Final Report

Mapping the production system and the supply chain and study the crop losses of Black Gram – Excerpt

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1. Introduction

India is world's largest producer of pulses with its total pulse production contributing a quarter of world's total production. While one-third of world's total acreage under pulses is in India, Indian population consumes 30% of world's total pulses. However, domestic production of pulses has not kept pace with population growth. Pulse production has grown at a CAGR of 1 % between 1951 and 2008 while CAGR for population is about 2 % during the same period.

Black gram (*urad*), one of the pulses, is mostly produced in Asian countries as their tropical climate and soil type suits its cultivation. India is largest producer of this pulse followed by Myanmar and Thailand. India produces 70% of worlds' black gram production and Black gram accounts for 10% of total pulse production in India. In absolute terms, 1.5 million tons of Black Gram is produced from 2.5 million hectare area with an average productivity of about 600 kg per hectare.

Despite being largest producer of black gram, India is not in a comfortable situation as it is also the largest consumer of black gram. Total Indian production is not sufficient to fulfill its domestic demand. Because of this, India is also the largest importer of this pulse.

Andhra Pradesh, Madhya Pradesh, Maharashtra, Uttar Pradesh, Punjab, West Bengal, Orissa, Tamil Nadu, and Karnataka are the major states producing black gram in India. While Andhra Pradesh contributes 24% of total production, Maharashtra and Madhya Pradesh contributes 20% and 13% respectively.

In this context, the proposed study understands post-harvest issues related to black gram leading to crop losses.

1.1. Objectives

Overall objective of this study is to understand the harvest and post-harvest issues related to black gram production. The specific objectives are to

- understand causes of crop losses
- map technologies currently available in India to prevent these losses
- figure out reasons why these technologies are not being broadly adopted
- identify potential for new technologies towards reducing post-harvest losses in India
- see opportunities for innovations in black gram supply chain

1.2. Methodology

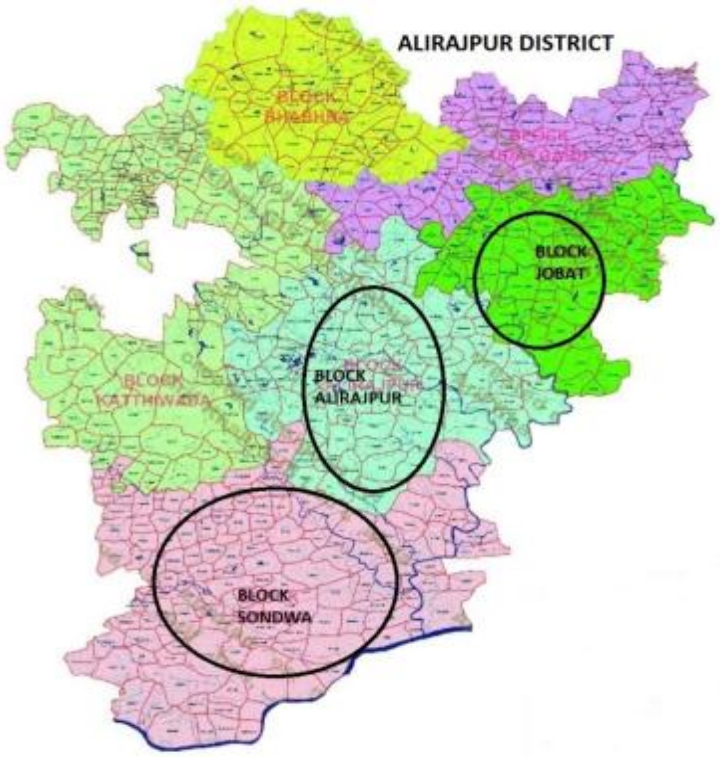
MART conducted an exploratory research for conducting this study. Following are respondent segments, geography, research tools and sample plan.

1.2.1. Geographical coverage

- Two states viz. Maharashtra (high production) and Madhya Pradesh (medium production), were covered for the study.
- One district each from both states viz. Buldhana in Maharashtra and Alirajpur in Madhya Pradesh, were covered.
- Overall 11 villages were visited during the study (5 villages in each district)

- 2 villages from < 1000 population strata
- 5 villages from 1000 - 2000 population strata
- 4 villages from >2000 population strata.

Maps of districts along with approximate study locations are presented below. District wise spread of villages covered under the study is presented thereafter.



The villages visited during the study are presented in the table below:

Population strata	Alirajpur district, MP			Buldhana district, MH	
	Alirajpur Tehsil	Jobat Tehsil	Sondwa Tehsil	Lonar Tehsil	Chikhli Tehsil
	Name of Village				
Pop. < 1K	--	Hardaspur	--	Khandala	--
Pop. 1-2K	--	--	Borgaon	Gandhari Chorpangra	Kinhi Naik Vairagad
Pop. > 2 K	Bardala	Kanda	Kundawat	--	Undri

1.2.2. Respondent Segments

- Farmers (< 4 ha landholding)
- Key Opinion Leaders
  - *Lead farmers, Agriculture co-operatives*
- Govt. Players
  - *Agri Dept. (SMS, Extension workers), Agriculture Universities, Agriculture Technology Management Agency (ATMA)*
- Private Players
  - *Traders, processors, warehouses, transporters*

1.2.3. Sample Plan

To fulfill objectives, interactions were carried out with various stakeholders. Table below provides details of these stakeholders and research tools employed to gather information from them.

Research Tool	Respondent segments	Total Sample	Grand Total
In Depth Interviews (IDI)	Farmers	50	68
	Key Opinion Leaders (KOLs)	6	
	Pvt. Players	6	
	Govt. Players	6	
Focus Group Discussion (FGD)	Farmer group	7	10
	Female group	3	
Participatory Rural Appraisal (PRA)	Farmer Group	4	4

A total of 68 IDIs, 10 FGDs and 4 PRAs were conducted. FGDs with women were conducted in the villages of Borgaon and Undri.

1.2.4. Research Tools used

The list of research tools used and information areas covered are presented hereunder. Brief description of each tool is placed under Annexure-4.

- Participatory Rural Appraisal (PRA) was employed for mapping
  - harvest and post-harvest practices
  - losses across supply chain
- Focus Group Discussions (FGD) were conducted with Farmer groups and Female Groups on key issues related to post harvest activities/practices.
- In Depth Interviews (IDI) were conducted with farmers, KOLs, Private and Govt. Players on key issues related to post harvest activities/practices.

SECTION A – MAHARASHTRA

4. Quantification of perceived losses

This section presents losses suffered by farmers across all post-harvest activities. These losses are dependent on following major factors:

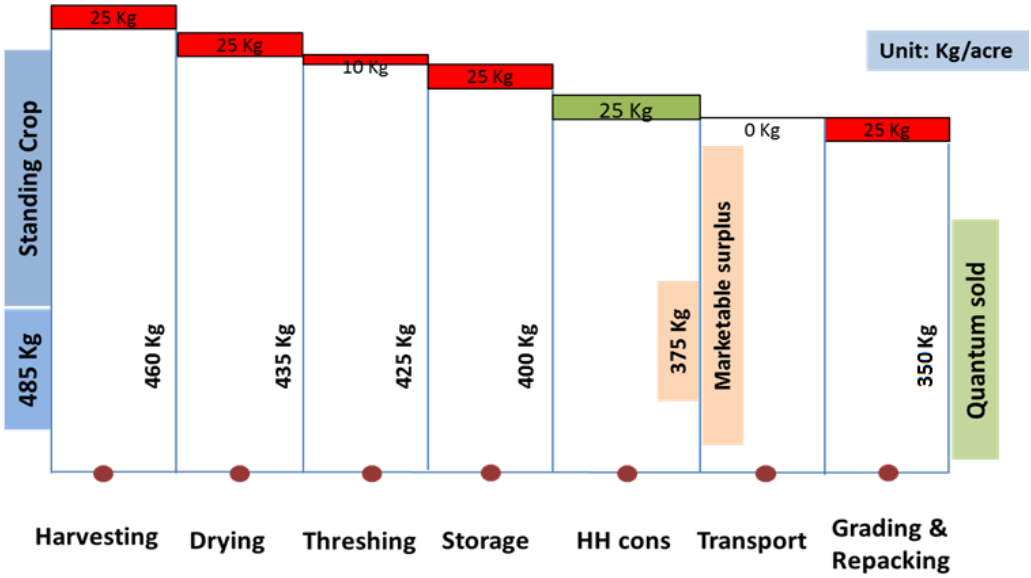
i) weather condition,
ii) labor availability &
iii) market condition.

Farmers are aware of the causes for loss. Though they could not attribute exact quantum of loss suffered due to each cause, they could assign approximate quantum of losses suffered during each process. These figures were cross-checked through numerous focus-group discussions and interviews with farmers, concerned government officials and market players. The average figures are used for quantification of losses.

The extent (percentage) of post-harvest loss during each process varies with influencing factors. Numerous scenarios can be created around the influencing factors like extent and periodicity of rains either during or after production, variations in labor availability and variations in market conditions. 3 scenarios have been created viz. best case, general case and worst case to capture such variations and look at post-harvest losses under each situation. Table below captures the influencing factors against the 3 scenarios.

Scenario	**Weather Conditions (Rains)**		**Labor availability**	**Market condition**
	Cultivation	**Post-Harvest**		
Best Case	Adequate & timely	No rains	Adequate family labor	High price during harvest
General Case	Adequate but erratic	A few rainy days	Labor available on time, either family or hired	Steady or increasing price during or shortly after harvest
Worst Case	Inadequate and erratic	Excess rainy days	Inadequate labor availability	Persistent low price for 2 to 3 months since harvest

The extent of loss has been calculated based on FGDs conducted in 4 villages. These losses took into account weight reduction due to handling & processing, moisture loss, pests (insect and rodent) and deductions in the market. Handling losses included spillage and breakage. Under general case, farmers estimated total losses suffered during harvest and post-harvest processes at 110 Kg. Breakup of this loss under each process is presented in the figure below:



It was found that for an acre of Black Gram cultivated, 350 Kg of produce is sold and 25 Kg is consumed by the household. Maximum losses were identified during harvest, drying and storage. While transportation caused negligible loss, significant loss was reported during grading and repacking in the *mandis*. This loss is borne by the farmer as trader makes payment after factoring such losses.

5. Conclusions and Recommendations

Farmers of Buldhana cultivate Black Gram primarily for sale purposes. However, focus is on getting acceptable level of production with fewer inputs. This is reflected in practices adopted and resources allocated to the harvest and post-harvest processes that include short storage of Black Gram at farmer level. In this light, constraints and bottlenecks faced by farmers during harvest and post-harvest processes are presented in the table below.

Process	Activities	Challenge faced	Reason
Harvesting	Cutting of plants	▪ Splitting and falling of pods ▪ Rapid harvest ▪ Fungal infection	▪ Slow progress due to uncomfortable posture ▪ Brittleness of dry plants ▪ Rains during harvest
Drying	Drying in field, Stacking of dry plants	▪ Splitting and falling of pods ▪ Wastage due to rodents ▪ Uncontrolled moisture loss ▪ Fungal infection	▪ Brittleness of dry plants ▪ Unavailability of scientific drying facility ▪ Rains during drying
Threshing	Setting the thresher, Winnowing	▪ Availability of thresher ▪ Wastage due to thresher operations ▪ High time and labor for winnowing	▪ Unavailability of specific thresher for Black Gram ▪ Lack of skills for thresher operation ▪ Dependence on wind for winnowing

Process	Activities	Challenge faced	Reason
Storage	Sacking and storage of grains	▪ Uncontrolled moisture loss ▪ Fungal infection	▪ Lack of dedicated storage facility at home ▪ Use of traditional storage practices ▪ Lack of proper drying
Transport	Transfer of dried plants from field to barn, Transfer grain from barn to home	▪ Splitting and falling of pods ▪ Spillage of grains	▪ Transportation in uncovered bullock cart or tractor

Following are being recommended towards overcoming the challenges presented in the above table.

i) Develop and promote package of practice based on area specific needs and identified challenges.

ii) Enhance skills and knowledge of farmers in post-harvest management.

iii) Enhance efficiency and effectiveness of existing equipment and devices through targeted research.

iv) Develop and promote low cost devices and storage facilities for use at farmer level.

SECTION B – MADHYA PRADESH

4. Quantification of perceived losses

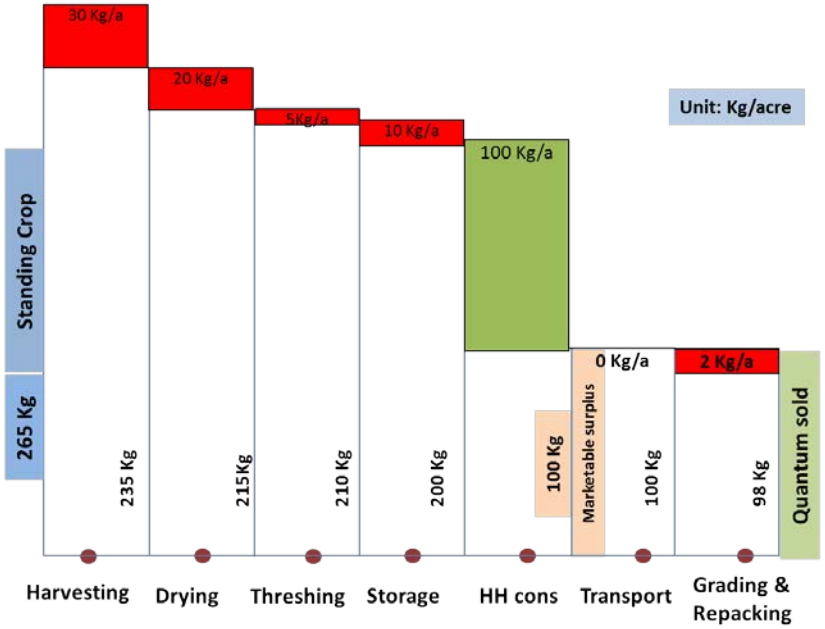
This section presents losses suffered across all post-harvest activities. These losses suffered by farmers are dependent on numerous factors, major ones being weather conditions, labor availability and market conditions. Farmers, though aware of reasons for losses, were unable to attribute exact quantum of loss to each reason. They assigned approximate losses for each process as a whole. These figures were cross-checked through numerous focus-group discussions and interviews with farmers as well as concerned government officials and traders. Average figures are used for quantifying post-harvest losses.

Extent (percentage) of post-harvest loss at each stage varies with change in the influencing factors, as farmers vary practices to cope with such changes. Numerous scenarios can be created around influencing factors viz. extent and periodicity of rains either during or after production, variations in labor availability and variations in market conditions.

Three scenarios have been created viz. best case, general case and worst case to capture such variations and look at post-harvest losses under each situation. Table below captures the influencing factors against these three scenarios.

Scenario	Weather Condition (Rains)		Labor availability	Market condition
	Cultivation	Post-Harvest		
Best Case	Adequate & timely	No rains	Adequate family labor	High price after 3-4 months of harvest
General Case	Adequate but erratic	No rains	Labor available on time either family or hired	Steady price after 3 -4 months of harvest
Worst Case	Inadequate and erratic	A few rainy days	Inadequate labor availability	Persistent low price over 6 months or more after harvest

Extent of losses has been calculated based on FGDs conducted in 3 villages. These losses take into account weight reduction due to handling & processing, moisture loss, pests (insect and rodent) and deductions in the market. Handling losses include spillage and breakage. Under the general case, farmers estimate the total losses suffered during harvest and post-harvest processes at 67 Kg. Breakup of this loss under each process is presented in the figure.



It was found that for an acre of Black Gram cultivated, 98 Kg of produce is sold and 100 Kg is consumed by household. Maximum losses were identified during harvest and drying. Farmers reported negligible loss during transportation. Traders deduct 2 Kg per quintal of produce during sale to account for loss during grading and repacking.

5. Conclusions and Recommendations

Farmers of Alirajpur cultivate Black Gram primarily for consumption purpose. Therefore, focus is on getting an acceptable level of production with fewer inputs. This is reflected in practices adopted and resources allocated to the harvest and post-harvest processes that include year round storage of Black Gram at farmer level. In this light, constraints and bottlenecks faced by farmers during harvest and post-harvest process are presented in table below.

Process	Activities	Challenge faced	Reason
Harvesting	Cutting of plants	• Splitting and falling of pods • Rapid harvest	• Slow progress due to uncomfortable posture • Brittleness of dry plants
Drying	Drying in field, Stacking of dry plants	• Splitting and falling of pods • Wastage due to rodents • Uncontrolled moisture loss	• Brittleness of dry plants • Unavailability of scientific drying facility
Threshing	Setting the thresher, Winnowing	• Availability and cost of hiring thresher • Wastage due to thresher operations • High time and labor for winnowing	• Unavailability of specific thresher for Black Gram • Lack of skills for thresher operation • Dependence on wind for winnowing
Storage	Sacking and storage of grains	• Segregation of varieties • Control loss due to weevils and rodents	• Lack of dedicated storage facility at home and use of traditional storage practices
Transport	Transfer of dried plants from field to barn; Transfer grain from barn to home	• Splitting and falling of pods • Spillage of grains	• Transportation as head loads & in uncovered bullock cart

Following are being recommended towards overcoming the challenges presented in the above table.

1. Develop and promote package of practice based on area specific needs and identified challenges
2. Enhance skills and knowledge of farmers in post-harvest management
3. Enhance efficiency and effectiveness of existing equipment and devices through research.
4. Develop and promote low cost devices and storage facilities for use at farmer level.

Major Insights

- Black gram grown as an inter-crop; cultivation done by taking loan
- Lack of timely availability of labor; Lack of drying and storing practices
- Lack of timely availability of thresher
- Lack of awareness / Govt. effort
- Technology adoption is low in both the states
- Maximum losses reported during harvesting
- Trader pays same price for any quality
- Traders indemnify themselves from any losses since they shift the incidence to the farmer

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