NIAM Research Report

Guar Industry Vision 2020:

Single Vision Strategies

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Abbreviations

EU	European Union
R&D	Research and Development
PCP	pentachlorophenol
GDP	Gross Domestic Product
TE	Triennium Ending
HYV	High Yielding Variety
CV	Coefficient of Variation
CGR	Compound Growth Rate
CMC	carboxymethylcellulose
MIA	Marudhara Industrial Area
NCDEX	National Commodities and Derivatives Exchange
MCX	Multi Commodity Exchange
NMCE	National Multi Commodity Exchange
APEDA	Agricultural and Processed Food Products Export Development Authority
VKGUY	Vishesh Krishi and Gram Udyog Yojana
HS	Harmonized System
DGFT	Director General Foreign Trade
ARS	Agricultural Research Station
CCS HAU	Chaudhary Charan Singh Haryana Agricultural University
MAI	Market Access Initiative

Foreword

Guar is a neglected commodity from farmers, researchers, extension workers as well as from policy makers, though its derivative i.e., guar gum is being exported and fetches foreign exchange. India is the largest producer of guar and contributes about 75% of total guar and guar gum production in the world. Guar Gum is an important ingredient in producing food emulsifier, food additive, food thickener and other guar gum products. Guar gum is purely an export oriented commodity with about 80% of total output exported from the country.

The guar processing industry is fragmented and food safety concerns are growing in export front. Processing technology in the country is still not well developed and product specific guar gum derivatives are not processed in the country. To achieve all these, measures required are brought-out in this report in the form of Guar Industry Vision 2020. The study follows the methodology of consulting various stakeholders like farmers, traders, processors, exporters, researchers, etc. at various locations in Rajasthan and Haryana and taken their views for wholesome development of the industry.

The major concern regarding the export of Guar derivatives is that there is high fluctuation in the quantum of export and declining share of guar exports relative to the country's total exports. Since guar gum is mainly being used in food and bakery industry, food safety concerns have become all the more important for guar processing industry. Thus preparedness of guar split and gum manufacturing industries for these food safety concerns, high fluctuation in area, production and productivity of guar seed, high volatile prices of guar seed and gum splits, are of prime importance in achieving the India Guar Industry Vision 2020.

In order to promote the exports of guar and its derivatives from the country, need of the hour is long term planning with single vision by taking into account the views of prime stakeholders. This report discusses well about the single vision strategies which unites all parts of the value chain and links the supporting pillars to maximize benefits to all participants in the industry. The main thrust of single vision document is to provide a road map for enhancing export of guar derivatives by bringing operational efficiency through improving different activities.

The study clearly brought out important concerns for the overall development of guar production and guar industry and made relevant suggestions. It will prove a great instrument for the policy makers in the decision making.

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Director General,
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Executive Summary

Single vision strategy is an approach to align the views of producers, processors, exporters, traders, policy makers, researchers and other stakeholders in the value chain. It stresses to provide a road map to enhance guar derivatives export by increasing the efficiency and profitability of the industry. Single vision unites all parts of the value chain and links the supporting pillars to maximize benefits to all participants in the industry. The first of its kind efforts made in Australia for grains by Grain Research and Development Corporation through the Grain Grower Organizations of Australia. The vision of the Single Vision Grains Australia is to achieve a united, vibrant and internationally competitive Australian Grains Industry. The main approach is identifying consensus between growers and other industry participants on the need for a 'single vision'.

Guar is annual arid and semi-arid legume crop grown during Kharif season in India. Guar gum, extracted and processed from guar seeds, is the source of a natural hydrocolloid, which is a cold water soluble forming thick solution at low concentrations. The guar seed consists of three parts: the seed coat (14-17%), the endosperm (35-42%), and the germ (43-47%). It is from the endosperm that guar gum is derived, which is the primary marketable product of the plant. This spherical-shaped endosperm contains significant amounts of galactomannan gum (19 to 43% of the whole seed), which forms a viscous gel in cold water. Like other legumes, guar is an excellent soil-building crop with respect to available nitrogen. Root nodules contain nitrogen-fixing bacteria, and crop residues, when plowed under, improves yields of succeeding crops. The by-products of guar processing, 'Churi' and 'Korma' are used as cattle feed. Guar gum recovery normally comes around 31% of total guar seed processed, whereas Churi and Korma account for 29% and 37% respectively.

Guar is annual arid and semi-arid legume crop mainly grown in India (about 80% of global guar production), Pakistan (15%), Sudan, Australia, and USA countries. In India, Rajasthan is the leading producer of guar seed (more than 60% of total production in the country), followed by Haryana, Gujarat, Punjab. The crop is grown in marginal lands mainly rainfed, thus production fluctuates from 2 lakh tones to 15 lakh tones annually

with the level and intensity of monsoon rainfall in the major producing areas. Current production of guar seed in the country is 12.61 lakh tones from 28.5 lakh hectares of area under cultivation.

The current average productivity of guar seed achieved in Haryana state is 1200 kg/ha, if the same level of productivity is achieved at the national level, the total production can be increased at 35.70 lakh tones, three times of the present level. Taking a conservative and achievable estimate of doubling the productivity, the total production can be achieved at 23.34 lakh tones. Highest production in the country was 15.13 lakh tones in the year 2003-04. With this level of expected production of guar seed, about **7 lakh tones of guar gum** can be produced.

The yield in Haryana is higher by 206%. If 10% growth in productivity is achieved every year, the total productivity can be doubled by the year 2020. The present revenue (foreign exchange earned) is 1125.77 Crores from export of guar products which would also be doubled at the same level of prices, if India is able double its guar seed productivity. The guar processing industry is fragmented and food safety concerns are growing in export front. Processing technology in the country is still not well developed and product specific guar gum derivatives are not processed in the country. To achieve all these, measures required are brought-out in this report. This forms the Guar Industry Vision 2020.

Through the different stakeholder's discussions/ consultations at different major production and industry locations and structured interview, the views and suggestions were sought and consensus has been identified for the overall development of the guar industry from farm production till export. Different stakeholders including farmers, traders, researchers, processors and exporters, etc were consulted at Jodhpur, Bikaner, Sri Ganganagar, Hanumangarh, Hisar, Siwani, etc. locations.

The views expressed by stakeholders were:

Related to Production and Yield

A. Production or supply pattern of Guar is erratic as guar is largely grown in rain fed conditions therefore production and yield is dependent on vagaries of nature. Most of the farmers grow guar on their waste land and not taking it as a

commercial crop. Therefore, it is hard to maintain consistent supply to the industry.

B. Productivity is poor because farmers cultivate on marginal soils with poor management conditions and hardly use any inputs. High yielding and drought resistant variety seeds are not available. Maximum use of local strains/ land races due to inadequate availability of the quality certified seed of improved varieties. The seed replacement rate is lowest in all crops (less than 10%).

C. Though research on development of high yielding varieties of guar seed is done and few good varieties have been developed, but there is nobody to look after the certified seed development and dissemination of these varieties. Farmers' wants to use HYV seeds but seed is not available in the market.

D. The research institutions/ agricultural universities face fund crunch for research in new variety development and product processing and technology development.

E. Agricultural extension system in the states does not give much attention on guar crop and the crop is treated as marginal crop. The improved varieties have been developed by research institutions/ agricultural universities, improved agro-technology is defined but it does not reach to the farmers.

F. **Enhancing Productivity:** The productivity level in Rajasthan is 3.25qt/ha under irrigated conditions and 2.75 qt/ha under rain-fed conditions. While Haryana state made success in improving productivity and the current productivity level in Haryana is about 11.0 qt/ha. Therefore, continuous research and extension work needs to be in place for increasing Guar seed production and productivity in the state. Total guar seed production in Haryana have increased to about 35 lakh qt presently from a level of 5-7 lakh qt. Variety development according to market demand is poor and guar production technology and research extension is not fully reaching upto the farmers' level. Therefore, the extension system should be strengthened in the state.

G. It is possible to have two crops in a year in certain areas where irrigation facilities are available. Second crop can be taken after Rabi (April-July) but short duration varieties would be needed which should mature before onset of the monsoon.

H. The industry's knowledge about the developments in agricultural research is poor. In case of guar although chemical analysis of different varieties is available and the processors could exercise preference for varieties with higher gum contents, but is not being done due to lack of knowledge by the trade and industry. The parameters for buying are quite subjective to parameters like colour, shape and size. Even farmers are not aware of varieties suitable for their area.

I. Guar is considered as a minor crop by the State Agriculture Departments and Agricultural Universities, who give more attention to crops like cereals, oil-seeds and pulses rather than guar.

J. Since Guar crop is highly dependent on monsoon rainfall, and if production fails there is no risk cover for farmers. Therefore, crop insurance product in guar seed should be developed and farmers' guar crop should be insured.

K. As the crop is highly dependent on monsoon rainfall, if there is long dry spell crop fails completely. In this case, promotion of rainwater harvesting as was prevailing in the form of tanka in Churu district of Rajasthan can be used critical life saving irrigation to the crop and increase productivity.

Related to Marketing

A. There is wide fluctuation in prices of guar seed and its derivatives. Though commodity futures in guar seed and guar gum is available for risk management, but the farmers are not in a position to take direct benefit of this complex method for them.

B. The information on domestic consumption as well as export potential is also not available to industry. There is also lack of market intelligence in guar seed and guar gum.

C. **Market Fee:** Mandi fee for Guar in Rajasthan is chargeable at the rate of 1.60%, while in Haryana it is 1.0%, in Gujarat- 0.50% and in Punjab there is no mandi

fee chargeable on Guar. Mandi fee structure needs to be corrected and made uniformly.

D. **Warehousing and pledge financing:** Warehousing facilities for storage of guar seed is inadequate thus needs more storage structures to be built. The quality of the commodity is not maintained properly at the warehouses, and there should be strict regulations for the warehouses on quality issue. Also the benefit of pledge financing scheme is not reaching farmers and other stakeholders. Therefore, wider publicity of the scheme is needed.

E. **Logistics:** Manufacturers send their processed product through train to the port. The main problem regarding this transport is unscheduled train timings. They can't send it through road, as it is very expensive means of transportation.

F. **Packaging:** For packaging of splits they use plastic bags and each bag contains upto 50 kg of splits. Guar powder is packed in paper bags and each bag contains 25kg of powder. Then these packets are being filled in the containers and each container consists of 800 packets. Packaging also poses a problem occasionally.

Related to Value addition and Exports:

A. Value-addition is poor. The pulverized gum is largely sold as a commodity. About 40% of the exports are still in the form of refined splits. Also machinery and technology for the product specific value addition is required in the country.

B. Cheaper substitutes of Guar are available for industrial applications. Tamarind kernel powder has considerably replaced Guar Gum in textile sector. Similarly Cassia Tora is expected to substitute guar gum in textiles, pet food etc. Only food and pharmaceutical end-users have stable demand due to increasing preference for natural products.

C. USA, China and Germany are the major importing countries accounting for more than 50% of total exports from India. Considerable quantities of value added derivatives are being re-exported from European countries.

D. There is a potential for marketing of value added Guar based health foods, dietary fiber, slimming-aid, fat replacers, medicines etc. in the international markets. For

technical grades, the potential for exporting value added derivatives exists in the areas of oil-drilling and textiles. But hardly any efforts are being made in this regard in the country.

E. Harmonized product codes meant for Guar products are not being used by internationally important trading countries. While India is using Harmonized product codes, USA and E.U. countries are using different codes which are perhaps resulting in some discrepancies in the data.

F. **Quality certification:** The quality certification of guar seed as well as of the guar derivatives is negligible. The stakeholders opined that there should be a third party certification of the produce and products. There are negligible arrangements for quality certification of guar gum for export. Exporters have to face lot of problems regarding certification. Like phyto-sanitary certification facility is not available at Jaipur, Jodhpur and Bikaner. Foreign quarantine restriction has become very strict. Therefore, appropriate agencies should be in place to help facilitate smooth exports. Exporters have gone through Kosher and Halal certification when they export their product to Israel and Pakistan, respectively.

G. China's custom tariff on Indian Guar Gum powder is 15% and on guar splits is 5%. Thus, China's policy is to encourage import of raw material (guar splits) from India and process it into their own processing industries and re-export it, rather than importing finished products. While import tariff for products imported from Pakistan is nil, thus there is clear discrimination between India and Pakistan.

H. There is no any reputed Research and Development institution working on guar seed production and development of guar gum powder industry specific products, and its processing technology, plant and machinery in the country.

I. Many of the guar processing industries are small and does not have technical manpower/ skilled labour, and operate under unhygienic conditions. There is urgent need of capacity building of manpower working with guar processing industries in all respect including food safety and quality aspects.

J. **Port Handling:** Guar seed derivatives are being exported from Mundra port. Exporters face problems regarding infrastructure available at port. Port infrastructure as well as the handling process is not upto the required. Capacity building of personnel and workers working at port is required for safe keeping and handling of food grade produce particularly food safety aspects. Containers should available at industry site, so that problems in container stuffing at port can be avoided.

The suggestions and recommendations are given below:

- There is need to develop a Research and Development centre as the centre of excellence for Guar. The major activities of this centre could be collection and dissemination of information, promoting usage of Guar and its derivatives, development of processing technology according to changing market demand and food safety concerns and development of value added products. This centre should also have R&D facilities and pilot plant/ machinery for trial production of value added derivatives of Guar. The centre should also have facilities and authority to issue quality certification. Capacity building of small and medium enterprises in guar processing on the lines of growing food safety concerns is of utmost importance. The objectives of the institute can be defined as:
    - Research and development of High yielding varieties along with quality requirements of industry,
    - Certified seed development and distribution,
    - Research and Development of processed guar gum products, industry use specific,
    - Research and development of Guar gum products processing technology and machinery, pilot plant for industry training
    - Export facilitation to industries like export documentation, specialized container and transport arrangements, port handling, etc.
    - Guar production technology extension dissemination to farmers,
    - Market information creation and dissemination to all stakeholders,
    - Promotion of contract farming.

    - Authority to keep vigil on industry and to issue certification like GMP, HACCP, ISO 22000 and Food Safety Management,
    - To impart training among human resource engaged in guar industry and develop skilled manpower for the industry.
- Consistent funding for Research from government is required. The institutes/ agricultural universities lack funding for guar research.
- Major problem of farmers and industry is the non-availability of certified seed at the time of sowing. Multiplication of certified seed by agricultural universities/ state seed corporations is required. A well organized research program for seed production of high viscosity varieties, and cultivation practices is needed.
- Proper and targeted extension mechanism for dissemination of agro-technology of guar production, and technology/ knowledge support to farmers need to be ensured.
- Farmer-Industry linkages to be enhanced through direct marketing arrangements at the mandi yards and promotion of contract farming.
- Since Guar crop is highly dependent on monsoon rainfall, and if production fails there is no risk cover for farmers. Therefore, crop insurance product in guar seed should be developed and farmers' guar crop should be insured.
- Many of the guar processing industries are small and does not have technical manpower/ skilled labour, and operate under unhygienic conditions. There is urgent need of capacity building of manpower working with guar processing industries in all respect including food safety and quality aspects.
- Product diversification keeping in view the demand of importing countries.
- Value addition of Guar Meal. Guar meal can be used for animal and human consumption. Research on odorless guar meal will prove a significant step to develop different uses of guar meal.
- Introduction and proper implementation of crop insurance by assistance of State Govt.

Chapter 1
INTRODUCTION

Guar or clusterbean (Cyamopsis tetragonoloba, (L) Taub) is an important agricultural produce widely grown in Indo-Pakistan subcontinent for numerous generations. India and Pakistan have distinct advantage of agro-climatic conditions for the cultivation of guar though it has also been successfully grown in U.S.A., South Africa, Australia, Brazil, Zaire and Sudan. Guar is a drought-tolerant, multi-purpose annual arid legume crop cultivated mainly during Kharif season and used for extracting of gum from seeds, animal fodder from vegetative part, and also used as green manure. Guar is being grown in India since ancient time and the tender green Guar is an important source of nutrition to both human being and animals, which is consumed as a vegetable and cattle feed, respectively. Guar constitutes about 0.27% share in India's agricultural GDP. Guar gum, extracted from guar seeds, is one of important item of export which constitutes about 0.23% of India's total exports under the agriculture & allied products.

Guar is the source of a natural hydrocolloid, which is cold water soluble and form thick solution at low concentrations. The guar seed consists of three parts: the seed coat (14-17%), the endosperm (35-42%), and the germ (43-47%). It is from the endosperm that guar gum is derived, which is the prime marketable product of the plant. This spherical-shaped endosperm contains significant amounts of galactomannan gum (19 to 43% of the whole seed), which forms a viscous gel in cold water. Like other legumes, guar is an excellent soil-building crop with respect to availability of nitrogen. Root nodules contain nitrogen-fixing bacteria and crop residues, when ploughed under, improves yields of succeeding crops. The by-products of guar processing, 'Churi' and 'Korma' are used as cattle feed. Guar gum recovery normally constitutes around 31% of total guar seed processed, whereas Churi and Korma account for 29% and 37% respectively.

In India guar crop is cultivated during Kharif season, with an annual production of 5.0 to 10 Lakh Tonnes. India is the largest producer of guar and contributes 70%-80% of total guar production in the world. Guar Gum is an important ingredient in producing food emulsifier, food additive, food thickener and other guar gum products. India is the largest producer of guar gum products. Its guar gum exporters, guar gum manufacturers, guar

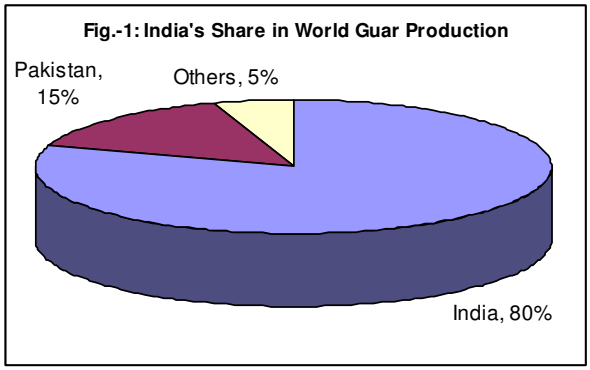
gum products suppliers, food emulsifier exporter have reached to many countries. As of now there is a lot of demand for Indian guar gum products, food additives, food thickener and other allied guar gum products. Guar gum is purely an export oriented commodity with about 80% of total output exported from the country.

Industrially it is used in mining, petroleum drilling and textile industry. In food it is used as a thickener and as a mean of preventing ice crystal formation in frozen desserts. Guar gum is produced from the seed and this is turned into powder. The powder is used in a host of industries, ranging from bakery, dairy, meat, dressing and sausages, beverages, pharmaceuticals and cosmetics, textile printing, mining, water treatment and paper industry.

Guar is a rain-fed monsoon crop, which requires 8-15 inch of rain in 3-4 spells and is harvested in October - November. It is sown immediately after first showers say in July and harvested around November each year. The crop yield is directly related to the monsoon. It requires a relatively long growing season of 20-25 weeks. Slight deviation in normal rainfall during budding period results in fluctuations in production.

1.1 Guar seed Production and Supply

India is the major producer of Guar Seed followed by Pakistan and US. India's guarseed production is subjected to temporal fluctuations and it ranged between 2-15 lakh tons during 2001-02 to 2006-07. Guar is a crop of arid, and semi arid areas spread over the north and north-west of India and east and south-east of Pakistan. It is grown in arid zones of Rajasthan, some parts of Gujarat, Haryana, and Punjab.

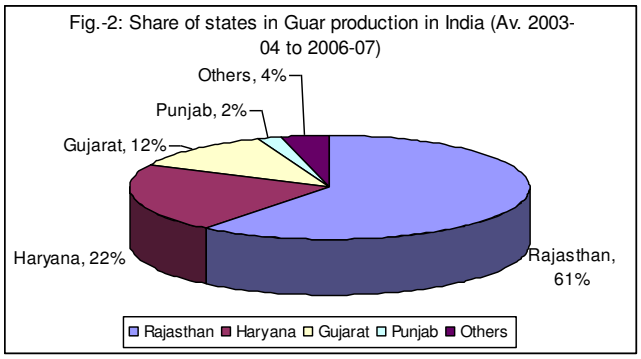


Total global production of guar seed is estimated at 10-16 lakh tones annually, which fluctuates highly depending upon the monsoon condition in India particularly western districts of Rajasthan. Nearly 75-80% of world guar seed production is contributed by India. Pakistan contributes nearly 15% of world guar seed production. Sudan, Australia and

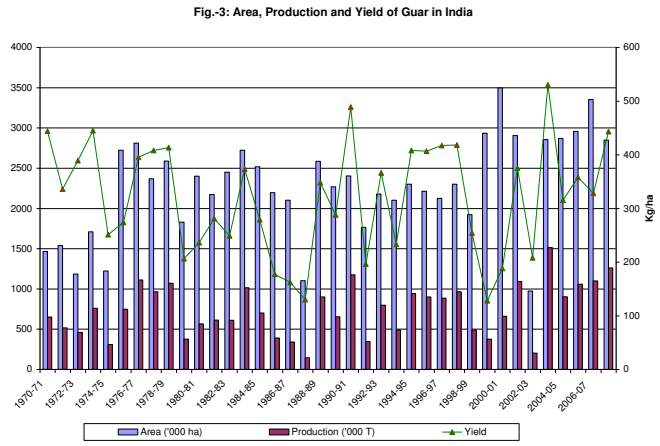
parts of USA are the other Guar growing countries. Nearly 75% of the Guar Gum or other derivatives of Guar seed are being produced in India and are exported mainly to USA, China and European countries. The value added derivatives of Guar Powder are used by the various industries in India as well as abroad. Taking the US, Australian, African crop the total world supply of Guar seed is around 10-16 lakh tons. In Pakistan, Guar seed is mainly grown in Punjab and Sindh province with about 80% of total guar area under irrigated conditions.

1.1.1 Guar seed Production in India:

India produces about 75- 80% of the total guar produced in the world. About 80% was contributed by Rajasthan state during 1991-92, but the share has reduced to about 60% of total guar production in the country (Triennium average ending 2006-07).



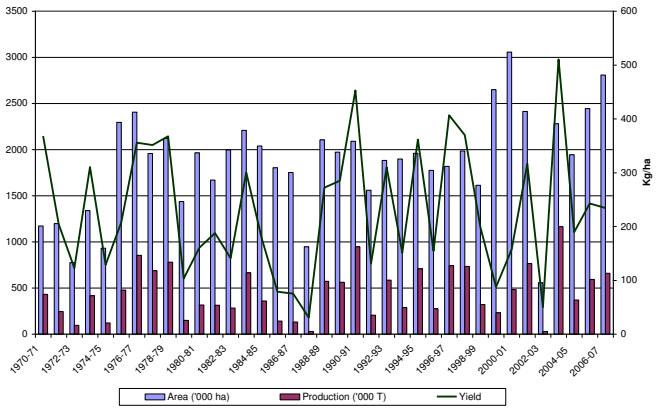
Apart from Rajasthan, it is being grown mainly in Haryana, Gujarat and Punjab. Share of Haryana has increased from 17% during 1991-92 to 29% of total guar production in the country at present. Gujarat contributes about 11% of total guar production. It is also grown in some parts of Uttar Pradesh and Madhya Pradesh.



The average production of guar seed in India is 9-11 Lakh Tonnes and it fluctuates highly mainly based on rainfall pattern. The year 2002-03 was marked by a low production to the tune of mere 2 Lakh Tonnes due to severe drought, whereas in 2003-04 the production rose to astronomical high levels of 15 Lakh Tones on increased acreage and good rainfall.

1.1.1.A Guar Production in Rajasthan

Fig.-4: Area, Production and Yield of Guar in Rajasthan



Since, guar is rain-fed crop cultivated mainly on marginal land and its cultivation starts with the onset of monsoon. If monsoon rains are delayed, the sowing progress hampers in the major producing districts. Area, production and yield of guar seed in Rajasthan over the years were plotted in fig.-1. It is apparent from the figure that production and yield of guar seed fluctuates highly with the level of monsoon rains as there is no other source of moisture for the crop. The lowest production of guar seed in Rajasthan achieved in the year 2002-03 at 0.28 lakh tones, followed by the highest production at 11.63 lakh tones in the year 2003-04.

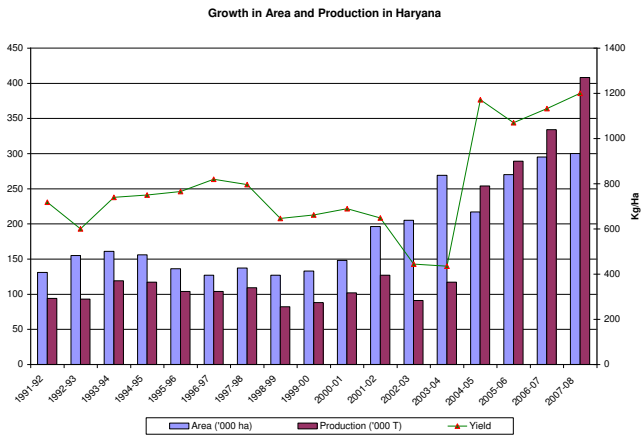
Though cultivation of guar in Rajasthan in practice from long ago, but farmers in Rajasthan still do not consider guar as a commercial crop and cultivate it on marginal land, where irrigation facilities are not available. It is grown mainly as rainfed crop and thus, production and productivity of crop is highly dependent on the intensity, spread and level of monsoon rainfall in the state. Non-availability of short duration and high yielding and drought resistant varieties of guar seed and lower seed replacement ration are adding to the fluctuation in area, production and productivity of the crop in the state.

It is being grown mainly in desert districts of western part of Rajasthan. In Rajasthan, presently Hanumangarh is the leading guar producing district contributing about one-fifth of total guar production and about 10% of area under Guar cultivation in the state. Though, Bikaner district accounts for about 17.5% of total production but area under guar seed accounts for 20% of area under guar cultivation in the state. Other major guar seed producing districts in Rajasthan are Sri Ganganagar, Nagaur, Barmer, Churu, Jaipur, Sikar, Alwar (see Table- 1). The share of Hanumangarh Bikaner and Barmer Districts in area under cultivation as well as production of guar has increased over the years, while share of Sri Ganganagar, Nagaur and Churu has decreased.

Table-1: Share of districts in total production and area of Rajasthan

Districts	Share in Area (TE Average)			Share in production (TE Average)		
	2007-08	1997-98	1987-88	2007-08	1997-98	1987-88
Hanumangarh	9.9	6.7	0.0	20.1	13.7	0.0
Bikaner	19.6	6.6	3.4	17.5	3.2	2.7
Sri Ganganagar	4.4	4.8	16.9	11.3	3.6	46.7
Nagaur	5.3	8.1	12.2	7.0	13.1	14.5
Barmer	13.8	18.2	17.1	6.2	6.4	1.2
Churu	13.6	22.7	22.8	4.9	17.8	16.1
Jaipur	2.0	2.9	3.2	4.5	8.9	4.0
Sikar	2.9	6.1	7.7	4.0	12.8	2.0
Pali	2.0	0.0	0.3	3.9	0.1	0.1
Jalore	2.3	4.7	5.3	3.8	3.0	0.3
Alwar	1.0	1.0	2.2	3.3	3.1	2.3
Jaisalmer	11.2	8.0	3.4	2.3	0.4	0.1
Jhunjhunu	2.4	3.0	5.5	1.8	6.5	3.6
Jodhpur	6.1	5.6	0.0	1.5	4.3	0.0
Bhilwara	0.9	0.0	0.0	1.3	0.1	0.2

1.1.1.B Guar seed Production in Haryana



The state has made remarkable progress in terms of growth in guarseed production and productivity. The production of guarseed in Haryana has increased from less than 1 lakh tonnes during the year 1991-92 to more than 4 lakh tonnes presently. The productivity also have increased from 600 kg/ha during 1992-93 to 1200 kg/ha presently, while the national average productivity of guar seed is 350 kg/ha only. The high yielding and short duration varieties developed by Haryana Agricultural University, Hisar viz.; HG 365, and HG 563 and extensive use of HYV seeds by farmers has improved the productivity level in the state.

1.1.2 Guar Production in Pakistan

Guar seed production in Pakistan ranges between 1.0 to 1.4 lakh tonnes and the trend in production is declining. Total guar seed production in Pakistan was 1.63 lakh tones

during 1996-97, while it reduced to 0.99 lakh tones during the year 2005-06. Guar is produced mainly in Punjab and Sindh province. Punjab province contributes about 79% of total guar production in Pakistan followed by Sindh with the share of about 17% of total guar production. Bhakkar district of Punjab province contributes about 43.2% of total guar production in Pakistan followed by Layyad (15.8%), Khusab (4.8%), Mianwali (4.7%), and rest by other districts.

1.2 Instability in Area, Production and Yield

An index of instability was computed for examining the nature and degree of instability in area, production, and yield of Guar in Rajasthan and India. The co-efficient of variation (CV) was worked out for area, production, and yield to measure of variability. However, simple CV does not explain properly the trend component inherent in the time series data. Alternatively, the Coefficient of variation around the trend (Instability index) rather than co-efficient of variation around the mean (CV) was suggested by Cuddy and Della (1978) as a better measure of variability.

A linear trend $y = a + bt + e$ was fitted to the indices of area, production and yield for the period 1970-71 – 2007-08 and trend co-efficient "b" was tested for significance. Whenever the trend co-efficient was found significant, the index of instability was constructed as follows:

Instability Index = (CV) x sqrt($1-R^2$)

Simple linear regression functions were employed for estimating the response of production of guar due to the change of area. Results of analysis show that production of guar significantly increased by 0.31 and 0.35 times in Rajasthan and country, respectively with the one unit increase in area (table-2).

Table-2: Testing the Dependency of Production on Area

	Constant	Coeff.	t-value	P(T<=t) two tail
Rajasthan	-116.276	0.305766*	4.606236	0.000
India	-66.5149	0.353645*	5.318503	0.000

* represents the significance at 1% level

Fluctuation in area and production of guar in Rajasthan and India are interrelated as wider area gives greater production if the inputs remain constant. But variation in yield may be

due to weather condition, technological changes, etc. The growth and instability in area, production and yield of Guar in Rajasthan and India are shown in Table-3. The results of analysis show that CV (%) for Production of Guar varies by 60% in Rajasthan and 44% in India indicating high instability. Similarly, CV in yield of guar in Rajasthan (51% and India (33%) shows instability in yield, whereas the lower CV for area shows the stability in Area under Guar cultivation. This signals that production of Guar can be stabilized with the stable yield of the crop over the years.

Compound annual growth rate in area, production and productivity of Guar in Rajasthan state and the country shows very limited growth in area and production of the crop and yield shown negative growth for the country as a whole. Thus the increase in production of guar can be achieved through stable yield growth.

Table-3: Growth and Instability in Area, Production and Yield of Guar in Rajasthan and India (1970-71 to 2007-08)

Items	Instability indicator	Rajasthan	India
Area	CGR (%)	1.20	1.14
	CV (%)	29.18	26.61
	Instability Index	26.02	23.47
Production	CGR (%)	1.33	1.05
	CV (%)	60.13	43.73
	Instability Index	58.04	41.42
Yield	CGR (%)	0.12	-0.09
	CV (%)	51.15	32.62
	Instability Index	51.06	32.62

1.3 CULTIVATION

Guar plant grows well under a wide range of soil conditions. It thrives best in fertile, medium textured and sandy loam soils, with good structure and well-drained subsoil. The plant cannot stand water-logging conditions, although it is considered to be tolerant of both soil salinity and alkalinity. The crop tolerates high temperatures and dry conditions, and is adapted to arid and semi-arid climates. In India, guar is a rainfed crop, which requires 8-15 inches of rain in 3-4 spells, and is generally sown after the initial spell of rains in the second half of July or early August and then harvested in October–November.

Ideally, guar requires two showers before sowing, one spell during budding and another one at the time of blossoming.

The crop yield is directly related to the monsoon. It requires a relative long growing season of 20-25 weeks. Too much of precipitation can lead to vigorous vegetative growth, reducing the number of pods and/ or the number of seeds per pod, affecting the size and yield of seeds. Guar is a photo-sensitive crop and it flowers and matures when sown in the kharif season. On maturity, the seedpods are brown and dry, and seed moisture content is less than 14 per cent. During harvesting, small plants are either uprooted or cut from the stem and kept in the open for sun drying. Seeds are taken out of the beans, either mechanically or manually at the farm level, so that they do not shatter.

Though guar seed production technology/ agronomic practices have been developed by Rajasthan Agricultural University, Bikaner and Haryana Agricultural University, Hisar, but farmers in Rajasthan do not know much about these practices to increase productivity. The extension efforts in Haryana, and Hanumangarh and Ganganagar districts of Rajasthan by agricultural extension agencies and guar processing industries like Vikas WSP, Jai Bharat Gums, etc., paving the way for higher use of HYV seed by farmers and increased productivity.

Example set by Vikas WSP by helping in the way of funding for variety development to Agril. University and distributing certified seed to farmers (more than 100 farmers) is remarkable in the area. The industry also provided extension support to the farmers by advising them on weekly basis. But the major problem as indicated by farmers and processing industries, is the availability of certified seed of HYVs. Therefore, seed multiplication in required quantity by Agricultural Universities and State Seed Corporations and timely distribution arrangements required to be pre-set for achieving higher yield. Vikas WSP plans to set up Kissan Sewa Kendra’s for production technology extension and help farmers linked to the industry.

1.4 USES OF GUAR AND ITS DERIVATIVES

Guar was traditionally used for feeding animals in Rajasthan and green pods were used for vegetable purpose. With the development in processing technology in the country, guar seed is being used for extracting gum powder, which has many applications

including food preparations, beverages, textiles, paper industry, petroleum industry, mining, explosives, pharmaceuticals and cosmetics.

1.4.1 Traditional Uses of Guar

The traditional uses of guar are as following:-

A. Human Consumption

- Immature pods are dried, salted and preserved for future use
- Immature pods are dried and fried like potato chips
- Green pods are cooked like French beans
- Mature seeds are used as an emergency pulse in time of drought

B. Cattle Feed

- Plants are cut and fed as green forage.
- Beans are boiled in a large kettle and fed to cattle a high protein source.

C. Medicinal Purposes:

- Plants are mashed, then mixed with oil and used as a poultice on cattle boils.
- Leaves are eaten to cure night blindness.
- Seeds are used as a chemotherapeutic agent against smallpox.
- Boiled guar seeds are used as poultices for the plague, enlarged livers, head swellings and on swellings due to broken bones.
- Seeds are used as laxative.

E. Crop and Soil Improvement:

- Plants are used as shade for ginger
- Guar commonly is used as a cover crop and green manure.

1.4.2 Applications of Guar Gum

Table-4: Industry-wise Applications of Guar Gum

S. No.	Industry	Uses	Derivatives	Functions
Industrial/ Technical				
1.	Oil well drilling	Driling Fluids hydraulic fracturing	Borate cross-linked guar gum, hydroxy alkyl ether derivatives	Control of water loss, viscosity, suspension, turbulence, mobility, friction reduction
2.	Textile Printing	Cotton, Rayon silk, wool sizing, carpet printing	Carboxy-methyl guar, hydroxy propyl guar, modified guar gum	Reduces wrap breakage, reduces dusting film forming thickening for dye
3.	Paper	Wrapping paper, kraft, photographic paper, filter	Oxidized guar gum, cross-linked guar gum, amino ethyl gum, modified guar gum, guar gum formate,	Replaces hemi cellulose, increase strength, fold, pick, pulp hydration, retention of fines, decreases porosity
4.	Mining	Concentration of	Aminoethyl guar gum,	Flocculating and settling

		ore, filteration	sulphate of guar gum	agent, filter aid
5.	Explosive	Stick explosive, blasting slurries	Reticulated guar gum, cyanoethyl ether of guar gum	Water proofing, gelling agent
6.	Water Treatment	Industrial water, drinking water	Food grade guar gum	Coagulant aid (food approved)
7.	Tobacco	Reconstitution of fragmental tobacco	Reaction product of carboxymethyl cellulose and guar gum	Binding agent, strengthening agent
8.	Coal Mining	Coal suspension, shock impregnation	Borate cross-linked guar gum	Friction reducing suspending agent
9.	Fire fighting	Water for fighting fires	Guar gum with ethylene glycol and glycerol	Friction reducing, dispersion and direction control
10.	Ceramic	Enamels, electroceramics	Chlorinated guar gum	Fixing, binding thickening agent
11.	Photography	Emulsions, gelatine solutions	Borate cross linked guar gum, hydrolysed guar gum	Gelling, hardening agent
12.	Synthetic Resins	Polymerization, suspension, collagen dispersion	Suspension of guar gum with CMC	Thickening, Binding agent
Food Applications				
13.	Frozen foods	Ice creams, Soft serves, frozen cakes	Food grade guar gum with CMC	Water retention, ice crystel inhibitor, stabilizer
14.	Bakery	Bread, Cakes, Pastry, Icing	Non-metabolised guar gum	Dough improvement, greater moisture retention, prolonged self life
15.	Processed Cheese	Cottage cheese, cream cheese	In combination with other water soluble gums	Increase the yield of curd solids, improves tenderness
16.	Dairy Products	Yoghurts, desserts, molasses	In combination with other water soluble gums	Inhibits when separate keeps texture after sterilization
17.	Dressing and Sauses	Salad cream, pickles, barbecue relish	In combination with other water soluble gums	Fast, cold dispersible thickening and texturising agent
18.	Instant mixes	Pudding sauses, desserts, beverages	In combination with other water soluble gums	Fast, cold dispersible thickening and texturising agent
19.	Canned Foods	Pet foods, corned meat, baby foods	In combination with other water soluble gums	Acid resistant thickening and suspending agent
20.	Beverages	Cocoa drink, fruit nector, sugarless beverages	In combination with other water soluble gums	Acid resistant thickening and suspending agent
21.	Animal Feed	Veterinary preparations, calf milk replacer	In combination with other water soluble gums	Suspending agent, granulating agent
Pharmaceuticals				
22.	Pharmaceuticals	• Laxative, slimming aids • Gastric hyper	Food grade guar gum Food grade guar gum	Bulking agent, bulk forming appetite depressant Synergistic activity with

		acidity		bismuth salt
		• Diabetic treatment	Food grade guar gum	Reduction of urinary glucose loss
		• Cholesterol		
		• Vitamin formation preparation	Food grade guar gum	Reducing aid
			Food grade guar gum	Stable water soluble suspension
Cosmetic				
23.	Cosmetics	Ointment	Hydroxypropyl guar (HPG)	Thickening agent gives unctuousness
		Lotions	Hydroxypropyl guar (HPG)	Lubricating, suspending agent
		Tablets	Food grade guar gum	Disintegrating and granulating agent
		Hair Shampoos	Cationic guar	Detergent compatible thickener
		Hair Conditioners	Hydroxypropyl guar (HPG)	Protective colloid film forming agent

Guar Gum is one of the most cost effective and functional ingredients available for formulating food products. Soluble in cold water, Guar imparts a high viscosity and exhibits superior water-binding capacity at low usage levels. These characteristics make it suitable for use in applications as diverse as cottage cheese, sauces, soups, and frozen desserts. The nonionic nature of Guar makes it tolerant to extreme salt and electrolyte levels, important criteria when selecting a thickener for nutraceutical beverages.

Guar is an all-natural ingredient, unlike other common thickeners such as modified food starch and cellulose gum (CMC), and has been shown to provide important health benefits. Numerous studies have shown that the consumption of Guar Gum lowers serum LDL cholesterol and triglycerides and increases glucose tolerance. In one of the study it was revealed that, rats fed Guar Gum as a part of their diets showed a 25% decrease in plasma cholesterol. Guar is also high in soluble dietary fiber.

Table-5: Application-wise global consumption of guar derivatives

Type of application	**Target industries**	**Global consumption**
Food grade	Bakeries (Bread), Dairy (Ice cream, Sherbets, *Cheese etc.), Dressing (Sauces, Ketchup's)* Beverages (Chocolate drinks), Pet Food (Thickener)	50-55%
Pharmacy grade	Cosmetics & medicines (as binder and thickener) Slimming (Reducing weight & laxative)	05-10%

Industrial grade	Oil drilling (as a well stimulant and fraction reducer), Mining (increased yield, filter aid) Explosives (Gelling agent),Coal Mining (fraction reducer, binding)	25-30%
Other	Textile printing (Thickening agent for dyes) Paper (increase strength and decrease porosity) Tobacco (binding and Strengthening) Photography (Gelling and Hardening)	10-15%

Table-6: Demand (%) from user-industries in major countries

USA	**Germany**	**India**	**Holland**	**Italy**	**UK**	**France**	**USA**
Petroleum	33	-	-	15	-	17	-
Food & Pharma	33	55	3	40	27	50	60
Paper	9	5	8	-	11	-	-
Textile	9	18	80	15	22	17	-
Explosives	4	12	5	15	22	-	30
Miscellaneous	12	10	4	15	18	16	10

A by-product of the guar processing is guar meal (mixture of husks and germ) which is a potential source of protein. It is used for cattle as well as poultry feeding. Toasting of guar meal improves its nutritive value. It can be used up to 10% in poultry diet and can replace up to 100% protein supplements such as ground nut oil cakes in ruminants. The gum is a Polysaccharide with a straight chain of mannose units and one galactose is 2:1. The gum contains about 6% protein.

Guar is more than 6 times as effective as starch in thickening power and is used for upgrading starches. Various derivatives of Guar Gum are available that will stiffen gels even up to a water content of 99%. Commercially important derivatives of Guar gum are:

a) Hydroxy Alkylated Guar gum

b) Carboxy Methylated Guar gum

c) Oxidised Guar gum

d) Acetates of Guar gum

e) Cationic derivatives of Guar gum

f) Sulphated Guar gum

g) Guar gum formate

h) Guar gum acryl amide

i) Borate cross linked Guar gum

j) Reticulated Guar gum

k) Carboxy methyl hydroxy propyl Guar gum

1) Depolymerised Guar gum

1.5 Guar Industry Vision 2020

The current level of guar seed production in the country is 11.67 lakh tones from an area of 29.75 lakh ha under guar seed cultivation (five year average ending 2007-08) and the average productivity level is 392 kg/ha. The current average productivity of guar seed achieved in Haryana state is 1200 kg/ha, if the same level of productivity is achieved at the national level, the total production can be increased at 35.70 lakh tones, three times of the present level. Taking a conservative and achievable estimate of doubling the productivity, the total production can be achieved at 23.34 lakh tones. Highest production in the country was 15.13 lakh tones in the year 2003-04. With this level of expected production of guar seed, about **7 lakh tones of guar gum** can be produced.

The yield in Haryana is higher by 206%. If 10% growth in productivity is achieved every year, the total productivity can be doubled by the year 2020. The present revenue (foreign exchange earned) is 1125.77 Crores from export of guar products which would also be doubled at the same level of prices, if India is able double its guar seed productivity. The guar processing industry is fragmented and food safety concerns are growing in export front. Processing technology in the country is still not well developed and product specific guar gum derivatives are not processed in the country. To achieve all these, measures required are brought-out in this report. This forms the Guar Industry Vision 2020.

Chapter 2
APPROACH AND METHODOLOGY

Single vision strategy is an approach to align the views of producers, processors, exporters, traders, policy makers, researchers and other stakeholders in the value chain. The main thrust of single vision document is to provide a road map for enhancing export of guar derivatives by bringing operational efficiency through improving different activities.

Single vision unites all parts of the value chain and links the supporting pillars to maximize benefits to all participants in the industry. The first of its kind effort was made in Australia for grains by Grain Research and Development Corporation through the Grain Grower Organizations of Australia. The aim of the Single Vision Grains Australia was to achieve a united, vibrant and internationally competitive Australian Grains Industry. The main approach was identifying consensus between growers and other industry participants on the need for a 'single vision'.

The major concern regarding the export figures of Guar derivatives is that there is high fluctuation in the quantum of export and declining share of guar exports relative to the country's total exports. Since guar gum is mainly being used in food and bakery industry, food safety concerns have become all the more important for guar processing industry. Thus preparedness of guar split and gum manufacturing industries for these food safety concerns, high fluctuation in area, production and productivity of guar seed, high volatile prices of guar seed and gum splits, are of prime importance in achieving the India Guar Industry Vision 2020. In order to promote the exports of guar and its derivatives from the country, need of the hour is long term planning with single vision by taking into account the views of prime stakeholders viz.; Producers, Processors, Government and policies, Exporters, Research and Development personnel, etc.

Hence an attempt is made in this document to suggest approach for devise strategies to achieve single vision with the following specific objectives:

2.1 Objectives of the Study:

1. To identify the critical issues and challenges in production, processing, marketing and export of guar and its derivatives for the long term profitability and sustainability of Guar industry in India.
2. To analyse the gaps in industry linkages, infrastructure, value addition, research and development and in policy for business growth.
3. To suggest strategies for enhancing the value chain to drive the industry to meet opportunities and threat.

2.2 Approach (Single Vision Strategy)

Single Vision document has been prepared aligning the views of prime stakeholders in the value chain of guar seed and its derivatives including production, trade, processing and exports.

a. Identifying a number of issues critical to the long term profitability and sustainability of Indian Guar Industry. Identifying future challenges of guar industry and providing the strategies necessary to meet those challenges. The following issues were considered in the present study

   - Assessing the current and potential gaps in relation to industry capacity, and
   - Gaps in relation to shared vision, strategy, structure, stakeholder responsiveness, people skills, leadership, management and the extent to which the shared values support and/or fragment the industry.

b. The study includes the series of stakeholder meetings and group discussions, grower consultations/ personal interviews, extensive research, industry strategic planning, etc was done to address the ambitious agenda, setting strategic directions for the industry. A high level consensus has been arrived at about the need for whole of farm approaches to guar production and whole of industry distribution and marketing.

c. The approach followed for guar single vision strategies can be outlined as:

- Meetings: meeting of all stakeholders/ task groups
- Interviews: personal/ telephonic interviews and discussion with producers, traders, processors and exporters.
- Inviting task group reports and their views and comments.
- Logical analysis of primary and secondary information.

Fig-6: Approach for Guar Single Vision Research

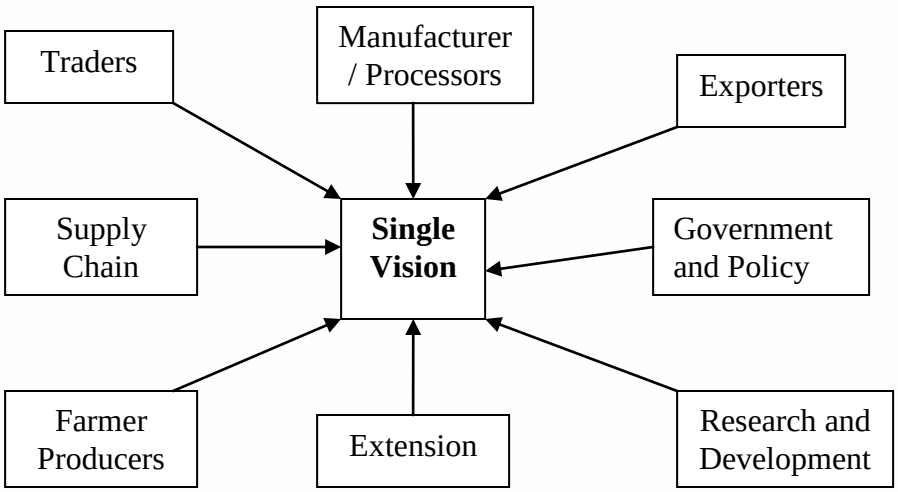


Table-7: Series of Meetings conducted with prime stakeholders:

S. No.	Date	Place	Stakeholders
1	01.08.2005	NIAM, Jaipur	Traders, Processors
2	17.05.2006	Sitapura, Jaipur	Processors
3	18.01.2007	MIA, Jodhpur	Producers, Traders, Processors, Exporters
4	29.12.2008	Bikaner	Producers. Processors, Traders
5	30.12.2008	Ganganagar	Producers, Processors, Traders, Exporters
6	30.12.2008	Hanumangarh	Producers, Traders
7	31.12.2008	Hissar	Traders, Research
8	31.12.2008	Siwani	Processors
9	01.01.2009	Churu	Producers, Traders
10	01.01.2009	Sikar	Producers, Traders

Chapter 3
PRICE MOVEMENT OF GUAR

Guar seed has shelf life of more than 3 years without losing out on any of its properties or qualities. It requires the barest minimum maintenance and handling environment. Therefore, traders or stockists store this even for more than 6-7 years. Guar crop in mainly grown under rain-fed conditions, prices of guar seed as well as its derivatives very much depend on the monsoon condition and its likely production. The prices are observed to be highly volatile during monsoon months. The price of Guar seed ranges from Rs 850/- per quintal to Rs 3500/- quintal. While guar gum price varies from Rs 3000 per quintal to Rs 8000 per quintal.

Guar seed prices are influenced by the following factors:

- Rainfall during sowing and critical stages of growth
- Area sown under the crop in major states like Rajasthan, Haryana, Punjab, Gujarat, etc.
- Pattern of arrivals on a regular basis in markets like Jodhpur, Bikaner, Sri Ganganagar, Adampur, Bhiwani, Siwani, etc.
- Demand from millers or processors and export demand.

3.1 Fluctuation in Spot prices

The spot price of guar seed for the last 8 years i. e., from 2000-01 to 2007-08 reflects high volatility of prices in this commodity upto 2004-05. The prices fluctuate highly during monsoon period i.e. July to October. Guar seed traded between Rs 890/qt during March, 2001 to Rs 1680/qt in the month of December, 2000. Highest fluctuation in prices of guar seed has been observed in the year 2002-03. During this year prices remains lower in the initial months at about Rs 900/qt. and increased in the monsoon months and remain high in the month of November, 2003 at Rs. 1845/qt.

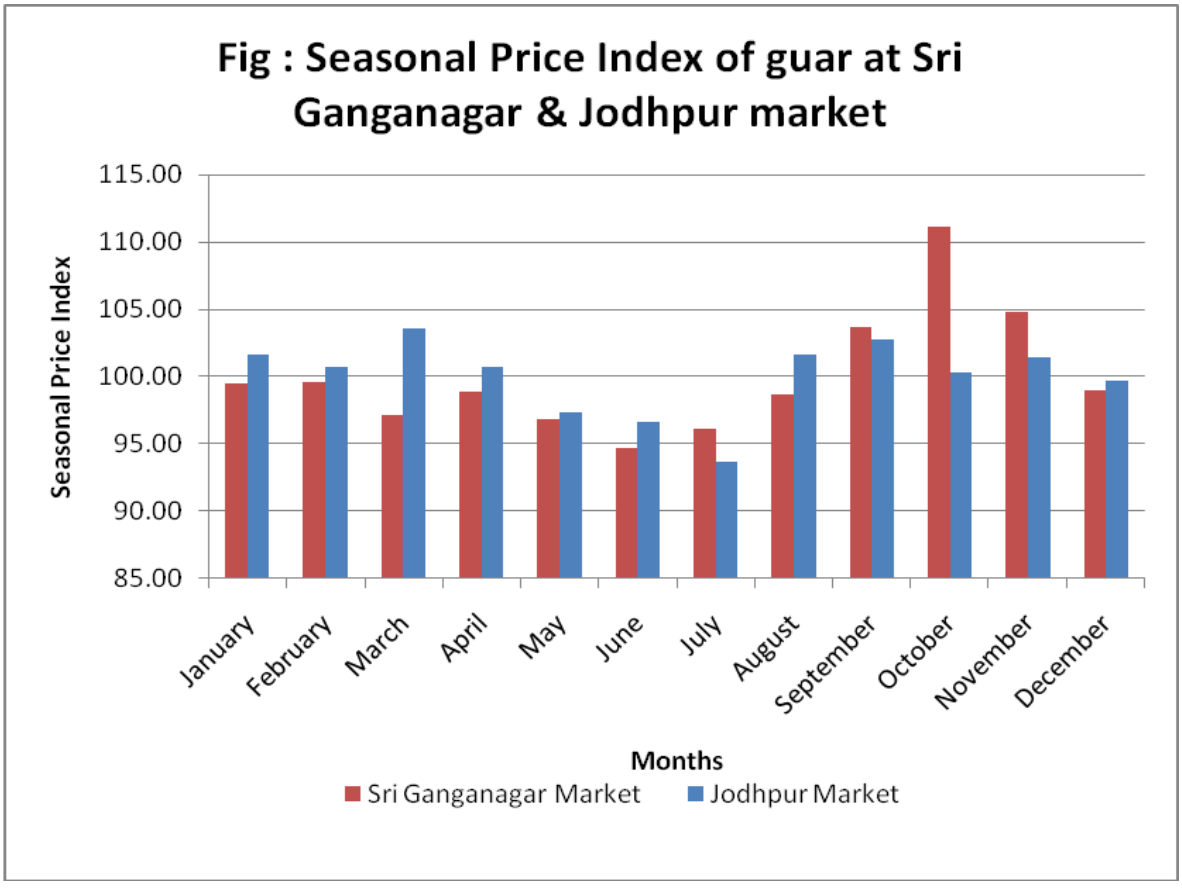
Annual volatility (measured as Coefficient of Variation) in mandi prices of guar seed at different markets has been worked out and presented in table-8 and Fig.7. Results of the analysis reflect that there was high volatility in prices of guar seed at Sri Ganganagar (26.5% in 2003, 21.3% in 2004 and 20.2% in 2007), Anupgarh (20% in 2004),

Hanumangarh (21% in 2004), Fatehabad (19% in 2004) and Hisar (25% in 2003) markets, as indicated by the higher magnitude of CV in the respective markets.

The high price fluctuation in guar is mainly on account of higher fluctuation in area and production of guar seed depending on the spread and level of monsoon rainfall in the producing centres and the export demand of guar gum from the importing countries.

Table-8: Volatility in Guar seed prices (C.V. in %)

Year	Rajasthan			Haryana		
	Sri Ganganagar	Anupgarh	Hanumangarh	Adampur	Fatehabad	Hissar
2002	5.0					
2003	26.5	11.2	17.4		7.7	24.7
2004	21.3	20.9	21.1		18.6	3.5
2005	10.2	9.4	8.6	2.1	8.3	8.1
2006	7.9	8.6	7.2	7.3	8.0	7.2
2007	20.2	5.7	8.1	5.7	7.8	9.9
2008	8.3	7.3	7.8	8.2	8.5	8.8



3.2 Futures Trade for minimizing price risk

Futures trade in Guar seed started in the month of April, 2004 on NCDEX platform with the objective of price discovery and price risk management. Since then Guar seed contracts are being traded on NCDEX, MCX, NMCE and Bikaner Commodity Exchange. Futures contracts for Guar Gum are available on NCDEX and MCX platform. Futures trade in agri-commodities provides good hedging platform for the farmers, processors, exporters, etc in the value chain. The total value of output of guar seed is estimated at Rs 1,238 crore during 2005-06 (June – July), which has enjoyed a futures turnover of Rs 299,305 crore (242 times of guar output) during May 2005- March 2006.

Table-9: Volume of trade on Commodity Bourses

Year		Guar Seed	Guar Gum	Agri Commodities	Total Commodities	% of Agri	% of Total
2002-03	Volume	0.0	0.0	314.4	314.5		
	Value	0.0	0.0	66342.3	66530.7		
2003-04	Volume	2.1	0.0	490.7	493.0	0.4	0.4
	Value	225.2	0.1	123914.3	129363.7	0.2	0.2
2004-05	Volume	799.1	28.8	1939.4	1942.1	42.7	42.6
	Value	129523.0	13412.1	390188.4	571759.6	36.6	25.0
2005-06	Volume	1902.0	79.7	5818.8	6788.7	34.1	29.2
	Value	330439.4	36986.3	1192226.9	2155122.0	30.8	17.0
2006-07	Volume	1609.9	25.9	5023.9	6129.3	32.6	26.7
	Value	324881.4	13132.1	1317125.2	3676926.7	25.7	9.2
2007-08	Volume	670.5	10.8	3145.2	5573.4	21.7	12.2
	Value	123752.6	4940.5	941361.1	4065989.5	13.7	3.2
2008-09(Aug' 08)	Volume	301.1	3.9	1153.2	2467.7	26.4	12.4
	Value	57189.1	1798.9	288607.1	2084442.6	20.4	2.8

Note: Volume in Lakh Tonnes, values in Rs. Crores

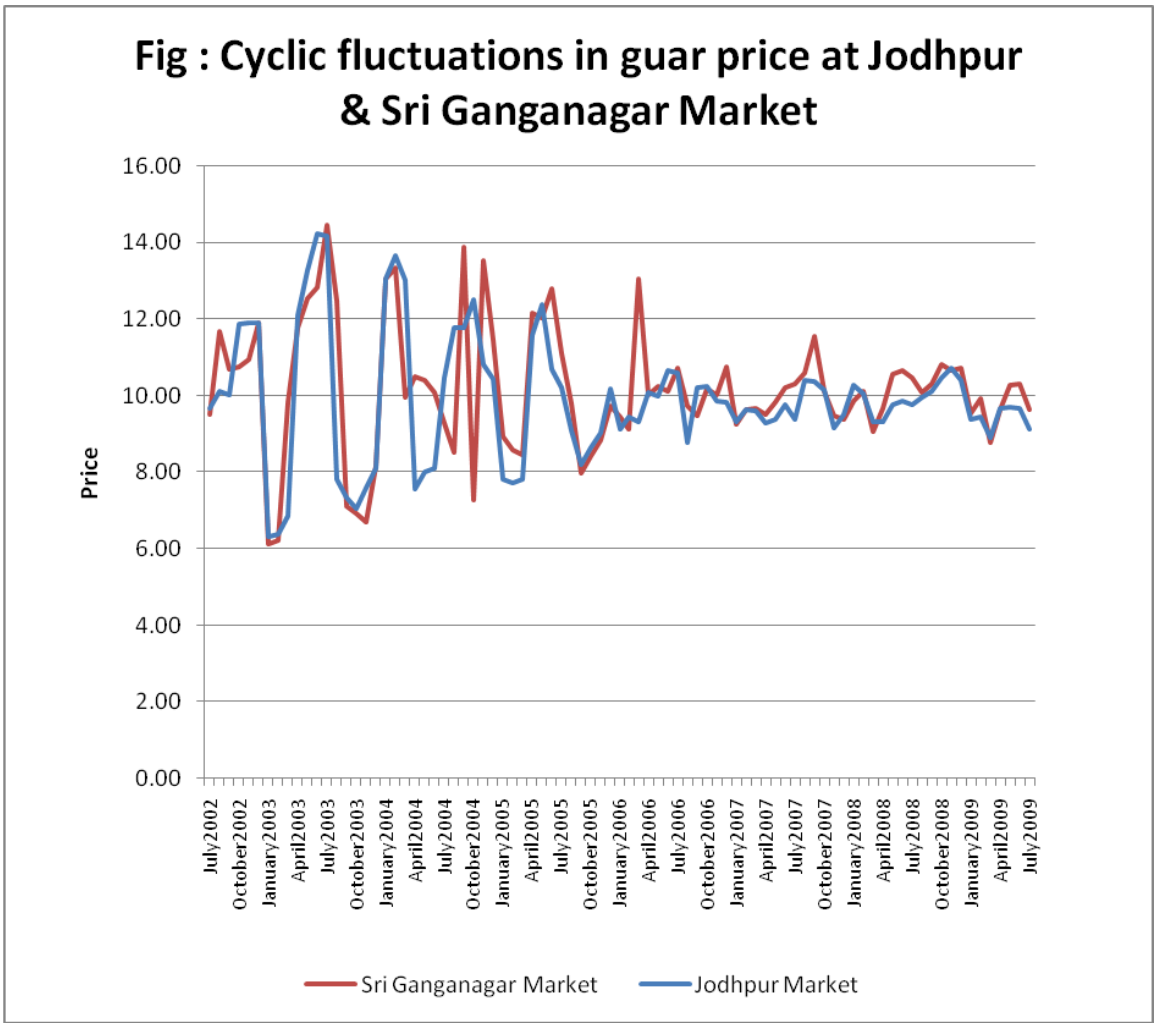
Total volume of guar seed and guar gum traded on commodity futures exchanges has continuously increased in the initial years and accounts for more than 30% of total volume traded of agricultural commodities. The total quantity traded on commodity bourses was 88 times of total quantity of guar seed produced in the year 2004-05, 179 times in the year 2005-06, 146 times in the year 2006-07 and 53 times in the year 2007-08 (Table-10).

Table-10: High –Low difference in Guar seed prices

(Rs/Qt)

Year	High	Low	Average	Difference (H-L)
2004	1881.65	1002.8	1399.9	878.9
2005	2040.40	1358.3	1567.1	682.1
2006	2336.35	1560.6	1824.2	775.8
2007	1963.70	1744.1	1848.6	219.6

The decreasing high-low price difference after introduction of commodity futures in guar seed indicates that the spot price volatility of guar seed has decreased (Table-10). The cyclic fluctuations in prices of Guar at Sri Ganganagar and Jodhpur markets (fig. 8) also shows that fluctuation in prices after 2005 is around mean and price are less fluctuating.



Chapter 4
GUAR SEED MARKETING AND SUPPLY CHAIN

Guar is a mainly grown in Kharif season, and seed output enters in the markets in the month of November- December. The part of produce (5-10%) is retained by farmers for seed, and animal feed purpose.

Table-11: Major APMC trading in Guar Seed

State	Mandi
Rajasthan	Jodhpur, Bikaner, Sriganganagar, Hanumangarh, Churu, Sikar, Jaipur, Jaisalmer, Barmer, Nagaur, Nokha
Haryana	Adampur, Fatehabad, Hisar, Sirsa, Bhiwani, Ellanabad
Gujarat	Kachch, Banaskanta, Sabarkanta, Mehsana, Patan, Ahemdabad
Punjab	Bhatinda

There are more than 150 split units in India, and the total installed capacity is more than 6 lakh tonnes per annum. There are two types of guar seed processing industries, namely, processing of guar seed to guar gum and guar gum to powder. All the split units have indigenous plant and machinery and are mainly located in Jodhpur and Bikaner of Rajasthan. Splits are available in various grades in terms of purity- 90%, 92%, 95% and 97%. The pulverized gum is largely sold as a commodity, and about 40% of the exports are still in the form of refined splits.

In regard to guar gum, although chemical analysis of different varieties is available and the processors could exercise preference for varieties with higher gum contents, it is not being done due to lack of knowledge by trade and industry. The parameters for buying are quite subjective like colour, shape and size.

Peak and lean period of guar marketing

Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Sowing		Crop growth		Peak arrivals			Lean arrivals				

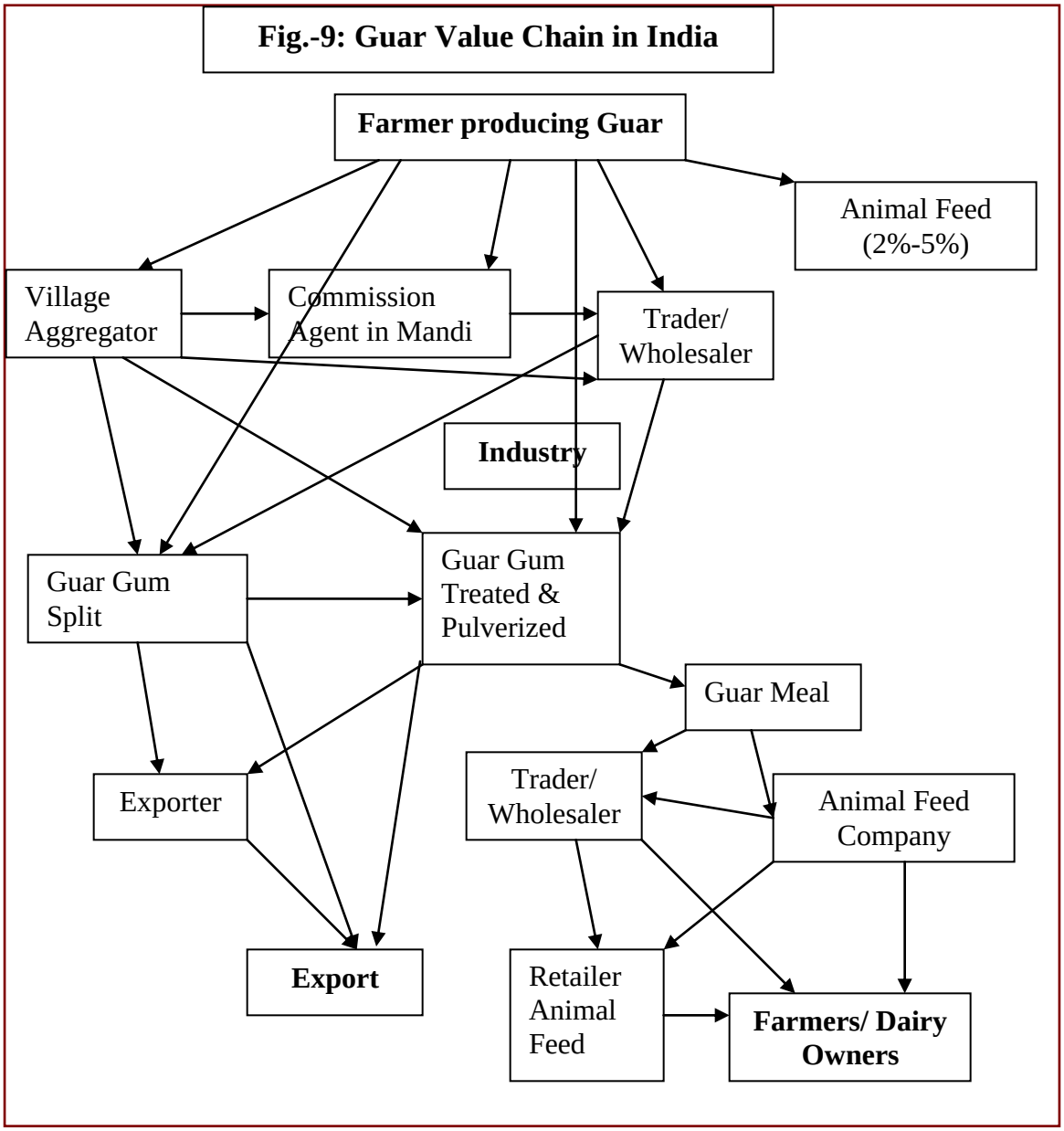
4.1 Guar Supply Chain

Guar seed is used for animal feed, and extracting guar split and gum. Farmers retain part of produce to feed animals or source from farmers in the village. There are number of

guar processing industries in Jodhpur, Bikaner, Ganganagar, Alwar and Jaipur in Rajasthan state, in Bhiwani and Sirsa in Haryana state and Deesa, and Ahemdabad in Gujarat state. These industries can be grouped into guar split manufacturers, and guar gum processors. The common supply chain of guar includes;

Guar Seed Value Chain in India

Fig.-9: Guar Value Chain in India



Split manufacturers source guar seed procurement either from village traders or from farmers in the mandi through commission agents. Another supply chain is farmers selling

guar seed in mandi through commission agent to stockists/ traders, and traders selling it to split manufacturers or guar gum processors. Split manufacturers after processing guar seed into split either export to the importing countries directly or through exporters, or sale it to the gum processors. Similarly gum processors source guar seed either from village traders, farmers in mandi through commission agents or from stockists/ traders, or they procure split from split manufacturers. After processing of guar seed/ split into different industry specific guar gum products, they export it to the importing countries or sale to the domestic industries for further use.

4.2 AGMARK Grade Standards

Table-12: Grade designations and definitions of quality of Dehusked split (Refined) Guar Gum

Definition of quality (Special characteristics)							
Grade Designation	Moisture % by weight (Max.)	Ash % by weight (Max.)	Protein % by weight (on dry basis)	Residue insoluble in acid (Max.)	Gum % by weight (Min.)	Black splits % (Max.)	General Characteristics
Standard	10.0	1.0	Not more than 9%	5.0	80.0	1.0	The dehusked split guar gum shall : (a) be obtained by milling guar seeds after removal of husk from guar pods of the plant botanically known as Cyamopsis tetragonoloba family Leguminosae. (b) be free from dirt, dust added colouring matter visible mould growth insect infestation and ob-noxious smell. (c) have characteristics shape, size and colour
General	11.0	2.0	Not more than 9%	7.0	75.0	2.0	

* Includes organic extraneous matter such as stems, straw, chaff.

Table-13: Grade designations and definitions of quality of Guar Gum (Pulverised)

Definition of quality (Special characteristics)									
Grade Designation	Moisture % by weight (Max.)	Ash % by weight (Max.)	Protein % by weight (on dry basis)	Residue insolubl e in acid (Max.)	Gum % by weight (Min.)	Viscosit y at 25^0C in centipoi ses (Min.)	pH	Arsenic As2O3 ppm (max)	Lead ppm (Max.)
Grade-I	11.0	0.5	<= 9%	3.0	80.0	3000	5.5-7.5	1.0	5
Grade-II	12.0	1.0	<= 9%	5.0	70.0	2000	6.0-8.0	1.0	5
Grade-III	13.0	1.5	<= 9%	7.0	55.0	1000	6.0-8.0	1.0	5

* Includes organic extraneous matter such as stems, straw, chaff.

4.3 Industry Standards of Guar Products

Guar Refined Split: Dehusking requires sophisticated processing capability with the price of the product being dependent on the splits meeting specifications laid down by buyers for moisture content, density, protein content, impurities and particle size.

Table-14: Specifications guar gum splits (from Shree Ram Gum Company (RamcoL Series, 2004)

Attribute	Specification
Gum content	80-85%
Dehusked split	90% minimum
Protein	5% Maximum
Ether Extract	0-6% Maximum
Ash	1% Maximum
Moisture	10% Maximum
Crude Fibre	1.5% Maximum
Degree of Refining	Double Refined

Guar Gum: Guar gum can be further differentiated by specialized processing such that highly refined guar gum is produced for the food ingredient industry, being used as a stiffener in soft ice cream, a stabilizer for cheeses, instant puddings and whipped cream substitutes as well as a meat binder. Lower grade guar gum also has applications in cloth and paper manufacture, oil well drilling muds, explosives, ore flotation and a host of other industrial applications. Specifications vary as per buyers' requirements but mesh (particle) size, viscosity, pH and for food grade guar gum, microbiological standard are all important attributes. Example guar gum specifications for the food ingredient and personal care industries are detailed in the Table-15.

Table-15: Chemical and physical specifications of guar gum for the Food Ingredient and Personal Care industries (from Swift & Company Ltd, 2000, Rhodia Inc, 2004)

Attribute	Specification
Sieve Analysis	
Retained on BSS 100 Mesh	Traces
Retained on BSS 200 Mesh	7% Max
Passed thru BSS 200 Mesh	92% Min
Viscosity (1% solution cps)	Brookfield RVT at 25^0C, 20 RPM
Cold Viscosity 2hrs	3500-4200
24hrs	Not less than 2 hrs (stable)
Hot Viscosity 2hrs	4300-4800 (5000-6000 now common)

Analytical indication	
Polysaccharide (gum content)	80% Minimum
Loss on drying (5hr. 105^0C)	10-12% Maximum
Ash Content (5hr. 700^0C)	1% Maximum
Protein (N-content x 6.25)	4.5% Maximum
Acid Insoluble Residue (AIR) (crude fibre)	3% Maximum
Fat Content	0.5% Maximum
pH (1% solution in distilled water at 25^0C)	5.5 – 6.5
Microboilogical Standard	
Total plate count	5000 cfu gm Maximum
Yeast	500 cfu gm Maximum
Moulds	500 cfu gm Maximum
E. coli	Absent
Salmonella	Absent

USA is the largest consumer of guar gum with an annual consumption of about 45,000 tonnes which constitutes about 25% of world trade. Germany & Japan together accounts for about 23%, while UK, Denmark and the Netherlands together take a further 22% of world trade. An area of growth is in Asia and South America as standards of living increase resulting in the increased consumption of processed food.

Processing of Guar Seed

Guar Seed - The pods are sun dried, manually separated from the seeds and the seeds are supplied to the industry for processing. Guar By-products, viz, Churi and Korma are used for Cattle feed.

Table-16: Constituents of Guar Seed

Part of Seed	Protein %	Ether extract %	Ash %	Moisture %	Fibers %	Types of Sugar
Hull (14-17%)	5	0.3	4	10	36	D-glucose
Endosperm (35-42%)	5	0.6	0.6	10	1.5	Galactomannon
Germ (43-47%)	55.3	5.2	4.6	10	18	Glucose

Refined Guar Splits - When the fine layer of fibrous material, which forms the husk, is removed and separated from the endosperm halves by polishing. When the polished endosperm are removed and separated from the fine layer of fibrous material a husk and refined Guar splits are obtained.

Guar Powder - These refined splits are then pulverized and treated and processed using tailor made technology for specialty grade products for usage in industries specified. After pulverization, sieving is done to get the required mesh size i.e. fine, coarse, etc. and is converted into powders by a variety of means and processing techniques depending upon the end product desired.

The Guar gum is mechanically extracted by roasting, differential attrition, sieving and polishing of Guar seeds. The sieved gum is then passed through the blenders to make it homogenous and later it is packed for marketing. The gum is refined to make yellowish white powder as per the quality specifications required by consuming industries and grades specified. It is consumed in this form world wide.

The modern high technology units employ hammer /or Jet mills and other equipment's using the latest techniques to produce powders with higher fineness, finer colloid formation, higher water absorption and consistency. Especially gum powder is produced as per the requirement of Pharmaceuticals, Cosmetics and Food processing industries'.

The Guar Gum: Guar Gum Refine Splits is the sole raw material for processing Guar Gum Powder for pharmaceutical and Food grade material. The properties of Guar Powder, which make it useful in various applications, are -

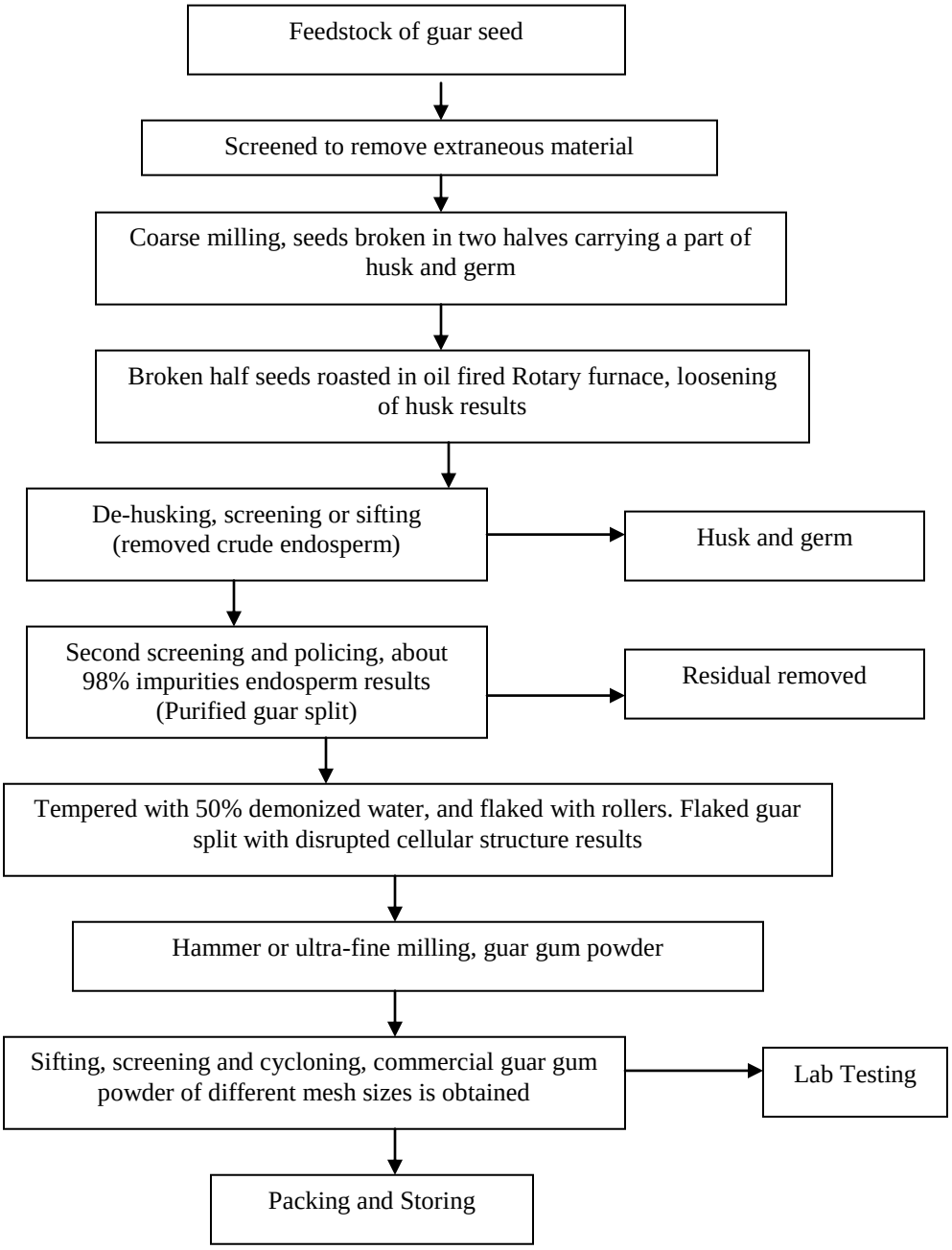
- Easy solubility in cold and hot water
- Film forming property
- Resistance to oils, greases and solvent
- Better thickening agent
- Water binding capacity
- High viscosity
- Functioning at low temperatures

4.4 Gaur Extracts

- Extracts from Gaur seed accounts for - Gaur Split/Gum- 29% (+/- 4% variance)
- The ratio of Churi and Korma varies from 30% to 41% depending upon the quality of the seed.
- Split/Gum is further refined to Guar Powder

- Churi and Korma are used as Cattle Feed

4.5 The Processes of extraction of Gum



Chapter 5
GUAR TRADE SCENARIO

The derivatives of Guar seed like guar gum and guar meal are being exported from India. Nearly 80 per cent of Guar gum and split produced in the country is being exported which fetches good amount of foreign exchange. The major markets are United States of America, China, Germany, France, Mexico, Argentina, Japan, Indonesia, etc.

Table-17: Major Exporting countries of Mucilages and Thickeners (HS code 13032)

2007			2006		
Exporting Country	**Value (000USD)**	**Percentage Share**	**Exporting Country**	**Value (000USD)**	**Percentage Share**
India	219,533	38.54	India	228,480	38.13
Spain	84,597	14.85	Spain	84,149	14.04
USA	46,700	8.2	USA	53,991	9.01
Italy	38,154	6.7	Italy	44,783	7.47
Pakistan	29,455	5.17	Pakistan	26,717	4.46
Germany	24,432	4.29	Morocco	23,304	3.89
France	19,649	3.45	France	21,853	3.65
Morocco	17,335	3.04	Portugal	21,446	3.58
Denmark	16,235	2.85	Denmark	21,159	3.53
Switzerland	15,595	2.74	Germany	20,293	3.39
Portugal	15,306	2.69	Switzerland	16,756	2.8
Netherlands	13,809	2.42	Netherlands	9,670	1.61
United Kingdom	6,007	1.05	United Kingdom	6,059	1.01
Japan	5,104	0.9	China	4,756	0.79
China	4,355	0.76	Japan	2,680	0.45
Turkey	3,774	0.66	Turkey	2,105	0.35
Belgium	2,318	0.41	Belgium	1,671	0.28
Canada	1,544	0.27	Philippines	1,209	0.2
Total	569696.2	100.00	Total	599253.9	100.00

Source:- APEDA website.

Guar gum is classified under Mucilages and Thickeners group (HS code 13032) in harmonized system of classification in international trade. Mucilages and Thickeners includes derivatives of Locust bean, Locust bean seeds and Guar Seeds. India is the largest exporter of guar gum and mucilages with 38% share of world mucilages and thickeners trade, followed by Spain (14%), USA (9%), Italy (7%), Pakistan (5%) and Germany (4%). Countries like USA, Spain, Italy, Germany, etc. imports guar refined split from India and process it into industry specific guar gum products and re-export it.

Major importing countries of guar gum or mucilages and thickeners group is USA with about 30% of total world mucilages and Thickeners import followed by Germany (12%), Japan (6%), Denmark (6%), Italy (6%), etc. (Table-17).

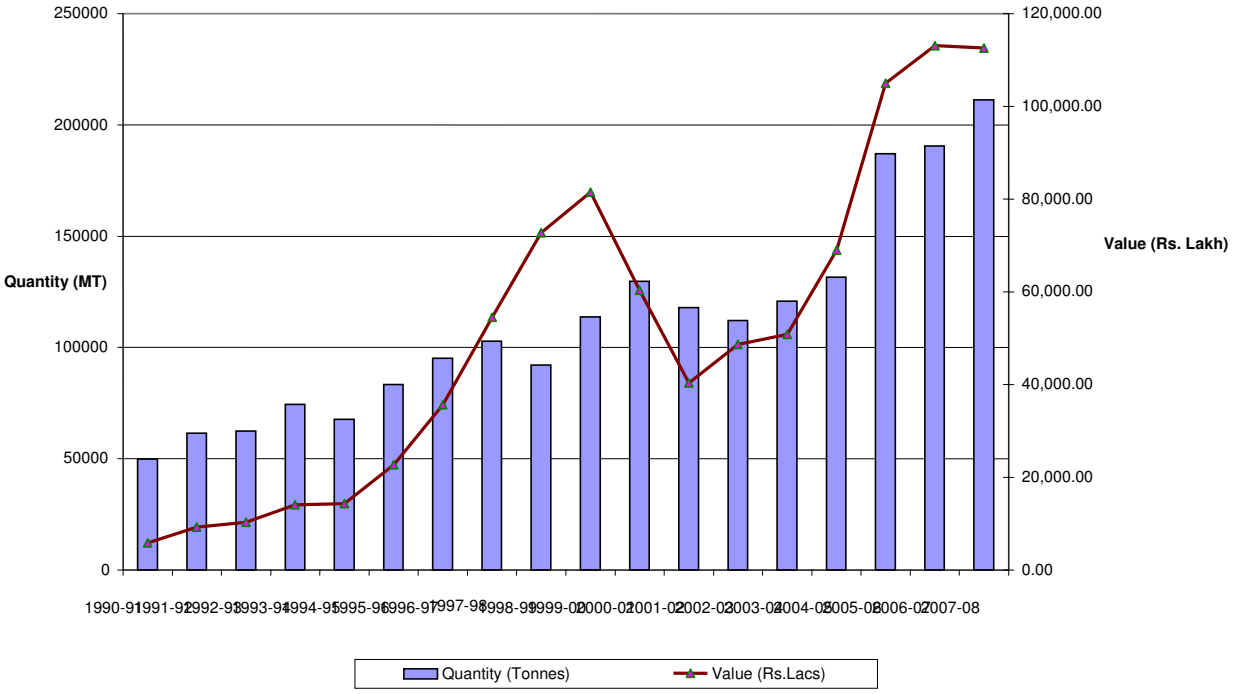
Table-18: Major importing countries of Mucilages and Thickeners

2007			2006		
Importing Country	Value (000USD)	Percentage Share	Importing Country	Value (000USD)	Percentage Share
USA	157,031	27.56	USA	183,657	30.65
Germany	69,297	12.16	Germany	71,409	11.92
Denmark	39,306	6.9	Japan	37,783	6.31
Japan	39,134	6.87	Denmark	32,641	5.45
Italy	28,978	5.09	France	26,722	4.46
France	27,099	4.76	Italy	22,745	3.8
Russian Federation	27,049	4.75	Canada	22,189	3.7
Canada	22,950	4.03	China	16,327	2.72
China	22,162	3.89	Russian Federation	15,759	2.63
Belgium	13,556	2.38	Belgium	14,640	2.44
Australia	13,148	2.31	United Kingdom	14,074	2.35
Switzerland	11,444	2.01	Spain	13,709	2.29
United Kingdom	10,439	1.83	Mexico	12,286	2.05
Netherlands	10,375	1.82	Australia	10,807	1.8
Brazil	7,674	1.35	Netherlands	10,468	1.75
Poland	7,512	1.32	Switzerland	9,207	1.54
Rep. of Korea	6,631	1.16	Brazil	8,509	1.42
Thailand	6,383	1.12	Thailand	8,136	1.36
Total	569696.21	100.00	Total	599253.9	100.00

Source:- APEDA website.

Exports of guar products are continuously increasing with the annual compound growth rate of 7.6% in quantity terms and 17.1% in value realized. The major items of export among guar products are Guar Gum Treated and Pulverized followed by Guar gum Refined Split and Guar meal. Total quantity of guar products exported from India was about 50 Thousand Tones valued at Rs. 5814.54 Lakhs during 1990-91, which has increased to 211 Thousand Tonnes valued at Rs. 112577.4 Lakhs during 2007-08 (Fig. 10). Export of guar derivatives have increased sharply from 2005-06. Growth in export of guar meal worked out at 25% in quantity terms and 32% in value terms. Export of guar gum refined split has grown at the rate of 5.3% in quantity terms and 14.6% in value terms. While export of guar gum treated and pulverized has shown an increase of 8.6% in quantity and 18% in value (Table 18).

Fig-10: Export of Guar Products from India



5.1 Exports of Guar derivatives from India

Nearly 75-80% of the Guar Gum or other derivatives of Guar seed are being produced in India and are exported mainly to USA and European countries. The value added derivatives of Guar seed are used by the various industries in India as well as abroad. Pakistan, Sudan and parts of USA are the other major Guar growing countries which produces nearly 20% of world guar seed production. The derivatives of Guar seed like guar refined splits, guar gum powder and guar meal are being exported from India. Nearly 80 per cent of Guar gum and split produced in the country is being exported which fetches good amount of foreign exchange.

Export figures of guar derivatives also shows sizeable inter year variability. A quick review of export figures shows that the export of refined guar split, an intermediate product, is increasing with 5.3% compound annual rate of growth in quantity terms and 14% in value terms. Export of guar gum treated and pulverized has increased at 8.3% C.A.G.R in quantity terms and 18% in value terms (table-19). Coefficient of Variation (CV) and Instability index (CVt) in export of guar products shows that the export of Guar

meal was highly instable and volatile in quantity and value terms. CV for value export of Guar refined split (64.2%) and Gum treated and pulverized (76.6%) indicates high instability in export value realization.

Table-19: Export of Guar Seed and Derivatives from India

Year	Guar Seed		Guar Meal		Guar Gum Refined Split		Guargum Treated & Pulverized	
	Quantity (Tonnes)	Value (Rs.Lacs)	Quantity (Tonnes)	Value (Rs.Lacs)	Quantity (Tonnes)	Value (Rs.Lacs)	Quantity (Tonnes)	Value (Rs.Lacs)
1987-88			57.12	9.52	29868.9	5850.38	22994.6	40482.01
1990-91			60.0	5.9	23344.0	2435.0	26448.1	3373.6
1999-00	18.00	8.36	1837.81	1,220.50	44515.7	31,575.93	67393.33	48,680.18
2000-01	143.24	41.13	1720.18	923.52	43954.92	20,597.64	83855.73	38,773.94
2001-02	3.40	7.02	756.00	334.69	32961.36	10,131.20	84165.66	29,843.24
2002-03	45.25	8.56	1097.46	459.11	41337.02	18,051.25	69513.88	30,163.40
2003-04	217.97	51.33	4691.37	1,868.63	38072.29	15,317.01	77797.60	33,603.89
2004-05	225.20	55.01	4706.02	2,256.71	49801.43	22,165.98	76792.54	44,524.99
2005-06	359.50	85.77	3146.53	1,078.01	49381.32	23,797.66	134190.56	80,047.61
2006-07	1286.21	562.51	192.50	85.87	41266.75	19,328.34	147845.12	93,164.99
2007-08	8.41	2.82	7025.1	1,329.41	63711.36	30,206.81	140430.13	81,038.35
CAGR (%)			25.3	32.1	5.3	14.6	8.6	18.0
CV (%)			132.73	120.77	31.29	64.21	48.32	76.58
CVt (%)			94.57	90.22	16.25	41.90	21.14	36.00

Source: DGFT

The export composition of guar derivatives shows that export of refined guar splits was 47% and guar gum treated and pulverized was 53% in the year 1990-91. The proportion of refined guar split, an intermediate product, has dropped to 30% of total guar derivatives export from the country, but still a sizeable quantity of exports is contributed by this raw material used for processing into different industry specific guar gum products. The major share of the guar processed in India is exported either in form of semi processed product i.e. refined splits or in form of guar powder. In the recent years export of modified/derivatives gums have also started. An area of growth is in Asia and South America as standards of living increase resulting in the increased consumption of processed food.

Per unit value realization from export of split and gum pulverized indicates that export of guar gum treated and pulverized fetches about 25% - 30% higher income to the country compared to export of Guar refined splits. Evening out 5-10% increase in cost (as discussed with processors) of processing splits to gum powder, still 15-20% net income

can be achieved, and also processing industry provides employment to the population in the area.

India is the leading exporter of guar gum. The major importing countries of Indian guar products are E.U, United States of America, China, United Kingdom, South Africa, and Japan. In 2005-06, the top importing countries were U.S with 75,000 tonnes, China with 27,000 tonnes, Germany with 17,700 tonnes, Italy with 4,500 tonnes and Netherlands with 4,500 tonnes. The country exported about 2,05,000 tonnes of guar gum during the year 2006-07 as compared to 1,86,000 tonnes in 2005-06. The exports are expected to climb slightly higher to 2,10,000 tonnes in 2007-08 as production in Pakistan is expected lower this year.

5.1.1 Export of Guar Meal to major countries from India

Guar meal is the by-product of guar gum processing industry and is mainly being used for animal feed purpose. Animal feed manufacturers and dairy owners are the larger buyers of guar meal. The major importer of Indian Guar Meal presently is Malaysia followed by Vietnam, Germany, China, Korea, Netherlands, Russia, Thailand and USA. Till 2006-07 USA was the largest importer of guar meal with about 40% share of total India's guar meal export (Table 20). During 2007-08 Malaysia accounted for largest import of guar meal from India (57%).

Table-20: Export destinations of Guar meal from India

1996-97		1997-98		2006-07		2007-08	
Country	Qty. (MT)	Country	Qty. (MT)	Country	Qty. (MT)	Country	Qty. (MT)
U S A	235.1 (43.5)	U S A	62.68 (27.4)	U S A	71 (36.9)	Malaysia	4,002.0 (57.0)
Hong Kong	100 (18.5)	Belgium	40 (17.5)	Yemen	68 (35.3)	Vietnam	2,639.0 (37.6)
Indonesia	60 (11.1)	Germany	20 (8.7)	Italy	20 (10.4)	Germany	25.8 (0.4)
Egypt	40 (7.4)	U K	40 (17.5)	Russia	20 (10.4	China	160 (2.3)
Nigeria	20 (3.7)	Hong Kong	40 (17.5)	China	4 (2.1)	Korea	33.5 (0.5)
Bangladesh	25 (4.6)	Japan	20 (8.7)	Iran	5 (2.6)	Netherlands	16.5 (0.2)
Japan	20 (3.7)	Malaysia	4 (1.7)	Sri Lanka	2 (1.0)	Russia	50.34 (0.7)
Germany	20 (3.7)	UAE	2 (0.9)	Nepal	2 (1.0)	Thailand	9 (0.1)
Singapore	20 (3.7)			Taiwan	0.5 (0.0)	U S A	12 (0.2)
						Yemen	9.7 (0.1)
						Syria	23 (0.3)
						Jordan	17 (0.2)
						Iran	4 (0.1)
						Others	23.26 (0.3)
Total	540.1 (100.0)	**Total**	228.68 (100.0)	**Total**	192.5 (100.0)	**Total**	7025.1 (100.0)

Source: DGFT, Note:- figures in parentheses are percentage to total export.

5.1.2 Export of Guar Refined Split to major countries from India

Guar refined split is manufactured from guar seed and is an intermediate product used for processing and producing different industry specific guar gum products. USA continues to be the major importer of guar refined split, followed by china, South Africa, Netherlands, Germany, United Kingdom, Spain, etc. During 2006-07, China emerged as largest importer of guar refined split, according to trade sources China imposes import duty to the tune of 15% on import of Guar gum and import of guar refined split is free. Thus, China is encouraging import of intermediate product, process it into different industry specific guar gum products and re-export it. Similarly all other countries who are importing guar refined split in bulk from India process it and re-export the finished product.

Table-21: Export destinations of Guar refined splits from India

1996-97		1997-98		2006-07		2007-08	
Country	Qty. (MT)	Country	Qty. (MT)	Country	Qty. (MT)	Country	Qty. (MT)
U S A	22,508.6 (72.0)	U S A	18,592.75 (45.3)	China	20,620.0 (50.0)	U S A	27,931.1 (43.8)
South Africa	1,858.0 (5.9)	Germany	6,163.76 (15.0)	U S A	12,825.63 (31.1)	China	23,339.12 (36.6)
Germany	869.2 (2.8)	Hong Kong	2,438.50 (5.9)	South Africa	3,313.53 (8.0)	South Africa	4,861.78 (7.6)
France	656.3 (2.1)	Netherlands	2,378.0 (5.8)	Netherlands	720 (1.7)	Netherlands	2,026.17 (3.2)
Pakistan	840 (2.7)	South Africa	1,555.5 (3.8)	Belgium	655.15 (1.6)	Germany	738.76 (1.2)
Japan	626 (2.0)	U K	1,394.63 (3.4)	Spain	640.22 (1.6)	U K	505.41 (0.8)
China	706 (2.3)	China	1,442.0 (3.5)	Germany	221.4 (0.5)	Spain	588 (0.9)
Hong Kong	500 (1.6)	Japan	984.25 (2.4)	Pakistan ir	440 (1.1)	UAE	433 (0.7)
Netherlands	364 (1.2)	Australia	804.35 (2.0)	Italy	252.6 (0.6)	Belgium	367.46 (0.6)
U K	375.36 (1.2)	France	734.5 (1.8)	Switzerland	248 (0.6)	Australia	248.58 (0.4)
Zimbabwe	429 (1.4)	Italy	718.7 (1.8)	Japan	99 (0.2)	Thailand	298.1 (0.5)
Spain	398 (1.3)	Belgium	716.75 (1.7)	Australia	140.7 (0.3)	Brazil	260.48 (0.4)
Italy	300 (1.0)	Spain	641 (1.6)	Brazil	71 (0.2)	Switzerland	247.5 (0.4)
Others	834.25 (2.7)	Others	2483.89 (6.1)	Others	1019.52 (2.5)	Others	1865.9 (2.9)
Total	31264.67 (100.0)	Total	41048.58 (100.0)	Total	41266.75 (100.0)	Total	63711.36 (100.0)

Source: DGFT, Note:- figures in parentheses are percentage to total export.

Figures in table 21 revealed that the export of refined guar split has increased mainly to USA and China. These are the countries acquiring strength in the processing of guar split to the value added guar gum and other industry specific products. China and USA now

started exporting value added products to other countries. The main demand of guar seed originates from the US petroleum industry and also the oil fields of Middle East. The major markets are United States of America, China, Germany, United Kingdom, Spain, UAE, Belgium, Austria, etc.

5.1.3 Export of Guar Gum treated and pulverized to major countries

USA continues to be the largest importer of Guar gum from India with an annual import of more than 53,000 tonnes presently which represents 38% of total guar gum exports of India. Germany & China are the other major importers of guar gum from India with more than 17,000 and 10,000 tonnes of annual imports respectively from India, which accounts for 12% and 7.7% of total guar gum export from India (Table-22). Other major importers of guar gum are Italy, South Africa, Russia, Australia, Netherlands, Japan, Brazil, Belgium and Canada. Presently India exports guar gum to more than 90 countries.

Table-22: Export destinations of Guar gum treated and pulverized from India

1996-97		1997-98		2006-07		2007-08	
Country	Qty. (MT)	Country	Qty. (MT)	Country	Qty. (MT)	Country	Qty. (MT)
U S A	16,743.16 (26.4)	U S A	20,234.68 (32.9)	U S A	54,032.23 (36.5)	U S A	53,831.46 (38.3)
Germany	10,141.03 (16.0)	Germany	9,635.80 (15.6)	Germany	18,518.88 (12.5)	Germany	17,135.12 (12.2)
Hong Kong	5,246.40 (8.3)	Hong Kong	4,422.00 (7.2)	China	10,916.95 (7.4)	China	10,799.87 (7.7)
U K	3,419.91 (5.4)	Italy	3,507.24 (5.7)	South Africa	6,632.50 (4.5)	Italy	4,720.54 (3.4)
Italy	3,033.26 (4.8)	Japan	3,454.22 (5.6)	Italy	5,567.68 (3.8)	South Africa	4,082.63 (2.9)
Netherlands	3,264.50 (5.2)	U K	2,979.66 (4.8)	Netherlands	4,321.66 (2.9)	Russia	3,708.45 (2.6)
Japan	2,653.05 (4.2)	Netherlands	2,789.63 (4.5)	Belgium	3,749.78 (2.5)	Australia	3,609.24 (2.6)
Australia	2,520.96 (4.0)	Australia	1,597.20 (2.6)	Australia	4,324.94 (2.9)	Netherlands	2,396.80 (1.7)
France	1,957.28 (3.1)	China	1,687.80 (2.7)	Russia	3,085.00 (2.1)	Japan	2,394.71 (1.7)
China	1,736.50 (2.7)	France	1,359.38 (2.2)	Canada	2,135.75 (1.4)	Brazil	2,610.67 (1.9)
South Africa	1,430.50 (2.3)	South Africa	1,092.00 (1.8)	Brazil	2,422.62 (1.6)	Belgium	2,122.06 (1.5)
Spain	1,256.68 (2.0)	Belgium	996.2 (1.6)	Switzerland	2,187.90 (1.5)	Canada	1,824.80 (1.3)
Belgium	1,001.00 (1.6)	Spain	916.8 (1.5)	U K	2,137.89 (1.4)	U K	2,042.42 (1.5)
Others	8,960.92 (14.1)	Others	6,778.72 (11.0)	Others	27,811.34 (18.8)	Others	29,151.36 (20.8)
Total	63365.15 (100.0)	**Total**	61451.33 (100.0)	**Total**	147845.1 (100.0)	**Total**	140430.1 (100.0)

Source: DGFT, Note:- figures in parentheses are percentage to total export.

5.2 Guar in EXIM Policy

The Harmonized System (HS) classification with code 130232 is mucilages and thickeners derived from locust bean seeds or guar seeds. This includes guar meal (which is a by product of guar processing industry mainly used for animal feed industry, is in no any case have thickening and binding properties), guar gum refined split (an intermediated product derived from guar seed and used for processing into different industry specific guar gum products, is a raw material for guar gum industry for further processing), and guar gum treated and pulverized (the final product of guar processing).

Table-23: Customs duty on Guar and its derivatives

Exim Code	Item Description	Customs Duty		Central Excise Duty & Tariff		Import Policy
07133910	Guar Seeds	Customs Basic Duty:	0	Cenvat :	nil	Free
		Addl Duty(CVD):	0			
		Spl Addl Duty(Spl.CVD):	0	Excise Cess :		
		Excise Cess	3			
		Customs Cess	2			
130232	Mucilages and thickeners, whether or not modified, derived from locust beans, locust bean seeds or guar seeds:					
13023210	- Guar meal (From 07.12.2008)	Customs Basic Duty:	30	Cenvat :	10	Free
		Addl Duty(CVD):	10			
		Spl Addl Duty(Spl.CVD):	4	Excise Cess :	3	
		Excise Cess	3			
		Customs Cess	3			
13023220	- Guar-gum refined split (From 07.12.2008)	Customs Basic Duty:	30	Cenvat :	10	Free
		Addl Duty(CVD):	10			
		Spl Addl Duty(Spl.CVD):	4	Excise Cess :	3	
		Excise Cess	3			
		Customs Cess	3			
13023230	- Guargum treated and pulverised (From 07.12.2008)	Customs Basic Duty:	30	Cenvat :	10	Free
		Addl Duty(CVD):	10			
		Spl Addl Duty(Spl.CVD):	4	Excise Cess :	3	
		Excise Cess	3			
		Customs Cess	3			

5.2.1 Benefits under VKGUY: the exports of agricultural produce, Minor forest produce and village and cottage industry products would be awarded duty free scrip @ 5% of the FOB value of exports under the Vishesh Krishi and Gram Udyog Yojana (VKGUY). In order to promote indigenous sourcing, a built-in incentive has been introduced under the

VKGUY for exporters utilizing domestic raw materials for export production. Such exports would now get additional benefits under VKGUY @ 1.5% of FOB value of exports compared to those who use imported agricultural products who shall get benefits at a reduced rate of 3.5%.

Table-24: List of items covered under Minor Forest Produce

Product Code	ITC HS Code	Description	Date of export from which benefits will be admissible
	130232	Mucilages and thickeners, whether or not modified, derived from locust beans, locust bean seeds or guar seeds:	
8.44	13023210	Guar meal	01.04.2004
8.45	13023220	Guar-gum refined split	01.04.2004
8.46	13023230	Guar-gum treated and pulverized	01.04.2004

Guar refined split is a raw material for processing into guar gum powder, and through this VKGUY scheme the export incentive is also going for export of an intermediate product or raw material. This matter should be looked into and export of raw material should not be incentivised.

Chapter 6
SWOT ANALYSIS

SWOT analysis is a strategic planning method used to evaluate the internal and external situation/ factors involved in a project or a business. SWOT analysis is a simple framework of generating strategic alternatives from a situation analysis. The internal and external situation analysis can produce a large amount of information, much of which may not be highly relevant. The SWOT analysis can serve as an interpretive filter to reduce the information to a manageable quantity of key issues. Through this method, it has been tried to evaluate the internal and external environment of Indian Guar industry.

SWOT Analysis:

6.1 STRENGTHS

1. India dominates in guar seed production with the share of about 80% of global guar seed production. Guar, the poor man's crop does not require intensive use of insecticide, fertilizers, labour and irrigation and thus results into an economical crop with low cost of cultivation and high scope of commercialization.
2. Guar produce has self life of more than 3 years without loosing out any of its properties and qualities. It requires barest minimum maintenance, storage facility and handling environment. Just a spread drying before storage gives it a favourable environment.
3. In terms of enhancing soil fertility, guar helps in fixing soil nitrogen better than Groundnut. Therefore guar cultivation adds in sustainable utilization of soil for crop farming.
4. Guar meal is regarded as a natural animal food supplement as it constitutes >47% of protein. But the reason for its low consumption for the purpose boils down to the fact that the farmers consider it improves quality of milk but not quantity, and thus its use as animal feed gets restricted. While in fact the Guar meal is as good as Cotton meal for animal feed.
5. One praiseworthy aspect of guar in India is that, unlike other crops it has good processing infrastructure. According to industry sources, India possesses more than 150 processing units of Guar.
6. Good industrial infrastructure is available in the country for processing of guar seed into guar gum powder. Labour in India is not only cost effective but skilled labour for processing is also available leading to cost effective processing technology.

7. Since negligible pesticides are being used in the cultivation of guar seed, the problem of pesticide residue is negligible and thus helps in meeting food safety requirements.
8. Haryana belt has good quality guar which has high demand outside the country due to high viscosity present in it.
9. Multiple uses of guar: industrially guar gum is used for mining, textile industry, petroleum industry, oil well drilling, ore floatation, and paper manufacture. In food industry it is used as thickener and a mean for preventing ice crystal formation.
10. Blackening of guar seed due to rains during harvesting and threshing, does not affect the quality of guar gum powder and under such circumstances, drying in open space will help to mitigate the problem of high moisture.

6.2 WEAKNESSES

1. Since the crop is mainly grown under rain-fed conditions the total quantum of production is directly related to monsoon. Thus the poor productivity and high fluctuation in productivity and production levels is common phenomenon. In Rajasthan, the rainfall fluctuates between years and thus results in fluctuation in productivity and high volatility in production consequently affecting prices.
2. Demand for guar is almost constant over the years but supply varies largely between years. Due to high fluctuation in production the demand derived mainly depends on demand from industries like oil, textiles, food products, etc. The price instability is mainly due to production instability.
3. The physical market of the commodity involves fluctuation in stocking and speculation. The commodity is subjected to long storage based on demand and market prices.
4. Processing industry is fragmented and most of the units are small scale units, which are not professionally managed and economies of scale for such unit do not operate.
5. Unhealthy competition between processing industries is pertinent widely.
6. Poor value addition in the country: There is lack of technology and Research on development of product specific guar gum products in the country, and skilled man power in respect of growing food security concerns, still more than 40% export is contributed by raw material i.e., guar gum refined splits.
7. Export policy of the country in respect of guar products is such that it does not restrict export of raw material i.e., guar splits, rather incentivise it. China strategically procure raw guar or guar split from India and process it in its homelands as they can easily regulate there processing cost there due to low cost.

8. Minimum efforts diverted on research and development on production and product development, and poor extension of guar to enhance the production and productivity. Research and development work done in this crop is negligible.

6.3 OPPORTUNITY

1. World guar market is a mature one, growing and increasingly steadily at >2% per year which opens a window of opportunity for exploiting the potential.
2. In food industry there is growing preference for bio-degradable, non-polluting and natural product, which gives ample scope of increase in guar gum applications.
3. With India gaining in Research and Development, there is a lot of scope for developing improved varieties, and required new applications of guar gum products.
4. Demand for value added products of guar from India in international market especially Europe and USA is increasing. With the increased use of ready-to-eat food items, uses of guar gum powder for food uses is also increasing.

6.4 THREAT

1. Substitutes: Guar is a rain-fed monsoon season crop, which requires 8-15 inch of rain in 3-4 spells and is generally sown after the monsoon rainfall in the second half of July to early August and it is harvested in October-November. Guar requires 2 rainfall before sowing, one rainfall during budding and another during blossoming.
2. Though Guar has a wide use in textile industry but at times tamarind seeds are also used as a substitute.
3. Though India accounts for 75-80% of the total guar produced in the world (60-70% is cultivated in Rajasthan) lack of technology on value addition diminishes the profits that can be earned from the crop.
4. Lack of awareness among the stakeholders regarding commercial value of the crop resulting in under-exploitation of the crop for export.
5. Meager efforts are made for stabilization of guar seed productivity in the country, since guar is not considered widely as a commercial crop.
6. Countries like USA and Australia are making concerted efforts to grow guar seed extensively and thus production is showing increasing trend in those countries. This may lead to loss of international market for Indian guar gum products.

Chapter 7
Research and Development Efforts in Guar

7.1 Production Research:

All India Coordinated Research Project on Arid Legumes including research in Guar crop as a mandate is the only research effort towards guar crop in the country. The progress made at different locations is mentioned below:

Agricultural Research Station, Durgapura under Rajasthan Agricultural University, Bikaner has developed eleven varieties of Guar seed with the main thrust on research in the areas of:

1. Breeding genotypes with early maturity, in built multi-stress tolerance towards drought, heat, salt and field resistance against important diseases and pests.
2. Breeding guar for high galacto-mannan content (>35%), improved meal quality and high seed protection content (25-27%) with increased proportion of essential amino acids in guar. Development of Photo thermo-insensitive varieties of guar.
3. Enhancement of breeder seed production to cater to the needs of high replacement rate annually in guar.
4. Ensure adoption of new technologies through frontline demonstration at farmer's fields.
5. Expansion of guar cultivation in non-traditional areas.

Table-25: Promising Varieties of Guar developed at ARS, Durgapura

S. No.	Variety	Year of Notification	Maturity Duration (Days)	Yield Potential (q/ha)	Area of Adoption
1.	Durgajay	1980	110-120	8-10	Rajasthan & Haryana
2.	Durga Safed	1980	110-120	10-12	All guar growing areas of India
3.	RGC-197	1990	110-120	10-12	All over the country. Most suitable for mixed and inter- cropping.
4.	RGC-471	1991	110-120	10-14	Rajasthan suitable for fodder grains and green manuring
5.	RGC-936	1991	85-90	8-11	Draught prone areas of Rajasthan, Haryana & Gujarat
6.	RGC-986	1999	110-115	18-19	Good soils of Rajasthan with partial irrigation facility
7.	RGC-1003	1997	85-92	12-15	All over India well suited under well drained & coarse textured soils
8.	RGC-1002	1999	80-90	8-12	Arid & Semi- arid tracts of India
9.	RGC-1017	2001	92-99	10-14	All over guar growing areas
10.	Durgabahar	1985	First picking 45-50 days after sowing	70-75 green pods	All over India for vegetable purpose
11.	M-83	2000	45-45 days	80-90 green pods	Suitable for summer and Kharif in Rajasthan

Source: Chaudhary, 2004.

HAU, Hisar

Objectives of research

- To produce good quality seed of notified varieties of guar
- To distribute the quality seed to the farmers
- To develop extra early maturing varieites (through hybridization & embro culture)
- To identify qtl's for biotic & abiotic stresses
- To impart training to the farmers for quality seed production

Table-26: Varieties released by CCS HAU

Name of crop/ variety	Av. Yield q/h	Growing conditions	Gum %	Viscocity ($mpas^{-1}$)	Salient features
Guar: Grain purpose					
FS-277	6.0	timely sown	29.58		Erect, unbranched.
HG75	8.0	do	30.76	1932	Branched, high yielding, bushy, BLB tolerant.
HG182	8.0	do	30.52		Branched, high yielding, pubescent little serrated.
HG258	8.5	do	29.10		Branched, pubescent, smooth, short leaf margins, resistant to diseases.
HG365	8.0	Early sown	31.51	2992	Branched, dwarf, serrated leaves, early and suitable for intensive cropping.
HG 563			30.92	3903	
HG 870			31.34	3702	Identified
HG 884			29.91	2568	Identified for All India
HG 2-20			30.26	2749	Identified for All India
Guar: Fodder purpose					
HFG-119	325.0	Timely sown			Broad, dark green leaves, moderately resistant.
HFG-156	350.0	Do			Tall, branched, tolerance to diseases.

Source: CCS HAU, Hisar

It was observed through the discussion held with stakeholders that varieties like RCG 1017, RCG 1002, HG 365, HG 563 are the best varieties of the above mentioned varieties of guar developed but the major problem is non-availability of seed and poor extension support system for guar production in the country.

Current progress

Two hundred twenty germplasm lines were grown and promising lines were selected. It was found that most of the lines were late in maturity. The seeds of wild species viz.; Cyamopsis serrata and Cyamopsis senegalensis was produced in sufficient quantity for their use in future breeding programmes particularly for inter specific hybridization. Crosses were made between these wild species and cultivated species but no seed set was observed. Seven fresh crosses were attempted and breeding material in different generations was evaluated and single plants in different generations were selected. With all these efforts four new varieties were identified for release namely HG 867, HG 870, HG 884 and HG-2-20. Trials have also been conducted for developing better agronomic practices.

Table-27: Genotypes with high gum content (>35%)

Sr. No.	Germplasm	Gum (%)
1.	DG8	35.35
2.	GP147-48-01	35.70
3.	SPSG96	35.70
4.	IC116616	36.23
5.	IC116709	36.75

Agricultural Scientists of the country are confident of developing the thermo-photo-insensitive varieties of Guar which would be suitable for non-traditional areas and for cultivation in the summer. Further research on development of varieties of Guar with higher gum content, disease resistance, more productivity etc. is going on.

The R&D project proposed by Shellac & Forest Products EPC (Shefexil) for development of high-yielding quality seed for enhancing India's guar gum exports, for assistance under the Market Access Initiative (MAI) Scheme of the Centre, has been cleared the project, which will be implemented with technical assistance from CCS Haryana Agricultural University, Hisar.

The three main issues facing the guar gum industry in India today are said to be inadequate crop size, fluctuating yield per hectare, and sub-optimal guar cultivation in non-productive arid regions. As per the proposals put forward by the council, the total cost of the project, scheduled for completion in the next three years, was Rs 98.85 lakhs. The total MAI assistance sought is for Rs 59.38 lakhs, with the balance coming from the

industry. The R&D project is felt essential to lift Indian guar exports in a big way, as it is now shackled by low yield and low quality.

Activities proposed: The activities proposed to be taken up under the project are production and distribution of quality guar seed, development of extra early maturing varieties, identification of QTL (Quantitative Trait Loci) for drought and disease resistance/tolerance and training of farmers for quality seed production. A strategic objective of the R&D project is to maximise arid land utilisation by bringing these under guar cultivation.

7.2 Processing Research

Al-Saidan et al (2005) studied guar gum processing with the objective to develop guar gum matrix tablets for oral controlled release of water-soluble diltiazem hydrochloride. Matrix tablets of diltiazem hydrochloride, using various viscosity grades of guar gum in 2 proportions, were prepared by wet granulation method and subjected to in vitro drug release studies. Diltiazem hydrochloride matrix tablets containing either 30% wt/wt low viscosity (LM1), 40% wt/wt medium-viscosity (MM2), or 50% wt/wt high-viscosity (HM2) guar gum showed controlled release. The drug release from all guar gum matrix tablets followed first-order kinetics via Fickian-diffusion.

Further, the results of in vitro drug release studies in simulated gastrointestinal and colonic fluids showed that HM2 tablets provided controlled release comparable with marketed sustained release diltiazem hydrochloride tablets (D-SR tablets). Guar gum matrix tablets HM2 showed no change in physical appearance, drug content, or in dissolution pattern after storage at 40^0C/relative humidity 75% for 6 months. When subjected to in vivo pharmacokinetic evaluation in healthy volunteers, the HM2 tablets provided a slow and prolonged drug release when compared with D-SR tablets. Based on the results of in vitro and in vivo studies it was concluded that that guar gum matrix tablets provided oral controlled release of water-soluble diltiazem hydrochloride.

Nath and Narsingarao (1983) studied the effect of sodium dodecyl sulphate, urea or guanidinium hydrochloride on the sedimentation velocity, viscosity, ultra violet spectra and fluorescence spectra of the 11S protein of guar seed has been determined. Sodium

dodecyl sulphate dissociates the protein directly to the 2S protein, whereas urea or guanidinium hydrochloride produces an intermediate 7S protein. These reagents denature the protein also. Both the dissociative and the denaturation effect follow the order, sodium dodecyl sulphate > guanidinium hydrochloride > urea when the concentration are expressed as mols per litre. The denatured states in the three cases probably differ.

7.3 International Experiences

The production and processing research efforts made in other guar producing countries is reviewed in this section.

7.3.1 Production Research

Australia

Approximately 400 lines of guar have been introduced into Australia and more than 100 of these have been included in field trials. The strongly branching varieties Brooks and ECR67 and the sparsely branching CP177 have been commonly used for research in Queensland. Seed yields of up to 4 t/ha have been achieved. Up to 35% gum yields have been produced, but this level is dependent on both variety and environment.

Pakistan

Guar has remained a minor crop until the recent past. Now it seems destined to assume a large role among the domesticated plants that supply the food and needs of human beings. It is well adapted to semi-arid and arid regions of Pakistan but 80% of the crop is grown under irrigation. Soils with pH of 7.0 are better suited for guar production. It is also tolerant to salinity.

Salim et al (2002) developed the new variety BR-99 through single plant selection. A promising line was selected from the local material during 1990 and was given the No 786. Replicated progeny row trial was conducted during 1991-92. The station yield trials of this variety spanned from 1992-93 to 1994-95. Zonal varietal trials were conducted from 1995 to 1998 at 8 different locations in comparison with checks (BR-90 and 2/1). On the basis of average of 33 yield trials, BR-99 gave 23.0 and 36.7% higher yield than BR-90 and 2/1, respectively. It best sowing time is the second fortnight of month of June. It gives best yield when NPK @ 20:80:0 kg haG1 area applied at the time of seedbed

preparation. It is tolerant to insect pests and diseases and requires minimum plant protection. Its yield potential is 1800-2420 kg haG1. It is early maturing with 1000-grain weight of 35 grams and 4.8-12.1% higher protein contents than checks. It was released for general cultivation in the irrigated and non irrigated areas of the Punjab province especially Thal and Bahawalpur areas.

Vahidy and Yousufzai (1991) studied two local and ten exotic accessions of guar (cluster bean), Cyamopsis tetragonoloba were evaluated for several vegetative and reproductive characteristics. Variables studied were: plant height, number of clusters per plant, pods per cluster, numbers of pods per plant, pod length, seeds per pod, 10-seed length, 100-seed weight and seed yield per plant. Significant differences among accessions were found for all the traits studied. Results indicated that accessions 'Mirpur' and 'D-safed' can be successfully cultivated for seed production in Sindh. Seed yield was highly significantly correlated to plant height, number of branches, clusters and total pods per plant. Similarly, number of pods per plant was correlated to plant height, number of branches and clusters per plant. Correlations of seed yield with pods per cluster, pod length, 10-seed length and 100-seed weight were positive but statistically non significant.

United States

Contract guar acreage in the Texas South Plains and surrounding areas for 2000 was about 30,000 acres in the year 2000. Most acreage in 2000 was concentrated in Terry county and west Dawson County and far-east Gaines County (after hailed-out cotton in early July). In the last 20 years 15,000 to 40,000 acres of guar has been grown in the Vernon, TX, area with some across the Red River in Oklahoma. There is one processing plant for field guar in the U.S., Rhodia, Inc., in Vernon although they mostly process guar endosperm from India and Pakistan.

In 2000, earlier planted guar, even into late April, was able to take advantage of early rains and out yielded guar at all other planting dates with some fields yielding as much as 1200 lbs/Acre. Production practices and rainfall received during the growing season cause yields to vary from about 300 pounds to more than a ton per acre. Guar is a minimal input crop and the cost of production is also minimal. Some fields with irrigation

have developed Alternaria and bacterial blight. Rhizoctonia is also a potential problem in heavily irrigated guar. Guar midge has been an occasional problem in the past in the Vernon area. Growers should watch for this insect if near alfalfa.

Four varieties are currently available, but little is known of their relative performance in West Texas. Kinman (released in 1975, is an F9 selection from the controlled natural-cross, Brooks X Mills, appears to be well adapted to the guar growing area of Texas and Oklahoma) and Esser (released in 1975, is an F10 selection from progeny of the same natural cross, Brooks X Mills) have the longest track record, but Santa Cruz and Lewis appeared to perform the best in 2000. Other varieties developed are Brooks (the first improved variety released in 1964 replaced Texsel and Groehler and has occupied about 95 percent of acreage since 1966), Hall (resistant to bacterial blight and Alternaria leaf spot), Mills (an early-maturing variety which is resistant to blight and Alternaria leaf spot)

South Africa: Zimbabwe

The production of guar bean in the Zambezi Valley has been promoted through a collaborative initiative between ITDG Southern Africa and Bindura Nickel Corporation (BNC). The Guar Been Production Project, initiated in April 2000 with the objective to facilitate thriving local guar bean production and processing by small-scale farmers in areas along the northern part of the country. About 2,050 farmers are benefiting from the project.

Seven farmer training workshops were carried out between February and June 2002 and a total of 226 farmers have acquired skills specific to guar bean agronomy, budgeting and marketing. This has been done to ensure that they are well equipped to meet the expected tonnage of beans. In paving way for the setting up of a local guar bean processing plant, a study has been carried out to explore the viability of an export market for the product.
The important lesson coming out from the project has been the importance of establishing effective communication networks that facilitate information dissemination among players. Local farmers' meetings remain an important vehicle for information

dissemination. The issue of pricing has been a great lesson for ITDG Southern Africa and the rest of the stakeholders. Farmers need proper incentives that improve their income base if they are to fully take part in any development initiative. ITDG is now working with producers to enable them to take advantage of the market opportunities available to them, offering support and advice on where and how to sell their product, ensuring they achieve a fair price. More effort directed towards training farmers to improve their knowledge and practices in the growing of the crop. This increase both yields and returns received by farmers.

7.3.2 Processing

Ahmed et al (2006) reported that the proximate composition, antinutritional factors and protein fractions of guar seeds were studied before and after autoclaving, soaking followed by dehulling and germination treatments. Chemical composition was varied between the treatments. Soaking of seeds followed by dehulling significantly increase protein content to 67.8%. Germination of seeds increased tannin and phytic acid content of the seeds. Polyphenols were fluctuating during processing. Albumin fraction of the seeds was decreased; prolamin and globulin were fluctuated during processing while glutelin was greatly increased.

Ahmad Bahamdan (2005) have reported the development of novel guar gum derivatives. These derivatives were synthesized from commercially available polyoxyalkyleneamine compounds and guar gum derivatives. The successful grafting process was verified and monitored by the FT-IR and 1H NMR. In contrast to the guar gum solutions, which tend to be cloudy and heterogeneous, homogeneous aqueous solutions of the new derivatives could be prepared. The viscosities of these solutions are approximately ten times less than the viscosities of the parent materials at comparable concentrations. The decrease in viscosity of the grafted products is attributed to a polysurfactant effect imparted by the polyoxyalkylene grafts. The low viscosities of the solutions are a processing advantage, both in the pumping and mixing steps as well as presenting the opportunity to prepare and ship concentrated master batches that could simply be diluted in the field.

A family of grafted guar gum derivatives was produced by employing polyoxyalkylene-amines with different hydrophobicity and hydrophilicity. A survey of the relative viscosities of derivatives prepared from a common guar precursor revealed that the more hydrophobic polyoxyalkylene grafts imparted higher viscosities. In general the best yields of the hydrophobic grafted derivatives were achieved with the Surfonamine B-30, which is a relatively low molecular weight, biodegradable reagent. We anticipate that this biodegradability will be transfer to the grafted guar products, which will make them environmentally friendly additives.

Guar gum and its derivatives account possibly for 90% of all gelled fracturing fluids; the new derivatives are considered excellent candidates for similar applications. The gelation characteristics of the derivatives were determined to evaluate this potential. All of the derivatives could be crosslinked successfully using a zirconium lactate crosslinking agent. Although the viscosities of the precursor solutions were lower than that of the guar gum precursors, most of the resultant gels exhibited properties comparable to or greater than those of gels formed from the guar gum precursors at a concentration of 40lb/1000gal (4.8 g/L) which is typical for field applications. The crosslinking was successful for all the CMG derivatives at a lower concentration of 20lb/1000gal (2.4 g/L) indicating that this concentration is still above the critical crosslinking concentration, However, most of the CMHPG derivatives failed to gel at the lower concentration, which must be below their Ccc. Only the B30 and M600 derivatives of the CMHPG were successfully crosslinked and showed good gelling behavior.

The final step of the fracturing process requires removal of the polymer gel from the formation. The biodegradability of the gel can be exploited to partially hydrolyze the carbohydrate backbone with a commercially available enzyme mixture. When hydrophobically modified derivatives such as MNPA1000 and B30 grafted guar gums are degraded, the resultant fragments behaved as surfactants that disperse easily into the oil phase. The low viscosity and the surfactant behavior of the fragments suggest that they will be less damaging to the formation since they can be removed easily from down hole either by the flow back of oil, condensate or water. The surfactant behavior of degraded guar adducts should facilitate the clean up process.

The purpose of this study was to identify the best candidates for the fracturing fluid application. Hydrophobic grafts were favored because upon degradation they would yield surfactant fragments that are easily driven from the formation. However, the addition of the hydrophobic grafts should not compromise the viscosity and stability of the crosslinked gels. The B30 and MNPA1000 derivatives of the three control guars used in this project should meet our criteria. All these products hydrolyzed to fragments that behaved as surfactants which should facilitate the cleaning process. From the viscosity trends discussed in chapter 5, we observed that the B30 and MNPA1000 derivatives of BMCMGGW-45 and BM12CMHPG exhibited the highest viscosities and retained their properties at high temperatures. Higher concentrations of the BM12CMHPG derivatives are required to form gels. If the possibility of using lower polymer concentration to decrease the cost of the process is considered, the derivatives of carboxymethyl guar are better. In conclusion, we think that both the MNPA1000 and B30 derivatives of BMCMGGW-45 are the best candidates for application in the fracturing fluid process.

Chapter – 8
Issues in Guar Industry and Trade

After stakeholder consultations through series of meetings with different stakeholders at different important locations, following issues have emerged:

8.1 Related to Production and Yield

L. Production or supply pattern of Guar is erratic as guar is largely grown in rain fed conditions therefore production and yield is dependent on vagaries of nature. Most of the farmers grow guar on their waste land and not taking it as a commercial crop. Therefore, it is hard to maintain consistent supply to the industry.

M. Productivity is poor because farmers cultivate on marginal soils with poor management conditions and hardly use any inputs. High yielding and drought resistant variety seeds are not available. Maximum use of local strains/ land races due to inadequate availability of the quality certified seed of improved varieties. The seed replacement rate is lowest in all crops (less than 10%).

N. Though research on development of high yielding varieties of guar seed is done and few good varieties have been developed, but there is nobody to look after the certified seed development and dissemination of these varieties. Farmers' wants to use HYV seeds but seed is not available in the market.

O. The research institutions/ agricultural universities face fund crunch for research in new variety development and product processing and technology development.

P. Agricultural extension system in the states does not give much attention on guar crop and the crop is treated as marginal crop. The improved varieties have been developed by research institutions/ agricultural universities, improved agro-technology is defined but it does not reach to the farmers.

Q. **Enhancing Productivity:** The productivity level in Rajasthan is 3.25qt/ha under irrigated conditions and 2.75 qt/ha under rain-fed conditions. While Haryana state made success in improving productivity and the current productivity level in

Haryana is about 11.0 qt/ha. Therefore, continuous research and extension work needs to be in place for increasing Guar seed production and productivity in the state. Total guar seed production in Haryana have increased to about 35 lakh qt presently from a level of 5-7 lakh qt. Variety development according to market demand is poor and guar production technology and research extension is not fully reaching upto the farmers' level. Therefore, the extension system should be strengthened in the state.

R. It is possible to have two crops in a year in certain areas where irrigation facilities are available. Second crop can be taken after Rabi (April-July) but short duration varieties would be needed which should mature before onset of the monsoon.

S. The industry's knowledge about the developments in agricultural research is poor. In case of guar although chemical analysis of different varieties is available and the processors could exercise preference for varieties with higher gum contents, but is not being done due to lack of knowledge by the trade and industry. The parameters for buying are quite subjective to parameters like colour, shape and size. Even farmers are not aware of varieties suitable for their area.

T. Guar is considered as a minor crop by the State Agriculture Departments and Agricultural Universities, who give more attention to crops like cereals, oil-seeds and pulses rather than guar.

U. Since Guar crop is highly dependent on monsoon rainfall, and if production fails there is no risk cover for farmers. Therefore, crop insurance product in guar seed should be developed and farmers' guar crop should be insured.

V. As the crop is highly dependent on monsoon rainfall, if there is long dry spell crop fails completely. In this case, promotion of rainwater harvesting as was prevailing in the form of tanka in Churu district of Rajasthan can be used critical life saving irrigation to the crop and increase productivity.

8.2 Related to Marketing

A. There is wide fluctuation in prices of guar seed and its derivatives. Though commodity futures in guar seed and guar gum is available for risk management,

but the farmers are not in a position to take direct benefit of this complex method for them.

B. The information on domestic consumption as well as export potential is also not available to industry. There is also lack of market intelligence in guar seed and guar gum.

C. **Market Fee:** Mandi fee for Guar in Rajasthan is chargeable at the rate of 1.60%, while in Haryana it is 1.0%, in Gujarat- 0.50% and in Punjab there is no mandi fee chargeable on Guar. Mandi fee structure needs to be corrected and made uniformly.

D. **Warehousing and pledge financing:** Warehousing facilities for storage of guar seed is inadequate thus needs more storage structures to be built. The quality of the commodity is not maintained properly at the warehouses, and there should be strict regulations for the warehouses on quality issue. Also the benefit of pledge financing scheme is not reaching farmers and other stakeholders. Therefore, wider publicity of the scheme is needed.

E. **Logistics:** Manufacturers send their processed product through train to the port. The main problem regarding this transport is unscheduled train timings. They can't send it through road, as it is very expensive means of transportation.

F. **Packaging:** For packaging of splits they use plastic bags and each bag contains upto 50 kg of splits. Guar powder is packed in paper bags and each bag contains 25kg of powder. Then these packets are being filled in the containers and each container consists of 800 packets. Packaging also poses a problem occasionally.

8.3 Related to Value addition and Exports:

K. Value-addition is poor. The pulverized gum is largely sold as a commodity. About 40% of the exports are still in the form of refined splits. Also machinery and technology for the product specific value addition is required in the country.

L. Cheaper substitutes of Guar are available for industrial applications. Tamarind kernel powder has considerably replaced Guar Gum in textile sector. Similarly Cassia Tora is expected to substitute guar gum in textiles, pet food etc. Only food

and pharmaceutical end-users have stable demand due to increasing preference for natural products.

M. USA, China and Germany are the major importing countries accounting for more than 50% of total exports from India. Considerable quantities of value added derivatives are being re-exported from European countries.

N. The steep increase in the price of Guar is a cause of concern for the end-users. For major non-food applications Guar is being replaced by cheaper substitutes.

O. There is a potential for marketing of value added Guar based health foods, dietary fiber, slimming-aid, fat replacers, medicines etc. in the international markets. For technical grades, the potential for exporting value added derivatives exists in the areas of oil-drilling and textiles. But hardly any efforts are being made in this regard in the country.

P. The value addition/margins of overseas suppliers from re-export is much more than the value addition/margins of Indian Suppliers.

Q. Harmonized product codes meant for Guar products are not being used by internationally important trading countries. While India is using Harmonized product codes, USA and E.U. countries are using different codes which are perhaps resulting in some discrepancies in the data.

R. **Quality certification:** The quality certification of guar seed as well as of the guar derivatives is negligible. The stakeholders opined that there should be a third party certification of the produce and products. There are negligible arrangements for quality certification of guar gum for export. Exporters have to face lot of problems regarding certification. Like phyto-sanitary certification facility is not available at Jaipur, Jodhpur and Bikaner. Foreign quarantine restriction has become very strict. Therefore, appropriate agencies should be in place to help facilitate smooth exports. Exporters have gone through Kosher and Halal certification when they export their product to Israel and Pakistan, respectively.

S. Difficulty in getting HACCP, ISO, Halaal certificate and lack of certifying agencies in Rajasthan.

T. China's custom tariff on Indian Guar Gum powder is 15% and on guar splits is 5%. Thus, China's policy is to encourage import of raw material (guar splits) from India and process it into their own processing industries and re-export it, rather than importing finished products. While import tariff for products imported from Pakistan is nil, thus there is clear discrimination between India and Pakistan.

U. There is no any reputed Research and Development institution working on guar seed production and development of guar gum powder industry specific products, and its processing technology, plant and machinery in the country.

V. Many of the guar processing industries are small and does not have technical manpower/ skilled labour, and operate under unhygienic conditions. There is urgent need of capacity building of manpower working with guar processing industries in all respect including food safety and quality aspects.

W. **Port Handling:** Guar seed derivatives are being exported from Mundra port. Exporters face problems regarding infrastructure available at port. Port infrastructure as well as the handling process is not upto the required. Capacity building of personnel and workers working at port is required for safe keeping and handling of food grade produce particularly food safety aspects. Containers should available at industry site, so that problems in container stuffing at port can be avoided.

8.4 EU PCP Issue:

The European Commission Decision of 29 April 2008 imposing special conditions on guar gum originating from India requires that all consignments of guar gum or products containing guar gum at significant amounts originating in or consigned from India, **which left India after 4 May 2008** and imported into the Community intended for human or animal consumption, shall be accompanied by an original analytical report issued by a laboratory accredited according EN ISO/IEC 17025 for the analysis of PCP in food and feed or by a laboratory that is pursuing the necessary accreditation procedures and which has adequate quality control schemes in place accompanying the consignment demonstrates that the product does not contain more than 0.01 mg/kg pentachlorophenol

(PCP). The analytical result must be reported with the expanded measurement uncertainty. **The analytical report shall be endorsed by a representative of the competent authority from the country where the laboratory is located.**

As regards **analytical reports endorsed by the competent authority of India**, according the findings of the FVO**, the Vimta Labs, Hyderabad, Andhra Pradesh is the only laboratory in India which fulfils the requirement of accreditation and/or having in place the appropriate quality control schemes.**

Table-28: Summary of proposed food uses and use levels for partially depolymerised guar gum in the EU.

Food category	Proposed food use	Use level %		
		min	average	max
Non alcoholic beverages	Fruit juice based beverages	0.05	0.2	0.5
	Instant powder drinks	0.05	0.2*	0.5
	Diary based drinks	0.05	0.1	0.2
Fruits preparations	Fruits preparations, toppings, fillings, fruit soups	0.1	0.3	0.7
Soups and broths			0.1-0.3*	0.5
Sauces and dressings		0.1	0.4	1.5
Fine bakery wares	Frozen doughs (rolls)	0.1	0.7	1.5
	Toast bread (prepacked)	0.1	0.4	1.5
Edible ices	Ice creams, sorbets, sherbet ice	0.05	0.3	0.5

* in ready-to-eat products

After the PCP issue in Guar gum exports from India, European Food Safety Authority provided scientific opinion on the safety in use of partially depolymerised guar gum as a thickener, emulsifier and stabilizer in food. The petitioner provided the proposed food uses and use levels for partially depolymerised guar gum (table 23).

The safety of native guar gum has been documented. Since the molecular weight of partially depolymerised guar gum appears to fall within the specifications of native guar gum, which is the guar gum already accepted for food use, the Panel concludes that there is no safety concern for the partially depolymerised guar gum prepared by either heat treatment, acid hydrolysis or alkaline oxidation at estimated levels of intake.

The Panel considers that the specifications for guar gum may need to be modified to take account of the increased level of salts and the possible undesirabe byproducts e.g. furfural and peroxides, that may result from the described processes for the production of partially depolymerised guar gum.

8.6 Suggestions and recommendations to achieve Guar Industry Vision 2020

The suggestions and recommendations are given below:

- There is need to develop a Research and Development centre as the centre of excellence for Guar. The major activities of this centre could be collection and dissemination of information, promoting usage of Guar and its derivatives, development of processing technology according to changing market demand and food safety concerns and development of value added products. This centre should also have R&D facilities and pilot plant/ machinery for trial production of value added derivatives of Guar. The centre should also have facilities and authority for quality certification. Capacity building of small and medium enterprises in guar processing on the lines of growing food safety concerns is of utmost importance. The objectives of the institute can be defined as:
    - Research and development of High yielding varieties along with quality requirements of industry,
    - Certified seed development and distribution,
    - Research and Development of processed guar gum products, industry use specific,
    - Research and development of Guar gum products processing technology and machinery, pilot plant for industry training
    - Export facilitation to industries like export documentation, specialized container and transport arrangements, port handling, etc.
    - Guar production technology extension dissemination to farmers,
    - Market information creation and dissemination to all stakeholders,
    - Promotion of contract farming.
    - Authority to keep vigil on industry and to issue certification like GMP, HACCP, ISO 22000 and Food Safety Management,
    - To impart training among human resource engaged in guar industry and develop skilled manpower for the industry.
- Consistent funding for Research from government is required. The institutes/ agricultural universities lack funding for guar research.

- Major problem of farmers and industry is the non-availability of certified seed at the time of sowing. Multiplication of certified seed by agricultural universities/ state seed corporations is required. A well organized research program for seed production of high viscosity varieties, and cultivation practices is needed.
- Proper and targeted extension mechanism for dissemination of agro-technology of guar production, and technology/ knowledge support to farmers need to be ensured.
- Farmer-Industry linkages to be enhanced through direct marketing arrangements at the mandi yards and promotion of contract farming.
- Since Guar crop is highly dependent on monsoon rainfall, and if production fails there is no risk cover for farmers. Therefore, crop insurance product in guar seed should be developed and farmers' guar crop should be insured.
- Many of the guar processing industries are small and does not have technical manpower/ skilled labour, and operate under unhygienic conditions. There is urgent need of capacity building of manpower working with guar processing industries in all respect including food safety and quality aspects.
- Product diversification keeping in view the demand of importing countries.
- Value addition of Guar Meal. Guar meal can be used for animal and human consumption. Research on odorless guar meal will prove a significant step to develop different uses of guar meal.
- Introduction and proper implementation of crop insurance by assistance of State Govt.

Chapter-9
References:

1. Advances in Arid Legumes Research/edited by A. Henry, D. Kumar and N.B. Singh. Jodhpur, Scientific, 2003, xiv, 523 p., tables, ISBN 81-7233-342-0.
2. Ahmed M. B., R. A. Hamed, M. E. Ali, A. B. Hassan and E. E. Babiker (2006). Proximate Composition, Anutritional Factors and Protein Fraction of Guar gum Seeds as Influenced by Processing Treatment. Pakistan Journal of Nutrition, Vol. 5 (5), 481-484.
3. Arid Legumes for Sustainable Agriculture and Trade, Vol. 2/edited by A. Henry and D. Kumar. Jodhpur, Scientific, 2005, viii, 201-424 p., tables, $75 (Vol. 2). ISBN 81-7233-408-7.
4. Arid Legumes for Sustainable Agriculture and Trade, Volume I/edited by A. Henry and D. Kumar. Jodhpur, Scientific, 2005, viii, 200 p., tables, figs., ISBN 81-7233-407-9.
5. Bahamdan, Ahmed (2005). Hydrophobic Guar Gum Derivatives Prepared by Controlled Grafting Processes for Hydraulic Fracturing Applications, Ph. D. Dissertation, Department of Chemistry, Agriculture and Mechanical College, Louisiana State University.
6. Chaudhary, SPS (2004). Genetic Advances and scenario of Guar research at Rajasthan Agricultural University, Journal of Arid Legumes, 1 (2): 75-81.
7. Department of Science and Industrial Research (2003). 'Executive Summary, Technology Status Study on Guar Based Industry in India', Department of Science and Industrial Research, GOI.
8. Douglas C. A. (2005). Evaluation of Guar cultivars in Central and Southern Queensland. RIRDC publication no. 05/036, Rural Industrial Research and Development Corporation, Australia.
9. Encyclopaedia of Agricultural Marketing: Vol. XI: Export Marketing: Liberalization and GATT Perspective, edited by Jagdish Prasad. New Delhi, Mittal, 2005, xxvi, 338 p., tables, ISBN 81-7099-744-5.
10. ESFA (2007). Opinion of the Scientific Panel on Food Additives, Flavourings, Processing Aids and materials in Contact with Food on a request from the Commission related to an application on the use of partially depolymerised guar gum as a food additive. The EFSA Journal (2007), 514, 1-17. http://www.efsa.europa.eu/cs/BlobServer/Scientific_Opinion/afc_ej514_guargum_op_en,3.pdf?ssbinary=true.
11. Guar in India/edited by D. Kumar and N.B. Singh. Jodhpur, Scientific, 2002, xii, 225 p., ISBN 81-7233-310-2.
12. Mohan Padmanabhan (2007). Indian guar gum, splits lose Chinese market to Pakistan, http://www.blonnet.com/2007/06/27/stories/2007062706271400.htm

13. Mohan Padmanabhan (2008). Nod for developing high-yielding guarseed, http://www.blonnet.com/2008/01/08/stories/2008010850571100.htm

14. NIAM (2005). Guar Trade from India: An Analysis, Commodity Trade Research Cell, NIAM, Jaipur.

15. Rural Industries Research & Development Corporation, Handbook for Farmers and Investors-Guar, Rural Industries Research & Development Corporation, Australia.

16. Saleem, M. I., S. A. H. Shah and L. H. Akthar (2002). BR-99 A new Guar Cultivar Released for General Cultivation in Punjab Province, Pakistan. Asian Journal of Plant Sciences, Vol. 1 (3); 266-268.

17. Trostle, Calvin (1999). Studies for Guar, Texas South Plains. Texas Agricultural Extension Service, The Texas A & M University.

18. Trostle, Calvin (2001). Guar production factsheet for West Texas. Texas Agricultural Extension Service, The Texas A & M University.

19. Vahidy A. A. and A. S. Yousufzai (1991). Variation and Correlation Studies of Vegetative and Reproductive Characteristics in Twelve Accessions of Guar, Journal of Islamic Academy of Sciences, Vol. 4 (3), 245-248.

Appendices

Annexure-1: Major issues and stakeholders view for guar industry

With the extensive stakeholder discussion/ consultation, interviews we have got key insights for the development of guar industry, which are summarized below:

A. Research and Development

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
A.1	Enhancement in Area, production and yield of guar	Low yield of guar in non-irrigated area is key concerned.	More area should be brought under cultivation / high yielding variety to be provided to farmers.
A.2	Development of varieties as per the market demand/ industry needs	High gum content and High viscosity varieties will help industry and application	High gum content and high viscosity varieties (like HG 365) to be developed. Involvement of Industry
A.3	Development of drought, pests and diseases resistant varieties	Being a food additive, use of pesticide / insecticide in guar is not desirable. Crop failure due to drought is frequent	- Diseases resistant variety of guar is to be developed. - Short duration (60-70days) and Drought resistant varieties are required
A.4	Farmer sustainability and profitability	- Lack of knowledge / technology at Farmers end to boost production. - Poor extension of production technology	- Technology inputs to be provided to farmers like, high yielding seed, pest management, harvesting, storage etc. - Farmer industry linkage through direct marketing and contract farming will improve profitability - Agro technology extension will increase productivity
A.5	Farmer access to technology and inputs	Poor technology and input access to farmer	Technology inputs to be provided to farmers like, high yielding seed, pest management, harvesting, storage etc. Guar R&D centre is required to develop and extend the technology and varieties to farmers
A.6	Funding bases for breeding and breeders Rights (IPR)	To be Funded by govt. as commodity is earning foreign exchange. Negligible involvement of	IPR to be given to breeders.

		Guar industry	
A.7	Future research agenda (Guar and products)	Still India is a supplier of raw guar gum powder to world only. Major research on guar / products is conducted by USA, Europe and Japan. So, key challenge for India is having focused research on guar derivatives for value added applications. Lack of gum processing technology	There is need for a National level research institution in country fully equipped who can undertake fundamental as well as applied research on guar products/ derivatives and technology.
A.8	Value drivers for Research and Development	Value added products will help all stockholders of industry Negligible industry – research linkage	1) Hydrolysed guar for dietary fiber use. 2) Cationic guar for personal care use. 3) Hydroxypropyl guar for construction, personal care, oil field uses 4) Odorless and tasteless guar for food use. 5) Development of HYV / viscosity for fast hydrating guar. 6) Organic guar (certified). 7) Removal of odor of guar meal and its use as a protein supplement for human consumption. 8) Research – industry linkage to be strengthened
A.9	Seed replacement ratio, farmers access to HYV seed	- Farmers generally use own produce or buy guar from other farmers from village and use as seed, seed replacement ratio is below 10%. - Availability of HYV seed and quality of seeds to farmers is major issue	- Development of required varieties and extension is required for quality production, better productivity and farmer income - Seed multiplication and timely availability in market by Agri. Univ/ State Seed Corporation is required

B. Marketing of Guar and its products

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
B.1	**Marketing infrastructure**		

B.1.1	Transportation	- Long distances to port of exports - Need significant improvement	- Hinterland ICDs to be developed nearer to the manufacturing locations; Indian Railways to give special consideration to the trade
B.1.2	Storage and warehousing	Lack of warehousing in rural areas	- Warehousing corporations / pvt developers to take the lead - Training to stockholders - Needs infrastructure for cleaning and grading in market yard
B.1.3	Quality certification	Non availability of Accredited Labs. in the processing hubs of guar; Lack of national food data, norms; Certification agency for food/ different application	For food grade guar gum exporters, HACCP is mandatory. But guar gum industry is not regulated by govt. In my view, guar, being a food additive and export potential, it should be regulated by govt. agency like, PFA and industry should follow GMP. - Quality certification lab - Food laws as per E.U./ Foreign countries;
B.2	Marketing policies	- Direct marketing arrangements at mandi yard - Promotion of Contract farming in Guar	- Specify place for direct marketing at each market yard - Help in farmer industry linkage for contract farming
B.3	Improvement in efficiency and effectiveness of supply chain	- Price sensitive commodity - Long supply chain resulting high procurement cost for industry and low price to farmers - Transportation; - Easy availability of containers	- Price stability can bring improvement in supply chain. - Direct marketing and contract farming should be promoted - More Hinterland I.C.D.s; - Enhanced Railway network/ infrastructure to swiftly carry the containers to port
B.4	Farmer access to market	Information of prices is not available with farmers	- Easy way of information dissemination - Commodity Futures Exchange price discovery helps farmers to get good price.
B.5	Marketing charges and fees	No issue	Local taxes like mandi tax etc are being charged.
B.6	Taxation (Sales	No issue	VAT is exempted on guar.

	tax, VAT, etc)	State entry tax is different across, needs harmonisation

C. Processing and exports

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
C.1	Availability and gap in the processing technology and up-gradation requirement	- Process / technology gap in value added products - Splitting technology – Yield and viscosity traits; - Pulvrising technology – certain chemical application like cationic guar, HPG guar	- Either import of process and technology or development of our own process /technology. - Techno centre be developed on a national /state level to identify and make available the technology; - Export promotion council to assign techno studies to international agencies
C.2	Capacity utilization of the available processing infrastructure (Gap and enhancement)	Sufficient capacity is available to meet export requirement.	Capacity enhancement is being undertaken by industry to meet market demand well on time.
C.3	Problems faced by the exporters in export of guar derivatives	- Major problem faced by exporter: PCP test by Vimta lab/ endorsement by SHEFEXL as per notification of govt. to Europe bound shipments. - Technical know how - Testing facilities	Exporters are suffering a lot as it takes more than three weeks to get this report and govt. endorsement. - Tech know how – support required - Well equipped Testing lab be established near to manufacturing area;
C.4	Challenges from alternatives to guar gum	Locust bean gum, starch, cellulose	Explore use in other industries, development of new products
C.5	Efficiency & cost effectiveness of processing industry	- Very competitive industry - Less efficient machineries but cost effective because of its export market demand at present	- Being a commodity, whole industry is cost effective. - Efficient and cost effective machinery for processing is required - Advanced milling technology be found out suitable for the process

D. Export and Industry Promotion

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements

D.1	Certification issues for export	HACCP, ISO 9000, ISO 22000, HALAL and Kosher certificates are required for food grade guar - Time consuming	It should be made mandatory for food grade guar industry to have these certificates or this industry should be regulated by govt. agency like PFA - Regional laboratories, certification agencies required
D.2	Government policies to enhance export of Guar products	- Govt. has already extended some policies to enhance export of guar, viz. VKGUY and DEPB But guar splits are intermediate product and export of processed & finished product is encouraged, guar splits & meal do not qualify for HS 130232-Mucilages and Thickeners - Neutralization of taxes to reduce the transaction cost	- These policies should continued to help exporters for growth of industry and value addition - Re-classify HS 130232, only Guar Gum Treated and Pulverized qualify for this, VKGUY benefits not to be given for Splits. Special assistance for adoption/ import of advanced technology
D.3	Tariff and non-tariff barriers	Govt. should impose export duty@ 15% on guar split (raw material for guar gum powder) export with immediate effect.	With this measure, value addition will be done in the country as a result more employment / forex earning will be generated.
D.4	Choice drivers for current/ emerging markets	- China is emerging market for guar gum industry. - Development of markets in developing countries to reach the customers directly	China has nil duty on guar split import from India and however imposed import duty @15% on guar gum powder from India to have value addition in China. Therefore, Indian govt. should imposed duty on guar split @ 15% and part of this money to be spent on guar gum R&D.

E. Price and market intelligence

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
E.1	Volatility in prices of guar seed and guar gum	Price volatility is a major issue face by guar	Commodity Futures Exchange price discovery

		industry.	mechanism has supported industry to reduce price volatility partly. But more transparency is required to reduce price volatility, viz. computerization of mandi record / sowing records, storage record etc.
E.2	Commodity futures trading and guar industry	Additional and transparent mechanism for price discovery and advance price signals	- Trading on Commodity Futures Exchange to be continued. - Capacity building of all stakeholders on hedging is required - Increase hedging and control excessive speculation
E.3	Price discovery mechanism	Based on Demand and supply	Through Commodity Futures Exchange, better price discovery is ensured.
E.4	Shaping of market influences/behaviour	Monsoon trend, Crop acreage; Harvest size	- More transparency is required. - Buffer carryover can be maintained to moderate prices and maintain supply
E.5	Market intelligence on trends & new product requirements / preferences- their impact on guar products requirement	- Sufficient market intelligence is not available to farmers and other stakeholders - Dissemination of information to grass root level	- Agency should be their for creation and dissemination of market intelligence; - Close rapport between the user of the product and the manufacturer/ exporter
E.6	Access to signals of producer/ consumer market	Limited but Enhanced after commodity futures in guar seed	- Information dissemination to farmers to be ensured - International benchmarks be identified which affect guar markets and regular dissemination of market info on these benchmarks

F. Guar Industry Value Chain

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
F.1	Supply Chain: from input suppliers to farmers and to the end	- No direct link between farmers and the manufacturer	- Certified HYV seed to be kept and stored separately. To be used for value added

	users of guar products	- High viscosity (HYV) seeds are mixed with normal variety. - Long supply chain	product. - Contract farming may be one of the options - Product specialization according to user industry
F1.1	Farmer's access to knowledge, resource and profitability to farmers	Lack of knowledge of farmers about guar	More training to be imparted to farmers. In Rajasthan and Haryana, there should be govt. farm house to impart training on this type of cash crop.
F1.2	Sourcing of Guar and other raw material and its role in enhancing returns to farmers		If contract farming and direct market arrangements are made, will help farmers getting assured market and better price & industry to be competitive
F.1.3	Value addition in each stage of guar processing and marketing	Good scope for value addition at each stage	- Support is required at each stage. - Export of raw material (splits) should be discouraged
F.1.4	Industry response to give farm viability and sustainability	Link missing	- A direct link with the farmer is required with the industry - This crop requires very less inputs and being a legume crop, nitrogen is fixed up in soil for better return in terms of high yield of next crop.
F.2	Demand	No issue	- Industry is growing 6-8%/ annum - Identification of more usages/ applications; - Research and development Identification of new markets
F.2.1	Identification of new market opportunities	New application of guar / China Action oriented plan	R&D institution for Guar seed production and processing technology development and dissemination is required, capacity building of fragmented industry particularly for food safety aspects is required
F.2.2	Understanding of	- Difficult to	- Every application demands

	demand, guar types (varieties) and production requirement	understand - Absence of know how with the Industrialists on various types/ varieties of guar seed	new sets of properties; products are tailor made as per customer requirement. - Dissemination of information and tech on various varieties of guar seed to the processors
F.2.3	What are the emerging sources of demand	New uses like building, ceramics etc	Technology is required to tap these emerging markets.
F.2.4	Demand for specialized labour, professional advise service and technical support as part of farm/ industry viability and sustainability	- Shortage of trained manpower in industry - Lack of know how and specific courses on technology, product bio chemistry like hydrocolloids, polymer technology	- Need to develop trained / skilled manpower by imparting technical training. - Guar industry is small and fragmented requires capacity building mainly on food safety aspects; - Specific streams of courses/ specialization be enacted relating to hydrocolloids, polymer techno etc
F.3	Industry Scales and Scope	Size of industry	Being a commodity, scale will play key role to make it sustainable in long term.
F.3.1	Impact of WTO/ trade rules	Access to various markets	Reasonable access to various markets of the world

G. Guar industry associations/ representation

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
G.1	Governance and representation of grower and other stakeholders in the interest of guar value chain	- Very poor representation from farmers. - Size of farm holdings or big size cooperatives are missing which can take the plantation of guar on an industrial scale	- All guar growing districts should have proper representation. - Stake of growers can be increased in case they come in adequate size
G.2	Roles, leadership quality, skills, competencies, decision structures	- Associations are not very effective and require change for growth of industry. - Participation of small and medium size industries and farmers	For the growth of entire guar industry, there should be sub –groups at each level and then it should be coordinated by a nodal agency to frame rules / std.

		cooperatives is missing	
G.3	Community factors/ impacts	- Very less participation - Regional factors strongly manifested	- To be strengthen. - Balanced approach should be taken in national interest
G.4	Regionalization and consolidation to match these efficiencies	Missing	Regional chapters of the associations be carved out;
G.5	Requirement of internationally sustainable and commercially competitive guar industry development	Due to contamination of PCP in food grade guar has damaged image of whole industry and some plants in un-organized sectors really need improvement	This industry need to be regulated by a competent govt. agency to sustain on long term basis.
G.6	Requirement of whole-of-chain industry body to address fragmentation and redefine roles	- Very much required - To be aware about the regional disparities and a wholesome approach	- R&D institution looking all aspects (right from production to export) of guar is required - A national approach be devised to rectify the gaps and fragmentation

H. Sustainability and Diversity

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
H.1	Subsidies (visible/ other)		Not required
H.2	Trade barriers	- High import taxes by China on gum powder discouraging import of finished product, low import tax on splits encouraging import of raw material	Discourage export of raw material
H.3	Research and Development base	Very poor on processing of guar seed	Extensive research is required for processing and development of derivatives
H.4	Funding bases for breeding	Govt. should imposed export duty on guar split	Revenue from export duty to be used for this purpose.
H.5	Segmentation and traceability capabilities required for an internationally	Industry is fragmented	Consolidation is required. Cooperatives of large size to be developed and identified;

	competitive guar industry		Commercial lots to be defined;
H.6	Trading systems/ processes and decision structure	No issue	Reasonable

I. Industry Risk

S. No.	Sub theme	Issues and Challenges	Recommendation/ requirements
I.1	Financial- level, type, scale, process and demand	Fluctuating prices cause concern	- Capacity of stakeholders may be enhanced on risk management (hedging) through commodity futures - Good knowledge about the product and user base will enhance scale, demand and process capabilities
I.2	Risk in terms of Competition, supply, technology access/ failure	Technology for value added products are needed.	- Govt. should support R&D funding to encourage technology development. - Strengthening of the infrastructure, technology, product quality will reduce chances of failure - Crop Insurance cover to farmers for Guar crop is urgently required
I.3	Environmental risk	Biodegradable	Eco-friendly

Appendix-2: Area, Production and Productivity of Guar seed in India

	Rajasthan			Haryana			India		
Year	Area ('000 ha)	Production ('000 T)	Yield	Area ('000 ha)	Production ('000 T)	Yield	Area ('000 ha)	Production ('000 T)	Yield
1990-91	2089.6	946.2	453	204	148	725	2402.9	1175.9	489
1991-92	1558.5	204	131	131	94	718	1764.8	345.8	196
1992-93	1882.2	583.4	310	155	93	600	2178.6	797.4	366
1993-94	1897.1	287.2	151	161	119	739	2101.1	489.9	233
1994-95	1959.4	708.3	361	156	117	750	2301.6	939.2	408
1995-96	1774.7	274.2	155	136	104	765	2213.45	900	406.6
1996-97	1819.1	739.9	407	127	104	819	2125.3	885.7	417
1997-98	1985.3	733.6	370	137	109	796	2301.2	962.7	418
1998-99	1611.9	319.6	198	127	82	646	1922.1	488.5	254
1999-00	2648.5	231.6	87	133	88	662	2933.9	375.1	128
2000-01	3056.3	481.2	157	148	102	689	3497.4	658.8	188
2001-02	2412.6	763.3	316	196	127	648	2903.1	1089.9	375
2002-03	556.5	27.9	50	205	91	444	974.1	202.6	208
2003-04	2278.35	1163.17	510.53	269	117	435	2854	1513.4	530
2004-05	1944.35	368.35	189.45	217	254	1171	2867.4	903.3	315
2005-06	2444.65	593.22	242.66	270	289	1070	2955.5	1059	358
2006-07	2807.91	658.43	234.49	295	334	1132	3352	1100	328
2007-08	2309.72	621.87	269.24	300	408	1200	2849	1261.5	443

Appendix-3: List of some of Industries and Research Persons discussed/ consulted

SN	Name	Industry/ Organisation	Stakeholder Type
1	Dr. D. Kumar	Scientist, CAZRI, Jodhpur	Research
2	Dr. S. K. Pahuva	Scientist, HAU, Hisar	Research
3	Dr. SPS Chaudhary	Scientist, ARS, Durgapura (RAU, Bikaner)	Research
4	Sh. S. K. Sharma	Lotus Gums, Jodhpur	Processor, Exporter
5	Sh. Prakash Mehta	President, Guar Traders Association, Jodhpur	Trader
6	Sh. T. C. Baid	Vimal Guar Gum Mills, Jodhpur	Processor, Exporter
7	Sh. G. C. Bhansali	Bhansali Industries, Jodhpur	Processor, Exporter
8	Sh. Mahesh Phophalei	Mahesh & Company, Jodhpur	Trader
9	Sh. Mangilal Tater	Jineshwar Kumar Traders, Jodhpur	Trader
10	Sh. S. V. Lohia	Arizona Gum and Chemicals, Jodhpur	Processor, Exporter
11	Sh. Suresh B. Shah	Badar Enterprises, Jodhpur	Trader
12	Sh. Ashok Tater	S.S. Chemical Industries, Jodhpur	Trader
13	Sh. Deepak Bhansali	Bhansali International, Jodhpur	Processor, Exporter
14	Sh. Paras Sethia	Pankaj Gum and Chemicals, Jodhpur	Processor, Exporter
15	Sh. Jeewan Gandhi	President, Rajasthan Guar Manufacturers Association, Jodhpur	Processor, Exporter
16	Sh. Damodar Prasad	Manoj Mediater, APMC, Bikaner	Trader
17	Bhanisali Bansal	Shambhu Trading Co., APMC, Bikaner	Trader
18	Sh. Anand Goyal	Director, Bikaner Commodity Exchange Limited, Bikaner	Trader
19	Sh. B. D. Agarwal	Vikash WSP, Sri Ganganagar	Processor, Exporter
20	Sh. Rajesh Kedia	Jai Bharat Gums & Chemicals, Siwani, Haryana	Processor, Exporter
21	Dr. D. K. Singh	Dabur Gum Industries, Alwar	Processor, Exporter
22	Sh. Pritam Kumar	Sisai Trading Co., Hisar	Trader
23	Sh. Sanjay Mahipal	Mahipal Food & Gum Industries, Sri Ganganagar	Processor, Exporter

Appendix-4: Farmers Interviewed

SN	District and State	APMC	No. of Farmers
1	Jodhpur, Rajasthan	Jodhpur	15
2	Bikaner, Rajasthan	Bikaner	15
3	Hanumangarh, Rajasthan	Hanumangarh	15
4	Ganganagar, Rajasthan	Ganganagar	15
5	Adamgarh, Haryana	Adamgarh	15
Total			75

Appendix-5: Targeted quantity of different categories of guar seeds in India

Year	Area (m ha)	Breeder Seed requirement (q)	Foundation seed requirement (q)	Certified seed requirement (q)
2008	4.76	79.3	2380	71400
2009	5.23	87.2	2615	78450
2010	5.75	95.8	2875	86250
2011	6.32	105.3	3160	94800
2012	6.95	115.8	3475	104250
2013	7.64	127.3	3820	114600
2014	8.40	140.0	4200	126000
2015	9.24	154.0	4620	138600

Seed rate 15 kg ha-1, multiplication ratio 1 : 30, seed replacement rate 10.0%

Appendix-6: Area, Production and productivity of Guar seed in Pakistan

Year	Punjab	Sindh	NWFP	Balochistan	Pakistan
Guar Seed Area In "000" Hectares					
1996-97	143.3	14.5	6.8	0.4	165
1997-98	140.1	14.7	5	0.7	160.5
1998-99	105	38	4.9	0.5	148.4
1999-00	109.3	10.2	5.8	2	127.3
2000-01	116.1	12.1	5.5	2.9	136.6
2001-02	129.3	31	4.6	2.1	167
2002-03	101.4	15.3	3.9	1.6	122.2
2003-04	126.8	42.6	3.2	2	174.6
2004-05	110.2	15.8	3	2.1	131.1
2005-06	109.1	16.5	2	3.2	130.8
Production in "000" Tonnes					
1996-97	145.6	8.4	8.6	0.3	162.9
1997-98	137.9	8.5	7.2	0.4	154
1998-99	105.6	22.1	6.7	0.4	134.8
1999-00	105.9	6.1	8	1.4	121.4
2000-01	107.6	7.6	7.6	1.8	124.6
2001-02	115.1	20.1	6	1.4	142.6
2002-03	87.8	10.4	4.8	1.4	104.4
2003-04	103.7	33.3	4.2	1.1	142.3
2004-05	91.5	11.7	3.9	1.2	108.3
2005-06	81.7	12.9	2.5	1.9	99
Yield in kg/Ha					
1996-97	1016	579	1265	750	987
1997-98	984	577	1440	592	960
1998-99	1006	582	1367	800	908
1999-00	969	598	1379	700	954
2000-01	927	628	1382	621	912
2001-02	890	648	1304	667	854
2002-03	866	680	1231	875	854
2003-04	818	782	1312	550	815
2004-05	830	741	1300	571	826
2005-06	749	782	1250	594	757

Appendix-7: Import duties for guar products in major countries

			Final Bound Duties				MFN Applied Duties			Import Duties	
Country	HS_Code	Product	[AVG]-FBD	[Duty Free in %]-FBD	[Max]-FBD	[Binding in %]-FBD	[AVG]-MFN	[Duty Free in %]-MFN	[Max]-MFN	[Share in %]-Imp	[Duty Free in %]-Imp
China	130232	Guar gum Refined Split	15	4.8	30	100	14.9	5	30	0.3	3.9
China	130232	Guar gum treated & pulverised	15	4.8	30	100	14.9	5	30	0.3	3.9
China	130232	Guar meal	15	4.8	30	100	14.9	5	30	0.3	3.9
Germany	130232	Guar gum Refined Split	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Germany	130232	Guar gum treated & pulverised	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Germany	130232	Guar meal	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
India	130232	Guar gum Refined Split	100.9	--	150	100	31.5	--	105	1.1	--
India	130232	Guar gum treated & pulverised	100.9	--	150	100	31.5	--	105	1.1	--
India	130232	Guar meal	100.9	--	150	100	31.5	--	105	1.1	--
Italy	130232	Guar gum Refined Split	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Italy	130232	Guar gum treated & pulverised	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Italy	130232	Guar meal	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Japan	130232	Guar gum Refined Split	13.2	20.4	646	100	12.9	19.8	646	1.7	14.4
Japan	130232	Guar gum treated & pulverised	13.2	20.4	646	100	12.9	19.8	646	1.7	14.4
Japan	130232	Guar meal	13.2	20.4	646	100	12.9	19.8	646	1.7	14.4
Pakistan	130232	Guar gum Refined Split	100	--	200	100	15.4	--	119	1.3	--
Pakistan	130232	Guar gum treated & pulverised	100	--	200	100	15.4	--	119	1.3	--
Pakistan	130232	Guar meal	100	--	200	100	15.4	--	119	1.3	--
South Africa	130232	Guar gum Refined Split	26.4	22.1	99	100	9.3	35.4	55	0.4	33.6
South Africa	130232	Guar gum treated & pulverised	26.4	22.1	99	100	9.3	35.4	55	0.4	33.6
South Africa	130232	Guar meal	26.4	22.1	99	100	9.3	35.4	55	0.4	33.6
Spain	130232	Guar gum Refined Split	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Spain	130232	Guar gum treated & pulverised	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
Spain	130232	Guar meal	10.7	22.6	199	100	11.8	21.4	195	1.3	16.1
United States	130232	Guar gum Refined Split	4.8	23.7	132	100	5	23.2	132	1.2	24.6
United States	130232	Guar gum treated & pulverised	4.8	23.7	132	100	5	23.2	132	1.2	24.6
United States	130232	Guar meal	4.8	23.7	132	100	5	23.2	132	1.2	24.6