Farmer Surveys on Postharvest Loss in India

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Introduction

India is the world's largest producer of pigeon pea and generates 75% of total global production. The cultivation area in India was 2.19 million hectares in 2008 – 2009 and the production level was 2.31 million tonnes at 791 kg/ha. Myanmar is the second largest producer of pigeon pea with 15% of global production followed by lesser producers Kenya, Uganda, and Malawi. India consumes 90% of pigeon pea produced globally, annually importing 300,000-400,000 tons of which 96% is from Myanmar. Pigeon pea is a rich source of lysine, riboflavin, thiamine, niacin, and iron.

Red gram, which accounts for approximately 20 percent of total pulse production in India, ranks sixth among pulses cultivated worldwide and is the second most cultivated pulse crop in India after Bengal gram. Primarily grown in Karnataka, Maharashtra, Uttar Pradesh, Orissa, and Andhra Pradesh, red gram is cultivated on 3,580,000 hectares of land which yielded 3.08 million tons in 2007-08 and 2.47 million tons in 2009-10. Among all pulses cultivated in India, red gram is cultivated on 14.5 percent of land area and accounts for 15.5 percent of productivity. On average, India produces approximately 2.0 - 2.5 million tonnes of Red gram annually, a level that has remained stagnant for the past 10 years. A shift from cultivation of pulses to that of commercial crops coupled with a lack of technology needed to increase yields has hindered the ability of Indian producers to increase crop yield. Figures 1-4 provide detailed information on growth area, production, and the growth rates of area, production, and yield for Red gram and other crops. Red gram consists of 22 percent protein, which is almost three times that of cereals, and also includes other nutrients such as fibre, ash, fat, magnesium, manganese, and copper. Red gram is most commonly consumed in the form of a split pulse such as Dal, which is an essential supplement of a cereal based diet.

Significant postharvest loss affects overall production by Indian farmers. According to the World Bank "Missing Food" report of 2011, loss is estimated to be 7-10 percent at the farm to market level and another 4-5 percent at market and distribution level. This loss constitutes 12-16 million tonnes of grain for which average annual per capita consumption is approximately 15 kgs. This level of loss, caused primarily by improper harvesting and processing methods, improper storage, and loss during transportation, constitutes enough grain to feed approximately 70-100 million people.

Assessment of post-harvest loss levels for pigeon pea at various stages of the supply chain would aid in identifying factors responsible for such loss and the extent of loss. This in turn would facilitate the development of measures to minimize postharvest loss. Significant reduction of postharvest loss would increase availability of pigeon pea to an increasing population. This study was conducted to assess the extent of postharvest loss of pigeon pea at the farm and market level.

Appendix A includes an explanation of terms used in this document for the convenience of the reader. This includes clarification regarding crop types and names as well as growing seasons.

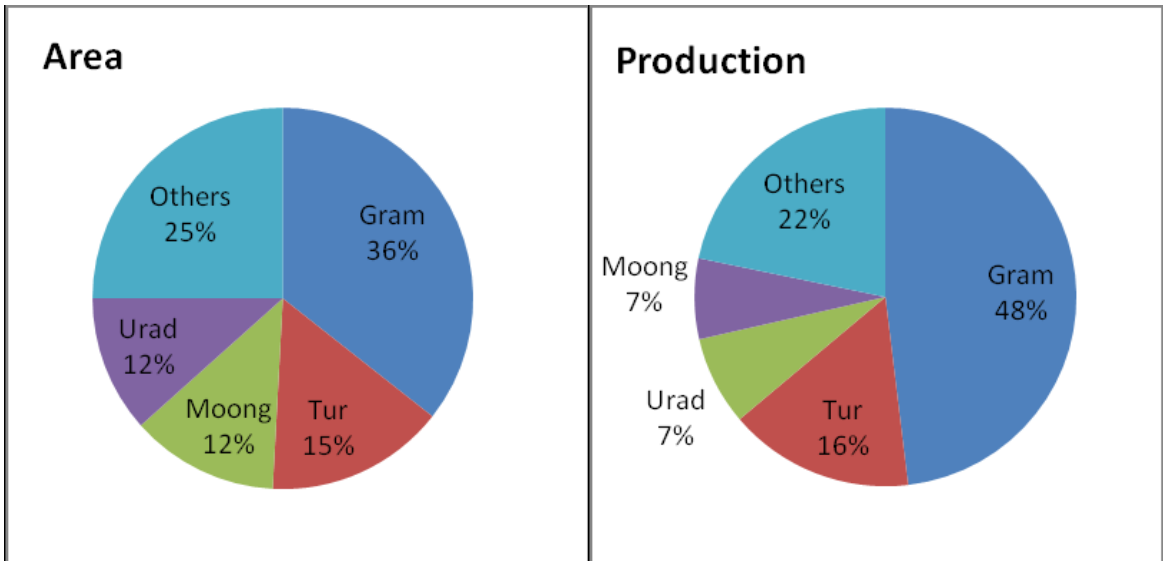

Fig 1: Pulses cultivation area and production 2010-11, DACNET Report

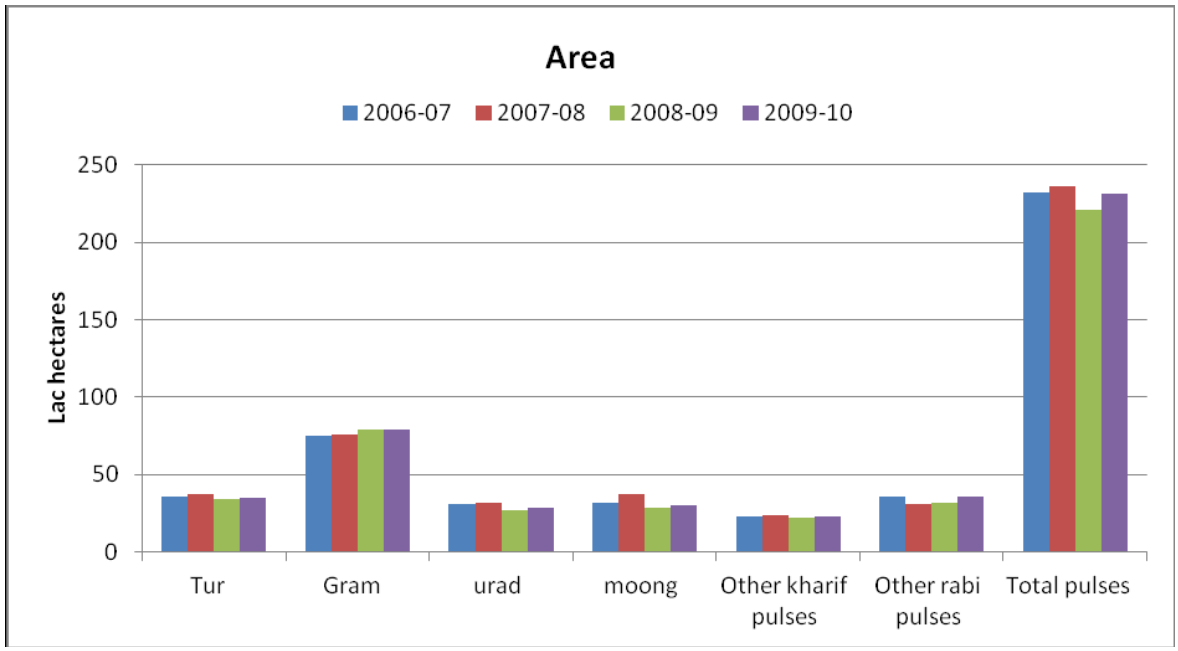

Fig 2: Pulses cultivation area in India 2006-2010, DACNET Report

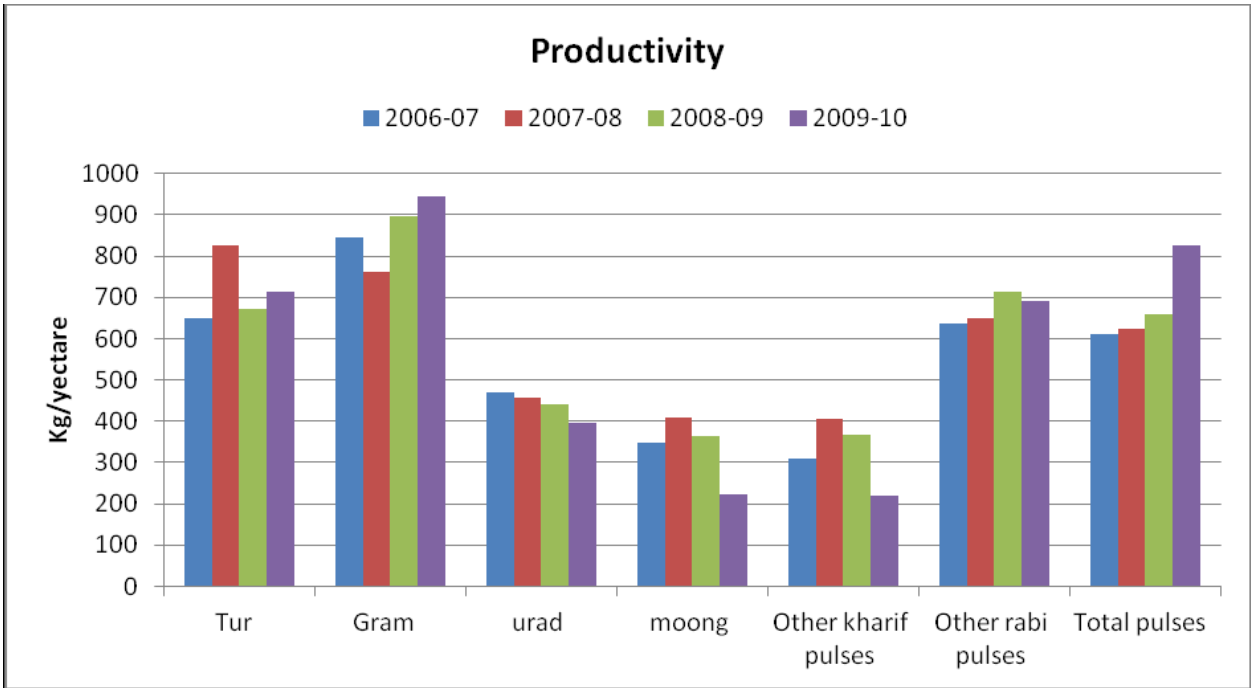

Fig 3: Productivity of Pulses in India, DACNET Report

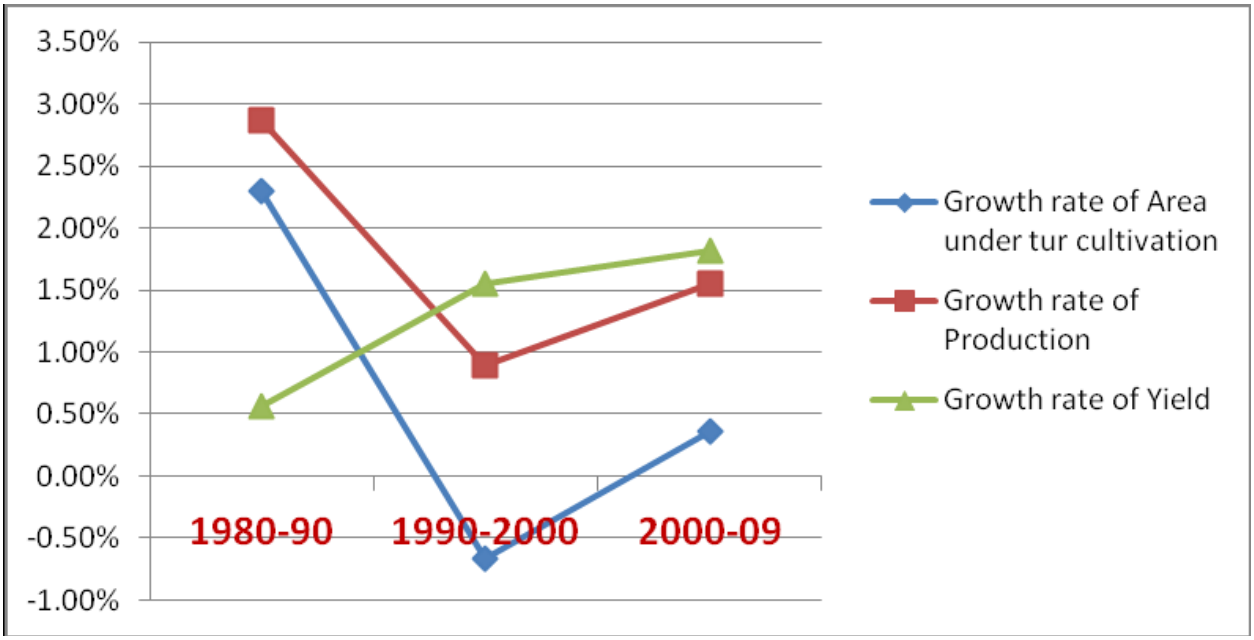

Fig 4: Growth Rate of Area, Production and Yield of pigeon pea (1980- 2009), DACNET Report

Materials and Methods

This study was conducted primarily Maharashtra during August 2011 and focused on a random sampling of villages including Ausa, Nilanga, Udgir, Chakur, Ahmadpur, Jalkot, and Shirur taluks. Two villages were selected from each taluk with five farmers from each village participating in the study for a total sample of 30 villages and 150 farmers. For the purpose of achieving the specific objectives of the study, open-ended interviews with structured questions were conducted. The data collected was subjected to statistical analysis.

Results and Discussion

Following is a summary and analysis of data collected during the study. Areas of focus include socio-economic impact, cropping patterns, reasons for growing pigeon pea, harvesting and sale, complications due to lack of labour force, sources of information on market prices, markets for Pigeon Pea and Red gram, and loss at various stages of the supply chain.

Socio-Economic Impact

1. Age Distribution of Farmers

The average age of participating farm owners, whom in general had extensive experience, was 46 years.

2. Education Level of Participating Farm Owners

The average education level tended to increase with increase in farm size. Marginal farmers had the lowest education level, primary education, while large farmer holders had the highest educational level of matriculation.

3. Occupational Profile of Participating Farmers

Agriculture was the predominant occupation of large holder famers whereas small holder famers relied more on diverse employment in order to meet their financial obligations.

4. Gender Issues

Gender roles were relatively clearly defined in terms of (i) pigeon pea cultivation, (ii) ownership of resources, (iii) decision-making with respect to different resources and (iv) utilization of resources. Land preparation, selection of variety of pigeon pea, inter-culture operations, harvesting, transport of pigeon pea produce, and seed selection and storage were the prerogative of men. In-hand weeding operations, sowing seeds, threshing and winnowing operations, and labour force hiring were jointly decided. Women were generally consulted regarding the education and marriage of children, and these matters were jointly settled.

5. Exploration of Irrigation Potential and Expansion of Irrigated Area

Pigeon pea is mostly grown under rain fed conditions and exposed to frequent drought during the maturity stage, which affects yield due to lack of water. Taluk officials play a vital role in facilitating irrigation system development and increasing and maintaining sustainable growth in the productivity of pigeon pea.

Cropping Patterns

In Maharashtra, principal inter-cropping combinations cultivated during the kharif (rainy) season included soybean and pigeon pea; cotton and pigeon pea; sorghum and pigeon pea; cotton, sorghum and pigeon pea; and green gram and pigeon pea. During the Rabi (winter) season, principal inter-cropping combinations included Rabi sorghum; wheat and sunflower; and soybean and sunflower. Soybean is raised as a primary crop with pigeon pea as an inter-crop at ratios of 4:2, 5:3, and 3:1. Pigeon pea, which requires a six to seven month cultivation period, is not grown as primary crop because it requires more space and a longer cultivation period than the three to four months required to cultivate soybean. Soybean cultivation is increasing, and sugarcane is replacing pigeon pea as an inter-crop due to a better market price.

Pigeon pea is being raised as a subsidiary inter-crop with cotton, sorghum, and soybean as the main crops under rain fed conditions. In crop rotations, pigeon pea is followed with chickpea, wheat, wheat and gram, and wheat and safflower.

Reasons for Growing Pigeon Pea

Primary reasons pigeon pea is cultivated include a relatively high market price and suitability to marginal farms. Input costs are low, and pigeon pea infuses nitrogen into soil thereby restoring fertility. Pigeon pea is utilized for food, animal feed, and fuel in addition to serving as a cash crop.

Harvesting and Sale

Farmers are forced to sell their produce just after harvesting in order to repay loans and to meet household financial obligations. During this period, prices are relatively low due to market glut. Farmers also sell produce immediately after harvesting due to a lack of on-farm storage facilities.

There is a clear need for construction storage facilities at the village level in the form of rural godowns. These facilities would enable the farmers to store their pigeon pea produce and sell it for higher prices and also to receive pledge loans.

Complications due to Lack of Labour Force

- Pigeon pea cultivation and harvesting is labour intensive, and Latur district is experiencing a severe shortage of labour.
- Labour shortages have resulted in the shutdown of numerous milling facilities.
- Sometimes farmers wait for a second crop to grow which they sow after the harvest of soyabean, harvesting pigeon pea and the second crop together because of shortage of labour.
- Approximately 30% of crop damage is due to a shortage of labour (1 labour-1q of pigeon pea harvesting and threshing per day)

Sources of Information on Market Prices

Information on market prices is primarily procured from fellow farmers and through mobile phones.

Market for Pigeon pea

- Pigeon pea is primarily sold at the Mandi with a small quantity sold to the Mahamandal for seeds.
- 2011 prices were good prompting farmers to cultivate larger crops of pigeon pea, but 2012 crop levels decreased because of a late monsoon and a low market price.

Market for Red Gram

- The price of Red gram is low in the early postharvest period due to market glut with prices increasing later.
- Due to a lack of access to current market prices, farmers sell Red gram below market price in the village and nearby markets.
- Farmers usually do not grade their produce and do not receive a remunerative price in the market as a result.

Losses at various stages

Loss of up to 14.5 percent of pulses occurs throughout the postharvest supply chain. Estimated loss of pigeon pea crop is outlined in table 1.

Table 1: Harvest and Postharvest loss

S.No	Stages and Factors	Loss % of yield	Loss (Kg/q)
1	Maturity stage	0.2	1.2
2	Weather impact	0.4	4
3	Harvesting	1	0.5
4	Threshing	1	1
5	Labour unavailability	0.3	1.5
6	Drying	0.1	0.025
7	Storage	10	5
8	Transportation	0.5	0.2
9	Processing	1	1
10	Total	**14.5**	**14.425**

Maturity stage – Postharvest loss due to bio-deterioration often occurs as the crop reaches physiological maturity at which point moisture content reaches 20-30 percent and the crop is close to harvest. While the crop is still standing in the field, pests may attack causing loss in grain quantity and quality.

Weather impact –At field level, approximately 40 percent of the crop is destroyed due to a lack of rain or due to mould and fungal growth resulting from unseasonal rain.

Harvesting - Loss at this stage may constitute up to one percent of yield and tends to result from a lack of field labourers. As a result, the crop is left on the field for up to a month after reaching maturity. Delays in harvesting and shattering of pods during the harvest result in loss.

Threshing - Loss of 0.5-1 percent occurs during threshing. This process, accomplished by beating vines and pods with sticks to separate out the seeds, is labor intensive and is followed by winnowing with wind. If there is no wind, the crop may remain in the open for days resulting in increased moisture content and greater potential for moisture-related damage. These factors cause loss of 1kg/bag.

Development of threshers specifically designed for pulses is crucial. With wide variation in size and other physical characteristics of pulse crops, no single thresher can be used for all pulse varieties. At present, modified threshers originally developed for wheat and paddy are used for threshing of pulse crops. However, these cause significant breakage and dehusking of grains when used for pulses. Threshing pigeon pea is yet more complicated as its hard stalk is difficult to feed into a conventional thresher. Furthermore, the plant biomass of pigeon pea has other uses including fuel and building material for thatched houses. Consequently, farmers do not want to discard the non-pod plant matter. Threshers designed specifically for pigeon pea should preserve the stalk part of the plant so it can be utilized for traditional purposes.

The majority of red gram producers prefer to utilize a wheat thresher, which results in loss of up to 20 percent due to grain damage and scattering, in order to decrease cost, time, and labour requirements. Typically, 80 percent of the crop is fully mature during threshing with 20 percent still green, which results in ineffective threshing leading to loss.

Drying – Drying takes place in the open field or an open courtyard at mills. In cloudy weather, mechanical dryers are used.

Storage – In comparison to wheat and paddy, pulses are more susceptible to pest damage during storage with approximately 30-40 percent of postharvest loss occurring at this stage. While the number of farmers who stored pigeon pea was marginal, the produce was typically stored for two to three months in gunny bags in farmer's houses. This demonstrates the urgent need to create rural godowns at the village level so farmers may store produce in order to sell at better prices obtain pledge loans to meet their financial needs.

Traditional storage at home results in significant levels of infestation. Farmers store produce on wooden planks and use aluminium phosphide capsules and gamaxine for fumigation to protect against pulse beetles and ants. Moisture content increases during storage which also results in loss. Approximately 80 percent of sample farmers do not have storage facilities.

Transportation – Transportation loss is 0.5%.

Processing – Raw material is brought from mandis to mills for mechanical processing. Loss of 1kg/q of red gram occurs during cleaning and storage. Oil and water mixture levels of mechanical milling

devices are maintained manually, leading to incorrect levels due to human error which results in loss. Milling technology causes loss of approximately 0.5-1%, and many mills in Latur face labour crisis and closures.

Policy Issues

A range of issues, including the wide price gap between whole and milled pulses in the supply chain, vulnerability of stored grain to pests due to lack of hermetic storage facilities at the village level, lack of government support for value addition (packaging etc.), and exclusion of produce from procurement policy governing wheat and paddy, may be addressed by the following interventions:

- Procurement of pulses including pigeon pea annually by the National Agricultural Cooperative Marketing Federation (NAFED) or other Government agencies from each production zone
- Construction of storage facilities for pulses similar to those that exist for wheat and paddy

Appendix A

Term	Synonymous Terms	Comments
Pigeon Pea	Tur, Tur Dal, Red gram	
Gram		This generally refers to Bengal gram (chickpea belongs to this family)
Pulse	Lentil	There are more than a dozen types of lentils grown in India. Many people use the word pulse to represent lentils with small seeds as opposed to the relatively large seeds of beans and chickpeas.
Urad	Black gram	A pulse
Moong	Mung Bean or Green gram	
Kharif		Kharif refers to summer crops. These are generally grown from April to September. Main lentils are pigeon pea and black gram. Other crops are rice, millets, sugarcane, cotton, soybean, and maize.
Rabi		Rabi refers to spring crops. These are generally grown from December to April. Depending on the end date of monsoons, it can refer to crops grown from September to April. Main rabi lentils are chick pea, Bengal gram, and masur (another pulse). Other crops include wheat, barley, and mustard/canola.