of Rs 50 lakh. Ministry of Food Processing, Govt. of India also has a scheme in the name of Kisan Sampada (Backward & forward linkage scheme) through which there is a provisioning of 35% subsidy for Farmers/Farmer Groups for establishing value addition facility for agri produce.

7.3. **Support at post-harvest stage, Primary and Secondary Processing.**

Storage facilities

Storage of the Green gram is performed at different level i.e. at Producers’ level, at rural level, at Mandi level, at CWC and SWC level and at Co-operative level. Post-harvest storage and related support is important.

At Producer's Level:

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17 Agmarknet (http://agmarknet.gov.in/) (retrieved on April 9, 2017)
Producers store Green gram in various types of traditional and improved structures. Generally, these storage structures are used for a short period. Different organizations/institutions have developed improved structures for storage of Green gram with varying capacities and shape like Hapur Kothi, Pusa Kothi, Nanda bins, and PKV bins. These are usually constructed on a raised platform or plinth constructed of plastered mud brickwork, stone slabs or wooden planks. Some producers also store Green gram in jute gunny bags or in gunny bags lined with polythene stacked in the livingroom.

**At Rural Level:**
Some rural Godowns are also located in Rajasthan for storage of green gram

**Table 17: Rural Godowns in Rajasthan**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name &amp; add. of rural godown</th>
<th>Capacity(In MT)</th>
<th>Ownership</th>
<th>Commodity stored</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M/s Atal W/H, Nagour Road, tehsil-Nokha, <strong>Bikaner</strong>.</td>
<td>1000</td>
<td><strong>Private</strong></td>
<td><strong>Guar, Green Gram, Mustard</strong></td>
</tr>
<tr>
<td>2</td>
<td>M/s Shree Ram warehousing, vill-Sogawas, tehsil-Mereta city, <strong>Nagour</strong>.- Unit-1</td>
<td>2352</td>
<td><strong>Private</strong></td>
<td><strong>Guar, Green Gram, Mustard</strong></td>
</tr>
<tr>
<td>3</td>
<td>M/s Shree Ram Warehousing, vill-Sogawas, tehsil-Mereta city, <strong>Nagour</strong>.- Unit-2</td>
<td>4500</td>
<td><strong>Private</strong></td>
<td><strong>Guar, Green Gram, Mustard</strong></td>
</tr>
<tr>
<td>4</td>
<td>M/s Permanand Paretha warehouse, vill- Harnawada, the,- Chhipa-barod, <strong>Baran</strong>.</td>
<td>990</td>
<td><strong>Private</strong></td>
<td><strong>Soybean, Spices, Urad, Green Gram</strong></td>
</tr>
<tr>
<td>5</td>
<td>M/s Pawan warehouse, vill- Govind Nagar road, tehsil-Nokha, <strong>Bikaner</strong>.</td>
<td>990</td>
<td><strong>Private</strong></td>
<td><strong>Guar, Green Gram mustard</strong></td>
</tr>
<tr>
<td>6</td>
<td>M/s Agrawal warehouse, vill- Sogawas, tehsil- Mereta city, <strong>Nagour</strong></td>
<td>2000</td>
<td><strong>Private</strong></td>
<td><strong>Guar, Green gram, mustard</strong></td>
</tr>
<tr>
<td>7</td>
<td>M/s K.C. Goel and Sons, vill- Badwa, tehsil Anta, <strong>Baran</strong>.</td>
<td>990</td>
<td><strong>Private</strong></td>
<td><strong>Soybean, Spices, Urad, Green gram</strong></td>
</tr>
<tr>
<td>8</td>
<td>M/s Dashmesh( Hardeep Singh) W/H, vill-2JJA, near Gurudwara satsang ghar, tehsil –Padampura, Sri Ganganagar</td>
<td>300</td>
<td><strong>Private</strong></td>
<td><strong>Mustard, wheat, jowar, Green Gram</strong></td>
</tr>
</tbody>
</table>

**At Mandi Level**
Most of the States and Union Territories have enacted Agricultural Produce Market (Regulation) Act. The reduction of loss of produce was aimed in the scheme of regulated market. The regulated markets developed modern market yard with necessary infrastructural facilities. The APMCs have constructed auction platforms for protecting the produce from rains and dampness. Godowns have been constructed so that the agricultural produce brought into the market should be stored safely by market committees. The produce is auctioned, weighed in the presence of producer/seller at the time of keeping the produce in the godown after grading and receipt is issued indicating the quality and weight of produce to be stored. The receipt is issued by the licensed general commission agents or brokers depending upon the case. The CWC, SWC and Co-operative societies have also constructed godown in the market yards.

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In most of the secondary and terminal regulated markets, central and state warehousing corporations also provide scientific storage facilities at prescribed storage charge and issue warehousing receipt against pledge of produce, which is a negotiable document for obtaining finance from the Scheduled Banks. Following are some Mandi Godown in Rajasthan:

Table 18: Mandi Godowns in Rajasthan for Moong

<table>
<thead>
<tr>
<th>Sr.no.</th>
<th>Mandi Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anoopgarh</td>
</tr>
<tr>
<td>2</td>
<td>Barmer</td>
</tr>
<tr>
<td>3</td>
<td>Beawar</td>
</tr>
<tr>
<td>4</td>
<td>Bhadra</td>
</tr>
<tr>
<td>5</td>
<td>Bijaynagar</td>
</tr>
<tr>
<td>6</td>
<td>Bikaner (Grain)</td>
</tr>
<tr>
<td>7</td>
<td>Chaksu</td>
</tr>
<tr>
<td>8</td>
<td>Deedwana</td>
</tr>
<tr>
<td>9</td>
<td>Gharana</td>
</tr>
<tr>
<td>10</td>
<td>Hanumangarh</td>
</tr>
<tr>
<td>11</td>
<td>Jaipur (Grain)</td>
</tr>
<tr>
<td>12</td>
<td>Jodhpur (Grain)</td>
</tr>
<tr>
<td>13</td>
<td>Kekri</td>
</tr>
<tr>
<td>14</td>
<td>Khajuwala</td>
</tr>
<tr>
<td>15</td>
<td>Kuchaman city</td>
</tr>
<tr>
<td>16</td>
<td>Loonkarnsar</td>
</tr>
<tr>
<td>17</td>
<td>Malpura</td>
</tr>
<tr>
<td>18</td>
<td>Nagaur</td>
</tr>
<tr>
<td>19</td>
<td>Nohar</td>
</tr>
<tr>
<td>20</td>
<td>Nokha</td>
</tr>
</tbody>
</table>

**Central Warehousing Corporation (CWC)**

It is the largest public warehouse operator in the country. Apart from storage, CWC also offers services in the area of clearing and forwarding, handling and transportation, distribution, disinfestation, fumigation and other ancillary services like safety and security, insurance, standardization and documentation. The CWC has also introduced a scheme, called the Farmers’ Extension Service at selected centres to educate farmers about the benefits of a scientific storage. The CWC is also operating custom bonded warehouses. These bonded warehouses are specially constructed at a seaport or airport and accept imported commodities for storage till the payment of customs duties by the importer of the commodities.

The Central Warehousing Corporation (CWC) is the largest public sector warehouse operator with their godown established in almost all the states of the country. At present, CWC have already established and operating more than 450 warehouses with a capacity of 93.25 lakh tonnes (as on 29/02/2004). The list of scientifically constructed warehouses of CWC which facilitate the farmers to store their produce safely and to derive the benefit of pledge finance during the period of glut situation in the markets is given in (refer Annexure 2).

**State Warehousing Corporations (SWC)**

Different states have set up their own warehouses in the country. The area of operation of the State Warehousing Corporations is district places of the state. The SWCs are under the dual control of the State Government and the CWC. State Warehousing Corporations (SWCs) were established in
different states under the purview of concerned state governments and constructed godown at distant places. The SWCs also provide storage facilities for green gram. (Refer Annexure 3).

Co-operatives
Cooperative storage facilities are provided to the producer at cheaper rates, which reduces the storage cost. These cooperatives also provide pledge loan against the produce and storage is more systematic and scientific than traditional storage. Financial assistance and subsidies are provided by Government organisations/banks to build cooperative storage. To meet the increasing need for storage capacity, the National Cooperative Development Corporation (NCDC) encourages construction of storage facilities by cooperatives, particularly at rural and market level.

Pledge Finance system
The farmers are often compelled to sell their produce immediately after harvest, when the prices are low Micro level studies indicate that distress sale by the small farmers account for about 50% of the marketable surplus. To avoid such distress sale, Government of India, promoted Pledge Finance Scheme through a network of rural godown and negotiable warehouse receipt system. Through this scheme, small and marginal farmers can get immediate financial support to meet their requirements and retain the produce till they get remunerative price.

According to the RBI guidelines, loan/advances upto 75 percent of the value of the produce stored in the godown can be advanced to farmers against pledge/hypothecation of agricultural produce (including warehouse receipts) subject to a ceiling of Rs. 5 lakh per borrower.

Such loan is given for a period of 6 months, which can be extended upto 12 months based on financing banks commercial judgement. The commercial banks/co-operative banks/RRBs provide credit to the farmers for the produce stored in the godown under this scheme. The banking institutions accept the godown receipts on its being duly endorsed and delivered to bank for pledge loan against hypothecation of produce as per RBI guidelines. Farmers are given freedom to take back their produce once the pledge loan is repaid. Facility of pledge finance is extended to all farmers, whether they are the borrowing members of Primary Agricultural Credit Societies (PACS) or not and the District Central Cooperative Banks (DCCBs) can directly finance individual farmers on the strength of the pledge.

Benefits of Pledge finance scheme
- This increases the retention capacity of small farmers, which consequently also enable farmers to avoid distress sale.
- This minimises farmer’s dependency on commission agents as the pledge finance provides financial support to them immediately after harvest period.
- Participation of farmers, irrespective of their land holding size, increases the arrivals in market yard throughout the year.
- This gives a sense of security to the farmers even if their produce not sold out in the market yard immediately.

India Meteorological Department: The service is provided by the India Meteorological Department, under the Ministry of Earth Sciences of Government of India. The IMD has set up nine agromet field units (AMFU) in the state. After these units get the forecast, they prepare agro advisory with the help of the experts. This advisory is sent to IMD where the bulletin is composed and then disseminated to farmers through SMS, radio, newspapers and other means.

Tata Consultancy Services (TCS), a Tata Group’s information and technology firm created a customizable Mobile Agro Advisory System called mKrishi that would address farmers’ specific
queries in real time. The name mKrishi combines “m” for mobile and “krishi,” which refers to agriculture in many Indian languages.

**Agmark app, Myagriguru** are some other applications that is helping farmers in getting updated market rates, weather report etc.

**CFTRI, Mysore:** CSIR-Central Food Technological Research Institute, abbreviated to CSIR-CFTRI, is one of the 40 national research laboratories in India, set up under the aegis of the Council of Scientific and Industrial Research (CSIR). The institute is engaged in research in the production and handling of grains, pulses, oilseeds, spices, fruits, vegetables, meat, fish, and poultry. The institute develops technologies to increase efficiency and reduce postharvest losses, add convenience, increase export, find new sources of food products, integrate human resources in food industries, reduce costs, and modernize.

**Indian Institute of Pulses Research, Kanpur:** IIPR is a government institute in Kanpur, Uttar Pradesh. It was established in the year 1983 by the Indian Council of Agricultural Research (ICAR) to carry out basic strategic and applied research on major pulse crops. The Institute develops appropriate production and protection technologies, production and supply of breeder seeds of improved varieties, demonstration and transfer of technologies and strategic coordination of pulse research through wide network of testing centers across the country.

**The Indian Society of Pulses Research and Development (ISPRD), Kanpur:** ISPRD was founded in 1987 with its headquarters at the Indian Institute of Pulses Research (IIPR), Kanpur to promote research and development on pulses (chickpea, pigeonpea, mung bean, urd bean, lentils, lathyrus, rajmash & pea and some other major & minor food legumes such as soyabean, groundnut, cluster bean, cow pea, horse gram, moth bean & the like) establish close association among pulse workers and dissemination of research results by publishing a quarterly periodical "Journal of Food Legumes".
Chapter 8- Gap & Constraint Analysis

8.1. As Perceived by Producers and Other Stakeholders

The producer and processor case illustrations and encapsulated below summarises some critical constraints.

**Producer Case Illustration**

A typical farmer in the region with about 1 hectare land under green gram cultivations as single harvest. The gross yield per acre is 8 quintal per ha. The market rate on sale is about Rs. 4500 per quintal or Rs. 45 kg or Rs. 36000 per ha. The cost of cultivation is about Rs 22110 per ha. Out of this about Rs. 6000 is cost of land preparation, seed cost is about Rs. 3600, fertilizer and pesticide cost is about Rs. 1560 per ha, weeding related (labour cost) is about Rs. 3600 and harvesting cost is and threshing cost is about Rs. 6600 per ha. Packing cost is about Rs. 500 per ha. Transportation cost to mandi is about Rs. 250 per ha- all totaling is around Rs 22110 per ha.

Varieties available in green gram are Naugar, Ajmer and Jaipur variety. This farmer is largely into Jaipur variety (C grade). Jaipur variety also has A and B grades but presently no facility for grading exists. Also there is no storage facility for farmers. Bunding facility has been facilitated under RACP through which soil conservation and water level increase have been realized. The scope of shed net for seed cultivation for tomato, onion, hot pepper etc is an option. Seed facilitation services are also requested as seed rates are on the higher side @ Rs 200 per bag. Also cost of pesticides like phuladon, merathin, and parathin is at significant cost. The price fluctuation in output is between Rs. 4000-4800 in a single year or over 20 percent. Combine harvester are used @ Rs. 3000 per ha saves on labour cost. In periods of good harvest yield is even 9 quintal per ha and in worst case scenario even 6 quintal per ha – largely monsoon dependent.

**Critical Constraints:**

- Fungal and pest attack during the cultivation.
- Occasionally, due to relatively lower prices prevailing in mandis in close proximity, farmers are forced to transport produce to distant mandis.
- Although producers are successful in storing green gram throughout the year, they follow the traditional methods of storage and grading rather than modern and scientifically proven methods.
- They do not have any centralized place/facility to store green gram at the village level.
- The risk of storage is high, as pest / moisture may lead to damages.

Based upon the critical constraints discussed with the farmers, who are the key stakeholders of the entire green gram value Chain, different areas of intervention pre-harvest and post-harvest stage have been suggested in the section 9.1.
**Processor Case Illustration**

**Expert Opinion:**

Mr. Gupta (President, Rajasthan Khadya Padarth Vyapar Sangh) is of the opinion that pulses (particularly, Green gram) and moth bean have significant potential. Apparently, Rajasthan produces about 8 lakhs TPA of Green gram, 4 Lakhs TPA of moth bean, 1.5 lakhs TPA of Urad, 17 lakhs TPA of Chana.

Mr. Goel (President, Rajasthan dal Miller’s Association) is of the belief that there are about 50 dal milling units in the region. The important mandis for green gram are Jodhpur and Nagaur. Processing units are clustered across Martha (Nagaur district) – 4 units, Bikaner – 15 and Jaipur – 20 units. There are some 50 SME processing units in the state.

The largest of the pulses processing units in Rajasthan is “Tirupati Industries” with a turnover of 100 crores. The other 49-50 odd SMEs are believed to have an average turnover of about Rs 20 crores. These units largely source their raw material from APMCs in Rajasthan which receives input from farmers in Rajasthan who produce Green gram @ about 5 quintals/hectare.

**Cost of Production and Value Arrivals:**

The 50 odd SME pulses processing units in Rajasthan apparently have average turnover of about Rs 20 crores each. A sample unit Pawan Dal Mill (operated by Mr. Goel) has a turnover of about Rs 20 crores. The unit has installed capacity of about 500 quintals per day but an effective operating capacity of 300 QPD. This implies that each such dal mill supports about 150 small and marginal farmers with holdings of about 1 acre each. The particular unit has investment of about Rs 3 crores in buildings and Rs 2 crores in Plant and Machinery.

**The constraints such typical processor faces in this trade are:-**

1- Despite being agro processing activity, there are no priority sector benefits/incentives
2- Fluctuating commodity prices

**Competitive Edge-**

- Right combination of personnel, machines-the total operating system
- Reputation based on quality, reliability, integrity and complete understanding of the market dynamics
8.2. SWOT analysis of the indicative Value Chain of Green Gram

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>• India is the world’s largest producer as well as consumer of green gram.</td>
<td>• Green gram productivity is less</td>
</tr>
<tr>
<td>• It produces about 1.5 to 2.0 million tons of Mung annually from about 3 to 4 million hectares of area, with an average productivity of 500kg per hectare.</td>
<td>• India is a net importer of mung. Imports are mainly sourced from Myanmar to meet the domestic demand. These imports have been hovering from around 0.5 to 1.5 lakh tonnes during the past few years.</td>
</tr>
<tr>
<td>• Green gram output accounts for about 10-12% of total pulse production in the country.</td>
<td>• Traditional package of practices in cultivation of Green gram</td>
</tr>
<tr>
<td>• Mung production in the country is largely concentrated in five states viz, Rajasthan, Maharashtra, Andhra Pradesh, Gujarat and Bihar which together contribute to about 70% of total Mung production in the country.</td>
<td>• Still Cultivated on marginal and degraded lands with more than 87% of the area being under rain fed conditions.</td>
</tr>
<tr>
<td>• Rajasthan and Maharashtra occupy the first two positions, contributing over 45% of green gram production in the country.</td>
<td>• Limited identification efforts for farmer leaders (entrepreneurs) and BOD at field level in Green gram Value Chain for capacity building</td>
</tr>
<tr>
<td>• Mung contains about 20-25% protein.</td>
<td>• Banks do not support individual farmers for crop loans etc.</td>
</tr>
<tr>
<td>• The plants are sometimes cut and ploughed into the soil to enrich soil nitrogen.</td>
<td>• High dirt content in harvested green gram</td>
</tr>
<tr>
<td>• Various products are marketed mung, mung dal chilka, mung dal whole etc.</td>
<td>• During good harvest prices may collapse and may lead to distress sale</td>
</tr>
<tr>
<td>• Large scope of innovation in terms of noodles/pasta, RTE Dal Khichdi etc.</td>
<td>• Processors lack awareness about special purchase license option to source directly from farmers/FPOs.</td>
</tr>
<tr>
<td>• Mung Besan flour is considered high in fiber and protein and is easy to digest</td>
<td>• No well-defined mechanism for procurement and marketing of green gram as is the case with Paddy or Wheat.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threat</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Option for intercropping in rainfed areas with sugarcane.</td>
<td>• Low productivity may reduce farmers’ interest to produce green gram.</td>
</tr>
<tr>
<td>• With growing demand for dal there is large scope for start-ups to be facilitated among the farmers of the PCs or individuals. Good processing opportunities for green gram value addition includes production of dal, flour, snacks, namkeen</td>
<td>• Natural calamity may impact production and hence productivity and profitability may decline.</td>
</tr>
<tr>
<td>• Productivity can be increased by development of improved varieties of seeds which can withstand weather aberrations like pest attacks etc.</td>
<td>• Taxation related policies (for example- proposed 5% GST on branded goods), liberal imports etc. affects the price levels.</td>
</tr>
<tr>
<td></td>
<td>• Processors operate on low profit margins and are also exposed to high speculations of prices in market also in increasing the probability of sickness.</td>
</tr>
</tbody>
</table>
• Farmer can be made aware of the modern production technologies
• Provision of cleaning grading pulse processing mills and other facilities like storage for farmers through the FCSC
• Development of alternate marketing channels for green gram procurement
• In terms of direct supply to SME and large processors, there is a scope to tie up with green gram producing farmers via FCSC to the big market players like Patanjali and Dal mill associations/ MSME
• Large scope of contract farming, buy back contracts, participation in traders etc.

- Lower prices in international markets may lead to higher imports by processors, also possible creation of deflationary trend in domestic markets.

8.3. **Key constraints in Green Gram crop**

**Production related constraints**

The farmers in the cluster follows local package of practices which are neither scientifically proven nor productivity boosters. This results in poor productivity which has direct impact upon farmer’s net earnings.

**Fluctuation in prices of seeds or other inputs:** Producers often face increase in cost of production of Green Gram due to fluctuation in price of seeds.

**Training of producer:** Farmers are not trained in the marketing system and lack knowledge about standard specifications and prevailing prices in mandis in vicinity as well as other key mandis. Proper training will improve their skill for better marketing of their produce. They should be trained on AGMARK standards, how to get market information and factors on which prices are determined. For e.g. size, shape, colour, moisture in grains.

**Post-Harvest related constraints**

There is lack of proper storage structure to keep the immediate harvest safe from moisture and pest/disease infestation.

**Non-Mechanized Harvesting:** Non-mechanized harvesting often leads to some percentage of post harvest losses due to manual handling procedures.

There is also lack of Primary processing facility except sun drying in Green Gram at farm level. Cost of transportation of carrying crops to market is very high.

**Inadequate storage facilities in rural areas:** Storage facilities in villages are found to be inadequate which contributes leads to distress sale. Due to lack of storage facilities, substantial quantity of commodity is also lost.

**Transportation facilities at producers’ level:** Due to inadequate facilities of transportation at the village level, producers are forced to sell Grain and pulses in the village itself to itinerant merchants or traders directly at low prices. Aggregation and negotiation with buyers is only possible if farmers have volume to trade and transport up to procurement centre.

**Unfavourable temperature/rains during harvest:** Too cold temperatures before harvest may lead to shrinking of seeds, whereas untimely and unfavorable rains before harvest may also lead to late harvest and also damage crop.
**Processing and market infrastructure related constraints**

Primary level processing units for green gram processing are negligible in the cluster. The farmer, therefore are deprived of the opportunity to get better value realization for the processed green gram compared to the raw one.

**Traditional system of marketing:** In the cluster, there is an absence of alternate channels of marketing. So farmers typically sell only through APMCs or village level traders.

**Lack of market intelligence services:** Farmers do not receive information on market prices. Some farmers sell crops through village level traders, because due to which they are not realising fair price.

**Lack of primary processing infrastructure:**

i. There is a non-availability of facilities for primary processing: cleaning, grading & sorting at the farm level.

ii. There is no practice and provision of producer level storage.

iii. There is acute lack of awareness among farmers regarding FAQ (Fair Average Quality) standards.

iv. Farmers do not practice the usage of basic equipment like moisture meter and weighing machine.

**Distant markets:** The nearest market from the cluster is the Kheruwala APMC that is 55 kms away. This leads to farm gate selling where farmers receive non-competitive prices for their produce.

**Fluctuations in prices:** Generally, the price of Green Gram goes down in the post-harvest period due to heavy arrivals in the market and later shoots up. Farmers in the catchment area do not have storage facility to store and they also don’t use a warehouse receipt system.

**Lack of marketing information:** Due to a lack of market information regarding prevailing prices, arrivals etc., most of the producers’ market grains and pulses in the Kheruwala Mandi without studying the price trends.

**Adoption of grading:** Grading of Green gram at the producers’ level ensures better prices to producers and better quality to consumers. At present there is no infrastructure available at the farmers’ level for primary processing.

**Malpractices in markets:** Many malpractices prevail in the markets of green gram i.e. incorrect weighing, delay in payments, high commission charges, delay in weighing and auction, different kinds of arbitrary deductions for religious and charitable purposes etc.

**Infrastructure facilities:** Due to inadequate infrastructural facilities available with the producers, traders, millers and at market level, the marketing efficiency is affected adversely.

**Long Supply Chain:** The existence of a long chain of middlemen also reduces the producer’s share in consumer’s rupee.

**Agri business policy related constraints**

**Contract farming:** Rajasthan has adopted a model APMC Act, 2007. In Rajasthan Contract farming of desired variety and quantity as per buyer’s/processor’s need, has been allowed. Buyer/processors may supply inputs and technical know-how and farmers may produce the crop for sale to buyers at an agreed price. However, this price shall not be lower than minimum support price and title of land shall remain with farmer. Produce will be purchased at buyer/processor’s business/factory place. But processors found less interested in registering under contract farming. As per the discussion carried out by Team ABPF with some of the processors regarding contract farming, the common issues and challenges are given below:

i. **Rule 5** – Each agreement shall be written on stamp paper of the value of Rs.100. This increases cost of procurement and procurement time.
ii. **Rule 9** – Separate registration form shall be filled for each agreement. Large amount of paper work can be reduced by group registrations or procurement directly from FPCs.

iii. **Rule 17** – In case the contract farming buyer fails or refuses to purchase the agreed quantity of the agriculture produce from the contract farming producer, he is to pay the amount of the difference between the agreed price and the actual sale price of the contracted produce in the market committee concerned to the producer. Mutual termination of contract should be allowed.

iv. **Rule 19** – The contract farming buyer need furnish an undertaking equal to 20% of the value of the contracted amount. This amount can be reduced and this will motivate big players to participate in contract farming.

### 8.4. Piestec Framework

#### Political
- Legislation required for FPC Formation

#### Institutional
- FPC model to be developed for strengthening farmers’ cause
- KVKs/State institutions to facilitate supply of inputs viz. HYV seeds, pesticides, etc. to farmers
- Training and handholding of farmers by institutions
- Contract Farming

#### Economics
- Sound economics green gram production i.e. net accrual to producers could be about Rs. 1750 per quintal.
- Net profit on primary processing (cleaning and grading) and direct sale to processors could fetch about 4.5%-5% additional.
- Value accruals are subject to commodity price fluctuations by up to even 20%.

#### Social
- Less labor-intensive crop
- Typically, small and marginal farmers in Rajasthan grow green gram at a very small scale and with little post-harvest facility at hand.

#### Technology
- Farm level FCSC for storage and primary processing; i.e. cleaning and grading
- FCSC may also facilitate Secondary processing like mini dal mill/flour mill/cattle feed unit

#### Environment
- Intercropping green gram with other crops is an environmental friendly option
- Green Gram not only fixes nitrogen in soil, improves soil nitrate content and saves fertilizer costs and increases yield in subsequent crops.
- Green Gram is generally grown in rain fed conditions and can be grown with minimum irrigation as well.

#### Competition
- Green gram is widely cultivated throughout the Asia
- India is a net importer of green gram and imports have been hovering from around 0.5 to 1.5 lakh tonnes during the past few years.
8.5. Impact of GST over Green Gram value chain:

The Goods and Services Tax is one indirect tax for the whole nation. GST is a single tax on the supply of goods and services, right from the manufacturer to the consumer. It will be levied at every stage of the product distribution chain by giving the benefit of Input Tax Credit (ITC) of the tax remitted in the previous stages. Therefore, the final consumer will bear only the GST charged by the last dealer in the supply chain, with set-off benefits at all previous stages. GST will replace all Central level taxes such as excise, service tax, custom duty as well as state level taxes like VAT, CST, entertainment tax among others.

Table 19: Tax Structure

<table>
<thead>
<tr>
<th>Transaction</th>
<th>New Regime</th>
<th>Old Regime</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sale within the state</td>
<td>CGST+SGST</td>
<td>VAT+ Central Excise/Service tax</td>
<td>Revenue will be shared equally between the Centre and the State</td>
</tr>
<tr>
<td>Sale to another state</td>
<td>IGST</td>
<td>Central Sales Tax + Excise/Service Tax</td>
<td>There will only be one type of tax (central) in case of inter-state sales. The Centre will then share the IGST revenue based on the destination of goods.</td>
</tr>
</tbody>
</table>

The impact on the Food Processing Businesses (with reference to Green gram):

- Branded pulses and flours deemed to be a registered brand under any law in the country, including the Copyright Act as on May 15, 2017, will attract Goods and Services Tax at the rate of five per cent. Under same, a mark or name on which actionable claim is available shall also be deemed to be a registered brand name.
- Many processors and traders across country have raised concern that this creates an undue advantage to unbranded products and distorts the level playing field concept. As unbranded products do not attract levy of tax, it may force processors to create new line of unbranded products. Since, good brands are generally a promise of good quality; the circumstance may lead to low focus on quality in future.
- On other hand, implementation of the GST will enable products to reach the consumer faster due to removal of state-level taxes such as Octroi and entry taxes which will significantly reduce the time and hassle of transporting goods across state borders.
- GST will also favour the National Agricultural Market on merging all the different taxation on agricultural goods will improve the marketing and virtual market growth.
- Because GST is a consumption tax, it will be levied only when food products are sold by the manufacturer and not when they are manufactured.
- The Confederation of Indian Industries (CII) has also in its representation called for a zero rate tax on products which have a rate of up to Rs. 10/- and Rs. 20/-. It also demanded that all packaged material used as inputs by the food processing industry should have a zero-percent rate.

Impact on Restaurants and Food Joints:

Service tax liability with the credit of input VAT on goods consumed will get submerged into GST and irrespective of goods and services, the credit of input will be available for adjustment against the output liability. This will further optimize the working capital of these restaurants and consumers can expect the superior quality of goods and services.

Please refer to Annexure 5 for product wise GST rates of Food Products.
Chapter 9 - Proposed Intervention and Investments

9.1. Intervention areas for Value chain strengthening

In the envisaged post-intervention re-structured value chain, channel 1 will have to be developed as alternate marketing channels where FCSCs play the role of an alternate private market yard and undertake basic primary processing (grading, sorting and packing) of Green gram (Apart from playing a role of facilitator to its members for institutional sales). In terms of other common infrastructure, Mini Dal mills, Mini flour mills or even mini Feed production plants may be pursed to provide 'job work based' services to members. In addition, an alternate marketing channel namely that of supplying to large distributors or retailers like Tata Rallis, Walmart, Patanjali may be developed.

The post intervention value chain map for Green Gram may be visualised as one with three production-distribution or activity-marketing channels: raw green gram, cleaned and graded green gram and value added products like dal, flour, etc. It is also envisaged that PCs of producers with FCSCs are evolved. Such FCSCs undertakes storage, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring, facilitating B2B connectivity etc. These could help in increasing net value accruals to farmers by about 5-15%. Farmers' income from green gram cultivation may be enhanced.

In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of producer motivation. There is also need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors. There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field-level. In this regard, it may be appropriate for ABPF to enable formation of FPCs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC like schemes may be explored. The RACP and line departments need also work in coordination with NGO/service providers and the KVK etc. on high moisture content in harvested green gram, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage and drying at farm level. The storage facility may be also therefore established as part of FCSC with assistance under the project. There is also need for awareness seminars and B2B meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively
aggregated into FPOs/ FPCs). Scope for re-orientation of Agri-marketing policy with reduced mandi taxes on
direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

**Table 20: Proposed intervention plan with stakeholders matrix for value chain of Green Gram**

<table>
<thead>
<tr>
<th>S.no</th>
<th>Stakeholder</th>
<th>Roles &amp; Responsibilities</th>
<th>Pre-intervention Constraints</th>
<th>Post Intervention Action</th>
<th>Action By</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Farmers</td>
<td>- Land Preparation</td>
<td>- Limited awareness of farmers</td>
<td>To promote high yielding and processing friendly varieties as well as Farm Information Dissemination through District level exhibition, Kisan Melas, Printed materials, electronic media.</td>
<td>Agriculture University, Agriculture Research Institute &amp; Station, Seed Companies, Extension team of RACP</td>
<td>Y1Q1-Y1Q2 (6 months after registration of FPC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Cultivation of crops</td>
<td>- Availability of improved &amp; good quality varieties of green gram among producers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Harvesting of crops</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- Sell the raw produce</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Farmers are trained with production lead extension approach till date</td>
<td>Market led extension approach is necessary to increase farmers income.</td>
<td></td>
<td>Extension team of RACP and Processors (through ABPF)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Traditional package of practices followed by farmers</td>
<td>Increasing Research-Extension–Farmers linkages by organizing farmers–scientists interaction, Field Days and Kisan Goshties, Farmers' Field Schools.</td>
<td></td>
<td>Extension team of RACP, Scientists from Agriculture universities and</td>
<td></td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Contractual harvesting of green gram</td>
<td>Setting up alternate channel to sell directly from FPC to processor or large retail shops.</td>
<td>ABPF agribusiness experts</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>During harvesting time, prices collapse and hence storage/pack house option could help reduce distress sale.</td>
<td>Storage facility for farmers as part of FCSC</td>
<td>Large Processor and ABPF</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Weather dependent drying of green gram seeds</td>
<td>Setting up of scientific and artificial drying systems as part of FCSC</td>
<td>ABPF, RACP</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Due to inadequate facilities of</td>
<td>Provision of Pick-up van as part of FPC services to the farmers.</td>
<td>ABPF, RACP</td>
<td></td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
<td>Action By</td>
<td>Timeline</td>
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<td></td>
<td>transportation at the village level, producers are forced to sell local merchants or traders directly at low prices</td>
<td>To make farmer aware about quality parameters of green gram for processing like value added products; Cleaning &amp; Grading facilities as part of FCSC/s. Additionally, mini dal mill plants could also be established as part of FCSC/s</td>
<td>RACP, SPs with inputs from ABPF</td>
<td>Y1Q3-Y2Q2 (6 months after registration of FPC)</td>
</tr>
<tr>
<td>2</td>
<td>Processors</td>
<td>• Process the raw produce</td>
<td>• Limited adoption of direct</td>
<td>• Setting up alternate channel to sell directly from PC to processor or Large Processor/Buyer and ABPF, RACP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
<td>Action By</td>
<td>Timeline</td>
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<td>-----------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Value addition</td>
<td>PROCUREMENT AND CONTRACT FARMING</td>
<td>large retail shops.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Packaging of value added product</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Limited processed product available in the market which limits the marketing potential of the commodity</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>• Many existing processors and budding entrepreneurs are not aware of schemes of the Govt Including CLCSS, cluster Development scheme or “Sampada” for</td>
<td>• Facilitate the entrepreneur development to set up small scale processed products like cleaned or graded green gram and dal/flour</td>
<td>ABPF, RACP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Awareness seminars for processors</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.no</td>
<td>Stakeholder</td>
<td>Roles &amp; Responsibilities</td>
<td>Pre-intervention Constraints</td>
<td>Post Intervention Action</td>
<td>Action By</td>
<td>Timeline</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>technology upgrading.</td>
<td></td>
<td>RACP</td>
<td>Y1Q1-Y2Q4</td>
</tr>
</tbody>
</table>
| 3    | NGO         | • Extension services to farmers  
            | • Disseminate RACP Schemes to the farm level  
            | • Distribution of seeds and farm kits as per various schemes  
            | • Hand holding support to the farmers regarding | • Training of NGO field staff on market led extension services  
            | • Lack of skilled personnel  
            | • Poor field-farm level coordination  
            | • Outdated extension activities  
            | • Lower level of interaction and adoption of RACP/govt. schemes | • Business planning training  
            | • Monthly/Fortnightly review meetings with RACP  
            | • Feedback of farmers from service area  
            | • Exposure visits of NGO staff to successful FPCs | • RACP  
            | • ABPF  
            | • KVKs |         |
| 4.   | RACP        | • establish the feasibility of sustainably increasing agricultural | • Lack of clarity on the form of FPC-Cooperative or FPC | • Create basic understanding among the RACP PMU staff about concepts of FPC  
            | • Clear understanding on | • ABPF  
            | • RACP  
            | • Line staff  
<pre><code>        | • NGO |         |
</code></pre>
<table>
<thead>
<tr>
<th>S.no</th>
<th>Stakeholder</th>
<th>Roles &amp; Responsibilities</th>
<th>Pre-intervention Constraints</th>
<th>Post Intervention Action</th>
<th>Action By</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>productivity and farmer income</td>
<td>Selections of capable leaders for the proposed FPO</td>
<td>fundamental differences between FPC &amp; Cooperative</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>integrate agriculture water management and agricultural technology, Establish farmer organizations (FPCs) and market innovations in selected locations</td>
<td>Low level of awareness among the PMU staff and farmers regarding the concept of FPC</td>
<td>Create market linkages by bringing more big players and processors to the cluster</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Poor or no Market linkages of the value chain crops in clusters</td>
<td>Conduct training of the potential farmer leaders about FPC and its functioning</td>
<td>•</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lack of active NGO staff deployed in the cluster</td>
<td>Capacity building training of the NGO staff regarding the extension services to be provided to the farmers</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>
In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of dissemination of benefit of going in for new high yielding varieties. Apt amendments in the contract farming Act could further facilitate this initiative.

Traditional package of practices results in lower yield as against potential. There is therefore need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors.

There have been limited efforts in capacity building of farmer leaders (entrepreneurs) and BODs at the field-level. In this regard, it may be appropriate for ABPF to enable formation of FPOs to meet minimum scale requirements for upgrading as well as developing alternate market channels. Also, bank linkages under KCC scheme etc. may be explored. The RACP and line departments need also work in coordination with the NGO/service providers and the KVK etc. on high dirt content in harvested green gram, harvesting of immature grains and inadequate post-harvest infrastructure facilities for storage. The storage facility may be established as an FCSC with assistance under the project.

There is also need for awareness seminars and b2b meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri-marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

The process of formation of Farmer Producer Company, its roles and responsibilities along with the details of the Farmers’ common facility centre is discussed in the section 9.2.2.

9.2 Proposed Post Intervention Value chain map of Green Gram

9.2.1. Post intervention Value Chain Map: Green Gram

In the envisaged post-intervention value chain of green gram, FPCs/farmer associations could bypass the APMC and commission agents and undertake the value chain activities like aggregation and operate common facilities (FCSCs) undertaking cleaning and grading, drying, storage, packaging and transportation. The cleaned and graded produce can be directly sold to processors leading to higher realization by eliminating middlemen and delivery of value added raw material. Apropos, the commodity may be supplied to SME as well as large processors like Tata, Patanjali, etc.

The post intervention value chain map for green gram may be visualised as one with three production-distribution or activity-marketing channels: cleaned and graded green gram and value added products like dal and flour. It is also envisaged that PCs of producers with FGSCs is evolved. Such FCSCs undertakes storage, grading and sorting and packaging of produce activity. These FCSCs may offer other related services in terms of input facilitation, custom hiring, facilitating B2B connectivity etc. The gross profit margin which would be directly transferred to the farmers by the virtue of the FPC could be 5-15%. This obviously is dependent on the level of value addition (i.e. cleaning and grading, dal milling/ flour milling) and pursuing of different services. Also, as the FPC would supply the good quality seeds by tie up with the large input players, the farmer would get

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18 Further value addition (dal milling, flour milling, feed milling) would lead to additional income: additional (about) 2% net profit (in general) for each additional business. Also, activities like input facilitation, custom hiring of equipments will generate additional income.
HYV at their doorstep. It would positively impact their cost of cultivation, bringing it down significantly.
Figure 15: Proposed Post intervention Value Chain map of Green gram
In terms of intervention on the production front, productivity is low which is also partly because of inadequate availability of high yielding varieties. There is, therefore, scope for intervention by the way of introduction of new high yielding varieties in the region. Line departments under RACP and NGO service-provider may support the initiatives in terms of dissemination of benefit of going in for new high yielding varieties. Traditional package of practices results in lower yield as against potential. There is therefore need to train farmers on the best package of practices. This could also be undertaken by stakeholders like large processors.

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There is also need for awareness seminars and B2B meets amongst processors and producers on the options for Special Licence and to source directly from producers (effectively aggregated into FPOs/ FPCs). Scope for re-orientation of Agri-marketing policy with reduced mandi taxes on direct procurement; and related capacity building interventions for farmers is a necessity that may be facilitated by the ABPF.

The yield loss which is mentioned in the Post intervention value chain map of green gram occurs at various stages of entire value chain starting right away from the harvest to storage, transportation, processing and distribution for wholesaling and retailing. Following table describes the post harvest losses to be expected at various stages along with the reasons and interventions to reduce the yield loss:

**Table 21: Post Harvest loss and interventions for Value chain of Green Gram**

<table>
<thead>
<tr>
<th>Stage of value chain</th>
<th>PH loss (in %)</th>
<th>Reason</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvesting by farmers</td>
<td>4-5</td>
<td>• Lack of mechanised harvesting</td>
<td>• Training on GAP and advance PoP to farmers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Random sowing methods</td>
<td>• Setting up storage structure in the CFC of FPC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Lack of appropriate storage structure on farm</td>
<td></td>
</tr>
<tr>
<td>Purchase by Trader/Processor</td>
<td>0.25-0.5</td>
<td>• Poor storage structure and inefficient handling of harvested produce</td>
<td>• Centralized aggregation from farmers at CFC of FPC</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Loss during transportation due to loose packaging and poor handling</td>
<td>• Packaging unit under CFC</td>
</tr>
</tbody>
</table>
9.2.1. Interventions through FPC in the Green Gram value chain crop: 

Introduction to FPC Model

Aggregation is the proposed solution of the constraints farmers are facing at present. It is proposed to form Farmers Producers’ Company by bringing farmers together in the form of voluntary groups of about 15 to 20 active farmers and federating 20 to 25 such groups into a Producer Company. These Producer Companies will be functioning on behalf of member farmers and will strive to undertake a range of activities which will result in added value accruals to farmers and value to farmers produce. To form a producer company, producer groups will be mobilized (in some cases, this initiative may have already been completed by NGO’s).

It is envisaged that an elected committee of members of Producers Groups will form a management committee and oversee the performance of an incentivized manager/CEO. The manager will be trained in technical issues of post-harvest management, marketing and in operating a transparent accounting system. The ABPF will support the operation of the Producer Company, and accelerate the cross learning of best practices.

FPC Development Approach

The FPC development approach may be viewed as depicted below:

| Processing | 2-2.5 | • Use low end and obsolete technologies  
| | | • Mismatch of capacities of various machine lines  
| | | • Set up primary processing units for FPC  
| | | • Support and guide agri-entrepreneurs for setting up modern and high end machines  
| Distribution to wholesalers/retailers | minimal | • Poor handling of value added product  
| | | • Inefficient packaging of product  
| | | • Improper storage facility  
| | | • Lower shelf life of product  
| | | • Support in storage facility through govt. warehouses  
| | | • Efficient packaging to prevent leakage and improve shelf life  

Following are the steps to be followed for formation of the FPC:

- **PRI of the MTG**: The MTGs will be made aware on the FPC model through PRI and individual farmers will be motivated to join the FPC as shareholder through respective MTGs.

- **Initial discussions with MTG leaders**: After PRI is done, initial discussion will be done with the MTG leaders for further orientation on FPC concept.

- **Identification of MTG leaders**: MTG leaders who show inclination to the concept will be selected in the executive committee for FPC formation.

- **Resource mobilization and FPC planning**: The executive committee will meet 2-3 times to plan further activities of FPC viz. crops, strategy for business etc.

- **Election of BoD and share collection**: 10-12 BoD will be identified along with 2-3 expert directors’ one each from Agri, Horti, AH and WS dept. The BoD will decide on share value and initiate collection of share through MTG leaders.

- **FPC registration**: Following identification of FPC BoD, registration will be done. This may take 1-2 months as DIN no of BoD has to be generated first. Care should be take that all elected BoD should have PAN no so that there is no delay in paper formalities for registrations.

- **FPC business**: Following registration of FPC, ABPF will prepare business plan for the FPC and facilitate market linkage for input and output.

- **Setup of processing/financing**: ABPF will further facilitate establishment of processing unit setup along with feasibility studies and planning business linkage with market players.

**Policy and Management**
A FPC will function within the overall policy and regulatory framework as per the Producer Company Act. The management of a FPC will vest with the elected Board from amongst the members. The provision about constitution of managing committee will be made in the byelaws. The management of FPCs will be by an elected Board of Directors. Therefore, the representatives of farmers will actually oversee and manage the affairs of a FPC.

The selection criteria for membership of FPC may be viewed as follows:
1. A member will express his willingness to become a member of MTG.
2. A member will actively participate in all functions and activities of MTG
3. A member will contribute his equity to the FPC
4. A member will bring all or part of his produce to the FPC for sale.
5. A member will purchase all or part of his farm inputs through the FPC.
6. A member will produce and prepare his produce for marketing as per directions of FPC.
7. A member will contribute his share to the Producer Association as upfront payment for the business development plan of a FPC as needed.
8. A member will contribute his share to the Producer Company towards the reserves of FPC as needed.

Illustrative list of components of a common facility of a Producer Company (Food Grain)
- Godown for storage, drying platforms
- 2-3 MT per hour grain cleaning, grading, and packing machinery with shed
- Additional need based Agricultural Equipment
- Computer with internet connectivity for market information
- Display Board with Accessories
- Auction Hall
- Input Suppliers Shops
- Toilets
- Drinking water & Electricity

Note: Though the illustrative infrastructure proposed is shown in the above tables, the actual infrastructure to be developed will be need based and on participative consultation process.

Typically, start-up may be involved in secondary and tertiary processing activities while FPO’s may be involved in post-harvest and primary processing activity. In many cases, start-up may emerge firm within FPO members.

The evaluation of success should be evaluated on the parameters as under:
I. PCs operating without financial support by the end of 36 months.
II. The PC operates with a reserve fund to cover short term cash flow deficit and with potential for reinvestment in various activities
III. The PC has an effective governing structure.
IV. The PC has a transparent accounting system.
V. The PC can function as a working example for other farmer organizations to observe and learn from.
VI. Contribution towards increasing farmers'/members incomes.

FPC Revenue model
The revenue model for typical FPCs may be viewed in terms of revenue from:
1. Input facilitation services (this could imply revenue by virtue of service such as dealership/distributorship for seeds, pesticides or fertilizers). About 50% of the dealer’s discount may be perhaps is retained by FPC and 50% be passed on to FPC farmer member as to reduce their input costs.

2. Processing and storage services through FCSCs to be offered to FPC members and other providers in the region and user/service change collected (typically) at perhaps the rate of 1 to 3 percent of value of commodity.

3. Marketing service may be offered in terms of facilitating charges typically @ between 1-2 percent of sales value.

4. MSP facilitation service in terms of facilitating procurement and supply to NAFED/SFAC etc. after, a 1 percent service charges is levied for such activity by FPCs.

5. NCDEX related farmers trading may be facilitated by FPCs as a risk hedging option and user charges collected at a negotiated rate with members.

6. Custom hiring services may be provided either through tying up with service providers or including equipment as part of FCSC.

Working capital service would be in terms of FPC providing and marketing of produce from member farmers. Here, the FPC may retain the price spread as service charge.

9.3. Conclusion

This value chain analysis of green gram clearly brings out that unlike any other enterprise, agriculture is critically dependent on external factors like the bounties of nature for its success; be it unseasonal rain, hailstorm, delayed monsoon, less rain, no rain, or excess rain, all of which makes agriculture a high risk and vulnerable proposition. This perpetual environment of high risk and vulnerability has significantly lowered farmers’ confidence and suppressed their entrepreneurial instincts as was amply reflected in the discussions held over cluster level meetings.

Till date, farmers have benefitted mainly from government’s input driven schemes while market access interventions such as mandis have created more barriers (middlemen) than benefits and resulted into market inefficiencies that eventually exploited farmers. Despite being at the receiving end of market barriers and inefficiencies for generations, individually, small farmers may perhaps never muster enough strength to overcome market challenges. In such a scenario, the intervention of establishing Farmer Producer Companies in the clusters has potential to unleash their suppressed energies and to promote rural entrepreneurship. It would encourage farmers to collectively delve into market operations to compete and design specific market solutions such as aggregation and sales of produce, operate custom hiring and composite input sales centres.

For the farmer, increase in input costs, without corresponding increase in output prices, has rendered agriculture unviable. And, in the absence of any other locally available alternate livelihood options farmers cannot even move away from agriculture. Thus, RACP along with the market driven intervention of ABPF also aims towards integration of farmers and help them join hands for a collective cause, assist them to move up the agriculture value chains as to actively participate in market functions, an unexplored but lucrative territory for them so far. This would spur vertical business integration and diversify their market portfolios to reduce their vulnerabilities.

Value chain actors or stakeholders decide sale prices of their produce/products and compete effectively in the markets whereas farmers often depend on Minimum Support Price (MSP) fixed by
government agencies to sell grains. Trader’s cartelisation ensures that MSP becomes the Maximum Gain Price (MGP) fetched by farmers, further squeezing their revenues. The end result has been a declining contribution of agriculture to the national economy. It is also true that given farmers’ inability to deal effectively with market forces, in the absence of MSP, farmers would have been possibly in an much worse off situation.

Hence, suggested interventions in context of Green gram could lead to remarkable change in their value realization at various stages. In nutshell, inputs facilitation by FPC will enable farmer members to purchase inputs directly from company, also ensuring discounts and better rates of inputs leading to lowering of cost of production/cultivation. In this context, FPC will also be able to monitor the right kind and quality of inputs (for example, recommended high yielding and processing friendly seed varieties, etc). Similarly, services like custom hiring of farm implements could be availed by FCSC, which will ensure easy availability of equipments and machinery at lower than market rates. In terms of primary processing, cleaning and grading facility at FCSC will enable member farmers and others in cluster to clean and grade their green gram produce and sell directly to large processors and also participate in government procurement of green gram through NAFED, etc. It will enable farmers and FPC to eliminate the long chain of middlemen and in turn get the higher realization for their value added produce. The FCSC may also house mini dal milling and mini flour processing unit which will further enable transacting directly with processors or even large retailers. In this context, sales facilitation services by FCSC will enable direct linkage with large buyer ensuring better remuneration and large orders. Storage facilities at FCSC will ensure that farmers need not distress sell their produce and hold same for a longer period. Importantly, based on mix of services being offered by FPC (i.e. input facilitation, primary/secondary processing, custom hiring of farm implements, sales facilitation, etc), the value realization to FCSC and farmers could be in the range of 5-15%.

The major role of ABPF- GT would in this circumstance also be to carry out capacity building initiatives of the potential leaders (BoDs) of the FPC, NGO staff and PMU staff line, conducting value chain studies of the crops (market led), plan interventions to improve the returns to the farmers in the 17 project clusters, develop the business plan for registered producer companies in clusters, support and assist agri start-ups in the region, and thus develop overall market linkages. The formation of FPC supported by RACP ABPF, local NGOs and facilitation centres like KVKs, provides the much needed opportunity to farmers to favourably and positively change their value realization in near future.
References

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8) Agmarnet; Post harvest profile of green gram, Department of agricultureand cooperation) directorate of marketing and inspection branch head office nagpur – 440001(http://agmarknet.nic.in/Greengram_profile.pdf) (retrieved on April 7,2017)
10) Farmers’ Portal; State wise list of CWC Godowns (http://farmer.gov.in/CWC_Link.aspx) (retrieved on April 7,2017)
12) Table 8: GNATT Chart Seasonal Availability (http://www.commoditiescontrol.com/eagritrader/staticpages/index.php?id=89 (retrieved on April 7,2017)
13) Table 7: Varieties in different states (http://www.ikisan.com/tg-greengram-varieties.html)
14) Table 11: http://agmarknet.nic.in/Greengram_profile.pdf (retrieved on April 7,2017)
15) Acknowledging inputs from RACP officials, related producers, processors, industry associations, NGOs, ATMA, Dept of Agriculture and Dr. Arjun Verma, Agronomist, KVK Jhalawar.
# Annexure 1: Stakeholders’ consulted over the study

<table>
<thead>
<tr>
<th>Producers</th>
<th>Processors</th>
<th>Traders</th>
<th>Government agencies</th>
<th>Others</th>
</tr>
</thead>
</table>
Annexure 2: List of Central Warehousing Corporation (CWC) Warehouses in Rajasthan

<table>
<thead>
<tr>
<th>Warehouse</th>
<th>Project Description</th>
<th>Manager</th>
<th>Phone</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>BHIWADI</td>
<td>C/o Jaquar &amp; Company Pvt. Ltd., SP-496, RIICO Inld Area, Bhiwadi – 301019</td>
<td>A. C. Yadav</td>
<td>01493 297825</td>
<td>4356</td>
</tr>
<tr>
<td>BARAN</td>
<td>Spl. No. 01 ,RIICO Indi Area, Baran Road, Baran</td>
<td>V. K. Jaiswal</td>
<td>9460079493</td>
<td>5000</td>
</tr>
<tr>
<td>BHARATPUR</td>
<td>Plot No. G-162 to 165 &amp; F-166 to 171, Brij Ind. Area, Behind Nafed Plant, Phase-II, Hathni Road, Bharatpur</td>
<td>Devendra Prakash</td>
<td>05644-228654</td>
<td>9674</td>
</tr>
<tr>
<td>BIKANER</td>
<td>Behind Sabzi Mandi, Pugal Road, Unit-I, Bikaner</td>
<td>Prit Pal</td>
<td>0151 2212399</td>
<td>25400</td>
</tr>
<tr>
<td>BIKANER-II</td>
<td>Opposite Govt. Engineering College, Karni Industrial Area, Ph.II Bikaner-334004</td>
<td>R. D. Punia</td>
<td>0151 211003</td>
<td>5000</td>
</tr>
<tr>
<td>SRIGANGANR-I</td>
<td>Near Power House Sriganganaga-335001</td>
<td>S.S. Brar</td>
<td>0154 2440107</td>
<td>25200</td>
</tr>
<tr>
<td>Warehouse</td>
<td>Project Description</td>
<td>Manager</td>
<td>Phone</td>
<td>Capacity</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>---------------------</td>
<td>----------</td>
</tr>
<tr>
<td>SRIGANGANGR-II</td>
<td>Udyog Vihar Plot No. E-194 to202 Sriganganaga-335001</td>
<td>N.K. Chabra</td>
<td>0154 2494403</td>
<td>10000</td>
</tr>
<tr>
<td>KESARISINGHPUR</td>
<td>C/o ARDC Godown,Mizewali Road,Kesrisinghpur Distt.Srigangar</td>
<td>Dhanwat Singh</td>
<td>01501-233710</td>
<td>10176</td>
</tr>
<tr>
<td>HANUMANGARH TOWN</td>
<td>C/o FCI, Opp. Railway Station, Hanumangarh Town</td>
<td>K. D. Dhiman, FCI</td>
<td></td>
<td>13262</td>
</tr>
<tr>
<td>HANUMANGARH-I</td>
<td>Sector - 8, New Mandi, Hanumangarh Junction, Hanumangarh</td>
<td>J. R. Sharma</td>
<td>01552 260602</td>
<td>21200</td>
</tr>
<tr>
<td>HANUMANGARH-II</td>
<td>RICCO Phase-II, Opposite RICCO, Water Works, Hanumangarh</td>
<td>Bhart Bhushan</td>
<td>01552 211794</td>
<td>15000</td>
</tr>
<tr>
<td>TIBBI</td>
<td>10, GGR, Hanumangarh Road, Tibbi, Distt. Hanumangarh</td>
<td>Anupam Kumar</td>
<td>01539 224111</td>
<td>1000</td>
</tr>
<tr>
<td>SITAPURA-I</td>
<td>Plot No.SPL-1296,EPIP Sitapura, Ind. Area, Jaipur-302002</td>
<td>S.K. Sharma</td>
<td>0141 2771710 , 2770227</td>
<td>14870</td>
</tr>
<tr>
<td>SITAPURA-II</td>
<td>Plot No.SP-1,RIICO Industrial Area,Sitapura, Jaipur</td>
<td>Y.K. Dubey</td>
<td>0141 2770223</td>
<td>11729</td>
</tr>
<tr>
<td>KOTPUTLI</td>
<td>Near Cement Factory,Vill.-Ramsinghpura Gopalpura Road,Kotputl, Distt. Jaipur.</td>
<td>Desh Raj</td>
<td>01421 215112 97</td>
<td>5000</td>
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<tr>
<td>JHUNJHUNU</td>
<td>Plot No. SP-287 RICCO Industrial Area,</td>
<td>Raghunath Singh</td>
<td>01592 250138</td>
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<tr>
<td>SURAJGARH</td>
<td>Bhuana Road, Surajgarh-333029</td>
<td>Rampal Singh</td>
<td>01596 2238349</td>
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<tr>
<td>KOTA I</td>
<td>Ind. Area DCM Road, Nr New Grain Market Kota-324007</td>
<td>S N Meena</td>
<td>0744 2363638</td>
<td>36830</td>
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<tr>
<td>KOTA II</td>
<td>Indraprasth md. Area, Road,No. 1, Near Daknia Railway Station Kota-324005</td>
<td>S.S.Meena</td>
<td>0744 2438019</td>
<td>49300</td>
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<td>Warehouse</td>
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<td>Manager</td>
<td>Phone</td>
<td>Capacity</td>
</tr>
<tr>
<td>-----------------</td>
<td>--------------------------------------------------------------------------------------</td>
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<td>---------------------</td>
<td>----------</td>
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<tr>
<td>KOTA III</td>
<td>Plot No. SP-1, Kuber Ind. Area, Ranpur, Kota III</td>
<td>S N Panchal</td>
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<td>25000</td>
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<td>RAMGANJ MANDI</td>
<td>Khairabad Road, Ramganj Mandil Distt.-Kota</td>
<td>OP Mudgil</td>
<td>07459 22264</td>
<td>9893</td>
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<td>NAGAUR</td>
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<td>R.S. Mathur</td>
<td>01582 241002</td>
<td>7401</td>
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<td>PARABATSAR</td>
<td>C/o ARDC Godown, Near Old Rly. Station, Parbatsar, Distt. Nagaur</td>
<td>Ram Behari</td>
<td>9460462881</td>
<td>28093</td>
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<td>SIKAR</td>
<td>Jagmalpura, Via-Katrathal, Post-Bhadwasi,Sikar-33200 1</td>
<td>Nand Lal Verma</td>
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<td>SRIMADHOPUR</td>
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<td>Kishore Prasad</td>
<td>01575 251699</td>
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<td>DEOLI</td>
<td>C/o Jupiter Metal Pvt. Ltd., NH—12, Deoli Distt : Tonk</td>
<td>Kailash Narayan</td>
<td>01434-239249</td>
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<td>FATEHNAGAR</td>
<td>MOR Mills Product, Plot No. H-49 Road No.2, RICCO Indl Area, Fatehnagar-313205</td>
<td>V. P. Singh</td>
<td>02955-220411</td>
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<td>Central Warehouse</td>
<td>Opposite Krishna Dharma Kanta, Udaipur By Pass, Beawar, Distt. Ajmer</td>
<td>Raj Raj Kumar Sharma</td>
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<td>Central Warehouse</td>
<td>Katori Waia Tibara, Near Water Works, Tizara Road, Alwar</td>
<td>Rajendra Prasad</td>
<td>1442731026</td>
<td>8133</td>
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<td>Central Warehouse</td>
<td>Village MOR, Kushalgar Distt. Banswara.</td>
<td>D.C. singh</td>
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<td>Central Warehouse</td>
<td>Plot No.G-162 to 165,F-166 to 171, Behind NAFED Plant, Phase-II, Brij Industrial Area, Hahteni Road, Bharatpur-321301</td>
<td>N. S. Meena</td>
<td>5644228654</td>
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Annexure 3: List of State Warehousing Corporation (SWCs) in Rajasthan

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<tr>
<th>Sr. No</th>
<th>District</th>
<th>Name of Warehouse</th>
<th>Warehousing Capacity</th>
<th>Utilization including Reservation</th>
<th>Percentage Utilization</th>
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<td>Own Constt.</td>
<td>Other than own Constt.</td>
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<td>Sr. No</td>
<td>District</td>
<td>Name of Warehouse</td>
<td>Warehousing Capacity</td>
<td>Utilization including Reservation</td>
<td>Percentage Utilization</td>
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<tr>
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<td>Own Constt.</td>
<td>Other than own Constt.</td>
<td>Total</td>
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<td>Churu</td>
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<td>32. Lalsot</td>
<td>1260</td>
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Annexure 4: Recommended Varieties of Green gram grown in different parts of India

<table>
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<tr>
<th>Name of State</th>
<th>Recommended Varieties</th>
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<tbody>
<tr>
<td>Rajasthan</td>
<td>R 288-8, D 66-26, RS 4, Jawahar 45, Mohini (S-8), T 44, Pusa Baisakhi, PS 16, Pant Moong 3, Pusa 105, ML 37.</td>
</tr>
<tr>
<td>Assam</td>
<td>T 44, Kopergaon, PS 16, K 851, PS 7, PS 10, Pusa Baisakhi.</td>
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<tr>
<td>Delhi</td>
<td>Pusa Baisakhi, Mohini (S-8), PS 7, PS 10, PS 16, Pusa</td>
</tr>
<tr>
<td>Bihar</td>
<td>BR 2, Sunaina, Amrit, Pusa Baisakhi, PS 16, PS 7, PS 10, T 51, PDM 54 (Summer &amp; Kharif) PDM 11 (Spring), Pusa Baisakhi</td>
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<tr>
<td>Gujarat</td>
<td>Gujarat 1, Gujarat 2, Pusa 105, Sabarmati PS 16, ML 337, PDM 11 (Spring), K 851.</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>Shining Mung No.1, PS 16, PS 7, PS 10, K 851, Pusa Baisakhi</td>
</tr>
<tr>
<td>Haryana</td>
<td>Varsha, PS 7, PS 10, Pusa 105, Pant Moong 1, Pant Moong 3, ML 5, T 44, PS 16, K 851, G 65, S-9, ML 267, ML 337, Pusa Baisakhi</td>
</tr>
<tr>
<td>Jammu &amp; Kashmir</td>
<td>T 44, Pusa Baisakhi, PS 16, PS 7, PS 10, PDM 34</td>
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<tr>
<td>Karnataka</td>
<td>Jawahar 45, Pusa Baisakhi, PS 16, Kopergaon</td>
</tr>
<tr>
<td>Kerala</td>
<td>Co 4, Pusa Baisakhi, Mohini (S-8)</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>Khargaon 1, Krishna 11, Jawahar 45, Kopergaon, Mohini (S-8), PS 16, Pant Moong 3, Pusa 105, ML 337, PDM 11 (Spring).</td>
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<td>Maharashtra</td>
<td>Jalgaon 781, Kopergaon, Pusa Baisakhi, PS 16, ML 131, Pusa 105, TAP 7, ML 337, PDM 11 (Spring)</td>
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<tr>
<td>North Eastern Hill Region</td>
<td>Pusa Baisakhi, PS 16, K 851, PS 7, PS 10</td>
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<td>Orissa</td>
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<tr>
<td>Punjab</td>
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</tr>
<tr>
<td>Tamil Nadu</td>
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</tr>
<tr>
<td>Uttar Pradesh</td>
<td>Type 1, Type 4, Type 51, K 851, Pusa Baisakhi, PS 16, PS 10, PS 7, Pant Moong 2, Pant Moong 3, ML 267, Pusa 105, ML 337, PDM 54 (Summer &amp; Kharif), PDM 11 (Spring) Pant Moong 1.</td>
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Source: iKisan
Annexure 5: Product wise GST rate of Food products

- **GST-28%**
  1. Molasses
  2. Pan Masala
  3. All goods [including aerated waters] containing added sugar or other sweetening matter or flavoured

- **GST-18%**
  1. Malt, whether or not roasted
  2. Sugar confectionery
  3. All preparations of cereals, flour, starch or milk for infant use and sold retail
  4. Corn flakes and other cereal flakes
  5. Waffles and wafers (other than chocolate coating)
  6. Pastries and cakes
  7. Extracts, essences and concentrates of tea or mate
  8. Soups and broths
  9. Ice cream and other edible ice
  10. Instant food mixes, soft drink concentrates, sharbat, betel, supari, packaged food
  11. Water, including natural or artificial mineral waters and aerated waters not sweetened
  12. Ethyl alcohol and other spirits
  13. Vinegar and substitutes
  14. Custard powder
  15. Chewing gum/bubble gum and white chocolate, not containing cocoa (17041000,17049090)
  16. Cocoa butter, fat and oil
  17. Cocoa powder, not containing added sugar or sweetening matter
  18. Chocolates and other food preparations containing cocoa
19. Malt extract (other than for infant use and mixes and doughs of bakers)
20. Waffles and wafers coated with or containing chocolate
21. Extract, essences and concentrates of coffee
22. Other non-alcoholic beverages
23. Food preparations not elsewhere specified or included i.e. Protein concentrates and
    textured protein substances, Sugar-syrups containing added flavouring or colouring matter,
    not elsewhere specified or included; lactose syrup; glucose syrup; and malto dextrin syrup,
    Compound preparations for making not alcoholic beverages, Food flavouring material,
    Churna for pan [other than pan masala].

➤ GST – 12 %
1. All meat in unit containers put up in frozen, salted, dried, smoked state
2. All meat and marine products prepared or preserved.
3. Butter, ghee, butter oil, cheese
4. All goods under Chapter 20 (preparations of vegetables, fruits, nuts or other parts of
5. plants, including pickle, murabba, chutney, jam, jelly)
6. Ketchup & sauces, Mustard sauces
7. Dry fruits
8. Starches
9. Animal fats and oils
10. Fruit and vegetable juices
11. Roasted chicory and coffee substitutes
12. Yeasts and prepared baking powders
13. Namkeens put up in unit container and bearing a brand name, bhujia, mixture, chabena
14. Bari made of pulses including mungodi
15. Soya milk drinks
16. Fruit pulp or fruit juice based drinks
17. Tender coconut water (in unit container with brand name)
18. Beverages containing milk
19. Batters including Idli/Dosa batter
20. Condensed milk
21. Refined sugar, sugar cubes
22. Pasta, whether or not cooked or stuffed (with meat or other substances) or otherwise
    prepared, such as spaghetti, macaroni, noodles, lasagna, gnocchi, ravioli, cannelloni;
    couscous, whether or not prepared
23. Curry paste, mayonnaise and salad dressing; mixed condiments and mixed seasoning
24. Diabetic foods

➤ GST – 5%

1. All fish variants (except seeds of fish, prawn & shrimp) processed, cured, frozen state
2. Ultra-high temperature milk
3. Milk and cream including skimmed milk powder but excluding condensed milk
4. Yoghurt and other fermented milk and cream
5. Chena or paneer in unit container and branded
6. Egg yolk, fresh or dried
7. Natural honey in branded unit container
8. Vegetables frozen or preserved (but unsuitable in that state for immediate consumption)
9. Edible fruits and nuts; peel of citrus fruit or melons, in frozen or preserved state
10. Coffee, tea, pepper, vanilla, cloves, cardamom
11. Seeds of anise, coriander, cumin
12. Ginger (other than fresh ginger), saffron, turmeric, other spices
13. Cereal groats, meal and pellets in branded unit container
14. Cereal grains worked upon (hulled, rolled, flaked)
15. Meal, powder, flakes, granules and pellets of potatoes
16. Meal and powder of the dried leguminous vegetables (pulses, sago, tamarind)
17. Wheat gluten
18. Soya beans
19. Ground nuts
20. Copra
21. Linseed, rape seeds, sunflower seeds, other oilseeds like mustard, poppy,
22. Flour and meals of oilseeds
23. Sugar beet and sugar cane (frozen and dried)
24. Vegetable fats and oils (groundnut, olive, palm, sunflower oil etc)
25. Beet sugar, cane sugar, khandsari sugar
26. Cocoa beans, shells and paste
27. Mixes and doughs for preparation of bread, pastry and other baker’s wares
28. Pizza bread
29. Seviyan
30. Rusks, toasted bread
31. Sweetmeats
32. Flours, meals, and pellets of meat, fish meant for animal consumption
33. Cashew nuts and cashew nut in shell
34. Raisin
35. Ice and snow
36. Walnuts
37. Tamarind Dried
38. Roasted Gram
39. Oil Cakes irrespective of end use
40. Mangoes Sliced Dried
41. Khakra and Plain Chapati/roti
42. Food preparation put up in unit containers and intended for free distribution to economically weaker sections of the society under a programme duly approved by the Central Government or any State Government, subject to specified conditions.
43. Namkeens other than those put up in unit container and bearing a registered brand name or bearing a brand name on which an actionable claim or enforceable right in a court of law is available.
44. All goods under Chapter 0202/0203/0204/0205/0206/0207/0208/0209/0210/0504 [except fresh or chilled], put up in unit container and,- (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].
45. Desiccated Coconut
46. Flour of potatoes put up in unit container and,- (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available (other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily).
47. Puffed Rice Chikki, Peanut Chikki, Sesame Chikki til chikki, til patti, til revdi, sugar makhana, gajak, groundnut sweets Khaja, Khajuli, Anarsa, Sakar, Khadi Sakar, harda, sakariya, gatta, kuliya, elaichidana, lukumdana.
48. Idli, Dosa Batter
49. Chutney Powder

➤ **GST – Nil %**

1. Meat (Other than in frozen state and put up in container)
2. Bones and horn cores, bone grist, bone meal etc., hoof meal, horn meal, etc
3. Fish, prawn and shrimp seeds
4. All fish, fresh or chilled (but not processed, cured and frozen)
5. Fresh milk, pasteurized milk but not concentrated, sweetened
6. Eggs (in shell)
7. Curd, lassi, buttermilk
8. Chena or paneer (except in unit container with brand name)
9. Natural honey (no container-no brand)
10. Fresh fruits and vegetables, roots and tubers (except in frozen state or preserved)
11. Dried fruits
12. Leguminous vegetables, shelled or unshelled
13. Dried leguminous vegetables, shelled, whether or not skinned or split (pulses)
14. Coffee beans, unprocessed tea leaves, fresh spices
15. All cereals (no container-no brand)
16. Cereal grains hulled
17. Flour
18. Atta, maida, besan (no container-no brand)
19. Wheat or meslin flour
20. Cereal flour, groats and meals (no container-no brand)
21. Flour of potato, dried leguminous vegetables (no container-no brand)
22. Oilseeds of seed quality
23. Cane jiggery (gur)
24. Palmyra jaggery
25. Puffed, flattened and parched rice
26. Pappad (except when served for consumption)
27. Bread (branded or otherwise) (except when served for consumption and pizza bread)
28. Prasadam
29. Water (other than aerated, sealed etc)
30. Non-alcoholic toddy
31. Tender coconut powder
32. Acquatic, poultry and cattle feed
33. Salt, all types
34. Cotton seed oil cake irrespective of end use
35. All goods [except fresh or chilled], other than Sl. No. 44 of GST 5% Category.
36. All goods under Chapter 0303/0304/0305/0306/0307/0308 [except fresh or chilled], other than those put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].
37. Vegetable (uncooked or cooked by steaming or boiling in water), frozen other than those put up in unit container and, (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other
than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].

38. Manioc, arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots and tubers with high starch or inulin content, dried, whether or not sliced or in the form of pellets.

39. Manioc, arrowroot, salep, Jerusalem artichokes, sweet potatoes and similar roots and tubers with high starch or inulin content, frozen, other than those put up in unit container whether or not sliced or in the form of pellets. and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].

40. Dried makhana, whether or not shelled or peeled other than those put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available [other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily].

41. Meals, powder, flakes, granules and pallets of potatoes other than those put up in unit container and, - (a) bearing a registered brand name; or (b) bearing a brand name on which an actionable claim or enforceable right in a court of law is available (other than those where any actionable claim or enforceable right in respect of such brand name has been foregone voluntarily).

42. Guar meal.

43. Hop cones, neither ground nor powdered nor in the form of pellets.

44. Coconut shell, un-worked.

45. Khandsari sugar
Annexure 6: PUESTEC Analysis of Green Gram

1. Political circumstance

Due to land ceiling norms, typically farmers in Rajasthan have barely 2-3 acres of holdings each. The small and marginal farmers can hardly be expected to invest in better farming technologies, nor aggregate adequate volumes of commodities as to develop alternate marketing channels away from typical APMC or multiple-trader led channel in vogue. There is, therefore, need for aggregation of such farmers into FPOs / FPCs. Typically, such FPOs / FPCs may have a combined holding of 1000-1500 acres.

2. Institutional context

Globally Green Gram is highly sought by buyers/processors. Given the fluctuations in prices as well as need for technology transfer for high yielding varieties, there is apparently need for contact farming agreements with processors.

Processors favourably supporting contract farming seek support in selecting high yielding varieties that ensure profuse podding, high productivity, early maturity, resistance to Fusarium wilt, and market-preferred seed traits (e.g. medium seed size in desi type and large seed size in kabuli type).

However, there are some limitations in the Contract Farming Act and mechanism in Rajasthan as detailed in section 8.3. These limitations need to be corrected to encourage and up-scale contract farming practices.

3. Economics

There is sound economics in green gram production with contract farming agreements, clubbing with primary value addition. In general, contract buyers look for high yielding processing friendly varieties. Even, in terms of direct procurement, there is inherent need for cleaned and graded and low moisture seeds by processors. Small seeds, damaged seeds, foreign material, and off color in the seed lot often lead to low price realization. In nutshell, assuming the market price realized by farmer is about Rs. 4500 per quintal; selling cleaned, graded and low moisture green gram directly to large processors could easily fetch 4-4.5% additional value; i.e. about Rs. 4703 (Rs. 4775 including cess) per quintal (for cleaned grains and about Rs. 1500 for immature grains). Even after deducting cleaning costs and other incidental expenses, the minimum additional value to producers is at least in range of Rs. 80 to Rs. 100 quintal. Assuming the cost of cultivation to be around Rs. 8,444 per acre and yield of 3.2 quintals per acre, the total additional realization in the direct procurement model could be around Rs. 650 more (about 11% higher) over traditional sale to local trader.

4. Social

Typically, small and marginal farmers in Rajasthan grow green gram at a very small scale and with little post-harvest facility at hand. In addition to being an important source of human food and animal feed, Green gram also plays an important role in sustaining soil fertility by improving soil physical properties and fixing atmospheric nitrogen. It is a drought resistant crop and suitable for dryland farming and predominantly used as an intercrop with other crops.
Green gram is a protein rich staple food. It contains about 25 percent protein, which is almost three times that of cereals. It supplies protein requirement of vegetarian population of the country. It is consumed in the form of split pulse as well as whole pulse, which is an essential supplement of cereal based diet. The moong dal Khichdi is recommended to the ill or aged person as it is easily digestible and considered as complete diet. Roti with Moong dal and Moong dal chawal is an important ingredient in the average Indian diet. The biological value improves greatly, when wheat or rice is combined with Green gram because of the complementary relationship of the essential amino acids. It is particularly rich in Leucine, Phenylalanine, Lysine, Valine, Isoleucine, etc.

5. Technology

Ideally, in FCSC, Green Gram Cleaning and Grading plant will be equipped with the machine needed for successful cleaning, grading operations of the crops having capacity of about 1 to 2 tons/hour. The processing facility may consist of various equipment namely pre-cleaner with screen set, gravity separator, de-stoner, vacuum blower/aspiration system, elevators and support accessories. The plant operations will require some support equipment like moisture meter/s, handheld stitching machine/s and weighing machine/s. Similarly, grain storage is needed to store the grains during the period from receiving the grains from the farmers at the plant till it is supplied to the dealer/farmer for sale; the plant site would have the shed built for proper storage, the details of which are attached with report.

In Green Gram Cleaning and grading machine, the un-cleaned grains when fed to the machine primarily pass through screens, then de-stoner, gravity separator, to give an output of clean graded grains which would be further sent for packaging.

Further, a mini dal mill of capacity up to 1 ton per day could be installed which will have equipment like Roll (milling), drier (electric-optional), polisher (optional), storage tanks, aspiration system, elevators and support accessories. In this context integrated mini dal mills developed by PKV and similar institutes could also be explored.

Some key suppliers like Padsons, Agrosaw, GD Agro, etc could be consulted for technology supply.

6. Environment

The scope for promoting green gram as an alternative crop to some of the other kharif crops/even intercropping is an environmental friendly option. Green Gram not only fixes nitrogen in soil, improves soil nitrate content and saves fertilizer costs and increases yield in subsequent crops. Green Gram is generally grown in rain fed conditions and can be grown with minimum irrigation as well.

7. Competition

Green Gram is generally processed and sold as whole seed, or value into ‘dall’ (with or without skin) and also “Moong Flour” which is also further used as key ingredient in healthy snacks like Moong Chilla. The by-products processed dall are also gaining popularity worldwide in terms of low fat-high protein biscuits/crackers, nutrition bars, pasta, etc.

The large pulses processing companies like ETG, Mother Dairy, and other small and large processors etc. are major buyers of various pulses like green gram. Green Gram’s advantage is that it is a low input crop and can be grown in marginal lands and it can be grown to process value added products like dal, flour, snacks, animal feed, etc. Green gram is widely cultivated throughout the Asia, including India, Pakistan, Bangladesh, Sri Lanka, Thailand, Laos, Cambodia, Vietnam, Indonesia, Malaysia, south China, and Farmosa. However, Green Gram is generally intercropped with other kharif crops and is (in most regions) less popular than Tur (another kharif pulse).

Even internationally, since Indian households are major consumers of this pulse, the export demand increases leading up to Islamic and Hindu festivals as does the domestic demand. Despite large production, India still imports in large quantities to meet domestic demand.