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SCIENTIFIC AGRICULTURAL PRACTICES FOR INCREASE PRODUCTION OF PIGEON PEA

Popular Article

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ABSTRACT

Pigeon pea [*Cajanus cajan* (L.) Millsp.], known by several vernacular and trade names such as red gram, tuar, Angola pea, Congo pea, yellow dhal and oil dhal, is one of the major grain legume crops of the tropics and sub-tropics. Pigeon pea is rich in starch, protein, calcium, manganese, crude fiber, fat, trace elements, and minerals. It is a hardy plant that can grow at temperatures as low and drought condition. Stagnant production, soaring prices, and enhanced imports of pigeon pea (red gram) have been matter of concern to the prime stakeholders in India. Improved technologies and efficient use of farm inputs under the changing environmental conditions can make pigeon pea production sustainable and profitable.

Introduction

Pigeon pea [*Cajanus cajan* (L.) Millsp.] has been considered as second most important crop after chickpea. India has virtual monopoly in pigeon pea production accounting to 90 % of world's total production. In India, pigeonpea is grown in an area of 4.37 m ha, with a production of 2.65 m t and the average productivity is 655 kg ha^{-1}. More than 85 % area of pigeon pea is under rainfed. Indian Council of Medical Research recommends about 60 g/day/person but the average intake is only 31 g/day (NNMB, 2012). Protein availability in developing countries at present is about one third of its normal requirements and with ever growing human population; various nutritional development programs are facing a tough challenge to meet the targeted protein demand. Its soil rejuvenation qualities such as release of soil-bound phosphorous, fixation of atmospheric nitrogen, recycling of soil nutrients, and addition of organic matter and other nutrients make pigeon pea an ideal crop of sustainable agriculture in the tropical and sub-tropical regions of India.

In *kharif* season, those regions receive higher rainfall in initial month of monsoon onset. It is very difficult to manage the waterlogged condition for seeding of arhar crop, because almost sown crop become softy due to high marshy condition of beds. Its needs boosting up the pigeon pea production through new innovative techniques to come the real compensative figure of production. To meet the demand, pigeon pea productivity has to be increased by adoption of hybrid varieties and best agronomical practices in India.

Importance of Pigeonpea

Nutritional Composition of Dry seeds: Broadly, pigeon pea seed contains 85% cotyledons, 14% seed coat, and less than 1% embryo. Carbohydrates and proteins are major constituents of cotyledons, embryo, and seed coat. Quantitatively, the cotyledons (66.7%) and seed coat (58.7%) are rich in carbohydrates while protein (49.6%) constitutes a major portion of embryo.

Nutritional Composition of Immature Seeds: In general, green pigeon pea was better in phosphorus by 28.2%, potassium by 17.2%, zinc by 48.3%, copper by 20.9%, and iron by 14.7%. The *dal*, however, had 19.2% more calcium and 10.8% more manganese.

Nutritional Value of *Dal* (Split Peas): Carbohydrates (67%) and protein (22%) are main constituents of pigeon pea seeds. Hulse [19] reported that the seed

protein among cultivars ranged around 22%. The quality of protein is determined by its quantity and digestibility, and amino acid contents.

Forage: Pigeon pea makes an excellent, high-protein forage for livestock. Crude protein ranges from 28–36% (Phatak *et al*., 1993). Livestock may browse foliage, but damage to the branches may result, so continuous grazing should be avoided.

Ethnobotany: Woody stems have been used for thatched roofs, baskets, and charcoal (Allen and Allen, 1981). Floral decoctions have been used to treat bronchitis, coughs, and pneumonia. Some Chinese use the dried roots to evacuate intestinal worms, as an expectorant, sedative, and a remedy for wounds.

Best agronomical practices

Synonyms Name:

Congo pea, Angola pea, Dhal, Fio-fio, Gungo pea, No eye pea, Kadios, Tur Redgram and Arhar.

Origin:

The centre of origin is the eastern part of peninsular India, including the state of Orissa. From India it traveled to East Africa and West Africa. There was first encountered by Europeans, so it obtained the name Congo Pea.

Morphology

Pigeonpea: Plant is an erect shrub with considerable variation in height from 1- 4 metre. Mostly branching begins from 6th to 10th node *i.e.* from 15-25 cm above ground. The stem is ribbed, hairy with grooved and silky profuse branches.

Roots: Root System consists of a well developed central tap root with numerous secondary and lateral branches bearing nodules on them like other legumes.

Leaves: Leaves are trifoliate compound, spiral and pubescent with central leaflets longer than laterals. The leaflets are elliptical or oblong lanceolate, with the lower leaflets shorter than top ones.

Flower and pod: Flowers are bright yellow, sometimes with red flags or red to purple veins on the dorsal side. Inflorescence is axillary raceme often forming a terminal panicle. Pod length varies from 5-10 cm and width from 0.6 to 0.9 cm and colour variation from green to dark brown. Seeds are round or lens shaped, the colour of the seed coat varied dirty white to silver white, light brown to chestnut brown and dark mottled brown to pinkish black with yellow cotyledons.

Varieties:

ICPL - 87119 (Asha): variety is a suitable for pre *Rabi* season and resistance to wilt and Sterility mosaic. It matures in 180-200 days and yield is 18-20 q ha^{-1}.

ICPL - 87 (Pragati): variety is medium duration and takes a time 130-140 days for maturity and it is determinant and spreading type plant and yield is 15-17 q ha^{-1}.

ICPL - 151: Long duration variety and takes a time 150-170 days for maturity. It is a medium height plant and yield is 15-18 q ha^{-1}.

UPAS - 120: This is a medium tall variety and plants attain a good height at flowering. It matures in 130-140 days. Flowering continues for a long period. It contains numerous branches with a large number of pods. Its average yield is 15 q ha^{-1}.

Type 21: This is a late maturing variety and takes 150-160 days for maturity. It is tall growing with more branching habit. Its average yield is 17.5-20 q ha^{-1}.

Pusa 9: This is a late maturing variety and takes duration 210-248 days for maturity. It is an indeterminate type plant and yield is 22-26 q ha^{-1}.

Hybrid varieties

ICPH 8: This variety is release from ICRISAT and yield is 40 q ha^{-1}.

ICPH 2671: Seed Rate is 7.5 kg/ha and spacing is 3ft x 1 ft (90 x 30 cm). This is release from ICRISAT and yield potential is 2750 kg ha^{-1}.

ICPH 2740: Seed Rate is 2.5 kg/ha and spacing is 5.5 x 1 ft (165 x 30 cm). Yield of hybrid variety is 1250 kg ha^{-1}.

ICPH 3762: Seed Rate is 1.0 kg used per acre and spacing is 4ft x 1 ft (120 x 30 cm). Yield potential is 2625 kg ha^{-1}.

Recently hybrids, viz. PPH 4, CoPH 1, CoPH 2, AKPH 4101, AKPH2022 and ICPH 8, have been released, which have high yield potential.

Climatic Requirement

Pigeon pea is cultivated in wide range of climatic conditions in tropical and subtropical areas of India with a temperature for germination 30 - 35 ^{0}C, vegetative and branching 20 – 25 ^{0}C, Flowering & pod setting about 15-18 ^{0}C and Maturity- 35 - 40 ^{0}C which is the optimum for growth and development. Pigeonpea

can be grown well in areas where 500-1000 mm of rainfall. Pigeon pea is a short day plant with critical photoperiod of 13 hours. Low light intensity at pod formation is harmful.

Soil requirement

Pigeon pea can be grown in a wide range of soils which is sandy loam to clay loams, however is very prone to water logging, so select fields with good surface and internal drainage. Avoid areas where water tends to back up after irrigation and/or heavy rainfall it can be grown on soils with a pH range of 5.5 - 8.0 successfully. It cannot tolerate soil acidity owing to aluminium toxicity.

Cropping system and intercropping

Cropping system

- Pigeonpea-wheat
- Maize-*Rabi* Pigeonpea
- Pigeonpea – blackgram
- Pigeonpea- sugarcane

Intercropping

- Groundnut (TMV-2) + pigeonpea (ICPL-87) (7:1)
- Pigeon pea + pearlmillet (2:6/2:1)
- Pigeon pea + greengram/ blackgram (1:2)
- Pigeon pea + soybean (2:1)

Field preparation

Pigeon pea with its deep root system (>150 cm) can break hard pans in plough layer. In case of hard pan in the soil, sub-soiling is done. A clod and weed-free seed-bed for proper germination and establishment of seedlings. This is achieved by opening the soil through soil turning plough or disc harrow followed by the cross-harrowing or ploughing with desi plough on or before the onset of monsoon. Finally the seed-bed should be planked and leveled. Thorough levelling is essential for quick drainage and also to avoid water logging.

Seed rate

Long duration varieties: 8-10 kg ha^{-1}.

Short and medium duration varieties: 10-15 kg ha^{-1}.

Rabi season: 15-18 kg ha^{-1}.

Sowing method

Seed should be sown behind the plough or with the help of seed drill in rows. After germination, the seedlings are thinned to maintain an intra-row spacing of 15-20 cm. The optimum population thus varies from 60,000-1, 00,000 in *kharif* and 1.5-3.0 lakh ha^{-1} in *rabi*.

Spacing

Long and medium duration varieties: 75 × 30 cm

Short duration: 45 × 30 cm

Rain fed: 90 × 30 cm

Rabi season: 30 cm row.

Seed Treatment:

- Treat the seeds with Carbendazim or Thiram @ 2 g kg^{-1} of seed 24 hours before sowing (or) with talc formulation of *Trichoderma viride* @ 4 g kg^{-1} of seed (or) Pseudomonas fluorescens @ 10 g kg^{-1} seed.
- Fungicide treated seeds should be again treated with a bacterial culture. Treat with Rhizobial culture CRR6 @ 600 g ha^{-1} and 2000 g of Phosphobacteria with 25 kg of FYM and 25 kg of soil before sowing. There should be an interval of at least 24 hours after fungicidal treatment for giving the bacterial culture treatment.

Table 1. State wise sowing time

Growing state	Time of sowing
Andhra Pradesh	Kharif - 1st June to 31th July Rabi - 15th Sep. to 15th Oct
Gujarat	15th June (Sole Crop), Aug.(Relay Crop)
Haryana	Mid-May to mid-July
Karnataka	1st June to 30th July
Madhya Pradesh	10th June- 15th July
Chhattisgarh	25th June – 15th July
Maharashtra	June-July
Odisha	1st June- 15th July
Tamil Nadu	June 15th - Aug.15th and F Sep 15th - Oct 15th
Rajasthan	15th June to 15th July
Uttar Pradesh	10th June – 15th July
West Bengal	Mid May-mid July

Fertilizer requirement

Use of FYM @ 5-10 t ha^{-1} is common under irrigated and rainfed situation. Apply 25-30 kg N, 50-75 Kg P_2O_5, 30 kg K_2O and 20 kg S in one ha area as recommended dose. For correcting Zn deficiency, foliar spray of 0.5 kg $ZnSO_4$ with @ 0.25 kg lime or soil application of $ZnSO_4$ @ 25 kg ha^{-1} to one crop on Zn deficient soils is helpful to both the crop of pulse based cropping system. Mo deficiency can be corrected by applying sodium molybdate 1 kg ha^{-1} and for boron deficient soils foliar spray of B @ 1.0 – 1.5 kg ha^{-1} or

soil application of 4 kg borax. Spray 1.0% $FeSO_4$ to recoup crop from Fe deficiency.

*Note: Applied in the form of gypsum if single super phosphate (SSP) is not applied as a source of phosphorus

Spraying of diammonium phosphate or urea, NAA and salicylic acid

- Foliar Spray of NAA 40 mg l^{-1} and Salycylic acid 100 mg l^{-1} once at Pre-flowering and another at 15 days thereafter.
- Foliar Spray of DAP 20 g l^{-1} or urea 20 g l^{-1} once at flowering and another at 15 days thereafter.

Water management

Long duration pigeon pea with deep root system and flushes of flowering can withstand drought. The short duration cultivars, however, are grown with irrigation only. The critical stages for irrigation are branching, flowering and pod filling. The crop requires 20-25 cm water to produce a tonne of grain. In crop planted in June, one or two pre monsoon irrigations should be given as per requirement.

Weed management

The initial 7-8 weeks period of crop *i.e*. from sowing to branching stage is critical period of crop-weed competition in medium and long duration varieties. In short duration varieties initial 4-6 weeks after sowing is critical. Thus, it is important to keep the crop free from weeds during this period. Manual weeding at 25 and 45 DAS or application of herbicide immediately after sowing is useful for weed control. Pre-plant incorporation of fluchloralin @ 1 kg ha^{-1} and pre-emergence application of pendimethalin 1 kg ha^{-1} are effective in controlling weeds.

Harvesting

Early varieties are harvested in the month of November, whereas medium and late varieties in month of January-March. When more than 80% pods are mature, the plants are cut close to the ground and bundled. These are taken to threshing floor and staked upright, dried for a few days and shaken vigorously to separate pods. Threshed and cleaned produce seeds should be further sun dried to reduce the moisture content to 10-11%.

Yield

Irrigated – 20-25 qt ha^{-1}

Rainfed – 12-15 q ha^{-1}

Inter/Mixed cropping- 5 - 6 qt ha^{-1}

Conclusion

Best agronomic practices (BAPs) and their different components shown potential to excel under the climate changes, there is need to adopt the all the component of advocated technology as a unit not to choose few of them at will, which were leading to several complication soil health hazards and poor response of technology. Improved practices such as use of improved seeds, use of macro and micronutrients, organic manures, biofertilizers, excellent extension services and provides favourable market and support price to sustaining the pigeon pea based cropping system at longer period. Profitability intercropping system including vegetables, floriculture and medicinal plants need to be developed for pigeopea growing region and to provide improved post harvest technology to minimize the post-harvest losses and meet out the pulses crises during lean period.

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