Title	**:**	**Chickpea production trends and marketing value chain analysis in Andhra Pradesh**
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Abstract

Chickpea (*Cicer arietinum* L.) is an annual crop widely cultivate in semi arid tropics. It is one of the most important pulse crops in India. There are two types of chickpea grown, *Desi* and *Kabuli* chickpea. Almost every part of the chickpea crop has commercial value and is most commonly used as *dal*, followed by whole grain and flour. This study uses a value chain analysis approach to identify the market channels and value additional at different stages of Chickpea marketing in Andhra Pradesh.

Chickpea is mainly grown a *rabi* crop (post-rainy season) in Andhra Pradesh. It is usually cultivated without irrigation and with minimal inputs. Area under chickpea cultivation has increased from 45 thousand ha in the year 1980 to 394 thousand ha in the year 2005. Kurnool and Prakasham are the largest chickpea producing districts. The present study was conducted in Prakasham district. Due to the widening gap between prices of *Desi* and *Kabuli* chickpea farmers are shifting from *Desi* to *Kabuli* chickpea in recent years.

Chickpea crop in the Andhra Pradesh is marketed either in the whole grain form or in *Dal* form or as *Futana*. *Desi* chickpea marketed as whole grain *Dal* and *Flour*; while *Kabuli* chickpea is marketed only as whole grain. Usually the *kabuli* type chickpeas are exported to either north Indian states or other countries. The demand for the *Kabuli* chickpea in north Indian states is gradually increasing. The processors produce the *Dal* and *Futana* and market through prevailing marketing channels. The Indian Government has implemented the export ban on pulses and zero per cent import duty. Due to this policy, imported *Desi* chickpea is available at lower price than domestically grown *desi* chickpea.

Presently farmers in Ongole district are relying on village traders and sell their produce and end up getting a lower price. To get better price farmers can form cooperatives to market their produce directly to processors and exports to other regions in India. Govt. should setup a platform to bring the producers and traders at one place so that farmers will get better price.

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INTRODUCTION:

Pulses are a cost effective source of protein in human diets. Additionally, they maintain soil fertility through biological nitrogen fixation in soil and thus play a vital role in furthering sustainable agriculture (Kannaiyan, 1999). In 2005-07, globally 60 million tones of pulses are produced annually from 72 million hectares (FAOSTAT).

Chickpea, also known as garbanzo bean, Indian pea, *ceci* bean, Bengal gram, and hummus, kadale kaalu (Kannada), *Chana or Channa* is an edible legume of the family fabaceae, subfamily Faboideae. Chickpea (*Cicer arietinum* L.) is the fourth largest grain-legume crop in the world following soybean, dry pea and dry bean (FAO, 2005). Developing countries like India, China, Brazil, Turkey and Mexico account for nearly two thirds of global chickpea production. However, the average productivity of chickpea in India is very low at about 600 Kg/ha against the average global productivity of 857 Kg/ha and 1,900 Kg/ha in Canada and USA in 2006-08. However, the per capita production in India of pulses has declined from 60g/day in 1970-71 to 36g/day in 2007-08.

The two commercial types of chickpeas produced are *desi* and *kabuli*. *Kabuli* chickpeas, also known as garbanzo beans, have a larger, cream colored seed with a thin seed coat. The *desi* type has a smaller, darker colored seed with a thick seed coat. Chickpeas thrive under good moisture conditions with daytime temperatures between 21 to 29 degrees Celsius and nighttime temperatures near 20 degrees Celsius. Length of maturity depends on available heat and moisture, but is in the range of 95-105 days for *desi* type and 100-110 days for *kabuli* type. The *desi* form is also known as Bengal gram or *Kala Chana*. *Kabuli* chickpea is the kind widely grown throughout the Mediterranean. Chickpea is a *Rabi* (post-rainy) crop and is sown from November to December and harvested from February to March and has an average shelf life of over a year.

In most of the regions in India chickpea crop is grown by smallholder farmers with no irrigation and minimal inputs other than land and labor. In contrast, in the Australia, Canada and USA Chickpea produced on a commercial scale using improved varieties and modern crop management practices, irrigation and purchased inputs. Yields are therefore considerably higher

and more stable than in India. These regions have the highest Chickpea productivity ranging from 1.32- 1.47 t/ha. In contrast Asia has the lowest productivity of 0.80 t/ha.

History of Chickpea Cultivation in India:

Chickpeas probably originated in southeastern Turkey and later spread throughout the Middle East and Mediterranean regions. Archaeological remains from present-day Israel and Turkey indicate that chickpeas had been domesticated by Neolithic times (about 7,000 years ago). The European (*kabuli*) and the *desi* forms of grams may be viewed as individualized races of Cicer arietinum L established as a result of such severe geographical isolation. Chickpea is now an extensively cultivated as a winter crop throughout India, especially in the Northern states. Chickpea fits into a wide range of farming systems. It can follow both cereals and pulses (sorghum and soybean).

Uses of chickpea:

Almost every part of chickpea has commercial value. Chickpea grain is high in protein and fiber (Table 1).

Chickpea Dal: Chickpea is commonly used as *Dal*, consumed with rice and *chapattis*. *Dal* is also used to prepare the Flour. Flour is used in making *Pakoras*, *Kadhi*, *Namkins* and several other dishes. Chickpea flour is one of the chief ingredients along with *Ghee* and sugar which is used to make many items of Indian confectionary. Parched gram is grounded into flour called *Sattu*, which is very popular in the states of Bihar and Uttar Pradesh. Chickpea flour is used in baking various dough like products i.e. *DhokIa* etc.

Chickpea Kernels: Whole kernels are used for frying, soaking, roasting and boiling and in different types of *namkeens*. Roasted Chickpea is the most popular way of eating. Kernels are also used as a spice in vegetables and as sprouts for *salad*. It is widely appreciated as a health food, used in salad and as sprouts.

Chickpea leaf: the leaves are consumed as a nutritious green known as "Chana Saag". The leaf extract, rich in malic acid, is sometimes used for medicinal purpose. The plants are also used for animal feed, where grazing vegetation is scarce. It is an important source of horse feed ingredient.

Chickpea Husk: Chickpea husk, which is the by-product of *dal* processing, is used as cattle feed.

Table 1: Nutritional value of Chickpea

	Chickpea	
Nutrient	***Kabuli***	***Desi***
Crude protein (N *6.25) %	20.9	21.2
Crude fibre (%)	3.35	9.7
E.E[1]. (fat)%	5.6	3.4
Ash (%)	2.92	2.97
ADF (%)	4.48	13.04
NDF (%)	16.31	23.72
Est. TDN (ruminant)%	>80	<79
Calcium (%)	0.11	0.12
Phosphorus (%)	0.39	0.35
Lysine (%)	1.36	1.36
Methionine + Cystine (%)	0.6	0.63
Threonine (%)	0.76	0.72

Source: Pulse Production Manual 2000 Saskatchewan Pulse Growers

1: E.E. = ether extract; ADF = acid detergent fibre; NDF = neutral detergent fibre; TDN = total digestible nutrients; DE = digestible energy.

OBJECTIVES OF THE STUDY:

The objectives of this study are to understand chickpea marketing systems and the constraints that exist along various links in the value chain. There is a lack of empirical data and information needed to facilitate formulation of strategies to strengthen chickpea value chain and to increase its competitiveness on small farms. A detailed analysis of the value chain is therefore needed to understand the various factors which will improve the value chain of the crop.

This study employs a value chain approach and provides an overview of the chickpea subsector in Andhra Pradesh. It examines the factors that affect the chickpea production, value addition, marketing and utilization of the crop in Andhra Pradesh. This study is to identify the existing chickpea marketing channels.

Specifically, the objectives of the study are:

- Document global and regional trends in chickpea area, production and productivity
- Understand the structure of chickpea markets in Andhra Pradesh.
- Map the value chains and quantify the marketing and transactions costs
- Identify the interventions that strengthen the chickpea marketing channels.

METHODOLOGY:

Using secondary data, the overall trends in global and regional area, production and productivity were tracked.

A value chain is a sequence of steps involved in the process of production to market delivery of a product. It provides a means of understanding relationships between business, methods for increasing efficiency, and ways to enable business to increase productivity and add value. Value chain approaches are a vehicle for linking small business to markets (Webber).

Value chain analysis is a method for accounting and presenting the value that is created in a product or service as it is transformed by end users. Value chain analysis typically involves identifying and mapping the relationships of four types of features

1. The activities performed during each stage of processing

2. The value of inputs, processing time, outputs and value added

3. The spatial relationships, such as distance and logistics, of the activities; and

4. The structure of economic agents, such as supplier, the producers, and the wholesaler.

Value chain can become complex when they reflects multi-stage production systems with multiple types of firms operating in different locations in one country or multiple countries around the world (FIAS).

The value chain affords each segment an interest in the key stages of the chain as well as a share of the financial risks and rewards (Katz and Boand, 2000)

In general, an in-depth value chain analysis consider the following

- Who are the most important actors in the value chain?
- What is the institutional framework of the value chain?
- What are the economic costs along the value chain?
- Where is the most value added in the value chain?
- Where are the bottlenecks in the value chain?

The value chain can be a very useful conceptual tool when trying to understand the factors that impact the long term profitability of your business and when developing a successful strategic plan for your business. The value chain can be thought of as a set of activities, services, and products that lead to a product or service that reaches the final consumer.

The value chain can help you answer questions regarding:

1. How the products you produce reach the final consumer.

2. The structure between players in the chain.

3. How this structure is likely to change over time.

4. The key threat to the entire value chain.

5. The key determinants of your share of the profits created by the chain. (Brent Gloy, Department of Applied Economics and Management)

For this study we adopt a broader concept of a value chain to assess the structure and functioning of all the actors along the chain till final product and try identifying the key constraints and weak linkages that determine the overall competitiveness of chickpea. Therefore the strict definition of value chains is not adopted and we use the term market chains and supply chains interchangeably with value chains.

Empirical Methods:

The study undertook a detailed review of literature and analysis of secondary data. The secondary data was collected from the FAOSTAT, Directorate of Economics and Statistics and Director General of Commercial Intelligence and Statistics.

Primary data was collected from 85 marketing channel participants in Andhra Pradesh using detailed questionnaires administered in one-on-one interviews. These participants include farmers, village traders, commission agents, brokers, traders, dhal millers, flour millers, wholesalers and retailers. These participants were from the second largest chickpea producing district in the AP, Prakasham District: Ongole, Addanki, Uppugundoor and Pamidipadu. Details of this market are given in the later part. Only representative and readily available respondents were purposively selected for the interviews.

Marketing costs were taken to include both transaction costs and standard marketing costs example transport, loading and unloading. Measurable transaction costs include the costs of finding a buyer/ seller and costs of the negotiating prices.

The estimation of participants net marketing margins was therefore stated as marketing margin less total cost, i.e:

Net Marketing Margin = Marketing Margins – Total costs

Marketing Margin = Selling Price – Buying Price

Total Cost = Standard Marketing Costs + Transaction Costs

Marketing costs included costs paid for labor to clean the grain, storage costs, loading costs and unloading costs, processing costs packaging costs and other costs. The standard marketing costs included transport costs incurred during the transport from seller to store and from store to buyer.

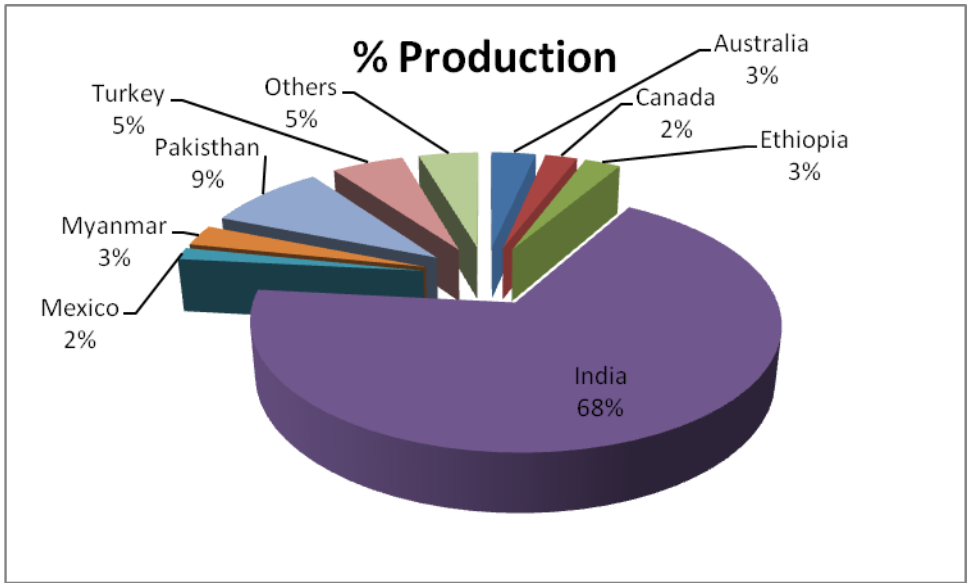
CHICKPEA AREA, PRODUCTION AND YIELD TRENDS:

Chickpea is cultivated in more than 50 countries in the world. In 2006-08 chickpea was grown on about 11 million hectares worldwide (Table 2). Compared to cereals and other crops, there have not been significant increases in chickpea yields. For 1994-2005, annual increase in average yield was only 0.9%. The annual growth rate of world chickpea production during the same period was about 1.87%. Despite the slow growth in yields from 649 to 802Kg/ha between 1980 and 2008, overall area and production has increased from 9 to 11 million ha, 6 to 9 million tons and. (Table 2)

Table 2: Trends in chickpea production in major growing countries and the world

	1980-82	1993-95	2006-08	1980-82	1993-95	2006-08	1980-82	1993-95	2006-08
Country	**Production (000' t)**			**Yield (kg/ha)**			**Area harvested (000' ha)**		
Australia	NA	183	308	NA	990	1,081	NA	191	283
Canada	NA	1	152	NA	1,385	1,384	NA	1	115
Ethiopia	124	86	250	803	598	1,194	153	140	209
India	4,109	5,278	5,886	576	774	805	7,146	6,785	7,311
Mexico	155	163	159	1,070	1,522	1,636	145	108	98
Pakistan	315	439	597	334	421	564	958	1,039	1,063
Turkey	263	707	525	1,155	928	1,044	228	762	503
World	**6,332**	**7,183**	**8,796**	**649**	**699**	**802**	**9,760**	**10,281**	**10,961**

Source: FAOSTAT

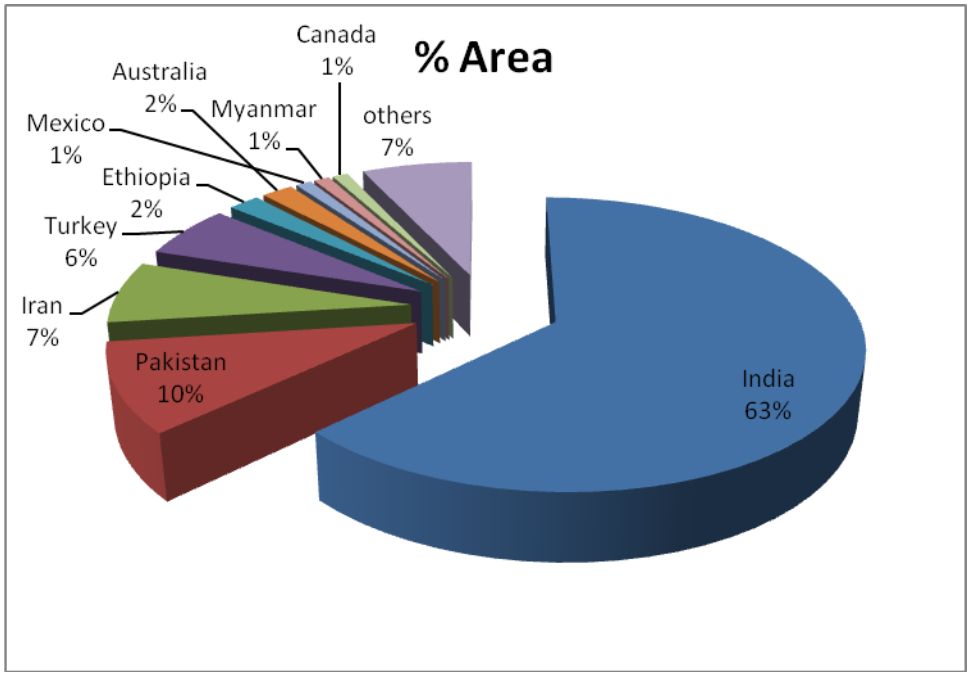


Source: FAOSTAT

Figure 1: Country-wise share of chickpea production, 2005-07

Country wise, India is the largest producer of Chickpea accounting for 68% (Figure 1) of global Chickpea production and 63% (Figure 2) of cultivated area followed by Pakistan 91%. Turkey 5%, Australia 3%, Ethiopia 3%, Canada 2%, and Myanmar 3% were the other major Chickpea producing countries during the same year.

Figure 2: Country-wise share of chickpea area, 2005-07



Source: FAOSTAT

In case of area also India ranked first with 63% in the world, during 2005-07, followed by Pakistan (10%), Iran (7%) and Turkey (6%). Ethiopia and Australia have 2% area each in the world. (Figure 2)

Chickpea Crop Seasons in the World:

Chickpea crop seasons are varying for the different countries. Among the major Chickpea producing countries in India and Pakistan it is a post-rainy (Rabi) crop. In these countries the sowing is done in the month of October and November, harvested in the month of January and February. The major exporting countries like Australia and Canada sowing is done in the month of April, May and June, harvesting in the month of October, November and December (Table 3).

Table 3: Harvesting schedule for chickpea in different countries

COUNTRY	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
INDIA	**G**	**G**	**H**	**H**						**S**	**S**	**G**
TURKEY			**S**	**S**	**G**	**G**	**H**	**H**				
PAKISTAN	**G**	**G**		**H**	**H**					**S**	**S**	**G**
AUSTRALIA					**S**	**S**	**G**	**G**	**G**	**G**	**H**	**H**
CANADA				**S**	**S**	**G**	**G**	**G**	**G**	**H**	**H**	

Note: G= Growth period; H= Harvest period; S= Sowing period

Chickpea area and production trends in India:

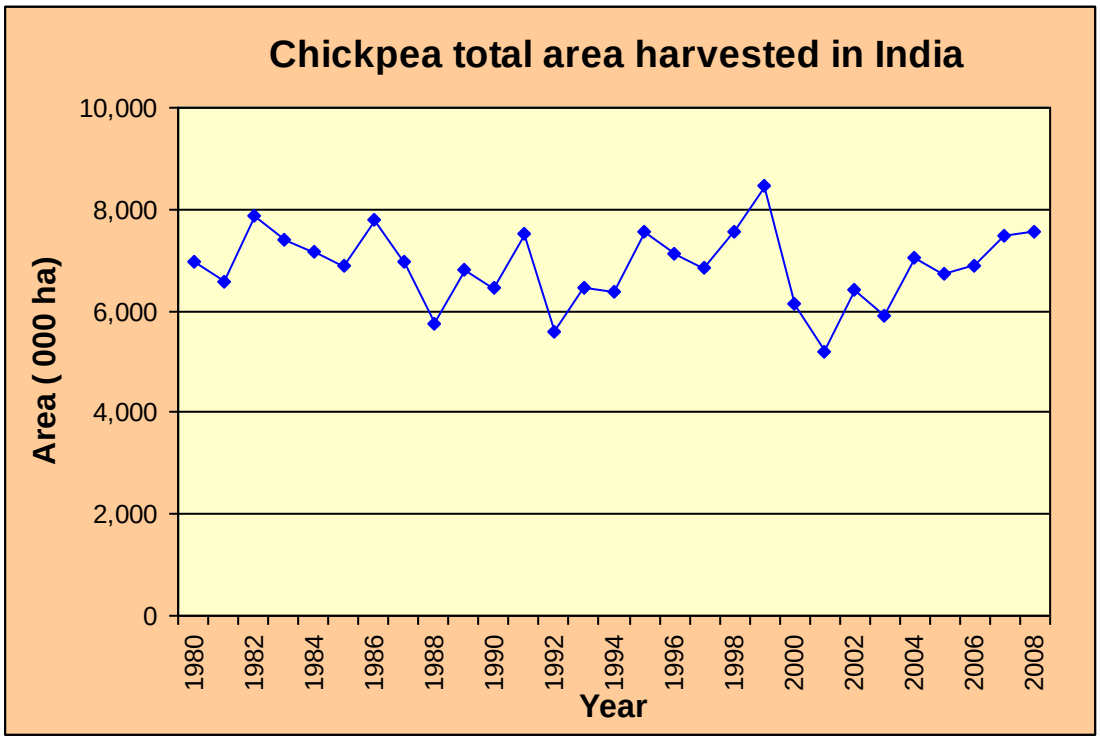
Chickpea Area Trends in India:

India is a world's largest producer of the Chickpea crop, with 7.3 million ha (Table 2) of cultivated area in the year 2008. Area under Chickpea cultivation has increased from 7.1million ha in 1981 to 7.3 million ha in the year 2008 (Table 2, Figure 3).

Chickpea is grown mainly in six states namely Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka and Andhra Pradesh, and together they account for more than 90% of the crop's area (Table 4, Figure 4). Madhya Pradesh and Rajasthan account for more than half of the cultivated area. Madhya Pradesh and Rajasthan states share about 37 and 18 percent of the total Chickpea area respectively in the country. About 8 per cent of the total Chickpea area is in the state of Andhra Pradesh (Table 4). However, chickpea area in Rajasthan is fluctuating due to erratic rainfall. For example, in 1998 area increased owing to above average rainfall and decreased drastically in 2002 when the rainfall was about a third of the normal rainfall. Additionally, area under chickpea in Rajasthan is being replaced by rape-mustard.

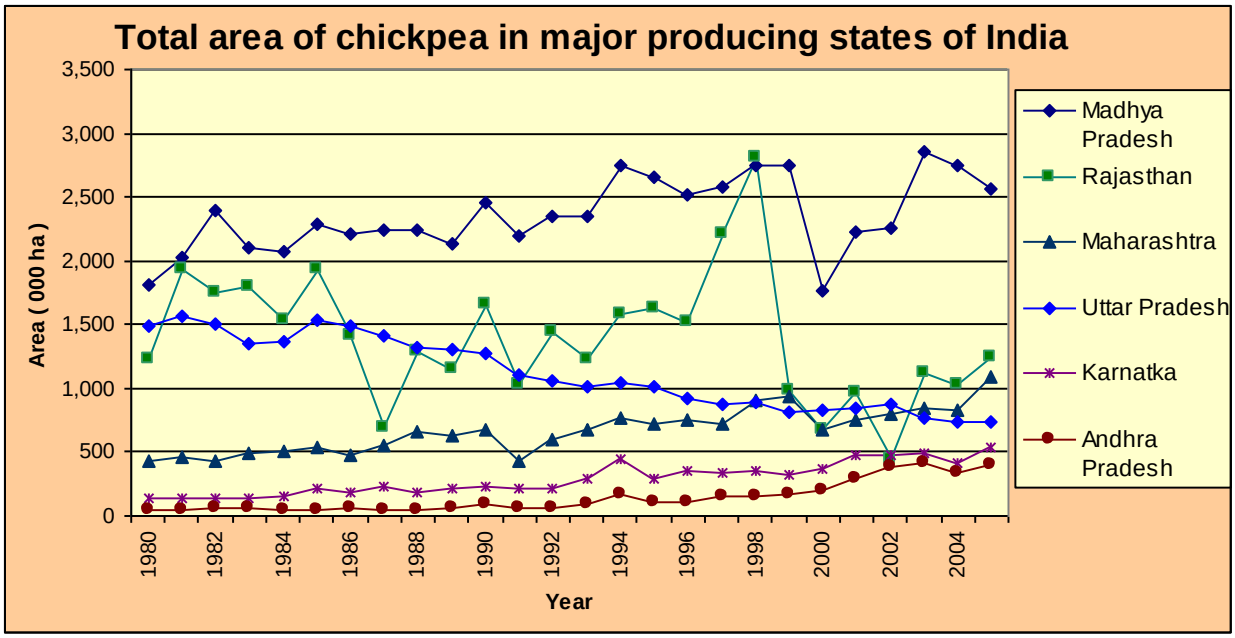
The Green Revolution in cereals in the 1970s progressively relegated chickpea to more marginal lands in India. Until the 1970s it was a premier crop of northern region. With the adoption of irrigated wheat cropping system, especially in Punjab, Haryana, and western Uttar Pradesh, the farmers shifted land away from the cultivation of chickpea. Area under chickpea decreased by nearly 3million hectares the North India region between 1965 and 2004 (Figure 5). Consequently, the chickpea cultivation moved southwards into warmer and more drought prone environments. In the hot and dry areas of south India, mainly Madhya Pradesh, Maharashtra, Karnataka and Andhra Pradesh, the crop is grown on about 4 million hectares (more than half of the total chickpea area in the country) (Figure 5). This was possible due to the introduction of short- and medium duration varieties that are suitable for cultivation in hot and dry environments.

Figure 3: Trends in area harvested of chickpea, 1980 to 2008



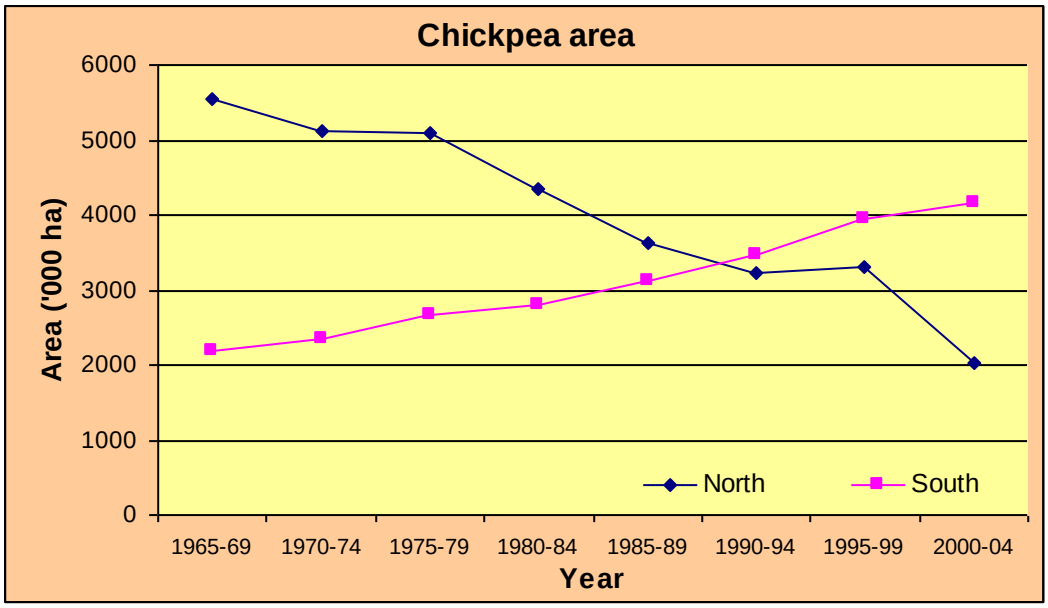
Source: FAOSTAT

Figure 4: Trends in chickpea area in major producing states India, 1980 to 2005



Source: Directorate of economics and statistics

Figure 5: Region-wise trends in chickpea area in India, 1965 to 2004



Source: Directorate of economics and statistics

Table 4: Trends in the area shares of chickpea of major growing states in India, 1980 to 2005

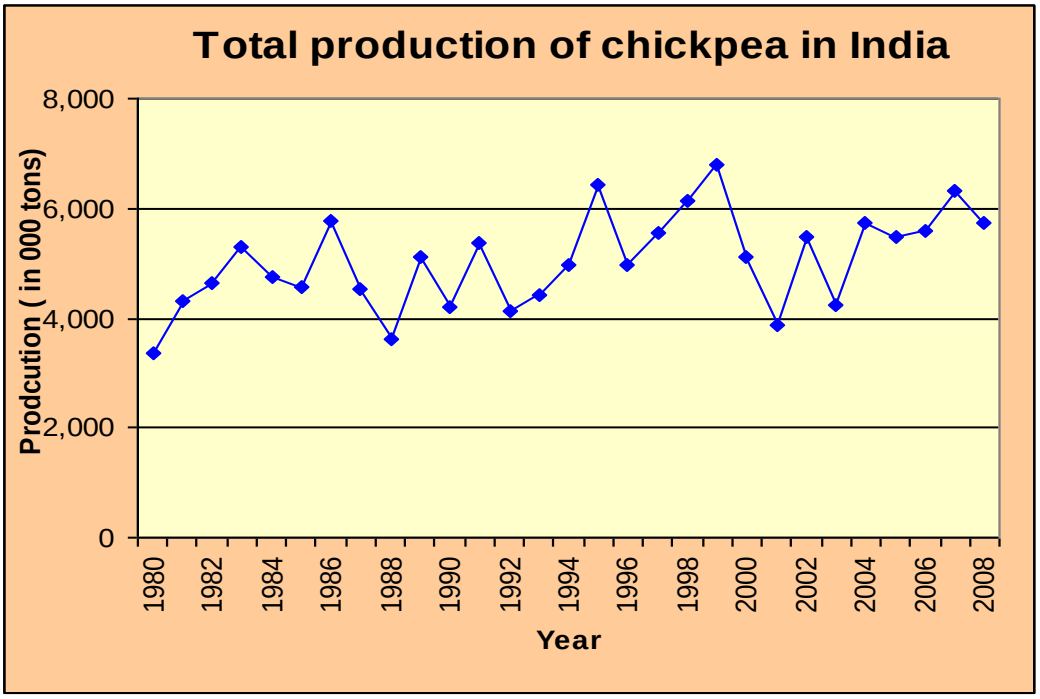
Years	Madhya Pradesh	Rajasthan	Maharashtra	Uttar Pradesh	Karnataka	Andhra Pradesh
1980-82	2074	1639	442	1524	141	53
1993-95	2581	1476	720	1018	341	123

2003-05	2723	1133	922	746	479	386

Chickpea Production trends in India:

Chickpea is the major source of pulses in India and constitute roughly about 35 per cent of the total pulse production. India is world largest producer of chickpea. Production has been increasing from 3.3 million tons in the year 1980-81, to about 5.7 million tons by the year 2008. Despite inter-year fluctuations in productions, the overall trend is an increasing one (Figure 5).

Figure 5: Trends in production of chickpea in India, 1980 to 2008.



Source: FAOSTAT

Chickpea production trends closely mirror area trends. About 90 per cent of the production comes from Madhya Pradesh, Rajasthan, Maharashtra, Uttar Pradesh, Karnataka and Andhra Pradesh. Madhya Pradesh and Rajasthan alone contribute about more than 50 per cent of the total production in India (Table 5). The individual share of production of Andhra Pradesh, Maharashtra and Uttar Pradesh are 8, 10 and 12 per cent respectively.

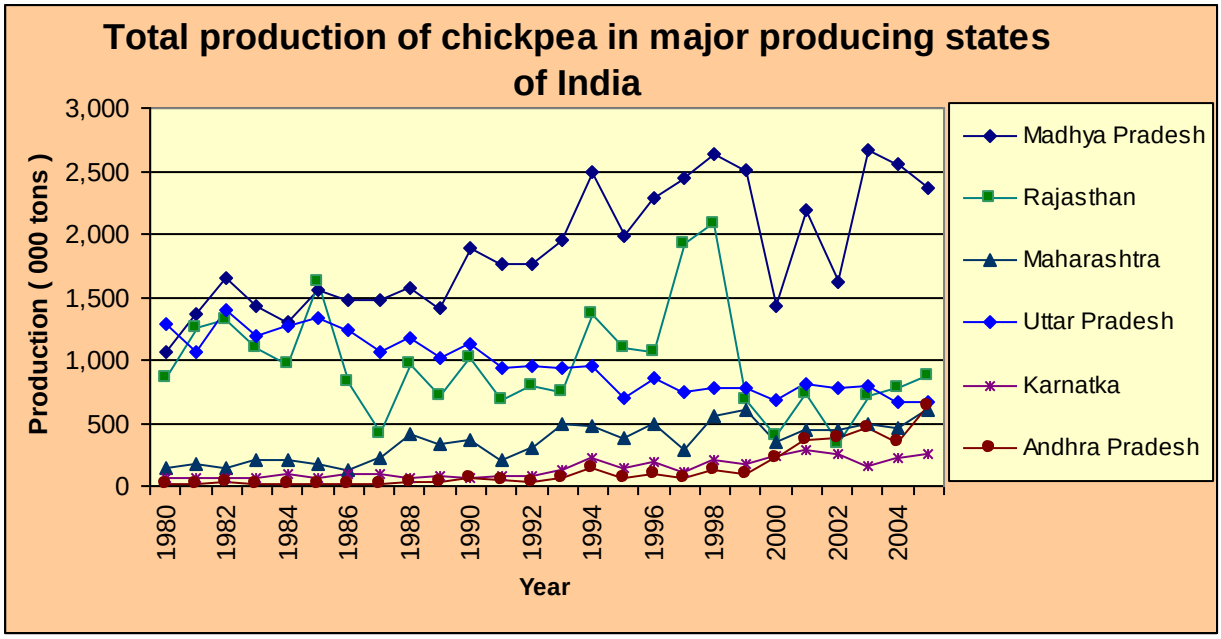
Table 5: Trends in chickpea area in major growing states in India, 1980 to 2005

Years	Madhya Pradesh	Rajasthan	Maharashtra	Uttar Pradesh	Karnataka	Andhra Pradesh
1980-82	1356	1143	158	1248	62	21
1993-95	2143	1070	446	859	165	91
2003-05	2528	784	519	707	213	476

Source: Directorate of economics and statistics

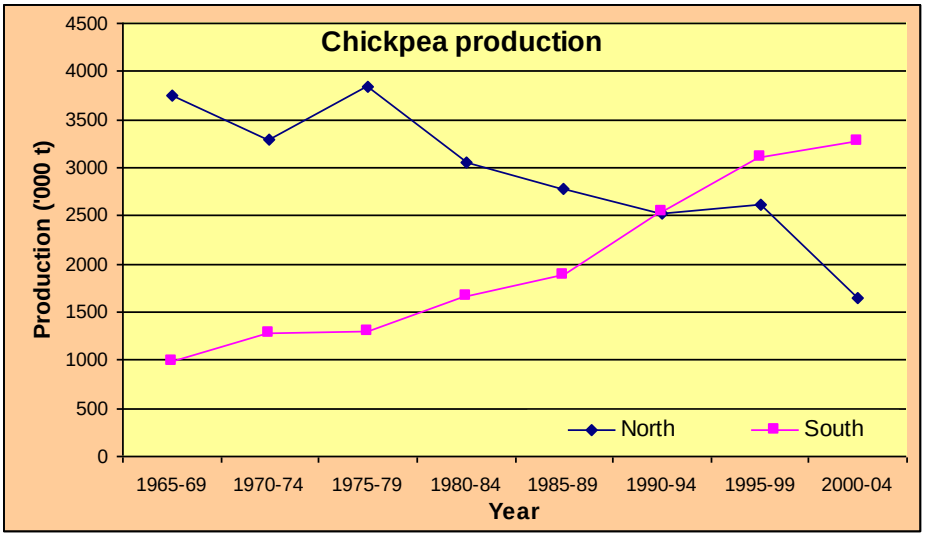
Over the years, chickpea production in Andhra Pradesh has increased from 23.6 thousand tons in the year 1981-82 to 417 thousand tons by the year 2005. Similarly in Maharashtra, production of chickpea has increased from 150 thousand tons in 1980 to 598 thousand in 2005 (Figure 6). However in Uttar Pradesh and Rajasthan production has declined from the year 1980 to 2005 owing to reduction in area in these states. Overall, the shift in production from the northern regions of India to the southern regions is observed (Figure 7).

Figure 6: Trends in chickpea production in major producing states India, 1980 to 2005



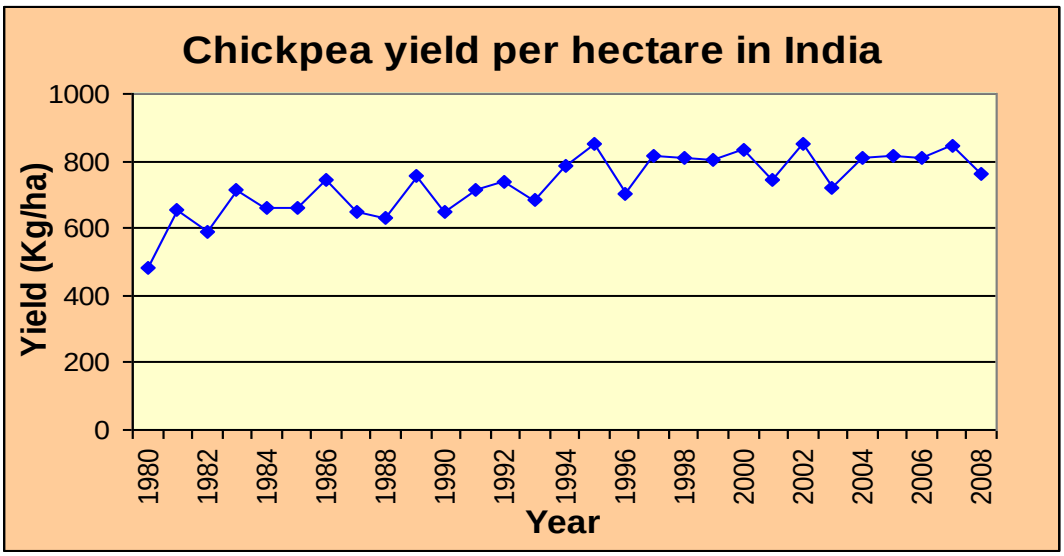
Source: Directorate of economics and statistics

Figure 7: Region-wise trends in chickpea production in India, 1965 to 2004



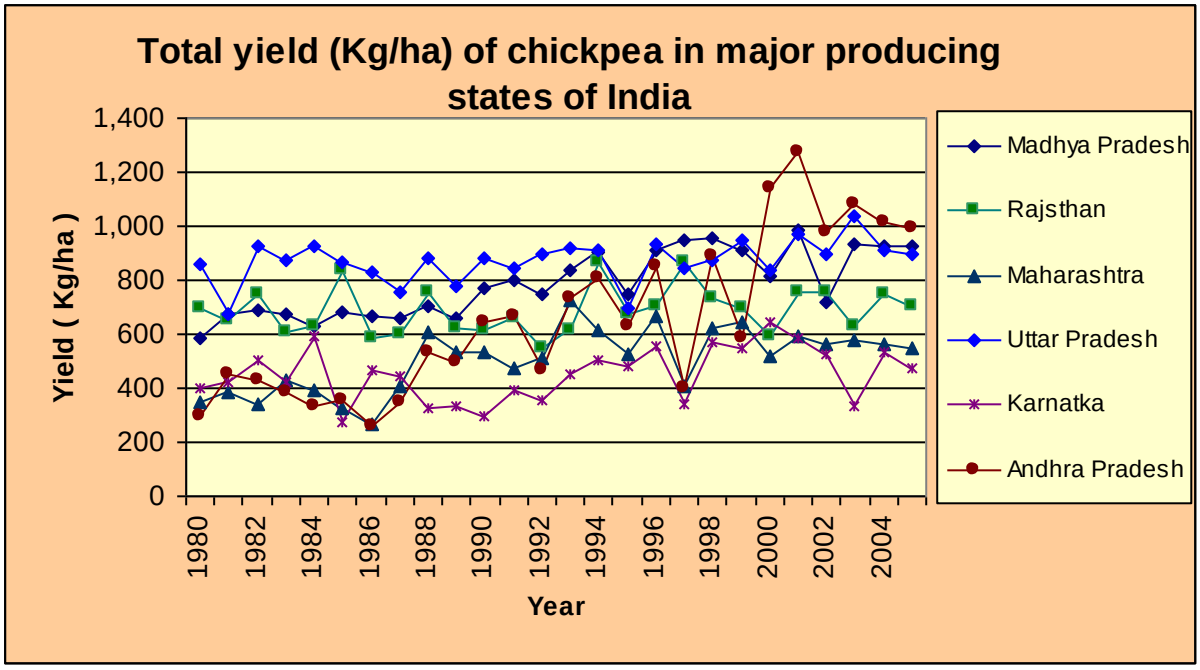
Source: Directorate of economics and statistics

Figure 8: Trends in yields of chickpea in India, 1980 to 2005



Source: FAOSTAT

Figure 9: Trends in the yields of chickpea of major growing states in India, 1980 to 2005



Source: Directorate of economics and statistics

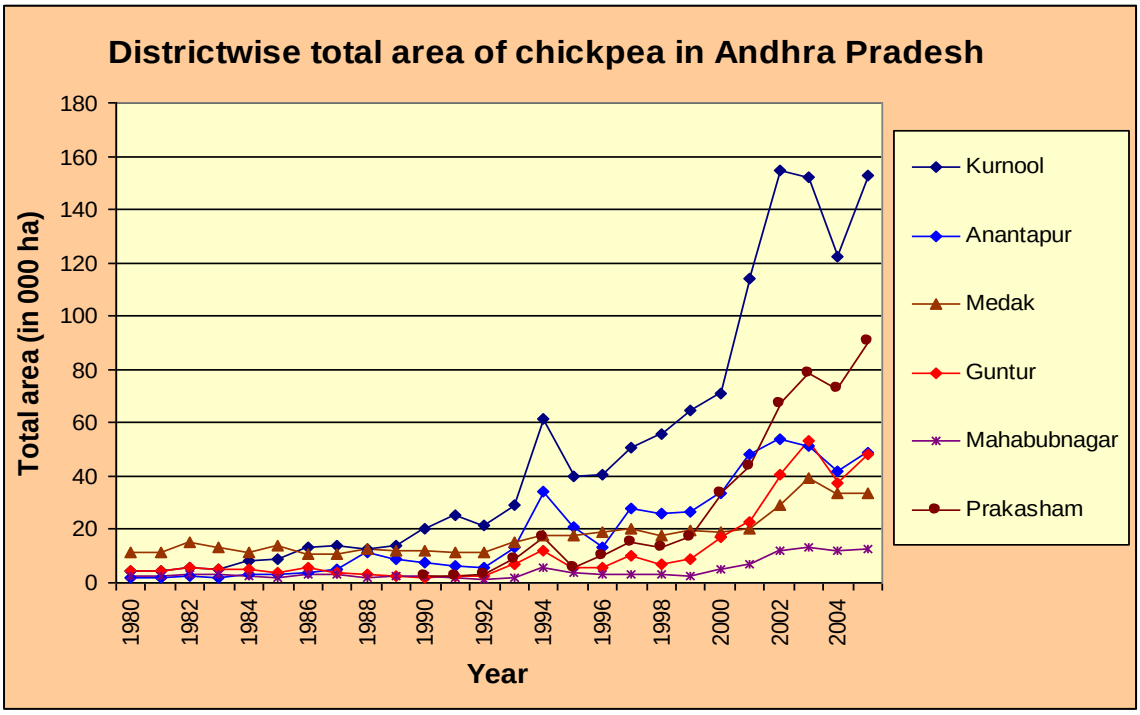
The current yield of chickpea in India is about 0.8 tons/ha. In the year 1980s the Chickpea yield was 0.6 tons/ha (Figure 8). The Chickpea yield level in India is very low because of 80 per cent of the crop is grown under rainfed conditions and is highly dependant on residual moisture. Compared to cereals and other crops, there have not been significant increases in Chickpea yields. For the same period, annual increase in average yield was only 0.9%.

Among different states producing chickpea, Andhra Pradesh has the highest yield 0.99 tons/ha followed by Madhya Pradesh (0.92 tons/ha) and Uttar Pradesh (0.89 tons/ha). Andhra Pradesh Chickpea yield was increased from 0.4 tons/ha in the year 1980s to 0.99 tons/ha during the 2005. Maharashtra and Karnataka chickpea yields are fluctuating between the 0.4 to .5 tons /ha during the 2005 (Figure 9).

Chickpea Situation in Andhra Pradesh:

Chickpea is mainly grown as a commercial crop in Andhra Pradesh. The area under chickpea cultivation has increased from 168 thousand ha in the year 1994 to 421 thousand ha in the 2005 (Figure 4). The main chickpea producing districts in Andhra Pradesh are Kurnool, Prakasham, Ananthpur, Cuddapah, Medak and Guntur.

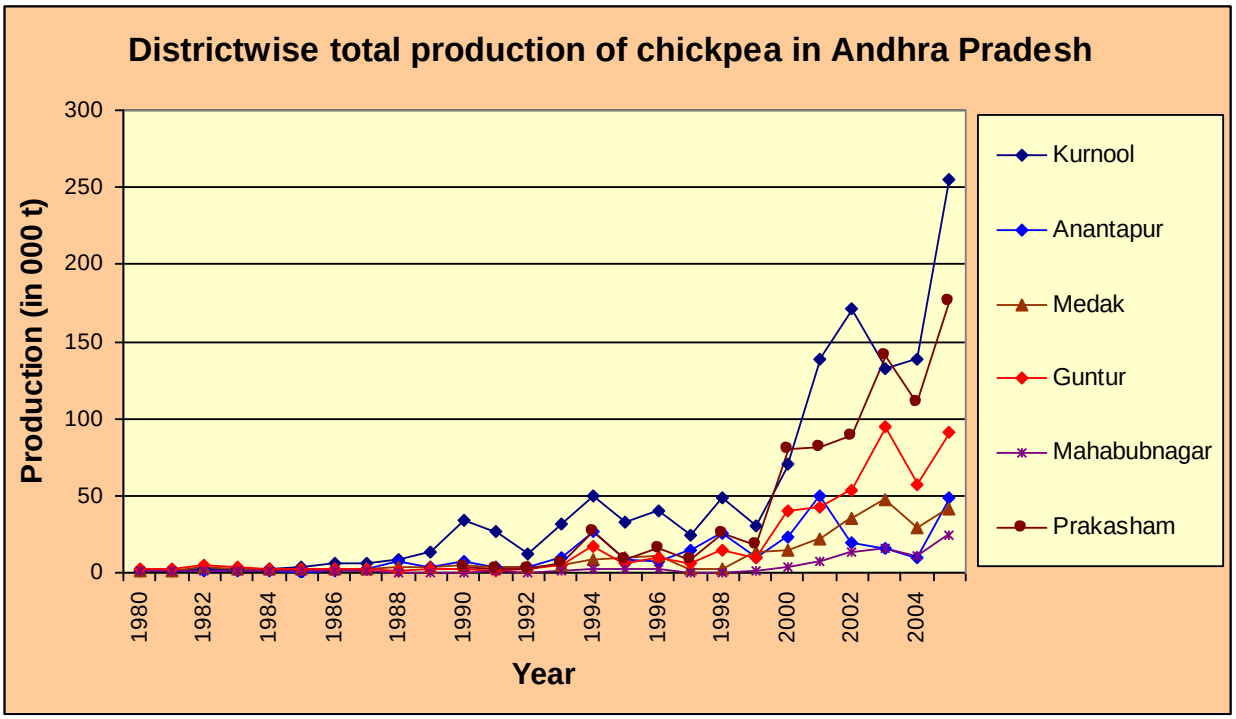
Figure 10: Area Trends in Major Chickpea Producing Districts of Andhra Pradesh



Source: Directorate of economics and statistics.

Kurnool district has the largest area under chickpea cultivation followed by Prakasham, Ananthpur and Cuddapah. In Andhra Pradesh, 36 % of the area under chickpea cultivation is in Kurnool district. In Prakasham district the area under chickpea cultivation has been steadily increasing. Kurnool and Prakasham districts account for more than 50% of the area in Andhra Pradesh (Figure 10).

Figure 11: Production Trends in Major Chickpea Producing Districts of Andhra Pradesh



Source: Directorate of economics and statistics.

As seen from Figure 11 chickpea production has increased significantly from the 1990 onwards. Kurnool district registered the maximum growth in the production from 1990- 2005 followed by Prakasham, Guntur and Cuddapah. Together Kurnool and Prakasham districts account for more than 50 per cent of area in Andhra Pradesh.

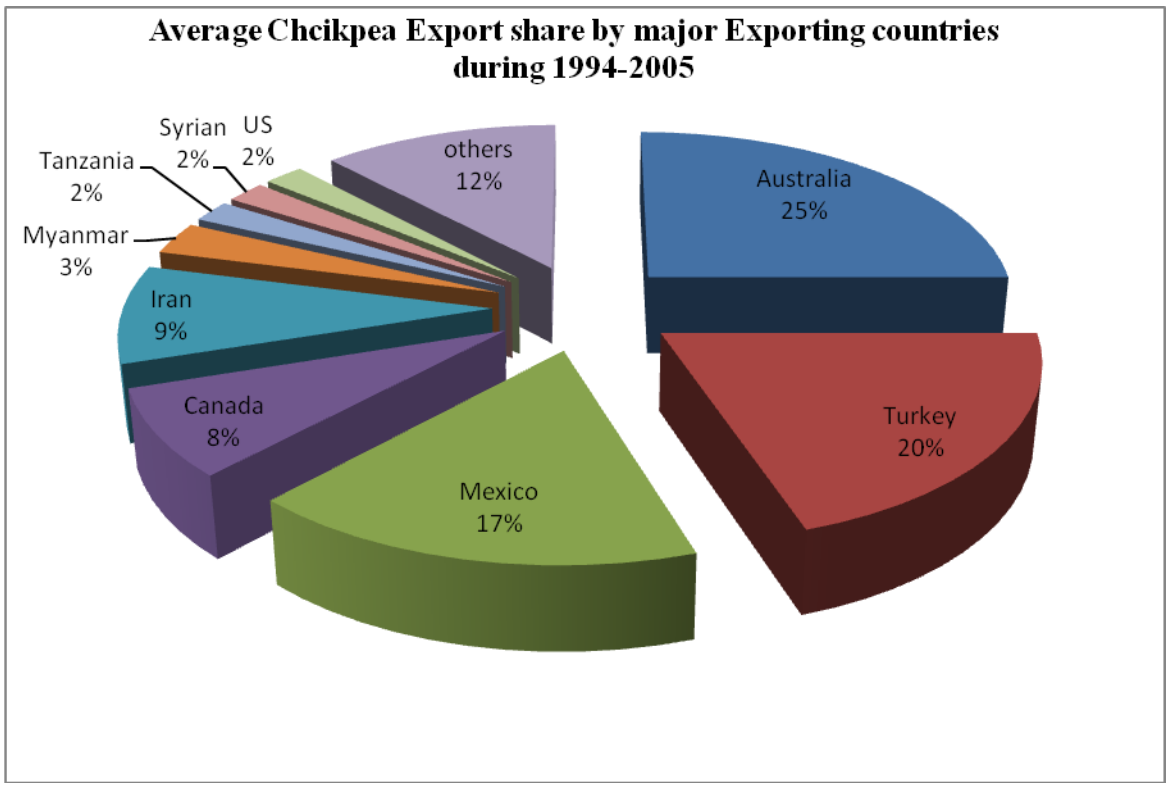
Utilization:

Chickpea is consumed primarily as a food grain in the world. It can be consumed as a whole grain, split into *dal*, or as flour. Over 75% of chickpea production is consumed as *dal* or flour. Husk and broken grain, the by-products of *dal* processing, are used as animal feeds. Its use as a feed grain is increasing but this demand is largely concentrated in the developed countries.

There is gradual shift in utilizing of *desi* chickpea to *kabuli* chickpea. So the demand for the *kabuli* chickpea has increased in domestic markets also.

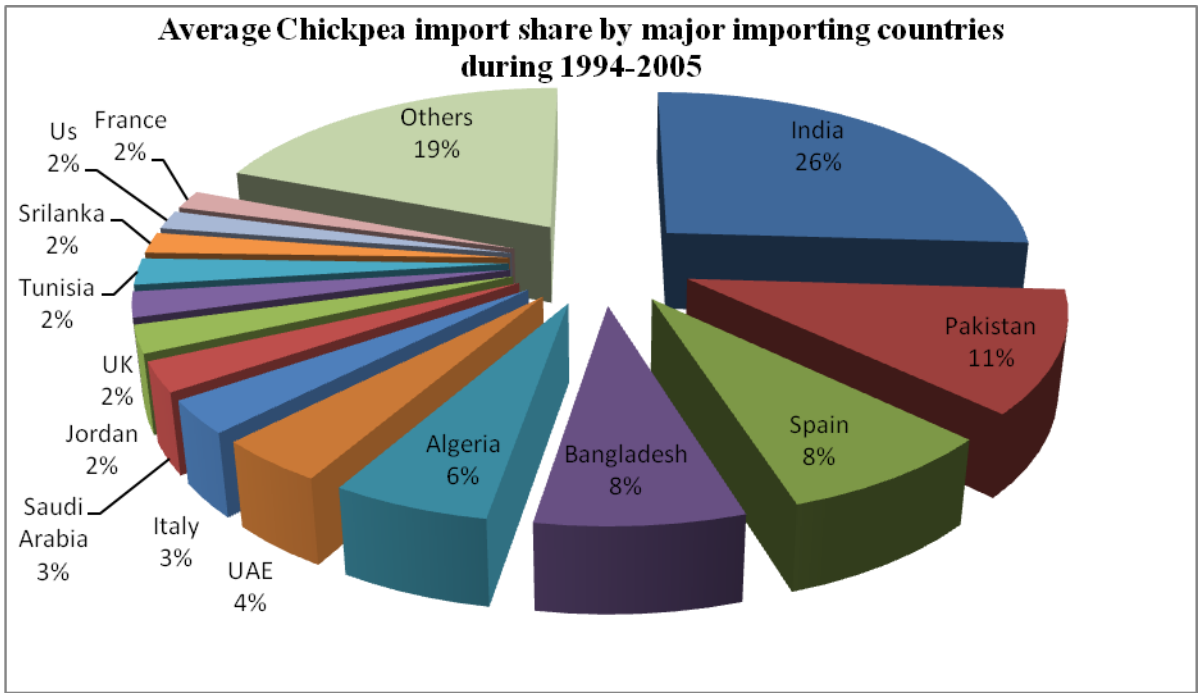
Chickpea International Trade:

International trade in Chickpea is relatively thin compared to other agricultural commodities. However, the marketed volume has increased and in 2005, 8.7% of the total average production (8,177 thousand tons) was traded. Major Chickpea exporters are Turkey, Australia, Mexico, Iran and Canada. The top three exporting countries (Australia, Turkey and Mexico) accounted for 53% of exports (Figure 12). The main Chickpea importing countries are India, Pakistan, Spain, Bangladesh, Algeria, United Arab Emirates and Italy (Figure 13). Unlike exports, imports were not concentrated on a few countries but distributed widely, with the top seven countries accounting for 64.3%.



Source: Agricultural Agri food Canada

Figure 12: Export share of major exporting countries



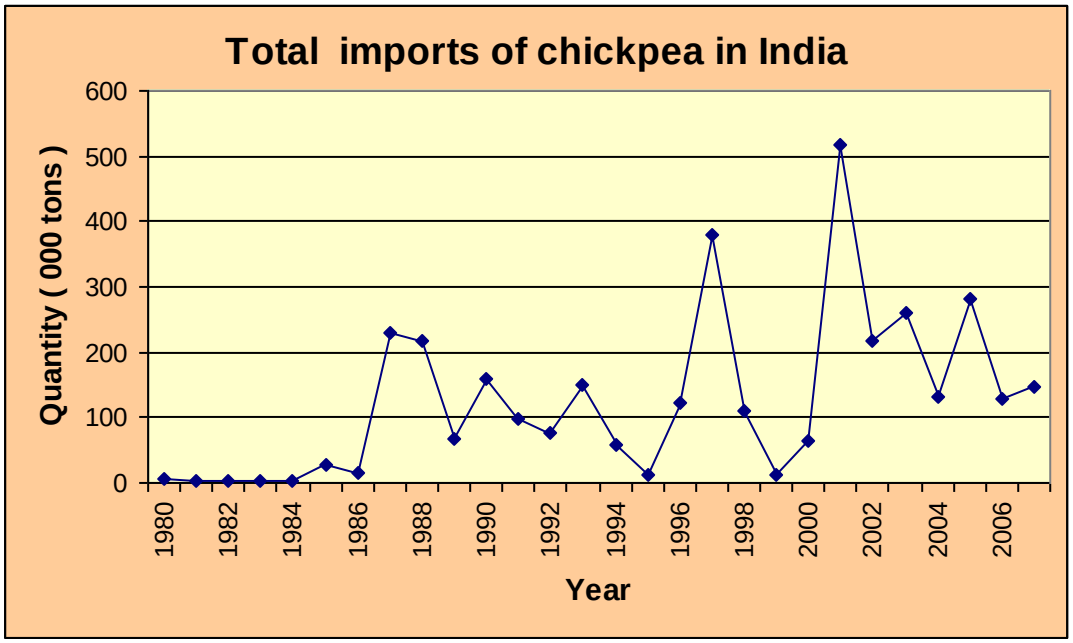
Source: Agricultural and Agri-food Canada

Figure 13: Import share of major importing countries

Turkey and Canada produce about 50% of *kabuli* type of Chickpea and export it. The major importing countries like India, Pakistan and Bangladesh import *desi* type, whereas developed countries, the Middle East, and Northern Africa import mainly the *kabuli* type (Agricultural and Agri-food Canada, 2004).

India over the years continues to be the world's largest importer of Chickpea. Despite being the largest producer, the country has to rely upon imports due to explosive growth in population. The country meets its domestic needs primarily through imports from Canada, Australia, Myanmar and Tanzania, etc. Among the two commercial types of Chickpea India is importing the *desi* Chickpea.

In order to supplement the availability of Chickpea India imported 0.1 million tons of Chickpeas in the year 2007. India has export meager quantity of the processed Chickpea Dal and *kabuli* Chickpea. (Figure 14)



Source: FAOSTAT

Figure 14: Imports of chickpea to India, 1980 to 2007

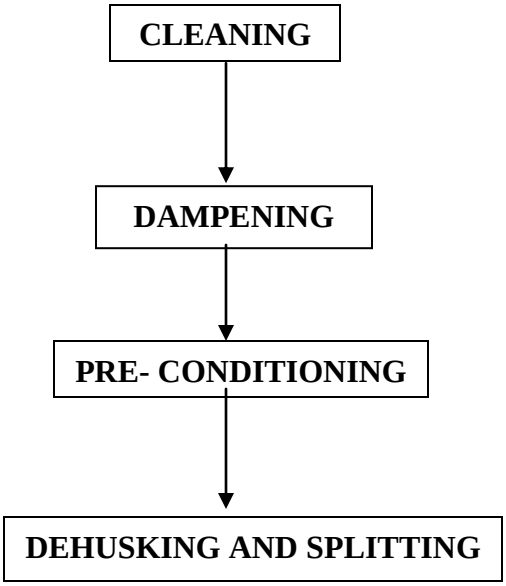
As seen from the above figure, chickpea imports were highest in the year 2001. General trend indicates that during drought or subsequent years, imports increase substantially in order to meet domestic demand. A part of the imports of whole grain are also for meeting processed *dal* requirements outside India, since the chickpea processing industry is not active in some growing countries. In recent years, however, India has been importing chickpea to balance the domestic consumption. Due to lower cost of production in exporting countries, chickpea import prices are lower than prices of domestically grown chickpea even after accounting for transport and other costs.

CHICKPEA MARKETS, GRADING, QUALITY AND PROCESSING SYSTEMS:

Chickpea processing system:

Processing unit in India can be classified into two parts: processing unit meant for making *dal* and processing unit meant for grinding *dal*l to produce flour. Many pulses in India are decorticated (hulls removed) and split. Mills process the pulses using a multi-step procedure. Operating machinery, bagging and hulling are labor intensive activities in all the milling plants. Wholesale price differences imply milling costs and margins of the millers. The milling sector in India consists almost entirely of small scale enterprises.

Processing steps:



60 percent of chickpea is consumed as *dal* and flour. Consequently the processing of chickpea is an important step in the marketing chain. Processing is concerned with the addition of value to the product by changing its form. Value addition is the process of changing or transforming a product from its original state to a more valuable state. Processing adds the value to its product from Bengal gram into Dhal, Futana and Besan (flour).. Milling of Chickpea means removal of the outer husk and splitting of the grain into two equal halves. The important steps involved in Dhal making are:

Cleaning:

The first stage of *dal* processing is cleaning the chickpea grain of dust particles, dirt, grit and chaff. This stage of the process is usually performed by daily wage laborers. After removing the impurities the cleaned chickpea is dried in the sun.

Dampening:

After cleaning the produce, the grain is sprinkled with water in order to increase the size of the seed. They use one liter of water for one qtl of grain. The soaked seed is kept aside for one day a side.

Pre- conditioning:

In this process the soaked produce is dried in the sun or dryers. In the traditional method, they the soaked peas ere dried in the sun. However, the use of mechanical dryers is prevalent as most millers have mechanical dryers. This step is carried out to loosen the seed coat to facilitate the Dehusking process.

Dehusking and Splitting:

At this stage of the processing chain, the husk is removed from the grain and the grain is split into *dal*. Both these actions are performed simultaneously.

There are two final products possible at this stage—fried *dal (futana)* and plain *dal*. On average 85% is made into plain *dal* and 15% into *futana*. The processing of these two products is essentially the same with the only difference that the grain that is to be made into *futana* is first roasted in wood-fired, brick-lined oven for 4-5 hours and then cooled. The dehusking and splitting of the grain is then carried out.

The recovery rates from one quintal of *desi* whole grain are given in Table 6. Table 7 gives the cost involved in the processing.

Table 6: Recovery rates in *dal* processing

	Dal	Fried Dal
Recovery Rate	78	72
Husk	18	18
Mud	1	1
Breakages	3	4
Roasting loss		3
Un-split grains		2
Total	100	100

Table 7: The cost involved to produce 1 qtl of Dhal:

Costs	**Rs**
Wood	33
Labor	25
Driver	12
Electricity	7
Loading	4
Unloading	4
Total	**85**

The by- product husk and broken grain are sold at the rate of Rs 500/qtl. Un-split grains are sold at Rs 35 /Kg. Husk and un-split grains are very good feed for the cattle. Husk is usually sold to out of state brokers while un-split grains are sold to local farmers. In some cases the Dhal millers have to approach the Broker to find a buyer for the husk. For this the Dal millers have to pay the commission of Rs 7/qtl. The Dal millers will get the payment within one week.

Marketing channel for husk:

Dal mill ⟶ Broker ⟶ Wholesalers ⟶ Farmers

Dhal millers are selling their husk to other states also through Brokers.

While selling the Dal sometimes they give discounts on immediate payment. If the buyer will pay the amount immediately Dhal miller will give the 2.5% discount on the sales value.

FLOUR:

2 flour millers in Ongole were interviewed. The processing capacity of both the millers was 1 qtl an hour for chickpea. Flour milling is a mechanical manufacturing process which produces flour from Chickpea Dal through comprehensive stages of grinding and separation. The recovery rate for the chickpea flour is 98 Kgs for one qtl of chickpea. There are no commission agents and brokers involved in the chickpea flour marketing channel. Super markets, hotels and hostels place the orders to the flour mill and buy the flour directly. To produce one qtl of chickpea flour 5-6 units of electricity are required that cost Rs. 40/qtl. Household consumer brings the chickpea to the mill to be ground into flour. In this case they pay the service charges. For large quantities for commercial establishments the flour miller charges Rs 100-120/qtl for making the flour. For domestic purpose (household use) they charge Rs 1.50/Kg of chickpea.

Cold storage:

Farmers are using the cold storages for two reasons:

1. To get better price for their produce in the future
2. To use seeds for the next year production

In cold storages the stock of chickpeas are high in the months of February and March i.e., immediately after harvest. The off take from the cold storage is generally high during other months like June, July and Aug. For maintaining the proper quality of the produces the temperature in morning were kept at nearly 8-9 degree C while in night time the temperature varies from 6-7 degree C. The charge imposed on storage varies from place to place. Mostly the rate is Rs. 100 per quintal for a season (Feb to Dec). In some cold storages the charges varies with the pea varieties. The charges are given below:

Table 8: Charges of Cold Storage

Variety	Bold	Kak 2	JG 11	Mosambi
Charges(Rs/qtl/season)	100	98	97	98
Insurance amount(Rs/qtl/season)	10	8	6	7

Some cold storage also charge on a monthly basis like Rs 10 per quintal per month. The cold storages also provide insurances for the produce. The insurance charges are included in the storage charges. The storage charges also include the loading and the unloading changes. *Hamalis* are paid an amount Rs 7/quintal for loading and unloading of the produce. The costs that the cols storage owners incur are insurance costs of 0.4% of the stored produce and electricity bills of nearly Rs. 80,000 per month.

The farmer receives a storage receipt from the cold storage unit for keeping the produce. According to the norms there should be proper quality check before receiving the produce from the farmer and giving the receipt to the farmer. The warehouse receipt acts as a negotiable bill for the banks and farmers are eligible for a loan amount of 60 percent of the value of the produce. However, the farmer has to repay the money back to the bank before selling the produces in the market. The cold storage owners also have sufficient contacts with the brokers and therefore eventually provide a marketing platform for the farmers.

Preferred quality traits:

The price for the chickpea grain is determined based on a number of characteristics. The most important are:

- Seed color
- Seed size
- Foreign matter
- Moisture content
- Recovery rate

The surveyed brokers, traders and commission agents stated that while they were unable to offer trait-wise premiums, on average the variation depending on the different quality traits were Rs. 20 to 30 per quintal for *desi* and Rs. 40-50 per quintal for *kabuli* chickpea.

Seed color:

Seed color is the one of the most important factor for determining the price of the produce. This characteristic is the primary determinant on price for *desi* chickpea by the traders, commission agents, and brokers. Golden yellow color is most preferred color in the *desi* chickpea. This trait is relatively less important in determining the price of *kabuli* chickpea. Creamy white color is preferred in the *kabuli* chickpea.

Seed size:

This trait is the most important trait in determining the price of *kabuli* chickpea. In *kabuli* chickpea 8-9 mm seed size is preferred. In *desi* chickpea, although it plays a relatively less influential role in determining price, generally bigger the seed size better the price.

Foreign matter:

Foreign matter includes dust, stones, and lumps of earth, chaff, husk, stem, straw or any other impurity including edible and non-edible seeds. Traders usually allow the up to 1 Kg of foreign matter per qtl. Higher the foreign matter lowers the price.

Moisture content:

Moisture content is another important factor for determining the price of the produce. This trait is the second ranked quality trait in determining the price of *kabuli* and *desi* chickpea. Secondary sources state that the ideal moisture content is 12%. However, in practice this trait is estimated in a crude manner with the traders estimating the moisture content by chewing the seeds.

Recovery rate:

It is a most important factor for the *dal* millers. Higher the recovery rate higher the price. Usually they recovery rate for the *dal* is 78 % and for *futana* it is 72 %.

Grading of the Produce:

According the FAO standards chickpea grading qualities (Maximum limits of tolerance (per cent by weight)) are given below in Tables 9 and 10:

For whole grain Chickpea (*desi* and *kabuli* chickpea):

Table 9: Standard Grading Qualities for Whole grain

	Moisture	Foreign matter		Other edible grains	Damaged Grains	Weevilledgrains per cent by count
		Organic	inorganic			
Special	10	0.1	Nil	0.5	0.5	3
Standard	12	0.5	0.1	2	2	6
General	16	0.75	0.25	4	5	10

Table 10: Standard Grading qualities for Chickpea Dal:

	Moisture	Foreign matter		Other edible grains	Damaged Grains	Broken grains	Weevilledgrains per cent by count
		Organic	inorganic				
Special	10	0.1	Nil	0.5	0.5	0.5	1
Standard	12	0.5	0.1	1	2	2	2
General	16	0.75	0.25	2	5	5	3

General requirements for the Chickpea:

Chana split (husked) /Dal Chana shall -

(a) Consist of husked and split grains of gram (*Cicer arietinum Linn*.);

(b) Be sweet, clean, wholesome, uniform in size, shape, color and in sound marketable conditions;

(c) Be free from living and dead insects, fungus infestation, added coloring matter, moulds, obnoxious smell, discoloration

(d) Be free from rodent hair and excreta;

(f) Uric acid and Aflatoxin shall not exceed, 100 milligrams and 30 micrograms per kilogram respectively

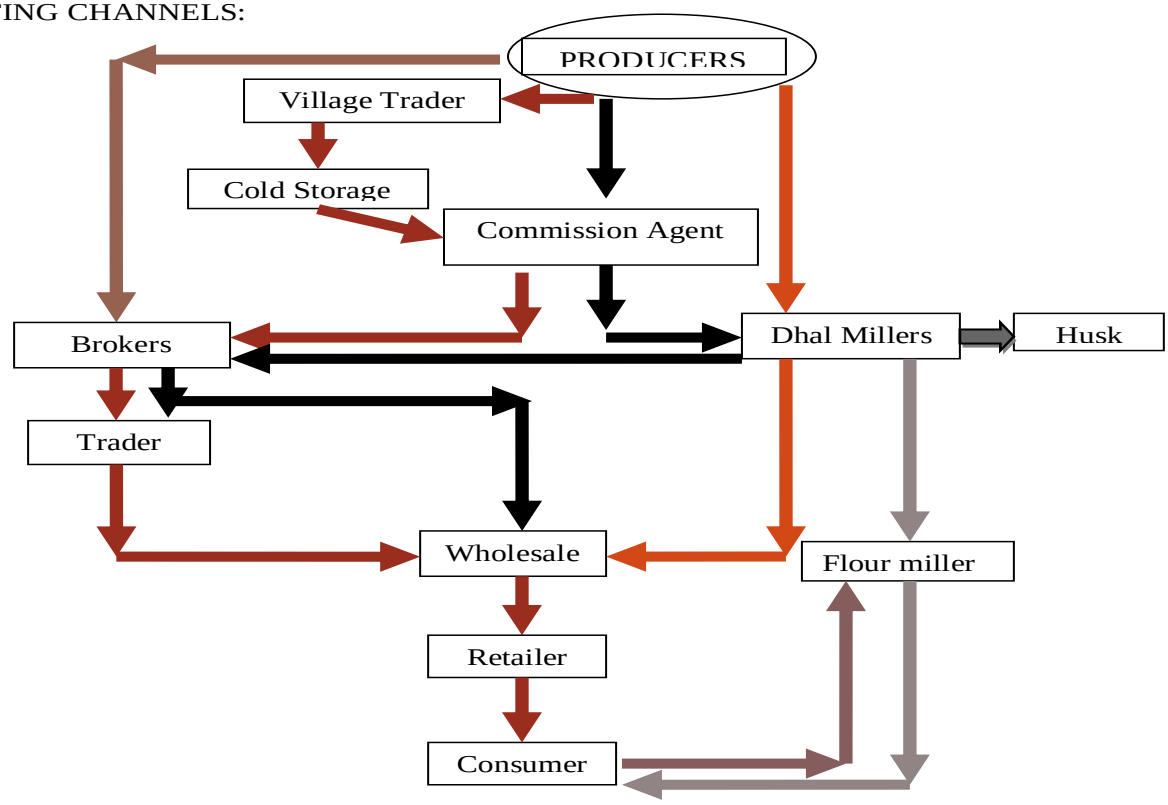
In general the grading of the produce was usually done on the basis of seed size, color and moisture. The grading process is done by visual inspecting small samples from the lot. Golden yellow color seeds are in *desi* Chickpea and Creamy White color in *kabuli* chickpea are the good quality seeds. To measure the moisture content simply they bite the seeds. Foreign matter and broken seeds are identified by seeing sample produce from the lot.

Marketing Channel for Chickpea Crop in Andhra Pradesh:

34 farmers were surveyed belonging to small, marginal and large farmers. Based on the information related to marketing of chickpea commission agents and brokers in Prakasam, Uppugundoor and Hyderabad were interviewed to complete the marketing chain. Processors in Addanki, Ongole and Hyderabad (Gaganpahad) were also surveyed. For secondary data I visited the MARKFED and AMC office in Ongole and Directorate of Marketing Office in Hyderabad. According to the results of the field survey, there are 6 marketing channels for chickpea.

The following are the existing marketing channels for chickpea in Ongole

MARKETING CHANNELS:



The marketing channel for chickpea and its processed products is marked by a few important bottlenecks.

1. A majority of the harvested produce is sold to the village traders owing to prior input-credit contracts. The market price that the farmers get in this situation is typically lower than when they their produce directly to the commission agent.

2. There is no organized market yard that records chickpea arrivals, and prices. The different actors are spread out geographically and information about prices is not available in one place.

3. In the absence of an organized market yard, information on prices and arrivals is not available. The only information that is available is the data that is record at the district check posts. However, it has been noted that these check posts are bypassed frequently. Further, the data that is maintained at the check post is for pulses or for chickpea, rather than for *desi* and *kabuli* varieties.

4. There are additional links in the chain between chickpea farmers and *dal* processors that further erode the farmer's share in the consumers' rupee. *Dal* processors prefer to buy whole grain in bulk in order to cut down on their transaction costs. However, since a lot of the chickpea farmers are small scale farmers with small marketable surpluses, a commission agent who collects all the grain from the farmers, and sells it to the *dal* millers in bulk quantity becomes an important actor in the value chain.

Marketing Channel for Desi Whole Grain:

Channel 1a: Farmer - Village Trader – Commission Agents – Trader – Wholesaler – Retailers

Channel 2a: Farmer – Commission Agents – Broker- export

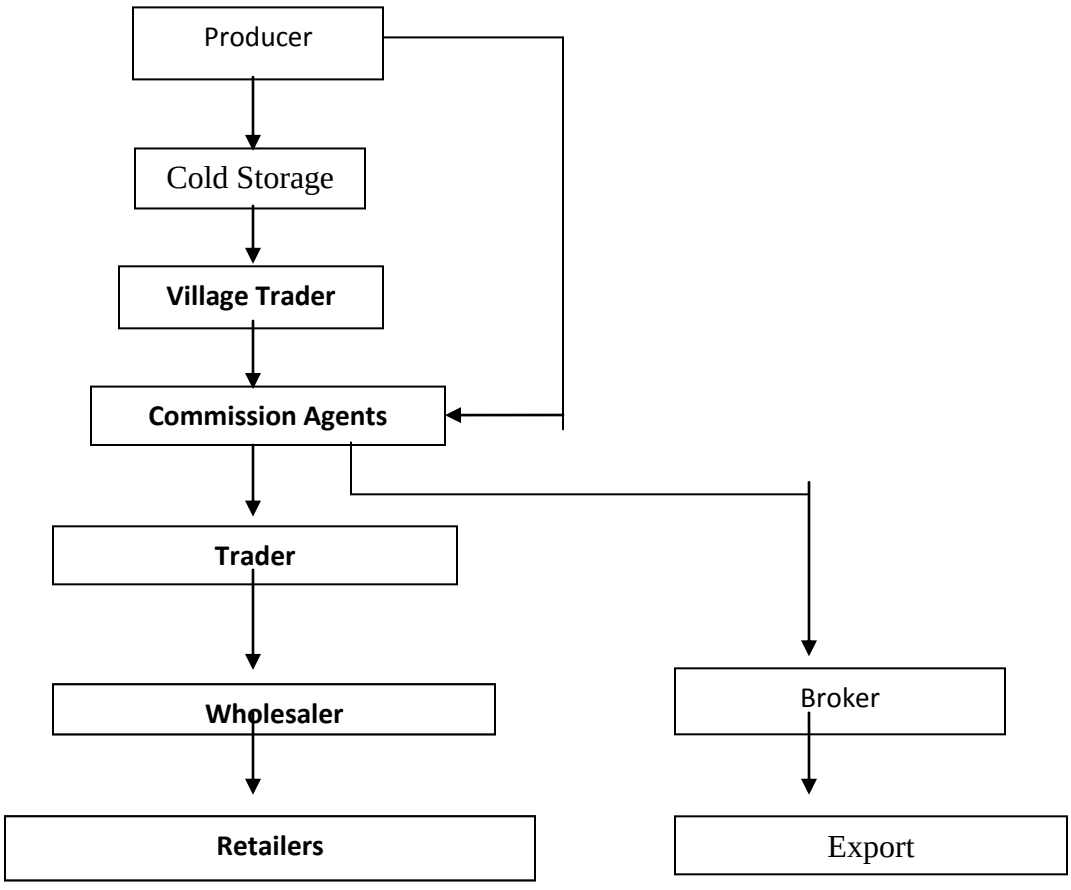


Table 11: Chickpea selling Price at different levels: Rs/qtl

DESI CHICKPEA WHOLEGRAIN		
Participants	Channel 1a	Channel 2a
Farmers	2200	2350
Village traders	2400	
Commission agents	2400	2350
Brokers		2750
Export		NA
Traders	2700	
Wholesalers	2900	
Retailers	3300	
Farmer share in the final price	66.60%	

Table 12: Marketing Margins and Costs: Rs/qtl

	Channel 1a			Channel 2a		
	Total Cost	Gross Margin	Net Margin	Total Cost	Gross Margin	Net Margin
Farmer	156			156		
Village Trader	32	200	168			
Commission Agent			14			14
Broker				320	400	80
Export						
Trader	56.5	300	243.5			
Wholesaler	50	200	150			
Retailer	102	400	298			
Total						

Marketing Channel for Kabuli Chickpea:

Channel 1b: Farmers – Village Traders – Commission Agent – Traders – Wholesalers – Retailers.

Channel 2b: Farmers – Commission Agents – Broker – Export.

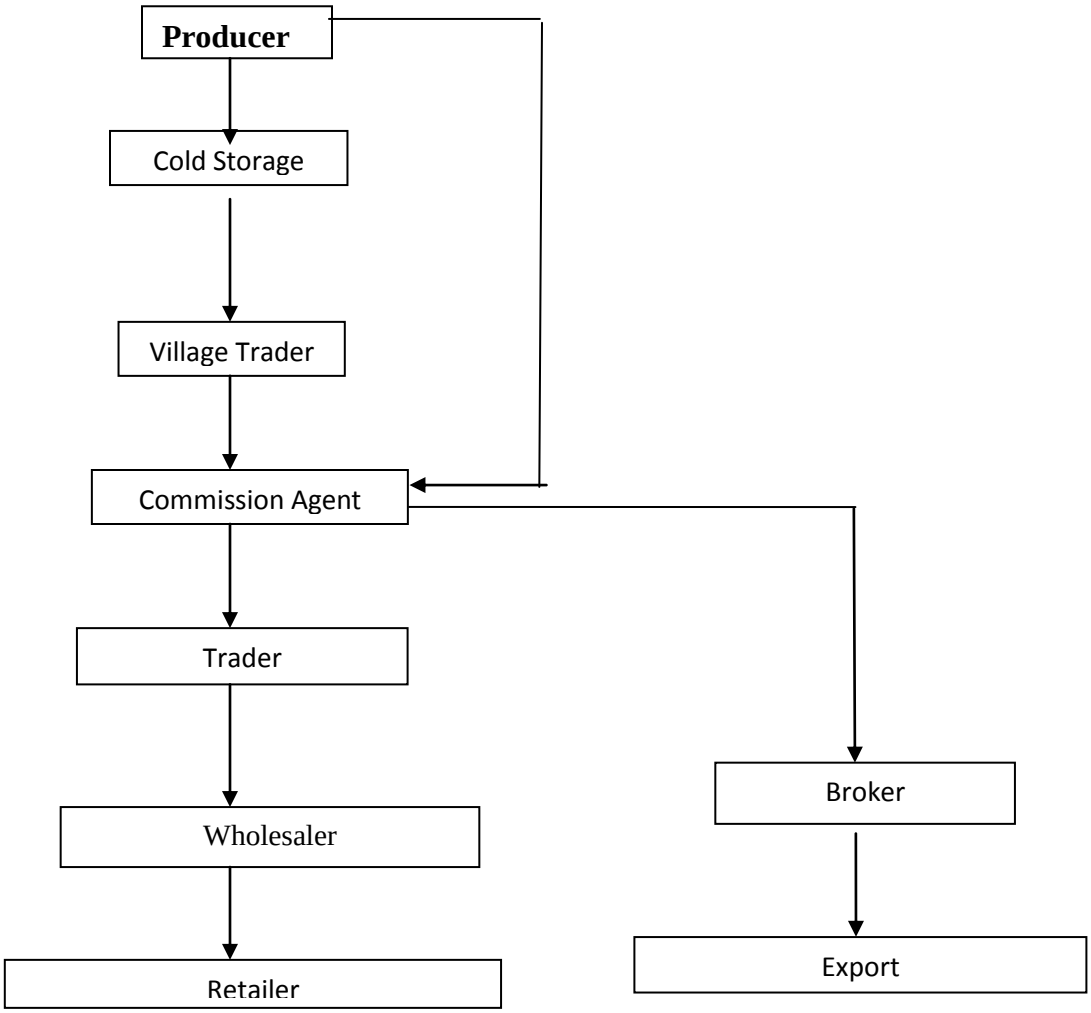


Table 13: Kabuli Chickpea Selling Prices at different Level: Rs/qtl

Kabuli Chickpea Whole Grain			
	KAK 2		**Bold**
Participants	Channel 1b	Channel 2b	Channel 2b
Farmers	3600	3700	5300
Village traders	3750		
Commission agents	3750	3700	5300
Brokers		4350	5750
Export		NA	NA
Traders	4300		
Wholesalers	4500		
Retailers	4800		
Farmer share in the final price	75%		

Table 14: Marketing Margins and Costs: Rs/qtl

	Channel 1b			Channel 2b			Channel 2b		
	Total Cost	Gross margin	Net Margin	Total Cost	Gross Margin	Net Margin	Total Cost	Gross Margin	Net Margin
Farmer	156			156			156		
Village Trader	32	150	118						
Commission Agent									
Dhal Miller									
Broker				370	650	280	370	450	80
Export									
Trader	160.5	550	389.5						
Wholesaler	50	200	150						
Retailer	102	300	298						
Total									

Marketing Channel for Dal and Futana (Desi Chickpea):

Channel 1: Farmer – Village Trader – Commission Agent – Dal Miller- Broker - export

Channel 2: Farmer – Commission Agent – Dal Miller – Traders – Wholesalers – Retailers

Figure no:

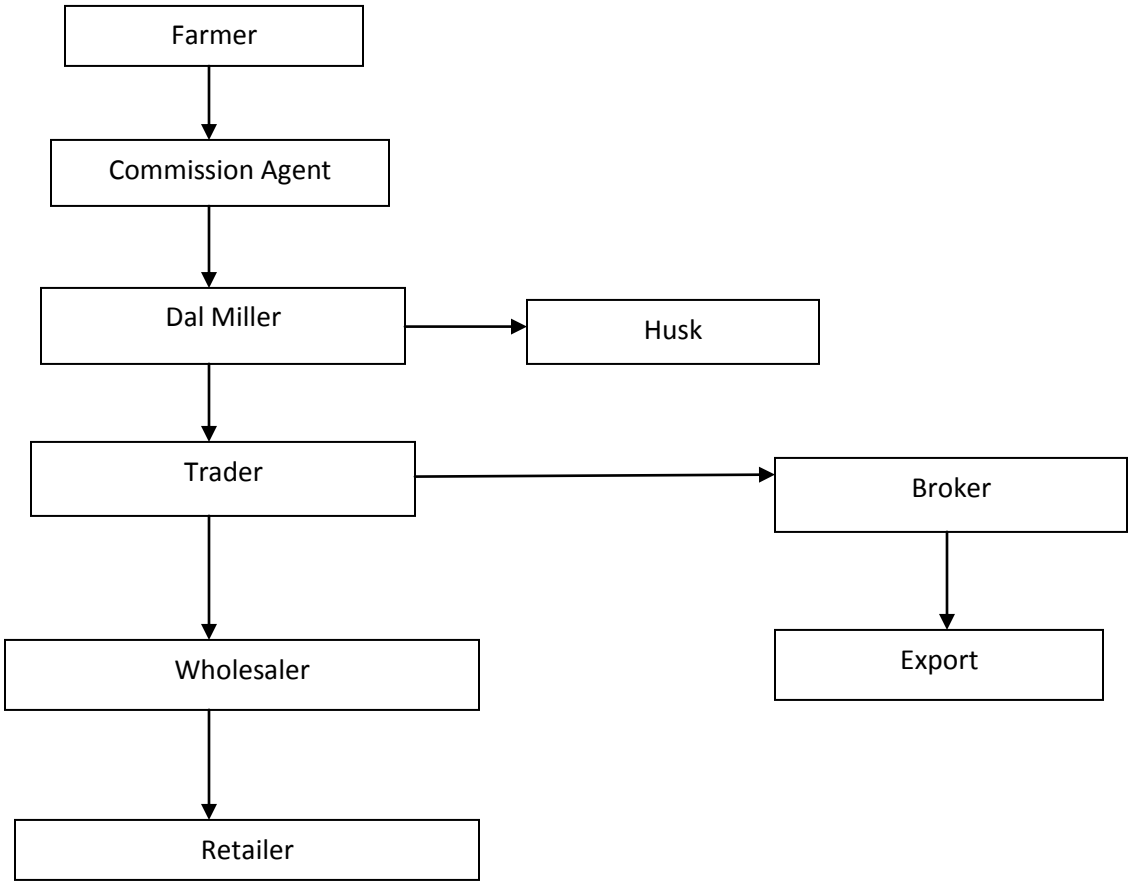


Table 15: Selling Price of Dal at different level RS/qtl

Desi Chickpea Dal			
Participants	Channel 1 (*dal)*	Channel 2 (*dal)*	Channel 2 (*futana)*
Farmers	2350	2350	2350
Village traders			
Commission agents	2350	2350	2350
Dal millers	3000	3000	3300
Brokers	3400		
Export	NA		
Traders		3400	3700
Wholesalers		3650	3850
Retailers		4100	4200
Farmer share in the final price		57.3 %	55.9 %

Table 16: Marketing Margins and costs: RS/qtl

Desi Chickpea Dal:									
	Channel 1			Channel 2			Channel 2		
	Total Cost	Gross Margin	Net Margin	Total Cost	Gross Margin	Net Margin	Total Cost	Gross Margin	Net Margin
Farmer	156			156					
Village Trader									
Commission Agent			14						
Dhal Miller	312	650	338	312	650	338	518	950	432
Broker	323	400	77						
Trader				112	400	288	112	400	288
Wholesaler				42	250	208	42	250	208
Retailer				105	450	345	105	450	345
Total									

Marketing Channel for Chickpea Flour:

Channel 1: Farmer – Commission Agent – Dal Miller – Wholesaler – Retailer – Consumer – Flour Mill – Consumer

Channel 2: Farmer – Commission Agent – Dal Miller – Flour Mill – Wholesaler – Retailer – Consumer.

Figure no:

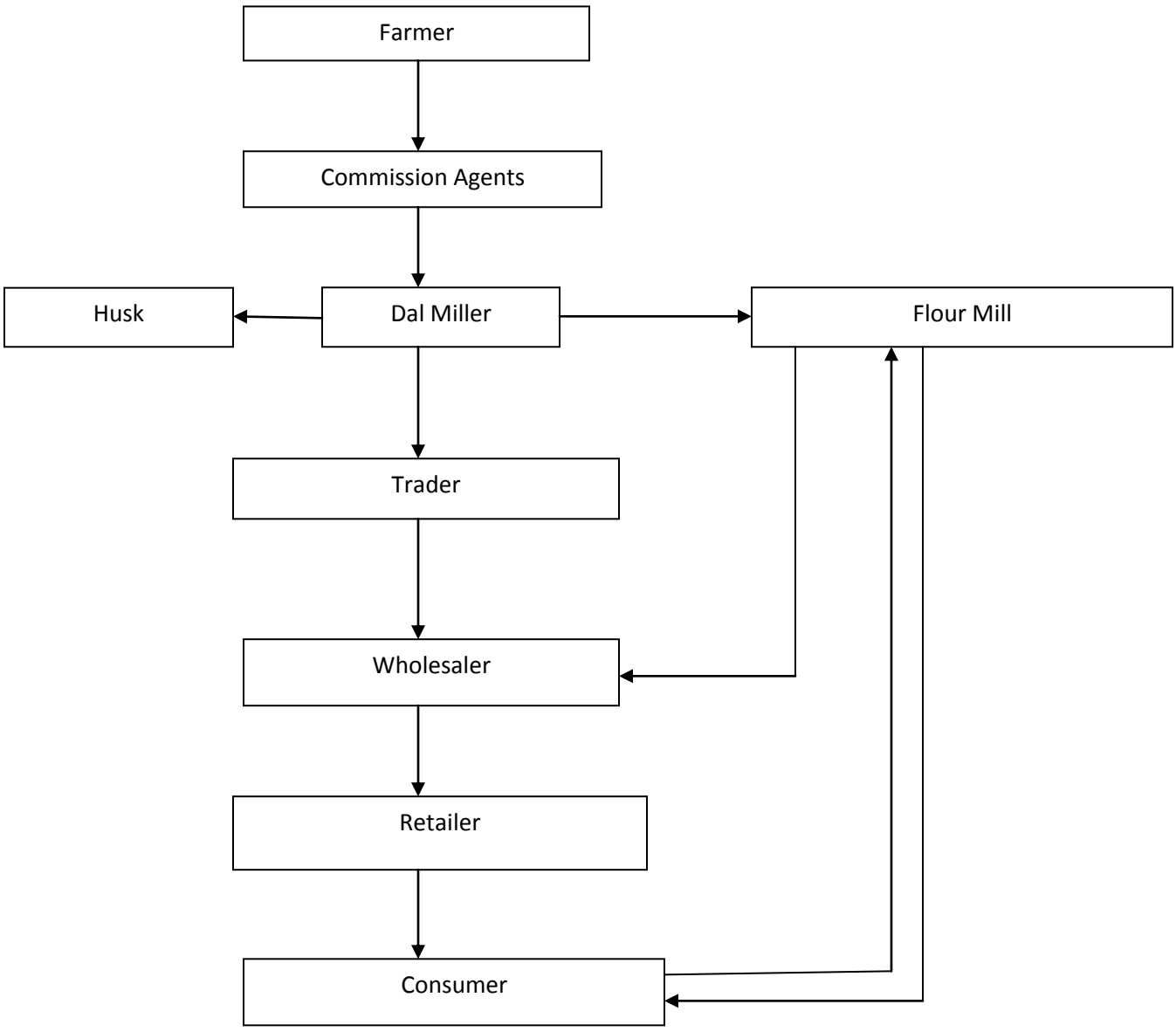


Table 17: Selling price at different level: Rs/qtl

Desi Chickpea flour		
Participants	**Channel 1**	**Channel 2**
Farmers	2350	2350
Village traders		
Commission agents	2350	2350
Dal millers	3000	3300
Traders	3400	NA
Wholesalers	3650	
Retailers	4100	
Flour mill	4220	
Consumer		
Farmer share in the final price	55.68%	

Table 18: Marketing Margins and Costs: Rs/qtl

Desi Chickpea flour:						
	Channel 1			Channel 2		
	Total Cost	Gross Margin	Net Margin	Total Cost	Gross Margin	Net Margin
Farmer	156			156		
Village Trader						
Commission Agent						
Dhal Miller	312	650	338	312	650	338
Broker						
Trader	112	300	188			
Wholesaler	42	350	308			
Retailer	105	450	345			
Flour Mill	65	120	55			
Total						

Husk Marketing Channel:

1. Dal mill – Farmer

2. Dal miller – Broker – Wholesalers – Farmers

The major participants of chickpea marketing channels are

1. Farmer
2. Village traders
3. Commission agents
4. Broker
5. Trader
6. Processors
7. Wholesaler
8. Retailer

Farmer survey: 34 chickpea growing farmers in Pamidipadu village who are cultivating Desi and Kabuli chickpea. In the village, before 2004-05 the farmers in the village used to cultivate only *desi* chickpea. The sample farmers who cultivate *desi* chickpea used to grow *Annigeri* and *Gulabi* varieties, however owing to the low yields and the high cost of cultivation, JG-11 and *Mosambi* are now more popular. Market demand for JG-11 and *Mosambi* are high. Of the two, *Mosambi* is in greater demand in the market due to its bigger grain size. However, since 2006-07 the demand for *Mosambi* has decreased due to the bitter taste of the seed. This bitter taste was due to the repeated use of saved seed for sowing. The reduction in the export demand for *Mosambi* has led the farmers to decrease the area under this cultivar in subsequent cropping seasons. Another reason for the falling popularity of this variety is the availability of *kabuli* chickpea varieties in the district. Typically JG-11 is milled for use as *dal* while Mosambi is grown to be consumed as a whole grain.

Since 2004-05, farmers started growing *kabuli* varieties as well. Currently, more than 50% of surveyed area is under *kabuli* varieties, primarily the KAK-2 and BOLD varieties. The KAK-2 variety of Kabuli chickpea is similar size to the *Mosambi* variety of Desi chickpea, but has a lighter color. After the entry of KAK-2 variety in the area the demand for Mosambi variety has decreased. The BOLD variety seed size is larger than the KAK-2. In local language they called as white chickpea. These varieties have a high demand in north Indian states. The BOLD

varieties are much costlier than the KAK-2 variety, with KAK-2 fetching Rs. 3600 per bag while BOLD fetches Rs. 5300 per bag. However, despite higher prices for *kabuli* varieties, many farmers continue to grow *desi* varieties. The primary reason for this is that the *kabuli* variety suffers significant loss of quality (the grain turns black) if there is any rainfall in the maturity stage of the crop. In this case the price that the farmer is ultimately able to get in the market is 15% lower than the normal price.

Farmers normally use saved seed from their previous crop or seed from other farmers for sowing. Some farmers buy the seeds from the village traders on credit and they sell their produce to them only. The government also distributes the seeds to the farmers at subsidized price. The government distributes the subsidized seeds of 25 Kgs / acre up to 5 acres of land. Popular seeds in the subsidy program include JG-11 and KAK-2. This year the government distributed the JG-11 at the rate of Rs 1750/qtl and KAK-2 variety at the rate of Rs2350/qtl for seed. The subsidy for JG -11 variety is 25% and for the KAK 2 variety is 40%. There is a leakage in the subsidy in the form of farmers who do not cultivate chickpea but take the seed from the government and sell in the market or to other farmers. Due to high quality of seed and uniform size of the seed these farmers get good prices.

In general farmers take loans from banks or middlemen for cultivation. In this case the farmers are given the fertilizers and pesticides from the village traders on interest rate of 2% per month. After the harvest the costs of cleaning the produce, sieving and bagging costs are borne by the farmer. The costs borne by farmers:

Sieving cost : Rs 24/qtl

Bag cost : Rs 14/qtl

Rope cost : Rs 0.80/qtl (Rs 40/kg it will sufficient for stitching the 50qtls (for stitching the bags))

Transport cost: Rs 20/qtl (Distance in Kms: 35)

85% of the farmers surveyed sold the produce to the village traders. The price that the trader buys the produce from is dependent on the prevailing market price. After deducting the value of the loan, the trader returns the remaining money, if any to the farmers. The average time that it

takes the farmer to get back his money is one week. 15% of the farmers sold their produce using commission agents who are located in Ongole.

Each chickpea bag accounts 50 kgs including the bag weight. Transport cost depends up on the distance of the destination. Generally farmers who sell their produce to commission agents in Ongole, entail a transport cost of Rs 20/qtl using either lorries, or auto-rickshaw. If the farmers hire a tractor (capacity 50-55 qtl) to transport their produce to the market, they have to pay a fixed rental fee of Rs. 1000 per tractor. Most farmers sell their produce in the village to village traders in order to reduce their marketing and transport costs. However the farmers have to pay the Rs 60/lorry for weighing charges. Small lorry accounts 10 tons and large one accounts 20 tons.

71% of the surveyed farmers stored their produce in cold storages for a certain time. They take the loan on storage receipt from the bank and repay their credit amount to the village traders. Before delivering the produce from the cold storage they have to repay the bank loan. The interest rate varies from bank to bank. Even the farmers who are selling the produce after the harvest store the required quantity as seed for next year sowing purpose. The following seed rates are preferred by the farmers

JG-11 : 40 Kg/acre

Mosambi : 50 Kg/acre

KAK-2 : 55-60 Kg/acre

Bold : 70 Kg/acre

Village Traders:

2 village traders in Pamidipadu village who are running fertilizer and pesticide shop in the village were interviewed under this project. These village traders deal with all the farmers in the village, not just the chickpea growing farmers. During the crop season they will give the fertilizer and pesticides to the farmers on credit. Sometimes they also provide the cash loan at an interest rate of 2% per month. After harvesting the crop they buy the produce from the farmers. Farmers have to sell the produce to them only due to the credit facility. The price is decided on the basis of quality of the produce. The quality characters are the foreign matter, green seeds,

mud particles and moisture level. After buying the produce they keep the high quality seed for next year to sell as seed to the farmers and the remaining produce is sold to commission agents. The commission agent charges a fee of Rs. 6 per quintal and bears the transportation costs. The village traders gather the chickpea produce from the farmers at the farm and village itself, so that the farmer does not have to transfer his produce from one place to another place. All the marketing costs are borne by the village trader only. In order to reduce marketing costs like transport and handling charges the traders procure the produce in large quantities. These traders sell their produce directly to dhal millers or indirectly through commission agents and brokers.

Commission agents:

The commission agent facilitates trades between buyers and sellers on an agreed commission. He provides the information about buyers to the farmers or village traders, and facilitates the transactions and payments. The major portion of the chickpea is sold through the commission agents. The commission charges ranges from Rs 6-8/qtl and are paid by both the buyer and the seller. Charges of transport from the farm to agent godown are borne by the farmer and from godown to mill or any other place borne by the buyer.

Sometimes the commission agents will sell the produce through the brokers. In this case, the brokers from the other states, primarily West Bengal, Tamil Nadu, and Delhi, approach the commission agents with orders. The commission agents then facilitate trades with the brokers and traders. When they are exporting to other states the broker will come to the commission agents and they see the quality of the produce then negotiate the transaction. Most of the KAK-2 and BOLD variety of Kabuli chickpea is exported to Delhi, West Bengal and Maharashtra. These varieties are not suitable for milling into *dal*. Mostly the JG-11 variety is sold in the domestic *dal* mills.

Broker:

6 brokers were interviewed in Ongole district and Hyderabad. Primarily the broker gathers information from out of state agents regarding orders and prices and sets up meetings with commission agents or village traders in order to facilitate trade. He also sometimes directly buys from the village traders in order to fill the orders that he has.

Sometimes the processors and wholesalers of outside the chickpea producing regions or outside the state recruit some people to get information about the chickpea buying and selling. These brokers purchase the chickpea directly from the farmers or through commission agents on behalf of the buyer. For this they charge the Rs 12-15/qtl. Most of the out of state brokers buy the chickpea through the commission agents. No other marketing costs are borne by the broker. He just mediates the transaction between trader and commission agent. All marketing costs are borne by the farmers and buyers. None of the surveyed actors have used this channel however.

Sometimes farmers are storing their produce in cold storages to get the high price in this case the brokers contact the cold storages to directly buy the produce. Instead of paying commission to the commission agents they are directly buying the produce from the farmers. When they are buying through commission agent they have to pay Rs 6/qtl commission to the agent. To get the payment from the Chennai and Calcutta it will take one week time and from Delhi it will take 10-12 days. Price for the produce is dependent on the quality of the produce.

Trader/ broker:

3 traders / brokers in Ongole district and Hyderabad, also dealing in *dal*, were interviewed. They serve as a link between processors of the grain (*dal* millers) and wholesalers. These traders buy the produce either directly with commission agents or through brokers. 80% of the time, traders buy the produce directly from the *dal* millers. The traders buy produce in large quantity and sell to the wholesalers. Transport cost will be borne by the trader / broker only.

Wholesaler:

12 wholesalers were interviewed in Ongole and Addanki. These wholesalers deal with traders, wholesalers, or *dal* millers. In the case of whole grains, they buy the whole grains from the commission agents. In case of *dal* they will buy either from the *dal* millers or brokers or traders. In this case the transport cost and loading and unloading charges will be borne by the wholesaler only. Mostly these wholesalers buy the whole grains from the commission agents or from the brokers. In festivals months, like September, October, and December, high sales are recorded.

Loading charges: Rs 6/qtl

Unloading charges: Rs 6/qtl

Retailer:

4 retailers were interviewed in Ongole district. These retailers buy the produce from the wholesalers and sell it to consumers. They reported buying on average 1 qtl per week of *dal* and *futana.*

Empirical Method to find the final value of derivative products produced from X Kg of Chickpea seeds:

Chickpea has processed to produce Dhal. Dhal is either directly sold in the market or produce the Flour. While producing the Dhal the husk will get. The percentage of Dhal and flour recovery rate is usually depends on the type of variety. However it's important to understand final value of derivative products produced from Chickpea. A detailed processing model has been worked on to derive the final value of products derived from Chickpea.

Chickpea processing at the Dhal mill:

The sum of the value of all final products from X Kg of Chickpea is

Total value = $P_{Dal} Q_{Dal} + P_{husk} Q_{husk}$

Total Value = $P_{Flour} Q_{Flour} + P_{Husk} Q_{Husk}$

Where P_{Dal} and Q_{Dal} are the prices and the quantity of Dal produced after milling the seeds P_{Flour} and Q_{Flour} are the prices and quantity of flour produced from the grinding of Dal P_{Husk} and Q_{Husk} are the price and quantity of the husk produced from the Dal mill.

Dal:

X Kg of Chickpea, when crushed by Dal millers for Dal usage, produces 100 α percent of Dal ($0<\alpha<1$).

$$\mathbf{Q_d = \alpha \times X} \text{ ..... (1)}$$

Where's is $\mathbf{Q_d}$ Kg of Dal.

Husk:

The remaining portion of Dal minus loss of 100 percent produce $\mathbf{Q_h}$ Kg of Husk

$$\mathbf{Q_h} = (1 - \boldsymbol{\alpha} - \boldsymbol{\eta}) \times \mathbf{X} \text{ ..... } (2)$$

Define S 1 such that S 1 = $(1 - \boldsymbol{\alpha} - \boldsymbol{\eta})$. the equation (2) becomes ,

$$\mathbf{Q_h = S\ 1 \times X} \text{ ..... (3)}$$

Flour:

Flour is produced through grinding the Dal. 1 minus loss percent of Dal produce $\mathbf{Q}_f$ Kg of flour.

$$\mathbf{Q}_f = \mathbf{Q}_d (1- \boldsymbol{\beta}) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots. (4)$$

Define S 2 such that S 2 = (1- **β**) then Equation (4) becomes,

$$\mathbf{Q}_f = \mathbf{S}\,2 \times \mathbf{Q}_d \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Final Equation:

If the Equation (1) has applied in the equation (5)

$$\mathbf{Q}_f = \boldsymbol{\alpha} \times \mathbf{X} \times \mathbf{S}\,2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (6)$$

According to equation no (3)…

$$\mathbf{X} = Q_h / S\,1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (7)$$

If the equation (7) is applied in the equation no (6)

$$\mathbf{Q}_f = \boldsymbol{\alpha} \times Q_h / S\,1 \times \mathbf{S}\,2$$

Parameters used in this model:

X	Quantity of the seed	Kg
Q_d	Quantity of the Dal	Kg
Q_f	Quantity of the Flour	Kg
Q_h	Quantity of the Husk	Kg
α	Recovery rate for the Dal	percentages
η	Waste produced during the milling	percentages
β	Waste produced during the grinding	percentages

CONCLUSION AND RECOMMENDATIONS:

India is the largest producer and consumer of chickpea in the world. Among the two types of chickpea i.e. Desi chickpea and Kabuli chickpea, India has more domestic demand for Desi chickpea than Kabuli chickpea. However, since 2000, consumption of Kabuli chickpea has been increasing in the North Indian states. The probable reason may the shifting of high value products from traditional consumption pattern. This rise in demand of Kabuli chickpea has led to an increase in the price of Kabuli chickpea in the last few years which became the main driving force behind the shifting of cropping practices from Desi to Kabuli chickpea. The current year prices of Desi chickpea is Rs 2300 per quintal and for Kabuli chickpea it is Rs 3600 per quintal i.e. more than 50 percentages from the Desi variety. Another reason for shifting of cropping practice from Desi to Kabuli chickpea is the presence of the Government seed subsidy. The Government gives 25 percentages subsidy for Desi chickpea seeds (sowing purpose) and 40 percentages subsidy for Kabuli chickpea seeds (sowing purpose). According to the field survey the table below shows that there was a 15 percentages decrease in the acreage of Desi chickpea while there was a increase of 14 percentages in the acreage of Kabuli chickpea.

Table 19: Percentage changes under chickpea area varieties in Pamidipadu

Variety	2008	2009
KAK-2	40	55
JG-11	50	35
BOLD	8	7
MOSAMBI	2	3

The major exporters of chickpea to India are Australia, Mexico, Canada and Ethiopia. The production of chickpea in these countries has increased by more than 50 percentages (Australia-66%, Mexico-50%, Ethiopia-85%) between the period of 1998 to 2007. During the initial period between 1998 to 2004 there were very less processing industries of chickpea in the exporter countries due to lack of consumer of those countries. At that time India had a comparative advantage in exporting the processed chickpea to other countries.

But at the same time India continued to be the largest importer of chickpea. Realizing the domestic demand the Indian Government put ban on export of pulses (export Kabuli chickpea) from India on June 28, 2006 and put zero import duty for pulses (except Kabuli chickpea). Therefore the imported pulse arrives to India in a comparatively cheaper price than the pulses produced in India. For reaching Mumbai port from Australia the pulses priced nearly Rs 2545 per quintal while the price of transporting the pulses produced in Andhra Pradesh to the same location priced Rs 2850 per quintal. In this way the imported pulses became cheaper than the own produced pulses in India. The imported pulses are always Desi chickpea. As a result of this Indian chickpea loss their competitiveness for the Desi chickpea market and hence Indian farmers are gradually shifting from Desi Chickpea to Kabuli Chickpea. Thus there is scope for re-visiting import duty tariffs.

Recommendations:

1. The Government should setup a platform to bring the producers and traders at one place so that farmers will get better price which is not happening presently. There is scope to increase the productivity through improved seed and delivery.

2. Farmers need to be linked to formal credit sources so that they are able to break away from their reliance on village traders for production loans.

3. To get better price farmers can form cooperatives to market their produce directly to local *dal* processors, bypassing the village traders and commission agents.

4. Price and other market information for outside the state or district should be available to the Farmers' association or group, for more informed decisions on selling times and increased bargaining capacity.