

2020

Ready Reckoner of Pulses

*(Chickpea, Pigeonpea, Mungbean, Urdbean, Lentil, Fieldpea,
Horsegram, Mothbean, Lathyrus, Rajmash, Cowpea, Clusterbean)*

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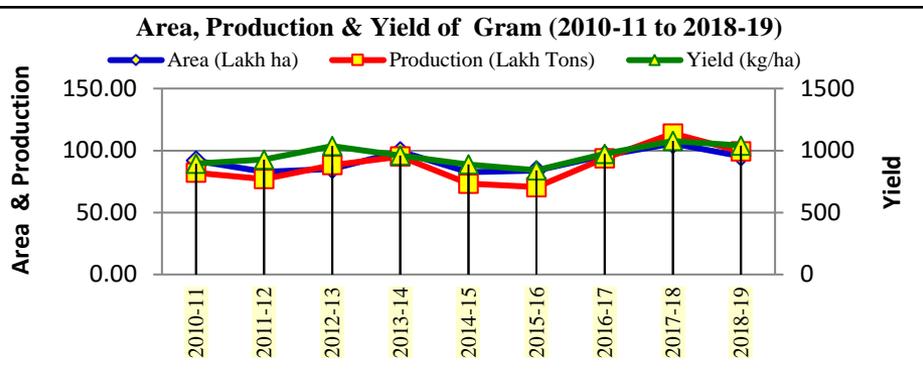
Email- shitlanijee@gmail.com



CHICKPEA (GRAM)

Scientific Name:
Cicer arietinum L.

Area : **92.77 Lakh ha**
 Production: **90.17 Lakh tonnes**
 Yield: **972 kg/ha**
(Avg. of 2014-15 to 2018-19)
Ever Highest Production –
114 Lt. (2017-18)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|------------|
| Madhya Pradesh | 31.57 | 34 | 36.93 | 41 | 1170 |
| Maharashtra | 16.99 | 18 | 13.63 | 15 | 802 |
| Rajasthan | 13.83 | 15 | 13.38 | 15 | 967 |
| Karnataka | 11.51 | 12 | 6.57 | 7 | 571 |
| Uttar Pradesh | 4.92 | 5 | 4.93 | 5 | 1001 |
| All Above | 78.82 | (85%) | 75.44 | (84%) | 957 |
| All India | 92.77 | | 90.17 | | 972 |

Major Districts (2018-19)

| Major states | Major districts |
|----------------------|--|
| Madhya Pradesh (53%) | Vidisha, Dewas, Sagar, Damoh, Dhar, Ujjain, Raisen, Ashoknagar, Guna, Khargone, Rajgarh, Panna, N.Singhpur |
| Maharashtra (61%) | Latur, Ahmednagar, Osmanabad, Beed, Buldhana, Nanded, Parbhani, Amravati, Yavatmal, Pune |
| Rajasthan (73%) | Bikaner, Churu, Jaisalmer, Ajmer, Hanumangarh, Jaipur, Ganganagar, Pali |
| Karnataka (75%) | Vijayapura, Raichur, Kalburgi, Gadag, Bagalkote, Belagavi |
| Uttar Prad. (65%) | Banda, Mahoba, Hamirpur, Chitrakoot, Fatehpur, Jalaun |

Major Countries (Avg.:- 2014 to 2018)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Country | Area | % Contri | Prod. | % Contri | Yield |
|------------------|---------------|--------------|---------------|--------------|-------------|
| India | 96.03 | 68 | 88.75 | 65 | 924 |
| Australia | 7.51 | 5 | 10.12 | 7 | 1348 |
| Myanmar | 3.72 | 3 | 5.48 | 4 | 1474 |
| Turkey | 4.01 | 3 | 4.93 | 4 | 1230 |
| Ethiopia | 2.39 | 2 | 4.83 | 4 | 2016 |
| All Above | 113.66 | (81%) | 114.11 | (84%) | 1004 |
| World | 141.08 | | 136.02 | | 964 |

Economic importance:

-Pulses crops besides, being rich in protein and some of the essential amino acids, enrich the soil through symbiotic nitrogen fixation from atmosphere.

-Used for human consumption as well as for feeding to animals.

Crop Products:

Chickpea Flour/Dal, Savoury products, Sweets, Biscuits/Nankhatai, Soups/Curry, Salad, Sprouted gram, Puffed chana, Stew etc.

New Varieties:

| Year | Varieties | Year | Varieties |
|------|--|------|--|
| 2010 | Pant Kabuli Chana 1, Gujarat Junagadh gram 3 | 2015 | WCGK 2000-16, Birsa Chana 3, BG 1084 |
| 2011 | MNK 1, RVKG 101, RVKG 201 | 2016 | GNG 2144, NBeG 119, JGK 5, CSJ 515, BDNGK 798, GJG 6, JG 36, GBM 2 |
| 2012 | AKG 9303-12, HK 4, RVG 202, RVG 203, CSJK 6, L 555, Phule G 0027 | 2017 | GJG 0809, GNG 2171, Pant Gram 5, Indira Chana 1, NBeG 49, Pant Gram-4, Pant Gram -3, Pant Kabuli Gram-2, NBeG 47, Phule Vikram |
| 2013 | GNG 1958, GNG 1969, GLK 28127, NBeG 3 | 2018 | BG 3043, GNG 2207, Phule G 0405, BGD 111-1 |

Sowing Season: Rabi (100%)

Sowing Time : **North India -Rainfed:** Second fortnight of October
Irrigated: first fortnight of November
Central & South India - First fortnight of October

Sowing Method : Flat Beds, Broad bed & Furrow (BBF)

Spacing : **Timely Sown-** 30 X 10 cm: **Late Sown-** 25 cm. X 10 cm.
Irrigated - 45 cm. X 10 cm. **Seed Depth:** 5-7 cm

Seed rate : **Small seeded-** 60-70 kg/ha; **Kabuli-**100-120
Bold seeded and late sowing–75-90 kg/ha

Seed Treatment : Hexaconazole @ 2 ml/kg seed.

Culture & Micronutrient : Rhizobium 5 gm+ PSB 5 gm/kg & after that apply Molybdenum 1 gm/kg.

Soil type: Well drained Sandy to fine textured deep black soils. Best suited deep loams or silty clay loams with a pH ranging from 6.0 to 8.0.

Rainfall : An average crop season rainfall of 600-900 mm

FYM : 5 tonnes FYM or compost or biogas spent slurry with 50% recommended dose of fertilizers (RDF) plus Rhizobium inoculation for better yields and Fertilizer Use Efficiency (FUE).

Fertilizer Recommendations: 15- 20 kg (N) and 50–60 kg (P) per ha. If soils are low in potassium (K), an application of 17-20 kg/ha is recommended.

- Foliar spray of 2% urea at flowering has been found beneficial in rainfed crops.
 -25 kg zinc sulphate and 10 kg borax /ha has positive effect on root growth, BNF and yield.

Application of fertilized should be based on Soil Test Report.

Irrigation : Critical stages are branching, Pod formation/development.

Cropping System:

Intercropped- Mustard Linseed, Wheat/Barley, Safflower, Coriander

Rotation - Kharif fallow-Gram; Paddy-Gram, Maize-Gram, Bajra-Gram; Jowar-Gram

| Major weeds | Management |
|--|--|
| Bathua,Gajri,Chatri, Matri, Ankari, Kateli, Senji, Jungli Piaji, Krishanneel, Canary Grass | Crop rotation, Intercropping, Mechanical & Manual weeding, Spray of Fluchloralin (Pre-em), Quizalofop ethyl/ I (Post-em) |

Seed Replacement rate :

| Crop | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------|-------|-------|-------|-------|-------|-------|
| Gram | 21.17 | 31.43 | 25.35 | 27.64 | 31.83 | 30.90 |

Harvesting : Leaves begin to fall, stem and pod turn brown or straw in colour and seeds are hard and rattle (most important) with 15% moisture inside them.

Economics of Crop cultivation:

| Parameters | Rabi |
|--|----------------------|
| Yield (Normal 2014-15 to 2018-19) | 9.72 qtls/ha |
| Gross income (at MSP 2019-20) | Rs. 47385/ha |
| Cost of Cultivation (CoC A ₂ +FL)* | Rs. 27923/ha |
| Cost of Production | Rs. 2873/qtls |

*CoC – Cost of Cultivation ; A₂ -Actual paid out cost ; FL- Imputed value of Family labour

Insect-Pest & Disease Management:

| Major Insect Pest | Management |
|-------------------|--|
| Cutworm | Summer deep ploughing, Crop rotation, Intercropping with wheat /linseed /mustard, Grow marigold on bunds, Spray Methyl Parathion (50 EC)@ 0.7-0.8 lt/hac. |
| Gram Pod Borer | Early sowing, grow short duration varieties. Intercrop with linseed, marigold, mustard, sunflower or wheat, coriander. - Install bird perches@ 10-15/ha -Spray neem seed extract (5%). Use moderate resistant cultivars like ICCV10, Vijay, ICCV 7andICCL86103, PBG-3. |
| Major Diseases | Management |
| Collor Rot | Crop rotations with cereals, Application of calcium fertilizer, Seed treatment with carboxin @ 3 gm/kg of seed. |
| Dry Root Rot | Crop rotation, Timely sowing should be done to avoid post-flowering drought and heat stresses, which aggravate the disease. |
| Wilt | Sowing should be third week of October. Deep Planting of chickpea (8-10 cm.) in light soil. In heavy incidence avoid chickpea cultivation for 3 to 4 years. |

Minimum Support Price:

(Rs. per qtls)

| Crop | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 |
|------|---------|---------|---------|---------|---------|
| Gram | 3425* | 4000^ | 4400@ | 4620 | 4875 |

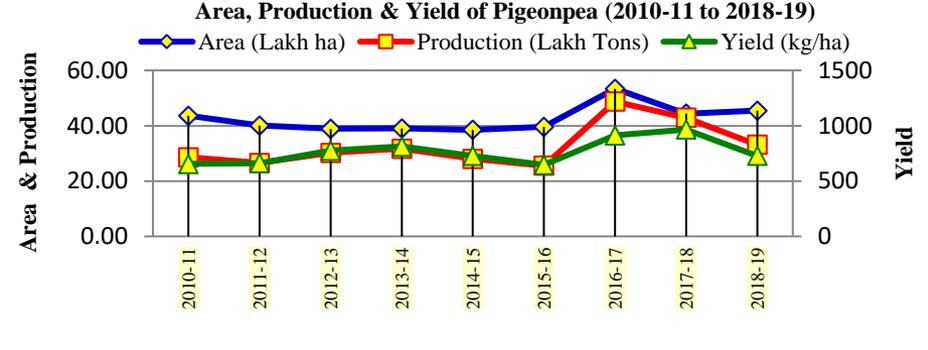
*Included bonus of Rs. 75 per qtl; ^Included bonus of Rs. 200 per qtls; @Included bonus of Rs. 150 per qtls.



PIGEONPEA (TUR)

Scientific Name:
Cajanus cajan (L.)

Area : 44.29 Lakh ha
Production: 35.69 Lakh tonnes
Yield: 806 kg/ha
(Avg. of 2014-15 to 2018-19)
Ever Highest Production –
> 48 Lt. (2016-17)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|------------|
| Maharashtra | 12.77 | 29 | 9.48 | 27 | 743 |
| Karnataka | 9.93 | 22 | 6.67 | 19 | 671 |
| Madhya Pradesh | 5.30 | 12 | 5.87 | 16 | 1108 |
| Gujarat | 2.63 | 6 | 3.08 | 9 | 1169 |
| Uttar Pradesh | 2.85 | 6 | 2.65 | 7 | 930 |
| All Above | 33.48 | (76%) | 27.75 | (78%) | 829 |
| All India | 44.29 | | 35.69 | | 806 |

Major Districts: 2018-19

(Except Gujarat : 2017-18)

| Major states | Major districts |
|----------------------|---|
| Maharashtra (86%) | Amravati, Yavatmal, Wardha, Latur, Buldhana, Nagpur, Chandrapur, Nanded, Akola, Washim, Jalna, Parbhani |
| Karnataka (98%) | Kalburgi, Vijayapura, Yadgir, Raichur, Bidar, Bagalkote, Davanagere, Belagavi, Ballari, Koppal |
| Madhya Pradesh (70%) | Narsinghpur, Chhindwara, Betul, Seoni, Rewa, Raisen, Shahdol, Singroli, Khandwa, Balaghat, Jabalpur, Morena, Satna, Sidhi |
| Gujarat (90%) | Bharuch, Vadodara, Chhotaudepur, Panchmahal, Surat, Narmada, Dahod, Tapi, Sabarkantha, Valsad, Mahisagar |
| Uttar Pradesh (50%) | Banda, Chitrakut, Kanpur Dehat, Jaunpur, Allahabad, Mirzpur, Fatehpur, Sonbhadra, Kanpur City, Hamirpur |

Major Countries (Avg.:- 2014 to 2018)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Country | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|------------|
| India | 45.38 | 75 | 35.38 | 68 | 780 |
| Myanmar | 6.25 | 10 | 6.54 | 13 | 1046 |
| Malawi | 2.45 | 4 | 3.84 | 7 | 1570 |
| Tanzania | 2.69 | 4 | 2.71 | 5 | 1010 |
| Kenya | 1.75 | 3 | 1.94 | 4 | 1106 |
| All Above | 58.52 | (96%) | 50.40 | (97%) | 861 |
| World | 60.65 | | 51.85 | | 855 |

Economic importance:

In India pigeonpea (Arhar), the IInd important pulse crop after chickpea, is largely cultivated under rainfed conditions (95%), remaining 5% is grown with critical irrigation support. Seeds are also rich in iron, iodine, essential amino acids like lycine, tyrocene, cystine and arginine.

Crop Products: Split Dal

- Mainly consumed in split form as 'dal'.
- Seed layer along with the kernel part provides a valuable feed to milch cattle.
- Pods husk, leaves constitute a valuable cattle fodder.
- Dry stick- fuel, thatches, storage bins (baskets) making etc

New Varieties:

| Year | Varieties | Year | Varieties |
|------|---------------------------------------|------|--|
| 2011 | TAT-9629, AGT 2, Rajeev Lochan | 2014 | BRG 4, IPA 203 |
| 2012 | WRG-65, BDN 711, Phule T 0012, RGT-1, | 2015 | GJP-1, TDRG 4, PRG 176, ICPH 2740, BRG 5, LRG 52, Rajendra Arhar-1, GT 103 |
| 2013 | ICPH 2671 | 2016 | GRG 881, BDN 716, CORG 8 |
| | | 2018 | AL 882, Pusa Arhar-16, GT-103, BRG-3, GT-104, CRG-2012-25 |

Sowing Season: Kharif & Rabi

Sowing Time : Early Maturing var.: First fortnight of June.

Medium & Late Maturing Var.: Second fortnight of June.

Sowing Method : Flat Beds, Broad bed & Furrow (BBF), Ridge & furrow

Spacing : Early- 45-60 cm X 10-15 cm

Medium/Late - 60-75 cm X 15-20 cm; **Seed Depth :** 7-10 cm

Seed rate : Early– 20-25 kg/ha, **Medium/Late** – 15-20 kg/ha

Seed Treatment: Treat the seed 2 days before sowing.

Fungicide: Tricoderma 5 (gm.) @ per kg.

Culture & Micronutrient : Use Rhizobium culture 10 gm/kg.

Irrigation : 1st -Branching (30 DAS); 2nd -Flowering (70 DAS)

3rd - Podding (110 DAS.)

Cropping System:

Rotation – i) Maize–Pigeonpea (Rabi); ii)Pigeonpea-Urd-Wheat; iii) Pigeonpea-Sugarcane; iv) Mung + Pigeonpea-Wheat; v) Pigeonpea (early) - Potato-urdbean.

Intercropping - 80 % - 90 % of the pigeonpea were intercropped.

-With cereals (sorghum, maize , pearl millet, finger millet & rainfed rice).

-With legumes (groundnut, cowpea, mung bean, black gram, soybean.).

-With long-season annuals (caster, cotton, sugarcane, and cassava).

Seed Replacement rate :

| Crop | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-----------|-------|-------|-------|-------|-------|-------|
| Pigeonpea | 22.16 | 21.46 | 46.25 | 40.97 | 45.24 | 48.11 |

Harvesting :With two third to three fourth pods at maturity judged by changing their colour to brown is the best harvesting time. The plants are usually cut with a sickle within 75-25 cm above the ground.

Economics of Crop cultivation:

| Parameters | Rabi |
|---|---------------|
| Yield (Normal 2014-15 to 2018-19) | 8.06 qtls/ha |
| Gross income (at MSP 2020-21) | Rs. 48360/ha |
| Cost of Cultivation (CoC A ₂ +FL)* | Rs. 38352/ha |
| Cost of Production | Rs. 4758/qlts |

*CoC – Cost of Cultivation ; A₂ -Actual paid out cost ; FL- Imputed value of Family labour

Soil type: It is successfully grown in black cotton soils, well drained with a pH ranging from 7.0-8.5.

Climate: 30-35°C for germination, 20-25°C for active growth, 15-18°C during flowering and pod setting (highly susceptible to frost) and 35-40°C at maturity.

Plant Nutrient Management: 25-30 kg N,50-75 kg P₂O₅, 30kg K₂O /ha at sowing time.

Zn : Foliar spray of 0.5 kg ZnSO₄ with 0.25 kg lime or soil application @ 25 kg/ha;

Mo:1 kg sodium molybdate/ ha; **Boron:** Foliar spray of B @1.0–1.5 kg/ha or soil application of 4 kg borax. **Fe:** Spray 1.0 per cent FeSO₄ to recoup the crop from Fe deficiency.

Weed Management : i) Raised bed system (2.7 m width) of planting; ii) One hand weeding of 30 DAS; iii) Pre-emergence application of Pendimethalin (1.0-1.5 kg/ha); iv) hand weeding 25-30 DAS optional second weeding (45-60 DAS).

Application of fertilized should be based on Soil Test Report.

Insect-Pest & Disease Management:

| Major Diseases | Management |
|---------------------|---|
| Wilt | i) Soil application-T. viride –2.5 kg/ha + 50 kg of well decomposed FYM or sand at 30 days after sowing. ii) Mixed cropping with sorghum; iii) Grow resistant varieties like Amar, Azad, Asha , Maruthi, C-11, BDN-1, BDN-2, NP-5. |
| Sterility mosaic | i) Spray Fenazaquin @ 1 ml/lit on 45 and 60 DAS; ii) Crop rotation with tobacco, sorghum, pearl millet, cotton. ii) Resistant var. like Pusa-885, Asha, Sharad , Narendra Arhar1. |
| Phytophthora blight | i) Seed treated with Metalaxyl 35 WS @3 g/kg of seed; ii) Crop rotation should be followed; iii) Grow resistant varieties - ICPL 7916/ 12055/12114/12161, JKM-189, JA-4 etc. |

| Major Insect Pest | Management |
|-------------------|--|
| Pod-sucking bugs | i) Soil application of Carbofuran 3G @ 15 kg/ha at sowing. ii) Spray with Ha NPV 3 x1012 POB (Polyhedral occlusion body) /ha in 0.1% teepol. |
| Plume Moth | i) Apply Neem oil 2%.;ii) Spray- Azadirachtin 0.03% WSP 2500-5000 g/ha or Emamectin benzoate 5% SG @ 220 g/ha or Indoxacarb 15.8% SC@ 333 ml/ha. |
| Pod borers | i) Use H. armigera pheromone trap @ 12/ha; ii) Spray the crop with Emamectin benzoate 5% SG @220 g/ha. |

Minimum Support Price:

(Rs. per qtls)

| Crop | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
|-----------|---------|---------|---------|---------|---------|---------|
| Pigeonpea | 4625* | 5050^ | 5450@ | 5675 | 5800 | 6000 |

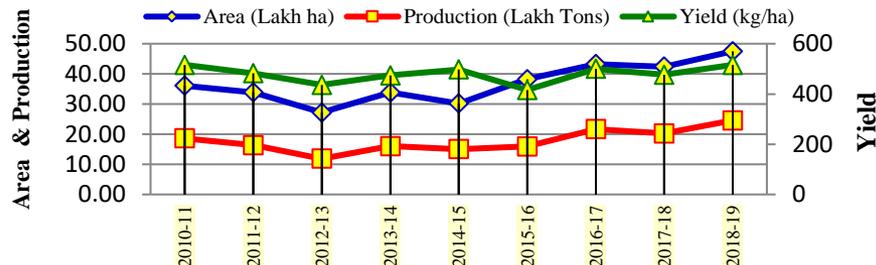
*Included bonus of Rs. 200 per qtl ; ^Included bonus of Rs.425 per qtls; @Included bonus of Rs. 200 per qtls.

MUNGBEAN

Scientific Name:
Vigna radiate (L.)

Area : 40.34 Lakh ha
Production: 19.48 Lakh tonnes
Yield: 483 kg/ha
(Avg. of 2014-15 to 2018-19)
**Ever Highest Production –
> 24 Lt. (2018-19)**

Area, Production & Yield of Mungbean (2010-11 to 2018-19)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|------------|
| Rajasthan | 16.16 | 40 | 7.66 | 39 | 474 |
| Madhya Pradesh | 3.54 | 9 | 2.19 | 11 | 621 |
| Maharashtra | 4.08 | 10 | 1.55 | 8 | 380 |
| Bihar | 1.71 | 4 | 1.12 | 6 | 652 |
| Andhra Pradesh | 1.55 | 4 | 1.04 | 5 | 670 |
| All Above | 27.04 | (67%) | 13.57 | (70%) | 502 |
| All India | 40.34 | | 19.48 | | 483 |

Major Districts (2018-19 Except Bihar-2017-18)

| Major states | Major districts |
|-------------------------|--|
| Rajasthan (90%) | Nagaur, Jodhpur, Pali, Churu, Ajmer, Jaipur, Tonk, Ganganagar, Jhunjhunu |
| Madhya Pradesh (65%) | Rewa, Jabalpur, Dhar, Damoh, Bhind, Raisen, Aagar, Hoshangabad, Barwani, Satna, Vidisha, Sidhi, Shivpuri |
| Maharashtra (70%) | Akola, Jalgaon, Nanded, Ahmednagar, Parbhani, Buldhana, Amravati, Osmanabad, Satara, Nasik, Jalna |
| Bihar (81%) | Supaul, Madhepura, Muzaffarpur, Madhubani, Saharsa, Vaishali, Darbhanga, Araria, Samastipur, Nawada, |
| Andhra Pradesh (95%) | Guntur, Srikakulam, West & East Godavari, Krishna, Vizianagaram, SPSR Nellore, Ananthapuram |

Economic importance:

Excellent source of high quality protein (25%) having high digestibility. Good source of Riboflavin, Thiamine and Vitamin C (Ascorbic acid). Fix the atmospheric nitrogen (30-40 kg N/ha). Preventing soil erosion. Being a short duration crop, it fits well in many intensive crop rotations.

Crop Products:

- Consumed as whole grains, sprouted form as well as dal in a variety of ways.
- Savoury products, Sweets, Khichdi, Weaning food, Sprouts.
- The husk of the seed can be soaked in water and used as cattle feed.
- Mungbean is also used as green manure crop.

New Varieties:

| Year | Varieties | Year | Varieties |
|------|--|------|---|
| 2009 | IPM 02-3, PKV AKM 4, Pusa 0672, MGG 347, MGG-207, VBN (Gg) 3 | 2016 | Pusa 1371, IPM 410-3 (Shikha), IPM 205-7 (Virat), SML 1115, MH 318, Utkarsh (KM 11-584), Pant Mung 8 (PM 09-6), Yadadri (WGG 42) Sri Rama (MGG 351), MSJ 118 (Keshvanand mung 2), RMG 975, ML 2056, GBM-1 |
| 2010 | IPM 02-14, Basanti, Pairymung, KM 2195, TM-2000-2, Pairymung SML 832 | 2018 | GM 6, KM 2328, Pusa 1431, SGC 16 (Rupohi), GAM 5, Gujarat Mung-7, Varsha (IPM 2K 14-9), Kanika (IPM 302-2), Tripura Mung 1 (TRCM 131) |
| 2013 | Shalimar Moong-2, CO (Gg) 8 | 2019 | VBN 4 (VGG 10-008), Pant M 9 (PM 09-11), SML 1827 |
| 2014 | DGGV-2, MH 421, SGC 16, BGS 9 (Somnath) | 2020 | IPM 512-1 (Soorya), MH 1142, KM 2342 (Azad Mung 1), IPM 312-20 (Vashudha), IPM 409-4 (Heera) |

Sowing Season: Kharif, Rabi and Spring/Summer (Zaid)
Sowing Time : **Kharif :** Last week of June to mid or 1st week of July.
Rabi: 1st – 2nd week of October
Spring/Summer- 15th Feb. to 1st week of March
Sowing Method : **Manually :** Line Sowing , Broadcasting
Mechanical : Raised bed with the help of seed drill.
Spacing : **Kharif:** 45 cm X 10 cm ; **Rabi/Summer:** 30 cm X 10 cm.
Seeds Depth: 5-7 cm.
Seed rate : **Kharif:** 15-20 kg/ha, **Rabi/Summer:** 25-30 kg/ha.
Seed Treatment: Treat the seed 2 days before sowing.
Disease: Hexaconazole @ 2 ml/kg seed.
Insect-Pest: Imidacloprid 70 WS @ 7g/ kg .
Culture & Micronutrient : Rhizobium and PSB culture (5 gm/kg seed)

Soil type: It is successfully grown sandy loam to black cotton soils having good drainage capacity. Mungbean is very sensitive to water logging conditions.
Climate: Crop needs high temperature, less humidity and moderate rainfall of about 60-80 cm. Water logging is fatal for root development and nitrogen fixation during early vegetative stage.
Plant Nutrient Management: 15-20 kg N,30-40 kg P₂O₅, 20 kg-S/ha at sowing time.
Boron: Apply 5 kg borax/ha/ 3.6 kg di-sodium tetra borate penta hydrate); **Manganese:** Seed soaking with 2% manganese sulphate or foliar spray of 1% manganese sulphate.
Weed Management : i) 1st- 20-25 DAS, 2nd – 45 DAS; ii) Pendimethalin @ 700 gm. a.i. per ha in 800 -1000 lit. of water a pre-planting spray; iii) Post-emergence Emejathoper (Persute)100 gm/ha spray 20 DAS to control grass family and broad leaf weeds..

Application of fertilized should be based on Soil Test Report.

Irrigation : **Kharif-** One irrigation at the time of Pod formation stage.
Spring/Summer- 1st (20-25 DAS) before flowering,
 2nd (40-45 DAS) at pod filling stage.

Cropping System:

Rotation: i) Rice-Wheat-Mung (summer); ii) Maize + Mung-Wheat-Mung; iii) Maize (early) Potato (early) wheat-Mung; iv) Sugarcane + Mung (summer 1:2); v) Cotton + Mung (1:3)

Intercropping

Kharif: Maize, Pearl Millet, Pigeonpea, Cotton

Spring/Summer: Sugarcane (2:1); Sunflower (2:6)

Seed Replacement rate :

| Crop | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------|-------|-------|-------|-------|-------|-------|
| Mungbean | 30.29 | 32.41 | 49.63 | 23.55 | 30.72 | 33.55 |

| Major Diseases | Management |
|---------------------|---|
| Yellow Mosaic Virus | i) Diseased plants should be Rogued out; ii) Grow resistant varieties- Narendra Mung1, Pant Mung 3, PDM 139 (Samrat), PDM 11, MUM 2 ,ML 337; iii) Spray with Oxydemeton methyl 25 EC @ 2.0 ml/l at 10-15 days intervals if required. |
| Leaf Curl | i) Treat seeds -Imidacloprid 70 WS@ 5 ml/kg.; ii) Rogue out the infected plants; iii) Grow res. var -D-3-9,K 12,ML 26,RI 59,T-44. |
| Anthracnose | Hot water seed treat. at 58°C for 15 min. for seed-borne infection; ii) Spray the crop with 0.2% Zineb 80% WP @ 2 g/l or Ziram 80% WP @ 2 gm/lit. with first appearance of symptoms on the crop and repeat after 15 days (if necessary). |

Harvesting :

When pods are turned into black colour, two to three pickings are done. Pickings should be carried out only during morning hours. Threshing should be done in threshing yard and seeds are separated and cleaned.

Economics of Crop cultivation:

| Parameters | Rabi |
|---|---------------|
| Yield (Normal 2014-15 to 2018-19) | 4.83 qtls/ha |
| Gross income (at MSP 2020-21) | Rs. 34757/ha |
| Cost of Cultivation (CoC A ₂ +FL)* | Rs.19375 /ha |
| Cost of Production | Rs. 4011/qtls |

*CoC – Cost of Cultivation ; A₂ -Actual paid out cost ; FL- Imputed value of Family labour

| Major Insect Pest | Management |
|------------------------------------|---|
| White fly | i) Install Sticky trap ii) Intercrop with Cotton; iii) Grow maize, sorghum or pearl millet as a barrier crop to minimize the incidence of whiteflies. |
| Stem fly & Bihar Hairy Caterpillar | i) Crop rotation, earthing up, growing trap crop, destroying alternative hosts; ii) Spray either Imidacloprid 17.8 SL @ 0.2 ml/lit. or Thiomethoxam 25 WG @ 0.3gm/lit. at 15 days after sowing. & dusting with Fenvalerate 0.4% @ 15 kg/ha. |

Minimum Support Price: (Rs. per qtls)

| Crop | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
|----------|---------|---------|---------|---------|---------|---------|
| Mungbean | 4850* | 5225^ | 5575@ | 6975 | 7050 | 7196 |

*Included bonus of Rs. 200 per qtl ; ^Included bonus of Rs.425 per qtls; @Included bonus of Rs. 200 per qtls.



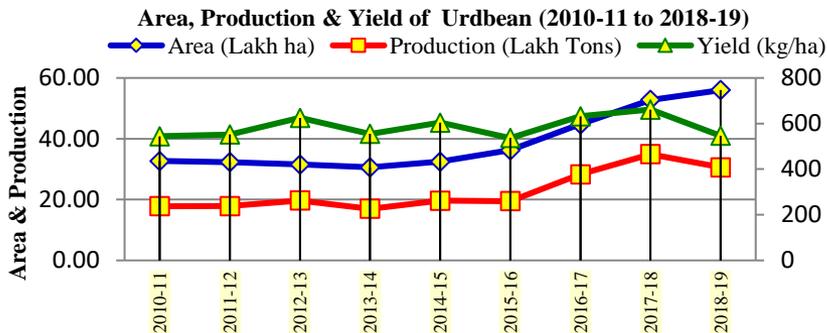
URDBEAN

Scientific Name:
Vigna Mungo (L.)

Area : 44.46 Lakh ha
Production: 26.58 Lakh tonnes
Yield: 598 kg/ha

(Avg. of 2014-15 to 2018-19)

Ever Highest Production –
35 Lt. (2017-18)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|------------|
| Madhya Pradesh | 14.65 | 33 | 8.62 | 32 | 589 |
| Andhra Pradesh | 3.98 | 9 | 3.44 | 13 | 863 |
| Uttar Pradesh | 6.01 | 14 | 3.08 | 12 | 512 |
| Tamil Nadu | 4.13 | 9 | 2.95 | 11 | 713 |
| Rajasthan | 5.13 | 12 | 2.86 | 11 | 558 |
| All Above | 33.91 | (76%) | 20.95 | (79%) | 618 |
| All India | 44.46 | | 26.58 | | 598 |

Economic importance:

- Black gram is one of the important pulse crop grown in all the 3 seasons such as kharif, rabi and summer and throughout India.
- Being deep rooted crop, helps in binding soil particles and thus prevents soil erosion.
- It fixes atmospheric N (42 kg/ha/year) to the soil through symbiosis and improves fertility of soil.

Major Districts : 2018-19

Except Tamil Nadu (2017-18)

| Major states | Major districts |
|-----------------------------|---|
| Madhya Pradesh (80%) | Sagar, Chattarpur, Damoh, Tikamgarh, Panna, Satna, Ashoknagar, Niwadi, Jabalpur, Shivpuri |
| Andhra Pradesh (96%) | Krishna, Guntur, Srikakulam, Kurnool, East 7 West Godavari, Prakasam, Vizianagaram |
| Uttar Pradesh (72%) | Lalitpur, Budaun, Unnao, Mahoba, Hardoi, Kanpur City, Jhansi, Hamirpur, Jaunpur, Sitapur, |
| Tamil Nadu (80%) | Villupuram, Cuddalore, Thanjavur, Thoothukudi, Thiruvavur, Nagapattinam, Tirunelveli, Thiruvannamalai |
| Rajasthan (90%) | Tonk, Kota, Baran, Sawai Madhopur, Bhilwara, Bundi, Ajmer, Jhalawar |

Crop Products:

- It is consumed in the form of dal (whole/split/husked/unhusked/parched).
- It is the chief constituent of papad and also of spiced balls – make a curry.
- Savoury Products, Sweets, Idli, Vada, Dosa.
- Used as a nutritive fodder specially for milch cattle, Green manuring crop.
- Urd grain contains 24% protein, 60% Carbohydrate, 1.3% fat and is the richest source of phosphoric acid among pulses (5-6% richer than others)

New Varieties:

| Year | Varieties | Year | Varieties |
|------|-------------------------------|------|---|
| 2009 | NUL7, LBG 752, CO 6 /COBG 653 | 2016 | LBG 787, Indira Urd Pratham, Tirupati Minumu-1 (TBG 104), PDKV Blackgold (AKU 10-1) |
| 2010 | LU 391, KUG 479 | 2017 | VBN 8, ADT 6, KKM-1 |
| 2011 | VBG 04-008, TU 40, VBN 6 | 2018 | Mulundra Urd 2 (KPU 405), Tripura Maskalai (TRC U 99-2) |
| 2012 | UH-1 | 2019 | VBN 10 (VBG 12-034), VBN 9 (VBG 12-111), Pant Urd 10 (PU 10-23), Pant U 7 (PU 10-16), Pant U 8 (PU 11-14), Pant U 9 (PU 11-25), IPU 13-1, IPU 10-26, IPU 11-02, GBG 1 (Ghantashal Minumu-1) |
| 2014 | DBGV-5, SBC 40, MDU1 | 2020 | VBN 10 (VBG 12-034), VBN 9 (VBG 12-111), KPU 12-1735 (Kota Urd 4), VBN 11 (VBG 12-062), OBG 33 (Shashi), KPU 524-65 (Kota Urd 3) |

Sowing Season: Kharif, Rabi and Spring/Summer (Zaid)
Sowing Time : **Kharif :** Last week of June to mid or 1st week of July.
Rabi: 2nd fortnight of Oct. To 2nd fortnight of November
Spring/Summer- 15th Feb. to 1st week of March
Sowing Method : **Manually :** Line Sowing , Broadcasting
Mechanical : Raised bed with the help of seed drill.
Spacing : **Kharif:** 45 cm X 10 cm ; **Rabi/Summer:** 30 cm X 15 cm
Seed Depth : 5-8 cm
Seed rate : **Kharif:** 12-15 kg/ha, **Rabi:** 18-20 kg/ha. (Upland);
40 kg / ha (Rice Fallow); **Summer :** 30-35 kg/ha.
Seed Treatment: Treat the seed 2 days before sowing.
Disease: Carbendazim @2.5 gm./kg.
Culture & Micronutrient : Rhizobium culture (5 gm/kg seed)

Soil type: Soils to heavy cotton soils .The most ideal soil is a well drained loam with pH of 4.7 to 7.5. Black gram cannot be grown on alkaline and saline soils.
Climate: Crop needs high temperature, less humidity and moderate rainfall of about 60-75 cm. Heavy rains during flowering are harmful.
Plant Nutrient Management: 15-20 kg N,40-50 kg P₂O₅, 30-40 kg K₂O at sowing time.
Sulphur : 20 kg/ha; **Manganese:** Seed soaking with 2% manganese sulphate or foliar spray of 1% manganese sulphate.; **Molybdenum:** 0.5 kg Sodium Molybdate/ ha as basal or two foliar sprays of 0.1% or seed treatment is recommended.
Weed Management : i) 1st- 20-25 DAD, 2nd – 45 DAS; ii) Pendimethalin @ 700 gm. a.i. per ha in 800 -1000 lit. of water a pre-planting spray;
Application of fertilized should be based on Soil Test Report.

Irrigation : **Kharif-** One irrigation at the time of Pod formation stage.
Spring/Summer- 1st (20-25 DAS) before flowering,
2nd (40-45 DAS) at pod filling stage.
Cropping System:
Rotation: i) Maize-Potato-Urd; ii) Maize-Toria-Urd; iii) Rice-Wheat-Urdbean; iv) Urdbean-mustard-mungbean/urd; v) Potato-wheat- urd
Intercropping: Kharif – Urd + Pigeonpea (1:1).
Spring – Urd+ Sugarcane (2:1), Urd+ Sunflower (2:6)
Seed Replacement rate :

Insect- Pest & Disease Management:

| Crop | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---------|-------|-------|-------|-------|-------|-------|
| Urdbean | 34.41 | 33.96 | 49.55 | 30.27 | 33.72 | 37.97 |

| Major Diseases | Management |
|---------------------|--|
| Yellow Mosaic Virus | i) Spray – Oxydemeton methyl 25 EC @ 2 ml/lit. at 10-15 days intervals. ii) Diseased plants should be rogued out; iii) Grow resistant var.-IPU94-1 (Uttara), Shekhar 3, Ujala (OBJ 17),VBN (Bg) 7, Pratap Urd 1. |
| Powdery Mildew | i) Spray -NSKE @ 50 g/liter of water or neem oil 3000 ppm @ 20 ml/lit; ii) Grow resistant var.- LBG 648, Prabha, IPU 02-43, AKU 15 .; iii) Adopt clean cultivation, crop rotation. |
| Leaf Blight | Basal application-zinc sulphate @ 25 kg/ha or neem cake @ 150 kg/ha or soil application P. fluorescens or T. viride @ 2.5 kg/ha + 50 kg of well decomposed FYM at the time of sowing. |

Harvesting :
Urd should be harvested when 70-80 % pods matured & most of the pods turn black. The clean seeds should be sun dried for 3-4 days to bring their moisture content at 8-10% to safely store in appropriate bins.

Economics of Crop cultivation:

| Parameters | Rabi |
|---|---------------|
| Yield (Normal 2014-15 to 2018-19) | 5.98 qtls/ha |
| Gross income (at MSP 2020-21) | Rs. 33309/ha |
| Cost of Cultivation (CoC A ₂ +FL)* | Rs.21033 /ha |
| Cost of Production | Rs. 3517/qtls |

| Major Insect Pest | Management |
|---------------------|---|
| Aphids | i) Spray with 5% crude neem extract or 2% neem oil 3000 ppm; ii) Spray with Imidacloprid 17.8 SL @ 0.2 ml/liter of water; iii) Conserve Coccinellid beetles, their grubs and Chrysoperla. |
| Tobacco Caterpillar | i) Foliar Spray of Novaluron 10 EC @ 0.75 ml/lit., chitin synthesis inhibitor against eggs of S. Litura; ii) Spray extract of custard apple as feeding deterrent against the pest. |

Minimum Support Price:

| Crop | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 | 2020-21 |
|---------|---------|---------|---------|---------|---------|---------|
| Urdbean | 4625* | 5000^ | 5400@ | 5600 | 5700 | 6000 |

*CoC – Cost of Cultivation ; A₂ -Actual paid out cost ; FL- Imputed value of Family labour

*Included bonus of Rs. 200 per qtl ; ^Included bonus of Rs.425 per qtls; @Included bonus of Rs. 200 per qtls.



LENTIL

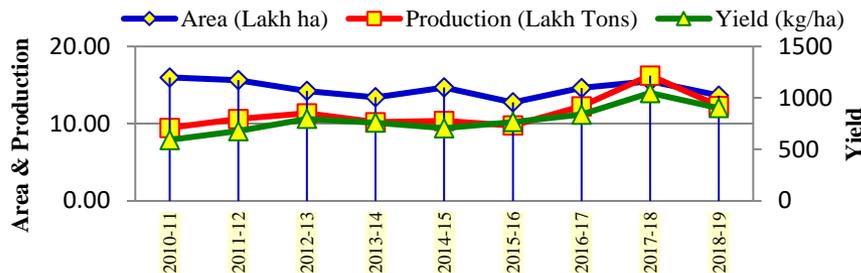
Scientific Name:
Lens culinaris

Area : 14.24 Lakh ha
Production: 12.17 Lakh tonnes
Yield: 855 kg/ha

(Avg. of 2014-15 to 2018-19)

**Ever Highest Production –
> 16 Lt. (2017-18)**

Area, Production & Yield of Lentil (2010-11 to 2018-19)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|------------|
| Madhya Pradesh | 5.41 | 38 | 4.53 | 37 | 837 |
| Uttar Pradesh | 4.44 | 31 | 3.66 | 30 | 824 |
| Bihar | 1.56 | 11 | 1.55 | 13 | 997 |
| West Bengal | 1.15 | 8 | 1.07 | 9 | 934 |
| Rajasthan | 0.49 | 3 | 0.47 | 4 | 966 |
| All Above | 13.05 | (92%) | 11.29 | (93%) | 865 |
| All India | 14.24 | | 12.17 | | 855 |

Major Districts : 2018-19

(Except West Bengal : 2016-17)

| Major states | Major districts |
|----------------------|--|
| Madhya Pradesh (78%) | Sagar, Rajgarh, Vidisha, Dindori, Rewa, Narsinghpur, Raisen, Shajapur, Mandla, Satna, Panna, Damoh, Anuppur, Seoni |
| Uttar Pradesh (65%) | Bahraich, Banda, Jhansi, Mahoba, Chitrakut, Balrampur, Jalaun, Hamirpur, Shahjahanpur, Sitapur, Ballia, Shravasti, Kheri |
| Bihar (76%) | Patna, Nalanda, Aurangabad, W. Champaran, Madhubani, Gaya, Jahanabad, E. Champaran, Bhabhua, Bhojpur, Arwal, Lakhisara |
| West Bengal (91%) | Nadia, Murshidasbad, Birbhum, North 24 Parganas, Malda |
| Rajasthan (99%) | Pratapgarh, Jhalawar, Bhilwara, Bundi, Tonk, Chittor, Nagaur |

Major Countries (Avg.: 2014 to 2018)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Country | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|--------------|--------------|-------------|
| Canada | 17.98 | 34 | 27.03 | 46 | 1503 |
| India | 15.92 | 30 | 11.50 | 20 | 722 |
| Turkey | 2.53 | 5 | 3.65 | 6 | 1441 |
| USA | 2.74 | 5 | 3.33 | 6 | 1218 |
| Nepal | 2.04 | 4 | 2.31 | 4 | 1131 |
| All Above | 41.21 | (79%) | 47.82 | (81%) | 1160 |
| World | 52.23 | | 58.84 | | 1127 |

Economic importance:

India ranked second in the area and production with 30% and 20% of world area and production respectively. Lentils are considered to remedy constipation and different intestinal afflictions. Seeds are also rich in protein, fibre, iron, calcium etc.

Crop Products: Split Dal

- Mainly consumed in whole/decorticated/split form as 'dal'.
- Dry leaves, husks, stems, broken pods are used as valuable cattle feed.
- Flour is used to make snacks, soups, stews, purees, and mixed with cereals to make bread and cakes; and as a food for infants.

New Varieties:

| Year | Varieties | Year | Varieties |
|------|--------------------------------------|------|--|
| 2011 | VL Masoor 133, VL Masoor-514 | 2016 | RLG-5 |
| 2012 | LL- 931 | 2017 | L 4717, RVL 11-6, PL-9 |
| 2013 | IPL- 316 | 2018 | RKL 607-1, RKL 14-20, L 4727 |
| 2014 | Raj Vijay Lentil -31, Azad Masur-1 | 2019 | IPL 321, IPL 315, RVL 13-5, RVL 13-7 |
| 2015 | KLB 2008-4 (Krati), KLS 09-3 (Krish) | 2020 | IPL 534, Kota Masoor 3 (RKL 605-03), L 4729, VL Masoor 148 |

Sowing Season: Rabi

Sowing Time : **Rainfed** -1st fortnight of Oct. in CZ and SZ and 2nd fortnight of Oct. in NZ

Late sowing - 1st week of Dec. in rice fallows of NEPZ.

Sowing Method : Flat Bed/Line sowing, Relay cropping with paddy

Spacing : Sowing should be done in rows 30 cm.

Seed Depth : 3-4 cm

Seed rate : **Small** – 35-40 kg/ha; **Bold** - 45-50 kg/ha;

Late – 45-50 kg/ha; **Utera cropping** - 60-70 kg/ha

Seed Treatment:

Fungicide: Hexaconazole @ 2 ml/kg seed.

Culture & Micronutrient: Rhizobium+PSB 1 packet each for 10 kg seed.

Irrigation : 1st - Branching (40-45 DAS); 2nd - Pod filling (80-85 DAS)

Cropping System:

Rotation – Paddy–lentil; Maize–lentil; Bajra–lentil; Cotton –lentil; Groundnut-Lentil; Kharif Fallow –Lentil (Rainfed areas)

Intercropping – Mustard , Linseed, Sugarcane (Autumn) with two rows of lentil at 30 cm row spacing in between two rows of sugarcane

Weed Management:

| Major Weeds | Management |
|---|--|
| Bathua, Gajri, Chatri, Matri, Senji, Ankari, Kateli, Jungli Pijji | Hand weeding /inter-culture : 1 st 25- 30 & 2 nd at 45-50 DAS; Pendimethalin 30 E.C@ 3-4 lit/ ha (Pre-em), Quazalophos@0.70 lit/ha(Post-em) |

Seed Replacement rate :

| Crop | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|--------|-------|-------|-------|-------|-------|-------|
| Lentil | 20.23 | 21.46 | 34.12 | 31.49 | 26.65 | 35.40 |

Harvesting :

Leaves begin to fall, stem and pod turn brown or straw in colour and seeds are hard and rattle with 15% moisture inside them.

Economics of Crop cultivation:

| Parameters | Rabi |
|---|---------------|
| Yield (Normal 2014-15 to 2018-19) | 8.55 qtls/ha |
| Gross income (at MSP 2019-20) | Rs. 41040/ha |
| Cost of Cultivation (CoC A ₂ +FL)* | Rs. 21042/ha |
| Cost of Production | Rs. 2461 qtls |

*CoC -Cost of Cultivation ; A₂ -Actual paid out cost; FL- Imputed value of Family labour.

Soil type: Well drained, loam soils with neutral reaction are best for lentil cultivation.

Climate: Lentil requires cold temperature during vegetative growth and warm at the time of maturity. Growth is optimum at 18-30°C. Very hardy and can tolerate frost and severe winter to a great extent.

Plant Nutrient Management: 20 kg N, 40 kg P₂O₅, 20 kg K₂O /ha in medium to low fertile soils as basal dressing.

Sulphur- In medium black soils and sandy loam soils - 20 kg S ha⁻¹ as basal. In red sandy loam soils - 40 kg S ha⁻¹. (This quantity is sufficient for one crop cycle).

Boron- In chickpea/ lentil grown in calcareous alluvial soils, apply 1.6 kg of B ha⁻¹ (16 kg borax/ 11 kg di-sodium tetra borate penta-hydrate) as basal to each crop.

Application of fertilized should be based on Soil Test Report

Insect-Pest & Disease Management:

| Major Diseases | Management |
|--------------------|---|
| Seedling Mortality | i) Delay planting until mid-November; Seed treat -Benomyl, a systemic fungicide@ 2.5 gm./kg. of seed. ii) Grow Resistant var.- Pant L-406. |
| Wilt | i) 3 yr. crop rotation; Seed treat with Benomyl @ 3 g/kg of seed; ii) Res. Var.- L-4076, Pant L4, Sapna, Pant L-406. |
| Stemphylium Blight | i) Affected plant trash should be burnt; ii) Spray the crop with Mancozeb 75 WP@ 0.2%. 2 spray at 15 days interval. |

| Major Insect Pest | Management |
|-------------------|---|
| Pod borer | i) Spray Neem extract (5%); ii) Spray Cypermethrin (0.02%) |
| Aphids | i) Follow crop rotation; ii) Spray Metasystox (0.04%)/ ha |

Threshing and Storage:

Dry for 4-7 days on threshing floor and threshed by manually or bullock/power drawn thresher after that sun dried for 3-4 days to bring their moisture content at 9-10%. Safely stored in bins & fumigated to protect them bruchids.

Minimum Support Price:

(Rs. per qtls)

| Crop | 2014-15 | 2015-16 | 2016-17 | 2017-18 | 2018-19 | 2019-20 |
|--------|---------|---------|---------|---------|---------|---------|
| Lentil | 3075 | 3325* | 3950^ | 4250@ | 4475 | 4800 |

*Included bonus of Rs. 75 per qtl ; ^Included bonus of Rs.150 per qtls; @Included bonus of Rs.100 per qtls.



FIELDPEA

Scientific Name:

Pisum sativum (L.)

Area : 8.74 Lakh ha

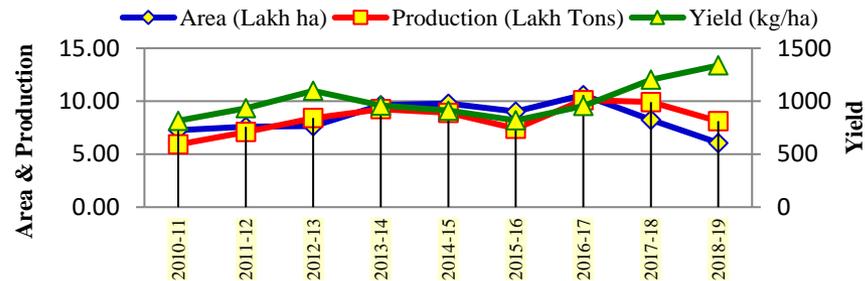
Production: 8.89 Lakh tonnes

Yield: 1018 kg/ha

(Avg. of 2014-15 to 2018-19)

**Ever Highest Production –
> 10 Lt. (2016-17)**

Area, Production & Yield of Fieldpea (2010-11 to 2018-19)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|-------------|--------------|-------------|--------------|-------------|
| Uttar Pradesh | 3.43 | 39 | 3.98 | 45 | 1161 |
| Madhya Pradesh | 3.30 | 38 | 2.72 | 31 | 825 |
| Jharkhand | 0.47 | 5 | 0.54 | 6 | 1141 |
| Rajasthan | 0.13 | 1 | 0.26 | 3 | 2061 |
| Assam | 0.27 | 3 | 0.25 | 3 | 922 |
| All Above | 7.59 | (87%) | 7.75 | (87%) | 1020 |
| All India | 8.74 | | 8.89 | | 1018 |

Major Districts (2018-19)

| Major states | Major districts |
|----------------------|---|
| Uttar Pradesh (75%) | Jalaun, Jhansi, Lalitpur, Mahoba, Hamirpur, Kashganj, Azamgarh, Sultanpur, Jaunpur, Amethi, Mirzpur, Pratapgarh |
| Madhya Pradesh (71%) | Jabalpur, Mandla, Datia, Narsinghpur, Dindori, Satna, Seoni, Vidisha, Raisen, Sidhi, Rajgarh, Chattarpur, Gwalior |
| Jharkhand (70%) | Ranchi, Gumla, E. Singhbhum, Chatra, Simdega, Garhwa, Lohardaga, Palamu, W. Singhbhum, Saraikela, Hazaribagh |
| Rajasthan (90%) | Jaipur, Nagaur, Bundi, Ajmer, Alwar, Sikar, Hanumangarh |
| Assam (51%) | Lakhimpur, Sonitpur, Jorhat, Nalbari, Darrang, Nagaon, Barpeta |

Major Countries (Avg.:- 2014 to 2018)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Country | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|--------------|---------------|--------------|-------------|
| Russian Fed. | 11.08 | 15 | 22.01 | 16 | 1987 |
| Canada | 15.70 | 21 | 39.08 | 29 | 2489 |
| China | 10.31 | 14 | 20.46 | 15 | 1985 |
| USA | 8.20 | 11 | 12.48 | 9 | 1521 |
| India | 5.53 | 7 | 8.86 | 6 | 1603 |
| All Above | 50.82 | (68%) | 102.89 | (75%) | 2025 |
| World | 74.40 | | 136.33 | | |

Economic importance:

- Pea is the third most important pulse crop at global level, after dry bean and chickpea and third most popular rabi pulse of India after chickpea and lentil.
- It provides a variety of vegetarian diet hence liked throughout the world.
- The mature seeds are used as whole or split into dal and put to use in various ways for human consumption.
- Beside vegetable purposes, it is also grown as a forage crop for cattle and cover crop to prevent soil erosion but mainly for matured seed for human consumption.

New Varieties:

| Year | Varieties | Year | Varieties |
|------|---|------|--------------------------------------|
| 2010 | Aman (IPF 5-19), Gomati (TRCP-8) | 2014 | IPFD 10-12, HFP 715 |
| 2011 | IPF 4-9, VL Matar 47 (VL47), Dantiwada Pea-1 (SKNP 04-09) | 2015 | Punjab-89 |
| 2012 | HFP-529, | 2018 | Pant Pea 243, IPFD 12-2, IPFD 2014-2 |

Sowing Season : Rabi

Sowing Time : 15th October to 15th November

Sowing Method : Line sowing with the help of seed drill or opening the furrows at 30-40 cm between the rows.

Spacing : Tall Varieties -30 X 45 cm; **Dwarf varieties** - 22 X 10 cm.

Seed Depth : 4-5 cm

Seed rate : Tall varieties -70-80 kg./ha; **Dwarf varieties** - 100 kg./ha.

Plant nutrient management: Apply 2.5-5 to biogas slurry/compost per ha, apply 60 kg P₂O₅ per ha. and 30 kg. Potash as basal dose in furrow bands based on soil test. In acid soils, rhizobium inoculated seed should be treated with 1.5 kg of finally powdered lime (CaCO₃, 300 mesh).

Irrigation : 1st - Branching (40-45 DAS); 2nd - Pod filling (80-85 DAS)

Cropping System:

Rotation – Maize –Pea; Paddy–Pea–Wheat–(being popular in Northern India); Cotton – Pea; Jowar–Pea; and Bajra–Pea.

Intercropping – It can be sown as intercrop with autumn sugarcane as two rows of pea at 30 cm row spacing in the centre of two sugarcane rows at 90 cm apart.

Weed Management:

-One weeding 30-45 DAS, depending upon the field conditions.

- Pre-emergence : Pendimethalin (STOMP) 30 EC @ 1 kg *a.i./ha* can also be used to control the weeds up to 50 days.

-Post Emergence- MCPB @ 1.2 kg *a.i./ha* in 500-600 liters of water after 6 weeks of sowing, is effective in sandy loam soils.

Seed Replacement rate :

| Crop | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------|-------|-------|-------|-------|-------|-------|
| Fieldpea | 21.76 | 28.48 | 36.12 | 34.09 | 29.97 | 30.23 |

Harvesting :

Leaves begin to fall, stem and pod turn brown or straw in brown colour and seeds are hard and rattle with 15% moisture inside them.

Threshing and Storage:

-Sun dried for 3-4 days to reduce their moisture up to 9-10% to be safely stored in appropriate bins.

- To avoid Bruchids and other storage pests, use fumigate before onset of monsoon and again after the monsoon with ALP @ 1-2 tablets per tonne.

-The small quantity of the produce can also be protected by mixing inert material (soft stone, lime, ash, etc) or by smearing edible/non-edible vegetable oils or by mixing plant products like neem leaf powder at the rate of 1-2% w/w basis.

Soil type: A well-drained loamy soils, free from excessive soluble salts with neutral pH range of 6.5 to 7.5 is suitable for successful cultivation of the crop.

Climate: Fieldpea requires cold temperature during vegetative growth time. Growth is optimum at 13-18°C. Frost can damage the plants during flowering stage. High humidity associated with cloudy weather results into spread of fungal diseases like damping-off and powdery mildews.

Application of fertilized should be based on Soil Test Report

| Major Diseases | Management |
|----------------|---|
| Rust | i) After harvest, the affected plants trash should be burnt. ii) Spray the crop with Mancozeb 75 WP at the rate of 2 kg. per hectare in 1000 lit. of water.;iii)Two to three sprays are sufficient. |
| Wilt | i) 3 yr. crop rotation; ii) Seed treat with Benomyl @ 3 g/kg of seed; iii) Drench the infected area with Carbendazim (0.5%); iv) Avoid early sowing in badly infested areas. |
| Powdery Mildew | i) Spraying with Karathon (0.05%) or wettable sulphur @ 3 gm/litre of water and repeat after 10-15 days, if necessary; ii) Adopt resistant var. Pant Pea-5, Malviya-15, JP-885, HUP-2 etc.; iii) Avoid late planting; iv) After harvest collect the plants left in the field and burn them. |

| Major Insect Pest | Management |
|-------------------|---|
| Pea Stem fly | i) Mix 30 kg. Carbofuran (Furadon) 3 % granules or 10 kg. Phorate (Thimet) 10% granules in the soils before sowing the crop.; ii) Avoid early planting.; iii) Apply 7.5 kg of phorate 10G or 25 kg of carbofuran 3 G per ha in furrows at the time of sowing. |
| Leaf Miner | i) Spray 250 ml. of Phosmidon 85 SL (Dimecron) or 1 lit. of Oxydemeton methyl (Metasystox) 20 E.C. in 1000 lit. of water per hectare when the attack begins and repeat at 15 days intervals. |
| Pea Aphids | i) Spray oxydemeton methyl (Metasystox) 25 E.C. in 1000 lit. of water per hectare; Repeat the spray after 10-12 days (if required). |

Economics of Crop cultivation:

| Parameters | Rabi |
|-----------------------------------|---------------|
| Yield (Normal 2014-15 to 2018-19) | 10.18 qtls/ha |

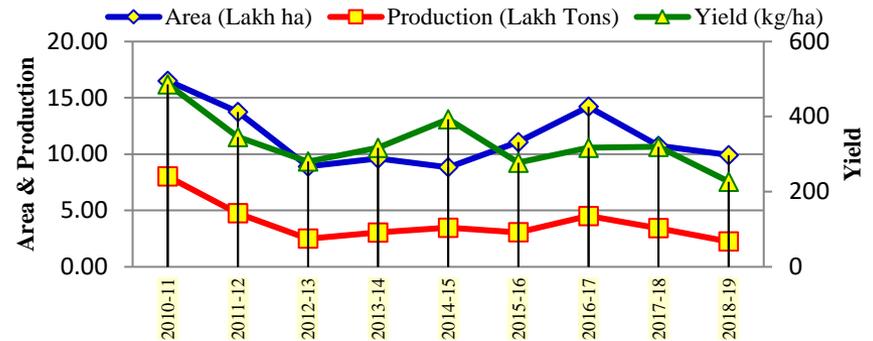
MOTHBEAN

Scientific Name:
Vigna acontifolia

Area : 10.95 Lakh ha
Production: 3.34 Lakh tonnes
Yield: 305 kg/ha
(Avg. of 2014-15 to 2018-19)
**Ever Highest Production –
8 Lt. (2010-11)**



Area, Production & Yield of Mothbean (2010-11 to 2018-19)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|--------------|---------------|-------------|---------------|------------|
| Rajasthan | 10.73 | 98 | 3.24 | 97 | 302 |
| Gujarat | 0.20 | 2 | 0.10 | 3 | 479 |
| All Above | 10.93 | (100%) | 3.34 | (100%) | 305 |
| All India | 10.95 | | 3.34 | | 305 |

Major Districts

| Major states | Year | Major districts |
|---------------------|---------|--|
| Rajasthan (100%) | 2018-19 | Bikaner, Churu, Nagaur, Jodhpur, Barmer, Hanumangarh, Jaisalmer |
| Gujarat (99%) | 2017-18 | Kutch, Ahmedabad, Banaskantha, Patan, Surendra Nagar, Surat, Mehsana, Bharuch, Bhavnagar, Rajkot, Vadodara, Kheda, Sabarkantha |

Economic importance:

This crop is rated as most economic and useful annual grain legume. This is probably due to genetic buffering embedded in this arid legume to quickly adjust and adapt to the fast fluctuating situations starved due to soil moisture depletion and nutritional deficiency.

Crop Products:

- Consumed as whole grains, sprouted form as well as dal in a variety of ways.
- Green pods are delicious source of vegetables
- Savoury products- Papad, Bhujia, Namkeen, Sprouts.
- Used as a source of food, feed, fodder, green manuring and green pasture.

New Varieties

| Year | Varieties |
|------|----------------------------------|
| 2002 | Maru Bahar (RMO-435), |
| 2003 | CAZRI Moth 2 |
| 2004 | RMO-423, RMB-25(RMO-2004), GMO-2 |
| 2005 | CAZRI Moth 3, |
| 2007 | RMO-257, TMV (Mb)1 |
| 2016 | RMO-2251 (I) |

State –wise recommended varieties:

| State | Varieties |
|-------------|---|
| Gujarat | GMO 1, GMO 2 |
| Rajasthan | RMO-257, RMO 435, RMO 2004 (RMB 25), RMO 225 Var.(Release Year) (1995), RMO 40 (1994), FMM -96 (1997) , Moth 880 (1989), Jwala (1985) |
| Maharashtra | Early Varieties of Rajasthan |
| Haryana | Early Varieties of Rajasthan |

Sowing Season: Kharif

Sowing Time : 2nd to 3rd week of July

(Delay in sowing may result in poor growth, poor germination, increased seedling mortality and incidence of pest and diseases and more conspicuously moisture stress at the flowering, the most critical stage.)

Spacing : 30-45 cm x 10-20 cm. **Seed Depth :** 2.5 – 4 cm.

Seed rate : **Grain-**10-15 kg/ha; **Mixed crop-** 4-5 kg/ha;

Fodder- 20-25 kg /ha

Seed Treatment: Carbendazin @2 gm / kg of seed.

After fungicide treatment seed inoculation.

Culture & Micronutrient : Rhizobium and PSB culture (5 -7 gm/kg seed)

Soil type: It is successfully grown sandy loam to black cotton soils having good drainage capacity.

Climate: It can tolerate high temperature without any adverse effect on flowering and fruit development. Optimum temperature requirement for growth and development is 25-37°C. Bulk of the cultivation is, confined to dry-lands of arid zone with 250-500 mm rainfall requirement with arrangement of proper drainage.

Plant Nutrient Management: 10-15 kg N,30-40 kg P₂O₅ /ha as a basal at sowing time.

Weed Management: One hand weeding at 30 DAS + pre plant incorporation of fluchloralin (Basalin) @ 0.5 to 1 kg a.i./ha effectively controlled the weeds in mothbean.

Application of fertilized should be based on Soil Test Report.

Irrigation : It is cultivated in dry land and rainfed condition but in long dry spell one irrigation should be given at pod formation stage.

Cropping System:

- Generally grown as single (mono) crop in a year mixed or as a sole crop. However, in a year of good rainfall, it can be rotated with mustard.
- Mixed cropping with pearl millet, cluster bean, cowpea, mung & sesame in risk prone areas during monsoon. Varieties recommended are RMO 40 & FMM 96 of mothbean and HHB 67 of Bajra.
- Inter cropping (2:1) - 2/3 rows of mothbean in between two rows of pearl millet.

Pest & Disease Management:

| Pest | Active Period | Incidence | Control Measures |
|----------------------------|------------------------------------|---------------------|--|
| Sucking Pest | | | |
| Jassids, White fly, Thrips | II week of Aug.- harvest | Regular | i) Early sowing; ii) Inter-cropping with Pearl Millet (1:4); iii) Application of Phorate or aldicarb @ 1.25 kg a.i. effective upto 4 week. |
| Aphid & mite, White grub | II week of Aug. to I week of Sept. | Sporadic minor pest | |

Harvesting /Threshing & Storage

Pods get mature and turn brown or yellowing of leaves. Estimated Post harvest losses are 9-10% during threshing transportation, processing and storage. Sun drying, heat treatment, and storage at low temperature with low moisture percentage in seeds (8-9%), is recommended.

Soil/Foliage Pest & Management :

Termite: Soil application- Phorate or aldicarb @ 1.25 a.i./ha before sowing.

Pulse beetle *calosobruchus chinensis*: i) Carry Seed moisture level below 10% before storing; ii) Fumigation; iii) Mixing/Smearing with neem leaves /cake & edible oils.

Yield: **Fodder** -12-25 qtls/ha; **Grain** - 3-8 qtls/ha.

| Name of Disease/ | Disease Symptoms | Control Measures |
|---------------------------------------|--|--|
| Anthracnose (Collectotrichum spp.) | Circular, black sunken spots with dark centres and bright red or orange margins on leaves and pods. In severe infection affected parts wither off. | i. Seed treatment with Carbendazin 2 gm/kg of seed. ii. Spraying the crop with Dithane M- 45 @ 2.5 gm/litre of water. |

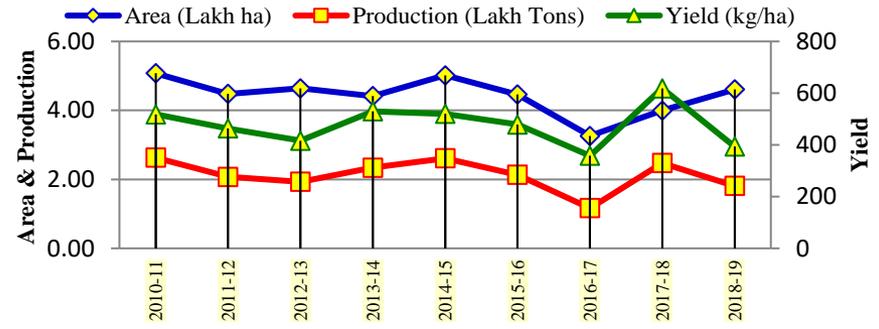


HORSEGRAM (KULTHI)

Scientific Name:
Macrotyloma Uniflorum

Area : 4.27 Lakh ha
Production: 2.04 Lakh tonnes
Yield: 478 kg/ha
(Avg. of 2014-15 to 2018-19)
Ever Highest Production –
2.63 Lt. (2010-11)

Area, Production & Yield of Kulthi (2010-11 to 2018-19)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|-------------|--------------|-------------|--------------|------------|
| Karnataka | 1.59 | 37 | 0.65 | 32 | 406 |
| Tamil Nadu | 0.69 | 16 | 0.45 | 22 | 650 |
| Andhra Pradesh | 0.53 | 12 | 0.21 | 10 | 395 |
| Chhattisgarh | 0.46 | 11 | 0.16 | 8 | 357 |
| Jharkhand | 0.23 | 5 | 0.16 | 8 | 703 |
| All Above | 3.50 | (82%) | 1.63 | (80%) | 466 |
| All India | 4.27 | | 2.04 | | 478 |

Major Districts (2018-19 Except Tamil Nadu-2017-18)

| Major states | Major districts |
|------------------|--|
| Karnataka (91%) | Chamarajanagar, Mysuru, Mandya, Tumakuru, Chikmagalur, Ramanagaram, Kolar, Haveri, Koppal, Chitradurga |
| Tamil Nadu (93%) | Krishnagiri, Dharmapuri, Vellore, Thiruvannamalai, Thiruppur, Salem, Karur, Dindigul, Coimbatore |
| A.P (98%) | Chittoor, Ananthapuram, Srikakulam, YSR Kadapa, Vizianagaram, Prakasam, Krishna |
| C.G (100%) | Rajnandgaon, Gariyaband, Janjgir, Bijapur |

Economic importance:

Horse gram is an important crop of south India. This crop is generally grown when the cultivator is unable to sow any other crop for want of timely rains and also grown in vacant space of citrus orchard. Horsegram is known as the cheapest source of vegetable protein.

Crop Products:

- Consumed as whole grains, sprouted form as well as dal in a variety of ways.
- Savoury products- Papad, Curry and whole meals.
- Used as a source of food, feed, fodder, green manuring.
- Medicinal Uses- Curing cough bronchitis, Kidney trouble, irregular periodicity of menstrual cycle.

New Varieties

| Year | Varieties |
|------|--|
| 2010 | VL gahat-19, Cridalatha (CRHG-4) |
| 2011 | Indira Kulthi 1 (IKGH-05-01) |
| 2012 | Gujarat (Dantiwada) Horsegram-1 (GRHG-5) |
| 2014 | Cridaharsha (CRHG-19) |
| 2016 | Pratap Kulthi-2 (AK-53), Cridavardhan (CRHG-22), SHG-0628-4, |
| 2017 | C.G kulthi-3 (BHG-03), Chhattisgarh Kulthi-2 (BHW-1) |

State –wise recommended varieties:

| State | Recommended varieties: |
|----------------|-----------------------------------|
| Rajasthan | KS-2, Pratap Kulthi (AK-42) |
| Andhra Pradesh | Palem-1, Palem-2, Paiyur-2, PHG-9 |
| Tamil Nadu | Paiyur-2 |
| Karnataka | PHG-9, GPM-6, CRIDA-1-18 R |
| Gujarat | Pratab Kulthi-1 (AK-42), GHG-5 |
| Uttarakhand | VL- Gahat-8, VL Gahat-10 |
| Chhattisgarh | Indira Kulthi-1, (IKGH01-01) |

Sowing Season: Kharif & Rabi
Sowing Time : **Grain-** Late August to November ;
Fodder- June-August

Spacing : Kharif : 40-45 cm ; Rabi: 25-30 cm.

Seed Depth : 1.5 to 2 cm

Seed rate :

Broadcast- 40 kg/ha for grain & Fodder.

Line Sowing- 20-30 kg/ha and about 5 cm plant to plant spacing.

Seed Treatment: 2 g/kg Bavistin or Trichoderma viridi 4g/kg seed.

Culture & Micronutrient : Rhizobium and PSB culture (5 -7 gm/kg seed).

Irrigation : Irrigation should be apply at before flowering and pod formation stage.

Soil type: The crop can be grown on wide range of soils from light to heavy soils which are free from alkalinity. Only 1-2 ploughings followed by planking provides desirable seed-bed.

Climate: Horsegram is extremely drought-resistant crop. Moderately warm, dry climatic conditions are suitable for its optimum growth. The temperature range of 25-30°C and relative humidity between 50 and 80% is optimum for its growth.

Plant Nutrient Management: 20 kg N,30 kg P₂O₅ /ha as a basal at sowing time.

Weed Management: Due to luxuriant growth an early weeding/hoeing is enough for weed. Application of Pendimethalin @ 0.75-1 kg a.i./ha as pre emergence application. After that, one hand weeding at 20-25 days after sowing.

Application of fertilized should be based on Soil Test Report.

Cropping System:

Crop is grown as pure crop as well as mixed crop with sorghum, pearl millet, pigeon pea, sesame or niger.

Harvesting /Threshing & Storage:

As usual with other kharif pulses of Vigna group, clean seed should be sun dried for 3-4 days to bring their moisture content at 9-10% to be safely stored in appropriate bins.

Storage :

Fumigate the storage material before onset of monsoon and again after the monsoon with ALP @ 1-2 tablets per tonne. The small quantity of the produce can also be protected by mixing inert material (soft stone, lime, ash, etc) or by smearing edible/non-edible vegetable oils or by mixing plant products like neem leaf powder at the rate of 1-2% wet-weight basis.

Yield: By adopting improved package of practices one can harvest 6-10 qtls of grain/ha depending upon the monsoon behaviour.

Insect-Pest Management:

| Insect-Pest | Control Measures |
|--------------------------------------|---|
| Aphids, Jassid | Spray of Oxydemeton methyl 25 @ 1 ml/liter. |
| Pod borer | Spray of NPV @ 250 LE/ha. or Quinolphos 25 EC @ 2 ml/liter water. |
| Yellow Mosaic Virus vector-white fly | i. Grown resistant varieties. ii. Destroy the infected plants. iii. Spray of Oxydemeton methyl 25 @ 2 ml/liter water and repeat after 15 days (if necessary). |

Disease Management:

| Disease | Control Measures |
|----------|--|
| Root rot | i) Seed treatment with Carbindazim 2gm/ kg of seed. ii) Avoid early sowing in infested areas. |

Recommendation to Achieved Higher Production:

- Deep summer ploughing once in 3 years.
- Seed treatment should be done before sowing.
- Application of fertilizer should be based on soil test value.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection.

LATHYRUS (KHESARI)

Scientific Name:
Lathyrus sativus L.

Area : **3.98 Lakh ha**

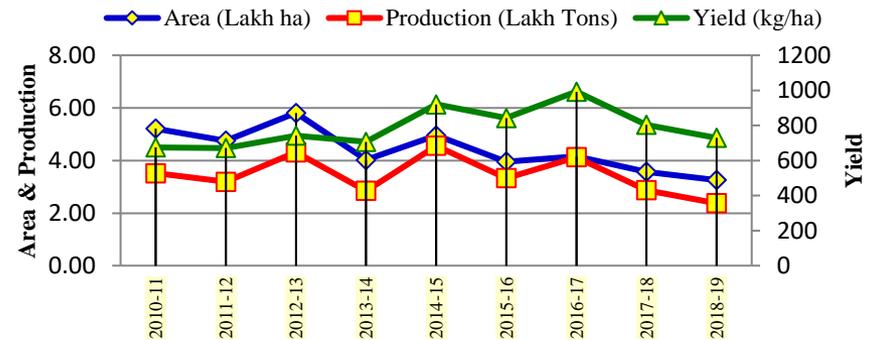
Production: **3.45 Lakh tonnes**

Yield: **868 kg/ha**

(Avg. of 2014-15 to 2018-19)

**Ever Highest Production –
4.56 Lt. (2014-15)**

Area, Production & Yield of Lathyrus (2010-11 to 2018-19)



Major States (Avg.: 2014-15 to 2018-19)

(Area in lakh ha; Production in lakh tonnes; Yield in kg/ha)

| Major states | Area | % Contri | Prod. | % Contri | Yield |
|------------------|-------------|--------------|-------------|---------------|------------|
| Chhattisgarh | 2.71 | 68 | 2.14 | 62 | 791 |
| West Bengal | 0.67 | 17 | 0.75 | 22 | 1127 |
| Bihar | 0.57 | 14 | 0.56 | 16 | 973 |
| All Above | 3.94 | (99%) | 3.45 | (100%) | 874 |
| All India | 3.98 | | 3.45 | | 868 |

Major Districts

| Major states | Year | Major districts |
|-----------------------|---------|---|
| Chhattisgarh (98%) | 2018-19 | Mungeli, Balod, Rajnandgaon, Dhamtari, Raipur, Bemetara, Balodabazar, Durg, Bilaspur, Kabirdham, Gariyaband |
| West Bengal (98%) | 2016-17 | Purba Medinipur, Murshidasbad, South & N 24 Parganas, Malda, Nadia, Birbhum, Paschim Medinipur, Howrah, Alipurduar, Coochbehar, |
| Bihar (95%) | 2017-18 | Aurangabad, Patna, Jahanabad, Bhojpur, Nalanda, Lakhisarai, Rohtash, Buxer, Shekhpura, E. Champaran, Nawada, Bhagalpur |

Economic importance:

Lathyrus is considered as drought-tolerant hardy crop, and is grown in low-rainfall regions under rainfed conditions.

The crop has unique tolerance ability against stress environmental conditions not only drought but also for water logging.

Lathyrus leaves about 36-48 kg/ha nitrogen economy for the succeeding cereal.

Crop Products:

- Consumed as whole grains, as well as dal in a variety of ways and Chappati.
- Green pods are delicious source of vegetables.
- Used as a source of food, feed, fodder.
- It contains 34% protein and other essential micro-nutrients and may provide nutritional security to the low income people in the society.

New Varieties

| Year | Varieties | Year | Varieties |
|------|--------------------|------|--------------------------------------|
| 1976 | Pusa-24 | 2008 | GNG-1581 |
| 1982 | Nirmal (B-1) | 2008 | Mahateora (RLS 4595) |
| 1997 | Ratan (Bio. L 212) | 2019 | Bidhan Khesari -1 BK-14 -1 (LAT15-6) |
| 2006 | Prateek | | |

Sowing Season: Rabi

Sowing Time : Crop is sown on residual soil moisture after harvest of kharif during last October to early November as pure crop. In utera cropping last week of September or first week of October.

Spacing : 30 cm x 10 cm.

Seed Depth : 2-3 cm

Seed rate : Broadcast- 70-80 kg/ha in Utera Farming

Line Sowing- 40-60 kg/ha

Seed Treatment: Seed must be inoculated with Rhizobium and PSB before sowing.

Soil type: It grows abundantly in loamy and deep black soils and produce excellent crop. For cultivation of lathyrus under utera system (relay cropping), no tillage is required. However, for planting after harvest of rice, one deep ploughing followed by cross harrowing and planking is necessary.

Climate: Being a winter season crop it prefers temperate climate with good adoption under climatic extremities.

Plant Nutrient Management: 100 kg DAP + 100 kg gypsum/ha applied as basal dose, 2-3 cm side and below the seed with the help of ferti-seed drill.

Weed Management: One hand-weeding at 30-35 days after sowing Weeds can also be managed effectively by spray of fluchloralin (Basalin) 35 EC @ 1 kg a.i./ha in 500-600 liters of water as pre-plant incorporation.

Application of fertilized should be based on Soil Test Report.

Irrigation : The crop is grown as rain fed crop on residual moisture. However, under high moisture stresses one irrigation at 60-70 days after sowing may be remunerative in terms of production.

Cropping System:

It is grown as single crop of the year in areas where water gets accumulated during rainy season or as a relay crop after paddy often as utera / paira crop in standing paddy, due to its ability to withstand in high moisture conditions at sowing time and moisture stress during growth period.

Harvesting /Threshing & Storage:

-When colour of pods change to brown and grains are at dough stage having approximately 15% moisture in-side them.

- Harvested produce after 3-4 days sun drying in the bundles and transferred to threshing floors.

- The clean seed should be sun dried for 3-4 days to reduce their moisture content up to 9-10%.

- The small quantity of the produce can also be protected by mixing inert material (soft stone, lime, ash, etc).

Yield: A well managed crop can easily give 8-10qtls/ha yields under direct sowing and 3-4 qtls under utera cultivation.

Insect-Pest & Disease Management:

| Name Insect-Pest/ Disease | Control Measures |
|---------------------------|--|
| Aphid | • Spray with Oxydemeton methy (Metasystox) 25 EC @ 1 ml/liter of water. |
| Rust | • Grow early maturing variety. • Seed Treatment with Agrosan GN @ 2.5 g/kg seed. • Spray the crop with Maneb, Zined or Ferbam @ 2.5 g/litre. |
| Downy Mildew | • Spray with Agrosan GN 0.25%) |
| Powdery Mildew | • Wettable Sulphur @ 3 gm/ litre of water. |

Recommendation to achieved higher production:

- Deep summer ploughing once in 3 years.
- Seed treatment should be done before sowing.
- Application of fertilizer should be based on soil test value.
- Foliar spray of 2% urea or 20 ppm Salicylic acid at flowering and pod formation stage increases the yield.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection.



RAJMASH

Scientific Name:
Phaseolus vulgaris L.

Nutritive Value:

| | | | |
|--------------|----------|-----------------|--------------------|
| Protein | 26-28% | Calcium | 260 mg/100g |
| Fat | 0.3-0.5% | Phosphorus | 410 mg/100g |
| Carbohydrate | 62-63% | Iron | 5.8 mg/100g |
| Fiber | 17-18% | Calorific value | 345-346 Kcal/100 g |

Crop Products:

- Consumed as Whole in Curry, Salad.
- Used as a source of food, feed, fodder.

Economic importance:

Rajmash, an important pulse crop, with high yielding ability as compared to gram and pea, require focussed attention both at the development and policy front. It is grown in **Maharashtra, H.P., U.P., J&K., and NE states** covering 80-85 thousand ha area. However, its cultivation during rabi and summer is also gaining popularity in northern Indian plains. Traditionally Rajmash is grown during kharif in Hills of Himalayas, however; high yield is attainable in Rabi in plains due to better management.

Sowing Season:

 Kharif, Rabi/Spring

Sowing Time : Kharif (Hills) - 1st week June to 1st week of July;
Rabi (Plains) - 2nd fortnight of October
Spring (Lower hills)- 2nd fortnight of March..

Spacing : Kharif (Hills) - 45-50 cm x 8-10 cm;
Rabi & Spring - 40 cm x 10 cm (irrigated)
30 cm x 10 cm (Rain fed)

Seed rate : 100-125 kg/ha

Soil type: Light loamy sand to heavy clay soil under adequate moisture.

New Varieties

| Year | Varieties |
|------|---|
| 2002 | IPR 96-4 (Amber) |
| 2003 | Kailash |
| 2004 | GR-1 |
| 2005 | IPR 98-5 (Utkarsh), Shalimar Rajmash-1 |
| 2007 | IPR 98-3-1 (Arun) |
| 2018 | RKR 1033 (Kota Rajmash 1), Shalimar Rajmash 2 (SKU-A-R13 2) |

State-wise Recommended Varieties:

| State | Recommended varieties |
|-------------|------------------------------|
| U.P. | HUR-137, Malviya Rajmash-137 |
| M.H. | Varun (ACPR-94040), HPR-35 |
| Bihar | IPR 96-4 (Amber) |
| Rajasthan | Ankur |
| Karnataka | Arka Anup |
| Gujrat | Gujrat Rajma-1 |
| Uttarakhand | VL Rajmash 125, VL Bean-2 |

Climate: The ideal temperature range for proper growth of this crop is 10-27°C. Above 30°C, the flower drop is a serious problem. It is highly sensitive to frost and water logging.

Plant Nutrient Management: Application of 90-120 kg N ha⁻¹ has been found optimum. Half of the nitrogen should be applied as basal during sowing and rest half as top dressing after first irrigation. Significant response to P application has been obtained up to a level of 60-80 kg P₂O₅ per ha.

Weed Management: One hand weeding/hoeing at 30-35 days after sowing or application of a pre-emergence herbicide like Pendimethalin @ 1 to 1.5 kg a.i./ha in 500-600 liters of water immediately after sowing helps to keep the losses by weeds below ETL (Economic Threshold Level).

Storage:

Storage material with ALP @ 1-2 tablets per tonne before onset of monsoon and again after the monsoon. The small quantity of the produce can also be protected by mixing inert material (soft stone, lime, ash, etc) or by smearing edible/non-edible vegetable oils or by mixing plant products like neem leaf powder at the rate of 1-2% w/w basis.

Yield: A well managed crop can easily give 20-25 qtls/ha yields under irrigated conditions of plain and 5-10 qtls/ha under rain fed conditions of hill with 40-50 qtls/ha of straw for cattle's.

Recommendation to achieved higher production:

- Deep summer ploughing once in 3 years.
- Seed treatment should be done before sowing.
- Application of fertilizer should be based on soil test value.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection.

Irrigation : Rajmash is the most irrigation responsive pulse crop due to its shallow root system and high nutrient requirements. It requires 2 to 3 irrigations in NEPZ and 3 to 4 irrigation in CZ for achieving highest productivity. Irrigation at 25 days after sowing is most critical followed by irrigation at 75 days after sowing.

Cropping System:

In hills, it is grown as intercrop with maize in 1:2 ratios. It is also grown mixed with maize and soybean.

In plains it is grown as spring season crop after harvesting of potato and mustard.

Harvesting /Threshing:

Full maturity judged by severe leaf fall, changing colour of pods and hardness of the grains. The clean seed should be sun dried for 3-4 days to bring their moisture content at 9-10%.

Insect-Pest Management:

Leaf Miner:

i) Spray of Cypermethrin 0.002% or Fenvalerate EC 0.04%/ha. ; ii) Roughing of infected plants. iii) Remove and destroy crop residues and all plant parts with symptoms of damage by bean flies.

Stem fly:

i) Soil application by Phorate G @ 1.0 kg. a.i./ha. ii) Mulch helps conserve moisture, promote adventitious root develop. & enhances tolerance to maggot damage; iii) Avoid planting beans near cowpea, soybean and many other leguminous crops, that may be the source of bean flies.

Disease Management

Anthraxnose :

i) Spray Mancozeb 0.25 % or Carbendazim 0.1 % of 2-3 foliar spray at 45, 60, 75 DAS; ii) Remove from the field and destroy crop debris after harvest.; iii) Practise a 2 to 3 year rotation; iv) Avoid overhead irrigation.

Stem Blight:

i) 2-3 Foliar spary of Benomyl @0.1 % starting at pre bloom or bloom stage; ii) Early or timely sowing.; iii) Planting in well drained soil; iv) Avoid dense planting.

Angular leaf spot:

Seed treated with carbendazim @2-3 g/Kg. of seeds. ;ii) 3 Foliar spray (0.1%) starting at the appearance (5-6 weeks after sowing) at 15 days interval; iii) Plough under bean debris after harvest.; iv) Practise a 2-3 year crop rotation without legumes.

COWPEA

Scientific Name:
Vigna anguiculata

Nutritive Value:

| | | | |
|----------------|---------------|-----------------|---------------------|
| Protein | 26-28% | Calcium | 0.08 – 0.11% |
| Dietary Fiber | 18.2% | Iron | 0.005% |
| Carbohydrate | 63-64% | Calorific value | 345-346 Kcal/100g |

Crop Products:

It is also known as Cowpea, black-eyed pea or southern pea etc. and has multiple uses like food, feed, forage, fodder, green manuring and vegetable.

Both the green and dried seeds are suitable for canning and boiling as well.

Economic importance:

- This crop is known as drought hardy nature, its wide and droopy leaves keeps soils and soil moisture conserved due to shading effect.
- Cowpea seed is a nutritious component in the human diet, and cheap livestock feed as well.

- In Indian context, it is a minor pulse cultivated mainly in arid and semi arid tracts of grown in pockets of **Punjab, Haryana, West UP along with considerable area in Rajasthan, Karnataka, Kerala, Tamil Nadu, Maharashtra and Gujarat.**

Varieties- Grain: C-152, Pusa Phalguni, Amba (V-16), Ramba (V240), Swarna (V-38), GC-3, Pusa Sampada (V-585),

Fodder: GFC 1, GFC 2, GFC 3 (Kharif), GFC-4 (Summer), Bundel Lobia-1, UPC-287, UPC-5286, Russian Giant, K-395, IGFRI-5450 (Kohinoor), C-88, UPC 5287, UPC-4200

Sowing Season: Kharif, Rabi & Summer

Sowing Time : Kharif - Early June to end of July

Rabi - October-November (southern India)

Summer- Grain : 2nd to 4th week of March;

Fodder: February; Hills: April-May;

Green manuring- Mid June to 1st week of July

Spacing : Row to Row - 30 (Bushing) to 45 cm (spreading),
Plant to Plant -10 (Bushing) to 15 cm (spreading)

Seed rate : Kharif & Rabi : 25-25 kg/ha (Grain)

30-35 kg/ha (Green Manure & Fodder)

Summer- 30 kg/ha (Grains)

40 kg/ha (Fodder & Green Manure)

New Varieties

| Year | Varieties |
|------|--|
| 2009 | Pant Lobia-1 |
| 2010 | Pant Lobia- 2, Hisar Cowpea 46 (HC 98-46) |
| 2014 | DCS 47-1 |
| 2015 | Pant Lobia-4 |
| 2016 | Pant lobia-3 , Phule Vithai (Phule CP-05040) |
| 2017 | Pant Lobia-5 , Phule Rakhumai PCP 0306-1 , TPTC 29 (Tirupati cowpea-1) , DC 15 |

State-wise Recommended Varieties:

Madhya Pradesh: V-240, UPC-622

Maharashtra : VCM-8

Gujarat : GC-2 , GC-3 , GC-4 , GC-5

Tamil Nadu: Vamban-1, Co-6, UPC-628

Karnataka : KBC-2, IT-38956-1, PKB-4, PKB-6, Co (CP)-7

Kerala : Subra , Hridya , Kankamony

Rajasthan : RC-101, RCP-27 (FTC-27), RC-19

Punjab : CL-367, UPC-622, VRCP-4 (Kashichand)

Uttarakhand: PL-1,2,3; UPC-622, Swarnaharita (IC285143), Kashi chandan

Haryana: Hisar cowpea 46 (HC 98-46)



Soil type: Well drained loam or slightly heavy soil are best suited. It can grow successfully in acidic soil but not in saline/alkaline soil.

Climate: Optimum temperature required for germination is 12-15 degree centigrade and for rest period 27-35 degree centigrade. It can grow under shade of tree but can not tolerate cold or frost.

Plant Nutrient Management: Apply FYM/compost- 5-10 t/ha as basal with last ploughing. 15-20 kg N/ ha as starter dose in poor soils (organic carbon<0.5%), 50-60 kg/ha P₂O₅ and 10-20 kg. K₂O/ha to promote growth and to mitigate the impact of water stress in plants when subjected to sub optimal soil stress.

Weed Management: One hand weeding at 20-30 DAS. Chemically, weed can be controlled by pre-planting spray of Basalin @ 1 kg a.i./ha as pre emergence in 800-900 litres of water. Application of Pendimethaline @ 0.75 kg.a.i./ha combined with one hand weeding at 35 DAS resulted in two fold increase in marginal benefit cost ratio and highest weed control efficiency.

Storage:

Storage material with ALP @ 1-2 tablets per tonne before onset of monsoon and again after the monsoon. The small quantity of the produce can also be protected by mixing inert material (soft stone, lime, ash, etc) or by smearing edible/non-edible vegetable oils or by mixing plant products like neem leaf powder at the rate of 1-2% w/w basis.

Yield: A good crop of cowpea yields about 12-15 qtls. of grain and 50-60 qtls.of straw per hectare. If the crop is raised for fodder purpose 250-350 qtls. of green fodder is obtained per hectare.

Recommendation to achieved higher production:

- Deep summer ploughing once in 3 years.
- Seed treatment should be done before sowing.
- Application of fertilizer should be based on soil test value.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection.

Irrigation : Generally, crop required 5-6 irrigation depending on soil, prevailing weather conditions etc, at an interval of 10-15 days. The response to irrigation is in order of flowering> pod filling>vegetative. Crop can tolerate flooding upto 2 days at flowering and pod setting thereafter, a marked decrease in yield and its attribute.

Cropping System:

| Grain/vegetables | Fodder |
|--------------------------|---------------------------------------|
| Cowpea-Wheat-Mung/Cheena | Sorghum+Cowpea-Berseem-Maize+Cowpea |
| Cowpea-Potato-urd/bean | Maize-Berseem/Oat- Maize+cowpea |
| Maize/Rice-Wheat-Cowpea | Sudangrass-Berseem/Oat - Maize+cowpea |
| Maize-Toria-Wheat-Cowpea | Cowpea-Berseem-maize+cowpea |
| Rice-Mustard-Cowpea | |

Harvesting /Threshing:

For grains, the crop can be harvested in about 90-125 days after sowing when pods are fully matured. For fodder, the cutting of the crop depends upon the need and the stage of growth of the component crop sown with it. Generally it should be done 40-45 days after sowing.

Insect-Pest Management:

Cowpea pod borer:

i) Collect and destroy the eggs and young larvae; ii) The young caterpillar can be killed by dusting 2% methyl parathion @ 25-30 kg/ha; iii) Spray Cypermethrin (25 gm. a.i. /ha.) or Permethrin (200 gm a.i /ha.) is also effective; iv) Fix 3 feet stick in the field @10/ha bird parches to attract predatory birds.

Aphids:

i)Spray the crop with0.1 % Oxydemeton Methyl (Metasystox) or monocrotophos 36 EC; ii) Give basal application of Phorate (Thimet) 10% granule @ 10 Kg. Per hectare.

Disease Management

Bacterial Blight:

i) Grow resistant varieties; ii) Use healthy seed from disease free field; iii) In case of severe infection, crop may be sprayed with 0.2 % Blitox.

Cowpea Mosaic:

i) Use healthy seed from healthy crop; ii) For controlling aphids spray 0.1 % Oxydemeton methyl (Metasystox) or any other systemic fungicide.

Powdery mildew:

i) After harvest, collect the plants left in the field and burn them; ii) The disease can be controlled by spray of wettable sulphur like sulfex, Elosal or Hexasual @ 2-3 kg./hectare in 800-1000 lit. of water.



CLUSTERBEAN (GUAR)

Scientific Name:
Cyamopsis tetragonoloba (L.)

Health Benefits:

- Gaur beans have low Glycemic Index , hence good for diabetes.
- Gaur beans help make bone strong, better blood circulation & heart health.

Crop Products:

- Tender pods are used as vegetables which is high protein and fibre.
- All plant parts are used as nutritious fodder for animals.
- Natural polysachharide (Galactomannan Gum) found in seed endosperm is the chief product used in many industries as it acts as binder, stabilizer, thickener in food/pharmaceutical/textile /mining/ tobacco /Oil well drilling/ Industrial water treatment and paper industry etc.
- It is also used as green manure (40-50 kg/ha Nitrogen).
- N- Fixation (25-30 kg/ha) is done by guar.

Economic importance:

Among Pulse crops cluster bean has a special contribution. It is grown in Rajasthan, Gujarat, Haryana, Uttar Pradesh. In India Rajasthan stands first in terms of area and production of Cluster bean. The crop produces gum which is called guar gum and is exported in foreign countries. Its seeds contain protein-18% and Fibre-32 % and about 30-33 % gum in the endosperm.

Varieties

Vegetable: Pusa Navbharat, Pusa Sadabahar, Durga Bahar, Sharad Bahar, pusa Mausami, Goma Manjari.

Seed & Gum: HG-365, HG-563, HG 2-20, RCG-1066, RCG-1003

Fodder: HFG-119, HFG-156

Sowing Season: Kharif & Summer

Sowing Time : Kharif - Early June to end of July
Summer- February to March

Spacing : Row to Row- 45 cm (normal), 30 cm (single stem variety)

Plant to Plant- 15-20 cm distance

Seed Treatment: 2 gm Thiram and 1 gm Carbendazim /kg seed. Seeds can be treated 2-3 day before sowing. After fungicide seed treatment the seed is inoculated with suitable Rhizobium culture @ 5gm/kg seed.

Seed rate : 12-15 kg/ha

New Varieties

| Year | Varieties |
|------|---|
| 2001 | HG 563 |
| 2002 | RGC-1017 |
| 2005 | RGM 112, HG 867, GG 2 |
| 2006 | RGC-1038 , RGC 1031 (Gaur Kranti), RGC 1055, RGC 1066 |
| 2010 | HG 884, HG 2-20, HG 870 |
| 2011 | RCG 1033 (Gaur Kunjal) |

State-wise Recommended Varieties:

Andhra Pradesh : RGM-112, RGC -936, HG-563, HG-365

Gujarat : GC-1, GC-2

Haryana: HG-75, HG-182, HG-258, HG-365, HG-563, HG-870, HG-884, HG-867, HG-2-20

Madhya Pradesh : HG-365, HG-563

Maharashtra : HG-365, HG-563, RCG-936

Rajasthan: RCG- 1033, RCG-1066, RCG-1055, RCG-1038, RCG-1003, RCG-1002, RCG-986, RGM-112, RCG-197

Uttar Pradesh: HG-563, HG-365

Soil type: Medium to light textured, well drained soil with a pH of 7.0 to 8.5 is best for cluster bean.

Climate: Cluster bean is a tropical plant. It requires warm growing season. The crop requires 30°C to 35°C temperatures at the sowing time for proper germination and 32°C to 38°C temperatures encourages good vegetative growth, but high temperature at flowering stage photosensitive and indeterminate crop.

Weed Management : Two manual weeding given at 20-25 and 40-45 days after sowing. Before germination of the crop application of Pendimethalin 0.75 kg/ha a.i. as pre emergence and for post emergence application Imazethapyr 40 gm/ha a.i. in 600 litres of water is applied at 20-25 DAS. Wheel hoe and Hand Hoe is used for Inter Culture operation to reduce the expenditure. Flat Fan Nozzle should be used for spraying.

Intercropping : Cluster bean can be grown with Bajra.

Crop rotation : 1. Guar-Wheat; 2. Guar- Chickpea; 3. Guar- Mustard

Recommendation to achieved higher production:

- Deep summer ploughing once in 3 years.
- Seed treatment should be done before sowing.
- Application of fertilizer should be based on soil test value.
- Weed control should be done at right time.
- Adopt integrated approach for plant protection.

Plant Nutrient Management: Apply FYM/compost- 5-10 t/ha as basal with last ploughing. A fertilizer dose of 50:60:60 kg NPK/ha is recommended .Half N, full P & K are applied as basal dose and remaining N-25-30 days after that.

Irrigation : For good production of the crop one irrigation can be given at the time of flowering and pod formation if crop suffers moisture stress. Cluster bean cannot tolerate water logging condition therefore proper drainage is required in the field.

Harvesting /Threshing: For grain purpose crop, harvesting is done when leaves become dry and 50% pod turn brown & dry. After harvesting crop should be sun dried to bring down the moisture content of 8-9%. Threshing should be done by manually or by thresher separately. For fodder crop, crop cut when crop at flowering stage.

Yield: By adopting improved package of practices, crop can produce 10-15 q seed yield/ha. If crop grown for fodder purpose 250- 300 q green fodder/ha can be achieved.

Insect-Pest Management:

Sucking insect

Jassids, Aphids and White fly are sucking insect. For controlling these insect apply Imidacloprid @ 0.2 ml/liter or Dimethoate @ 1.7 ml/liter of water.

Termite: Termites damage plants by eating away root and stem, which cause poor plant stand.

Disease Management

Bacterial Blight:

i) Use resistant/tolerant varieties and certified seed; ii) Seed treatment with Streptocycline for that soak the seed in 200 ppm (0.2g/liter) solution of Streptocycline for 3 hours; iii) In standing crop spray of Copper oxychloride @2.5g/liter of water can be use for controlling disease.