Ministry of Food Processing Industries
Government of India

NIFTEM
KNOWLEDGE • INNOVATION • OUTREACH

RAJMA PROCESSING

AATMANIRBHAR BHARAT

PM Formalisation of Micro Food Processing Enterprises Scheme (PM FME Scheme)

Kingdom: Plantae

Order: Fabales

Family: Fabaceae

Genus: *Phaseolus*

Species: *vulgaris*

INTRODUCTION

- Rajma is supposedly originated in Indian subcontinent, grown for food production and as a forage and cover crop.
- It is predominately grown in India, although it has been cultivated in the United States, Brazil, China, Myanmar, Tanzania and Mexico.
- Jammu and Kashmir, Uttarakhand, Punjab, West Bengal, Tamil Nadu, Kerala, Maharashtra and Karnataka are the major producers of Rajma in India. This crop is used as a source of food, feed, fodder, green manuring, and green pasture. Green pods are delicious source of vegetables.
- It is an excellent source of protein and hence is labelled as an vegetarian analogue of meat.

GROWING CONDITIONS

- ✓ It grows well in tropical and temperate areas receiving the annual rainfall of 60-150 mm, the optimum growing temperature ranges from 15-25 ^{0}C, and the harvesting temperature of 28-30 ^{0}C.
- ✓ Multiple ploughing (2-3 times) and levelling to avoid water stagnation is required as the crop is highly sensitive to water logging followed by addition of manure (well decomposed cow dung at 60-80qtl/acre.
- ✓ The crop is cultivated in both Rabi (February-March) as well as Kharif (May-June) season.

- ✓ The seeds are pre-treated with Thiram (4gm per Kg of seeds) followed by shade drying and immediate sowing.
- ✓ The recommended spacing between the rows is 45-60 cm and 10-15 cm between the plants with the sowing depth of 6-7 cm.
- ✓ This crop lacks biological nitrogen fixation because of poor nodulation and therefore, requires 100 to 125 kg/ha of nitrogen in addition to 60-70 kg/ha of phosphorous pentoxide.
- ✓ Requires four irrigations at 25, 50, 75 and 100 days after sowing for optimal yield, generally prior to blooming, during flowering and at pod development stage.

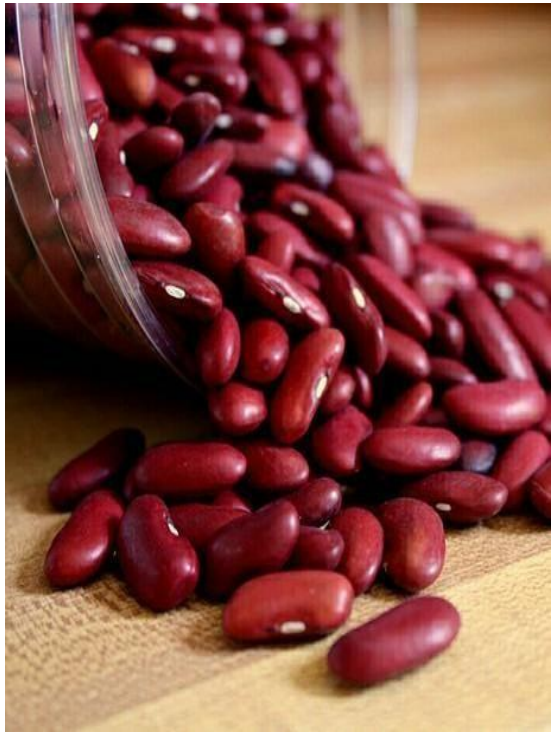
- ✓ Frequent irrigation may be skipped during rainy season and heavy water logging must be avoided.
- ✓ The crop is ready for harvest when the pod turns yellow to brown in colour. Changing of leaves colour from green to yellow accompanied by falling is also a sign of readiness of the crop.
- ✓ Overall duration of crop cultivation ranges from 120-130 days and it is very critical to harvest at the right time as delaying may lead to shattering and loss of yield.
- ✓ Following harvest, the crop is sun-dried for three to four days which is then followed by threshing using bullocks or sticks.

VARIETIES OF RAJMA

STATES	VARIETIES
Uttar Pradesh	HUR - 137, Malviya Rajmash - 137
Uttarakhand	VL Rajmash 125, VL Bean - 2
Bihar	IPR 96 - 4 (Amber)
Punjab	RBL 6
Rajasthan	Ankur
Gujarat	Gujarat Rajma- 1
Maharashtra	Varun (ACPR - 94040), HPR - 35 3
Haryana	CZM 45, CZM 99

PRODUCTION TREND (INDIAN SCENARIO)

- India is the largest producer with the share of 25% of global production, consumer as well as importer of pulses.
- The average production of Rajma over the period of 20121-14 has been 3.8 million tones which comprises 12% share in the world production.
- Jammu and Kashmir, Uttarakhand, Punjab, West Bengal, Tamil Nadu, Kerala, Maharashtra and Karnataka are the major producers of Rajma in India.

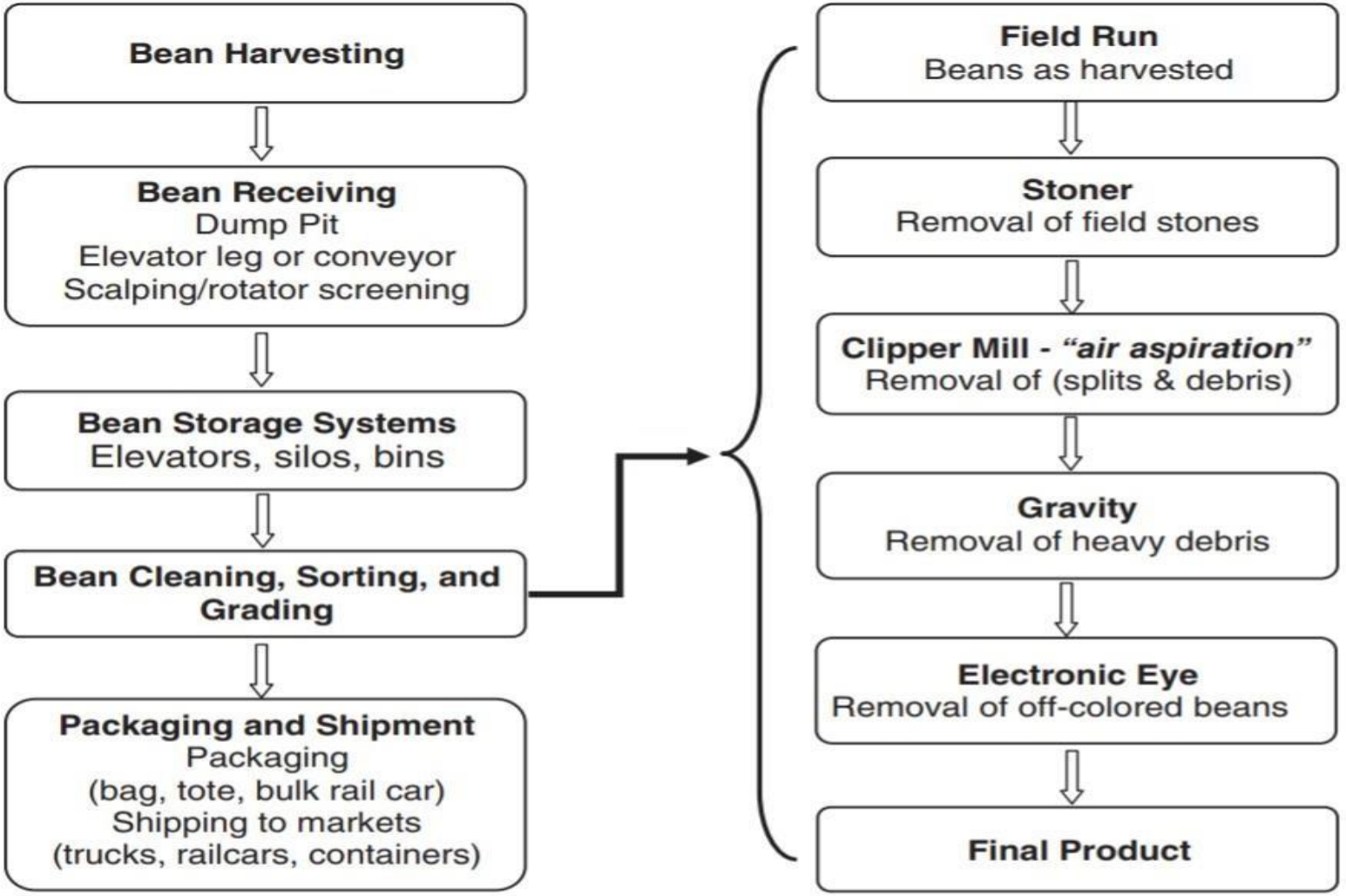


NUTRITIONAL COMPOSITION OF RAJAMA

Nutritional components	Value per 100 grams	% Daily values
Energy	232 cal	12
Protein	9.5 g	17
Carbohydrates	28 g	9
Fibre	2.7 g	11
Fat	9.1 g	14
Cholesterol	7.5 mg	2

Nutritional components	Value per 100 grams	% Daily values
Vitamin A	313.9 µg	7
Vitamin B1 (Thiamine)	0.1 mg	10
Vitamin B2 (Riboflavin)	0.1 mg	9
Vitamin B3 (Niacin)	0.5 mg	4
Vitamin B9 (Folic Acid)	161.7 µg	81
Vitamin C	14.7 mg	37
Calcium	136.9 mg	23
Iron	2.4 mg	11
Magnesium	78.6 mg	22
Phosphorous	178.6 mg	30
Sodium	34.5 mg	2
Potassium	634.2 mg	12
Zinc	1.8 mg	18

POST-HARVEST PROCESSING OUTLINE OF KIDNEY BEANS (RAJAMA)



- Upon receiving, the beans are immediately processed with air aspiration to remove contaminants which are lighter than beans namely, leaves, pods and stem.

- This is an important step as these materials interfere with subsequent air flow and adsorb moisture resulting in accelerated spoilage and degrade quality.

- Beans are then subjected to density separation using gravity table for removal of heavier materials like stones, mud balls etc. by the application of vibrating mechanical force.

- Bean size separation is achieved via screening over series of sieves to achieve uniformity of size and shape within the specific lot.

- The final cleaning step is the screening of beans for size and colour using the electronic eye system followed by storage prior to packing and distribution.
- The dried beans are stored in large silos or steel bins prior to further processing.
- Care must be taken to minimise seed coat damage; bean ladder is implemented for the purpose.
- The bean ladder enables the circular motion of beans along the walls thereby minimizing the damage.

- Moisture content is an important determinant of final product and bean with less than 18% moisture generally retain their stability while storage and hence drying prior to thrashing and storing is important.
- Retained moisture and low aeration results in moulding, off-flavours, off-odour development and significant product loss.
- Adverse storage condition results into seed hydration defect and as a consequence decrease in digestibility and bioavailability of nutrients is observed.
- Other effects of poor stability include bin burn, hard-shell and hard to cook beans leading to poor economic value

BEAN STORAGE STEEL BINS WITH MONITORED AIR FLOW AT THE BOTTOM.

QUALITY OF KIDNEY BEANS

- Quality of specific lot is kept in check by following food safety standards and programs like:

  Good Agricultural Practices (GAPs)

  Good Manufacturing Practices (GMPs)

  ISO 9000

  Hazard Analysis Critical Control Points (HACCP)

  Safe Quality Food (SQF) standards

- Post-harvest losses critically and extensively influence the product quality.

- These are substantiated by biological and environmental factors like pests, microorganisms, rodents, storage temperature, time and moisture.

SPECIFIC QUALITY FACTORS ASSOCIATED WITH BEANS

- **Moisture Content:** The moisture levels between 15-18 % during the packaging and storage is recommended to ensure superior quality of the product.
- **Extraneous Matter:** The term accounts for the presence of mineral or organic matter in the final product. Less than 1 % extraneous matter is permissible wherein mineral component must not exceed 0.25 % while the organic matter must be less than 0.10 %
- **Seed Discoloration:** Tannins and polyphenols are the major influencing factors in deterioration of colour, flavour and nutritional quality of pulses and legumes by catalysing the precipitation of alkaloids, gelatine as well as proteins. Enzymatic oxidation of polyphenols is also associated with the development of Hard to cook beans.

Mould Development and toxins: High moisture content, high relative humidity and high temperature during storage results into mould growth on beans.

Microbial factors like bacterial bloom and root rot during the crop cultivation and development also influence to mould growth post-harvest.

Cladosporium, Aspergillus amstelodami, Aspergillus dimorphicus and Penicillium cyclopium are the most common fungal strains infecting kidney beans during storage and the severity of the situation is further escalated by aflatoxin production.

Aflatoxins are carcinogenic secondary metabolites produced by *Aspergillus* fungi commonly associated with food poisoning and liver damage.

Heavy Metals: Presence of heavy metals in the final product at a range above the permissible limit may cause severe health issues to the consumers. According to WHO standard, the concentration of heavy metals must not be higher than 10 mg/kg.

Pesticide Residue: The maximum residue limits (MRL) for pesticides is as per the standards of Joint FAO/WHO Food Standards Programme of Codex Alimentarius Commission wherein the MRL of dry beans is 0.4 mg/Kg.

SEED DISCOLORATION

MOULD DEVELOPMENT

PACKAGING OF KIDNEY BEANS

Available packaging materials for cereals and pulses include:

Jute bags: Jut gunny bags are widely used packaging material for bulk transportations.

As per National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED), Packaging of Kidney beans must be done in New B Twill (Jute) bags in 100 Kg net.

The major supplier of these bags is Directorate General of Supplies and Disposal (DGS & D), Kolkata.

HDPE/pp bags: High density polyethylene bags are generally used for packaging of small quantities to the consumers.

Polyethylene impregnated jute bags: These bags are blend of jute with synthetics having improved strength.

Poly pouches: With the growing demand of consumers for handy supplies of commodities, the packaging has been transformed and poly pouches with attractive label and brand name has became a indirect reference to the quality of the produce.

Cloth bags: These are generally used to transport and store seeds.

A good packaging must have following qualities:

- It must protect the food commodity during transport and storage
- Must comply to the standard labelling and packaging regulations as described ahead in this chapter
- Must be convenient to handle
- Must be cost-effective and attractive
- Must be free of adverse chemical residues
- Should ideally be bio-degradable or re-cyclable

METHOD OF PACKAGING

i. Pulse shall be packed in jute bags, poly woven bags, poly pouches, cloth bags or other suitable contamination free and sound packaging material which is permitted under the prevention of food adulteration rules, 1955.

ii. When container packed, the quality of the material must be reassured to safeguard hygiene, nutritional and organoleptic qualities of the product.

iii. The containers must be processed using non-toxic chemicals and must not have a toxic residue or undesirable odour which may otherwise impact the safety and quality of the packaged product.

iv. The net weight of the commodity in the package must comply to the provisions prescribed under the Packaged commodities rules, 1977.

v. Each package must contain the product of same quality and grade designation.

vi. Each package must be securely sealed.

PACKAGING MACHINE FOR BEANS

HEALTH BENEFITS

- ✓ Have anti inflammatory properties.
- ✓ Rich source of protein.
- ✓ Prevent constipation.
- ✓ Boost immunity.
- ✓ Lowering the blood pressure.
- ✓ promoting Healthy Skin.
- ✓ Consumption of rajma helps in reducing LDL (bad) cholesterol.
- ✓ preventing the symptoms of diabetes.

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