

PIGEONPEA

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|----------------|-------------------------------------|
| Botanical Name | - <i>Cajanus cajan</i> (L.) Millsp. |
| Synonym | - Red gram, Tur, Arhar |
| Origin | - Africa |



Introduction

Pigeonpea (Arhar) commonly known as red gram or tur is a very old crop of this country. After gram, arhar is the second most important pulse crop in the country. It is mainly eaten in the form of split pulse as 'dal'. Seeds of arhar are also rich in iron, iodine, essential amino acids like lycine, threonine, cystine and arginine etc.

Crop Status

India ranked first in area and production in the world with 79.65% and 67.28% of world's acreage and production respectively. In productivity, Saint Vincent & Grenadines ranked first with 7926 kg/ha followed by Trinidad & Tobago and Malawi. The productivity of India was 587 kg/ha (*FAO Stat., 2014*).

During Twelfth Plan, the country's total area coverage and production of tur were 38.49 lakh hectares and 28.66 lakh tonnes respectively. More than 80% of tur production comes from 6 states of MS, MP, Karnataka, UP, Gujarat and Jharkhand. The state-wise trend shows that Maharashtra ranked Ist both in area and production (29.68% and 27.86%). Karnataka stand IInd for area (18.58%) and IIIrd in production (14.75%). Madhya Pradesh ranks IInd in production (15.87%). The highest yield has been recorded by Bihar (1695 kg/ha) followed by West Bengal (1450 kg/ha), Haryana (1100 kg/ha) and Gujrat (1082 kg/ha). The lowest yield has been observed in the state of A.P. (536 kg/ha) followed by C.G. (575 kg/ha) and Karnataka (591 kg/ha) (*DES, 2015-16*).

Nutritive value

| | | | |
|--------------|----------|-----------------|------------------|
| Protein | - 22.3 % | Calcium | - 73 mg/100 g |
| Fat | - 1.7 % | Phosphorus | - 304 mg/100 g |
| Minerals | - 3.5 % | Iron | - 5.8 mg/100 g |
| Fiber | - 1.5 % | Moisture | - 13.4% |
| Carbohydrate | - 57.6 % | Calorific value | - 335 Kcal/100 g |

State-wise recommended Varieties

| State | Varieties |
|----------------|---|
| Andhra Pradesh | Laxmi, LRG-41, LRG-38, WRG-27, WRG-53, Bahar, Pusa-9, NDA 1, WRG 65, Surya (MRG 1004) |
| Bihar | MA-6, Ajad, DA-11, IPA-203, Bahar, Pusa-9, Narendra Arhar-2 |
| Madhya Pradesh | JKM-189, TJT-501, JKM-7, TT-401, BSMR-175, ICPL-87119, BSMR-736 |
| Chhattisgarh | Rajiv Lochan, MA-3, ICPL-87119, Vipula, BSMR-853 |
| Gujarat | GT-100, GT-101, Banas, BDN-2, BSMR-853, AGT 2 |
| Haryana | Paras, Pusa-992, UPAS-120, AL-201, Manak, Pusa-855, PAU-881 |
| Karnataka | Vamban-3, CORG-9701, ICPL-84031, BRG-2, Maruti (ICP-8863), WRP-1, Asha (ICPL 87119), TS-3, KM 7 |

| | |
|---------------|---|
| Maharashtra | BDN-711, BSMR-736, AKT-8811, PKV Tara, Vipula, BDN-708, Asha, BSMR 175, Vaishali (BSMR 853) |
| Punjab | AL-201, PAU-881, Pusa-992, Upas-120 |
| Uttar Pradesh | Bahar, NDA-1, NDA-2, Amar, MA-6, MAL-13, IPA-203, UPAS 120 |
| Rajasthan | UPAS-120, PA-291, Pusa-992, Asha (ICPL-87119), VLA -1 |
| Tamil Nadu | Co-6, CORG-9701, Vamban-3, ICPL-151, Vamban 1, Vamban 2 |
| Jharkhand | Bahar, Asha, MA-3 |
| Uttarakhand | VLA-1, PA-291, UPAS 120 |

Source: Seednet GOI, Min. of Agri. & FW, & ICAR-IIPR, Kanpur

Potential Yield (FLD Result)

It is observed that in general average potential yield gap between FLD and farmer's local check yield is about 32%. The potential yield level could be obtained by adoption of improved package of practices.

| State | Varieties | | Yield kg/ha | | % Increased over Local |
|-----------------------|----------------|---------------------|-------------|---------------------|------------------------|
| | Improved | Farmers Local Check | Improved | Farmers Local Check | |
| Early Variety | | | | | |
| Haryana | H-82-1 (Paras) | - | 1127 | - | - |
| | Paras | Manak | 1387 | -1004 | 38.14 |
| Punjab | PPH-4 (Hybrid) | Local | 1400 | - | - |
| | AL-201 | - | 1344 | 1236 | 5.21 |
| | PAU-881 | - | 1512 | 1437 | 12.70 |
| Uttar pradesh | UPAS-120 | Local | 1295 | 817 | 46.8 |
| Odisha | UPAS-120 | Gokanpur | 337 | 173 | 94.8 |
| Tamil Nadu | COPH-2 | CO-5 | 850 | 610 | 39.3 |
| | VBN-2 | - | 894 | 791 | 13.2 |
| Madhya Pradesh | TJT-501 | Local | 1159 | 942 | 23.0 |
| Uttarakhand | PA-291 | Upas-120 | 1320 | 1034 | 27.6 |
| | VLA-1 | - | 1007 | 728 | 32.0 |
| Rajasthan | Pusa-992 | Local | 1333 | 1176 | 13.3 |
| | ICPL-88039 | - | 1445 | 1227 | 17.7 |
| | VLA-1 | - | 1286 | 826 | 55.6 |
| Gujarat | GT-101 | Local | 1827 | 1484 | 23.11 |
| Maharashtra | AKT-8811 | Local | 550 | 500 | 10.00 |
| Medium Variety | | | | | |
| Maharashtra | ICPL-87119 | Local | 1410 | 1060 | 33.0 |
| | (Asha) | - | 2185 | 1278 | 70.9 |
| | VSMR-583 | - | 1223 | 1039 | 17.70 |
| | PKV Tara | - | 1111 | 856 | 29.78 |
| | BSMR-736 | - | 1843 | 1552 | 18.75 |
| | Vipula | - | - | - | - |
| Chhattisgarh | ICPL-87119 | N-1481 | 514 | 407 | 26.3 |
| | (Asha) | - | 988 | 858 | 15.15 |
| | Rajiv Lochan | - | - | - | - |
| Bihar | BDN-853 | Local | 514 | 279 | 84.22 |
| Gujarat | ICPL -87119 | T-21 | 1762 | 1207 | 45.90 |

| | | | | | |
|---------------------|------------|--------|------|------|-------|
| | (Asha) | BDN-2 | 1400 | 887 | 57.80 |
| | JKM-7 | Local | 1085 | 924 | 17.42 |
| | Banas | - | 1209 | 1006 | 20.17 |
| | GT-101 | - | 1212 | 958 | 26.51 |
| | BSMR-853 | - | 1650 | 1236 | 33.49 |
| | BDN-2 | | | | |
| Madhya Pradesh | ICPL-87119 | Local | 1410 | 1060 | 33.0 |
| | (Asha) | - | 1350 | 1000 | 35.0 |
| | AKPG-4101 | BDN-2 | 1600 | 950 | 68.4 |
| | GT-100 | Local | 1256 | 836 | 56.2 |
| | JKM-189 | - | 1024 | 810 | 26.41 |
| | JA-4 | | 1442 | 1008 | 43.05 |
| Jharkhand | ICPL-87119 | Local | 1566 | 1000 | 56.60 |
| Tamil Nadu | VBN-2 | Local | 786 | 680 | 15.58 |
| Karnataka | ICPL-87119 | Local | 1465 | 1240 | 18.4 |
| | (Asha) | | | | |
| Andhra Pradesh | ICPL-87119 | Local | 1905 | 1452 | 31.1 |
| | (Asha) | - | 1214 | 964 | 25.93 |
| | WRG-27 | | | | |
| Late Variety | | | | | |
| Bihar | Pusa -9 | Sharad | 1791 | 1545 | 15.92 |
| | Bahar | Local | 1717 | 1446 | 18.74 |
| East Uttar Pradesh | Bahar | Local | 1995 | - | - |
| | Amar | - | 2168 | 1861 | 16.49 |
| | Aja | - | 2220 | 1847 | 20.19 |
| | MAL-13 | - | 1576 | 1082 | 45.65 |
| | NDA-1 | - | 1420 | 1110 | 27.92 |
| Rajasthan | NDA-1 | Local | 1895 | 1460 | 29.79 |
| Jharkhand | Bahar | Local | 1015 | 835 | 21.55 |

Source: ICAR-IIPR, Kanpur, Average of 2006-07 to 2012-13

Climate Requirement

Pigeonpea is predominantly a crop of tropical areas mainly cultivated in semi arid regions of India. Pigeonpea can be grown with a temperature ranging from 26⁰C to 30⁰C in the rainy season (June to October) and 17⁰C to 22⁰C in the post rainy (November to March) season. Pigeonpea is very sensitive to low radiation at pod development, therefore flowering during the monsoon and cloudy weather, leads to poor pod formation.

Soil type & Field Preparation

It is successfully grown in black cotton soils, well drained with a pH ranging from 7.0-8.5. Pigeonpea responds well to properly tilled and well drained seedbed. A deep ploughing with soil turning plough in fallow/waste lands, zero tillage sowing under intensive cropping system and Broad Bed Furrow/Ridge-furrow planting in low lying as well as intercropping areas is recommended. Raised Bed method of planting by dibbling at 2 inches depth with Row to Row distance 4 to 5 feet also 15 feet gap (2 pairs of Tur on bed) under intercropping of soybean under transplanting (Dharwad method/SPI), 5 X 3 and 3 X 1.5 feet spacing is recommended.

Sowing Time & Method

Early Maturing varieties- First fortnight of June; *Medium & Late Maturing Varieties*-Second fortnight of June. Line sowing by seed drill or desi plough or by dibbling on the ridge and beds, both are recommended as per the area.

Seed Rate & Spacing

The seeding rate of pigeon pea depends on the desired plant density for a genotype (early, medium or late), cropping system (pure crop, mixed crop, or inter crop), germination rate of seed and mass of seed.

Early Maturing Var. - 20-25 kg/ha (Row to Row-45-60 cm & Plant to Plant-10-15 cm)

Medium/Late Maturing Var.- 15-20 kg/ha (Row to Row- 60-75 & Plant to Plant-15-20 cm)

Seed Treatment

Fungicide: Thiram (2gm) + Carbendazim (1gm) or Thiram @ 3 gm or Tricoderma viridie 5-7g /kg of seed; *Culture*: Rhizobium and PSB culture 7-10 g /kg seed.

Method of Sowing

Three systems of sowings are practiced for pigeon pea. The common is flat sowing, the other methods are broadbed-furrow (BBF) for extra-early group and ridge-and-furrow for the late maturity group. Bund cultivation of pigeonpea in rice fallow areas have also been adopted in CG, MP and some rice fallow areas. The latter two methods are useful in fields with poor surface drainage and water logging. The raised beds or ridges also provide better aeration and nodulation in comparison to the flat sown crop. At ICRISAT a broad bed and furrow system is used for sowing extra-early genotypes, and ridges-and-furrows are used for medium and late duration genotypes.

Cropping system: The space between the rows could be profitably utilized by growing short duration crops such as urd, moong, cowpea, etc; *Important cropping systems* followed are:

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

Inter-cropping

Pigeonpea is commonly intercropped with a wide range of crops. In India, it was estimated that 80 - 90 % of the pigeonpea were intercropped:

- a) With cereals (sorghum, maize, pearl millet, finger millet and rain-fed rice).
- b) With legumes (groundnut, cowpea, mung bean, black gram, soybean).
- c) With long-season annuals (caster, cotton, sugarcane, and cassava).

Fertilizer and Manure application

The doses of fertilizers should be determined based on the results of soil test. All the fertilizers are drilled in furrows at a depth of 5 cm. and at the side of 5 cm. from seed. Apply 25-30 kg N, 40-50 kg P₂O₅, 30 kg K₂O per ha area as Basal dose at the time of sowing.

Secondary and Micro Nutrients

1. **Sulphur:** In medium black soils and sandy loam soils apply 20 kg S ha⁻¹ (equivalent to 154 kg gypsum/phospho-gypsum or 22 kg bentonite sulphur) as basal to each crop. If S deficiency is

diagnosed red sandy loam soils, apply 40 kg S ha⁻¹ (equivalent to 300 kg gypsum/phosphogypsum/or 44 kg bentonite sulphur) per hectare. This quantity is sufficient for one crop cycle.

2. **Zinc:** In sandy soil, apply 3 kg Zn ha⁻¹ (15 kg zinc sulphate hepta hydrate/ 9 kg zinc sulphate mono hydrate) as basal. If Zinc deficiency found in the standing crop can then spraying 5 kg Zinc sulphate + Lime 2.5 kg dissolved in 800-1000 liter water per hectare.
3. **Iron:** In light textured soils, foliar application of 0.5% FeSO₄ at 60, 90 and 120 DAS is recommended.

Irrigation and Drainage

Being a deep rooted crop, it can tolerate drought. But in case of prolonged drought there is need of three irrigation 1st at branching stage (30 DAS) 2nd one in flowering stage (70 DAS) and 3rd at the time of podding stage (110 DAS). A pre-requisite for the success of pigeonpea is proper drainage. Ridge planting is effective in areas where sub-surface drainage is poor. This provide enough aeration for the roots during the period of excess rainfall.

Weed control

The first 60 days is very critical and harmful for the arhar crop. Two mechanical weedings one at 20-25 days and another at 45-50 days after sowing but before flowering. The Pre-emergence application of Pendimethalin @ 0.75- 1 Kg a.i. per ha in 400-600 liter of water. Kills the germinating seedlings of weeds and keep the field weed free for the first 50 days. If weed found from long time use Fluchloralin 50 % EC (Basaline) 1 kg of a.i per ha in 800-1000 liter well incorporated in the soil before sowing or Alachlor 50 % EC (Laso) 2-2.5 kg a.i. per ha in 400-500 liter of water as pre-emergence.

Plant Protection Measures

Disease

The important diseases of Pigeon pea are Wilt, Sterility mosaic disease, Phytophthora blight, Alternaria blight, Powdery mildew. Symptoms of these disease and their suitable control measures are given below:

1. **Wilt**

Symptoms

Xylem gradually develops black streaks, dark purple bands appear on the stem surface plants extending upwards from the base. Main stem of such plants is split open, intensive blackening of the xylem can be seen. In humid weather, a pinkish mycelial growth is commonly observed the basal portions of the wilted plants. It may be seen in seedling, flowering & vegetative stage.



Control Measures

- i) Seed Treatment with Trichoderma viride @ 10 g/kg of seed or Thirum (2 gm) + Carbendazim (1gm)/kg of seed; ii) Soil application-T. viride-2.5 kg/ha + 50 kg of well decomposed FYM or sand at 30 days after sowing; iii) Mixed cropping with sorghum; iv) Uproot wilted plants; v) Avoid over or under watering plants; vi) Amendment of soil with oil cakes, appliances of trace elements such as boron, zinc and manganese and heavy dose of green leaf manure crops;

vii) Grow resistant varieties like Amar, Azad, Asha (IPCL-87119), Maruthi, C-11, BDN-1, BDN-2, NP-5, JKM-189, C-11, JKM-7, BSMR-853 & BSMR-736 etc.

2. Sterility mosaic disease

Symptoms: It is caused by mosaic virus & spread from plant to plant under field conditions through *Eriophyid* mite. Leaves become small and cluster near branch tips & reduced in size. Plants are pale green and bushy in appearance, without of flowers and pods. Diseased plants are usually in groups. It may be seen in Vegetative growth & Pre-flowers stage



Control Measures

i) Spray Fenazaquin 10 EC (Magister) @ 1 ml/liter of water on 45 and 60 DAS; ii) Rogue out the infected plants in the early stages of growth; iii) Crop rotation with non host crop like, tobacco, sorghum, pearl millet, cotton; iv) Grow resistant varieties like Pusa-885, Asha, Sharad (DA11), Narendra Arhar1, Bahar, BSMR-853, BSMR 736, Rajeev Lochan, BDN-708.

3. Phytophthora blight

Symptoms: Foliage blight symptoms are circular or irregular water soaked lesions on leaves. The lesions on stems and branches increases rapidly, girdles, cracks and dries the stem. Infected stem and branches break easily in the wind.



Control Measures

i) Seed treated with Metalaxyl 35 WS @3 g/ kg of seed; ii) Good drainage in the fields and the plants should be protected from stem injury; iii) Crop rotation should be followed; iv) Grow resistant varieties like ICPL 7916/ 12055/12114/12161, JKM-189, JA-4 etc.

4. Alternaria blight

Symptoms: Symptoms appear on all aerial part of plants are small, circular, necrotic spots that develop quickly, forming typical concentric rings. The spots are initially light brown and later turn dark brown. In severe infection, defoliation and drying of infected leaves, branches and flower buds.



Control Measures

i) Spray the crop with Mancozeb 75 WP @ 2 g/liter or Carbendazim 50 WP @ 1g/liter of water; ii) Cultivation of pigeonpea on ridges with proper drainage system and avoiding the sowing in heavy soil helpful in disease management; iii) Grow resistant varieties like DA- 2, MA 128-1, MA 128-2.

Insect-Pest

1. Pod borers

Nature of Damage

It is widely distributed and is the most injurious pest of early and medium maturing varieties. The larvae, after hatching, feed on tender leaves and twigs but a pod formation they puncture pods and feed on developing grains. It may be seen in vegetative & podding stage.



Control Measures

i) Use *H. armigera* pheromone trap @ 12/ha; ii) Spray the crop with Emamectin benzoate 5% SG @220 g/ha. or Indoxacarb 15.8% SC @333 ml/ha; iii) The caterpillar should be picked by hand after shaking the plants and destroyed in the early stages of attack.

2. Tur Pod fly

Nature of damage: Stripes can be seen on the surface of the affected grains, while the attacked pods are somewhat twisted or deformed. In case of severe damage, as many as 80 per cent pods and 60 per cent grains may be damaged.

Control Measures

i) Spraying Neem seed kernel extract (NSKE) 5 per cent at 50% flowering stage to manage the insect's populations; ii) Pest can be controlled by spraying the crop with Monocrotophos (Nuvacron) 36 SL 1 liter in 800-1000 litres of water per hectare.



3. Plume Moth

Nature of damage: The larvae damaged seeds as well cause flowers, buds and pods to drop. The caterpillar is greenish-brown in color and fringed with short hairs and spines. It also enters into the pod and feeds on developing grains.

Control Measures

i) Apply the Neem oil 2%; ii) Spray the crop with Azadirachtin 0.03 % WSP 2500-5000 g/ha or Emamectin benzoate 5% SG @ 220 g/ha or Indoxacarb 15.8% SC @ 333 ml/ha.



4. Pod-sucking bugs

Nature of damage: Damaged seeds become shriveled, and develop dark patches. Shedding of green pods.

Control Measures

i) Soil application of carbofuran 3G @ 15 kg/ha at sowing; ii) Spray the crop with HaNPV 3 x10¹² POB/ha in 0.1% teepol; ii) Immature bugs can be handpicked and destroyed; iii) The main natural enemies of bugs are egg parasitoids, ants and birds reported reduce feeding by green shield bugs; iv) Spraying with aromatic plants (e.g. gums, lantana, Neem-based pesticides).



Harvesting & Threshing

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.

Harvested plants should be left in the field for sun drying for 3-6 days depending on season. Threshing is done either by beating the pods with stick or using Pullman thresher. The proportion of seed to pods is generally 50-60%.

The clean seeds should be sun dried for 3-4 days to bring their moisture content at 9-10% to safely store in appropriate bins. To avoid further development of bruchids and other storage pests, it is recommended to 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% w/w basis.

Yield

With use of improved technology of agronomic practices pigeon pea may yield about 25-30 q/ha from irrigated condition and 15-20 q/ha from un-irrigated condition. (depending upon maturity group of variety and climate) and 50-60 q/ha of sticks for fuel, as well.

Recommendation to achieved higher production

- i) Deep summer ploughing once in 3 years.
 - ii) Application of fertilizer should be based on soil test value.
 - iii) Seed treatment should be done before sowing.
 - iv) Use wilt and Sterility Mosaic disease (SMD) resistant /tolerant varieties BSMR 736, 853, 846, ICPL 96053, BDN 2010, ICPL 43, 44, IPA 203, 204, 234 and IPH 09-5 as per suitability of region.(IIPR AICRP Pigeonpea).
 - v) Wilt resistant varieties VL Arhar -1, Vipula, JKM -189, G.T.-101, Pusa 991, Azad (K-91-25), BSMR-736, MA-6 etc.
 - vi) Use hybrid varieties PPH -4, ICPH-8, IPH 09-5, ICPH -2740 as per suitability of region.
 - vii) Weed control should be done at right time.
 - viii) Adopt integrated approach for plant protection.
- For technical information of crop production please contact to district KVK/ nearest KVK.
- To avail benefit from Centrally and State Government running schemes for crop production (ploughing, fertilizers, micronutrient, pesticide, irrigation equipment), agricultural implements, storage infrastructure etc., please contact to your DDA/SADO office.

For more information also visit

- M- kisan portal - <http://mkisan.gov.in>
- Farmers portal - <http://farmer.gov.in>
- Kisan Call Centre (KCC)-Toll Free No.-1800-180-1551
