Chronicle of Bioresource Management 2022, 6(3):084-088

Chronicle of Bioresource Management
An International E-magazine

September, 2022 *Popular Article*

Open Access

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Citation: Kumar et al., 2022. Super Early Pigeonpea- Scope and Opportunities in India. Chronicle of Bioresource Management 6(3), 084-088.

Data Availability Statement: Legal restrictions are imposed on the public sharing of raw data. However, authors have full right to transfer or share the data in raw form upon request subject to either meeting the conditions of the original consents and the original research study. Further, access of data needs to meet whether the user complies with the ethical and legal obligations as data controllers to allow for secondary use of the data outside of the original study.

Conflict of interests: The authors have declared that no conflict of interest exists.

Keywords:

Cropping systems, inter crops, super early, photo and thermo insensitive

Article History

Article ID: CBM125
Received on 16th September 2022
Received in revised form on 24th September 2022
Accepted in final form on 27th September 2022

Super Early Pigeonpea- Scope and Opportunities in India

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Abstract

Pigeonpea is a one of the oldest food crops to provide rich source of food proteins. It occupies an important place among pulses and has been rated the best as far as its biological value is concerned. It has been recommended for a balanced diet with cereals, especially to fill in the nutritional gap for proteins among the poorer section in developing economies that cannot afford a non-vegetarian diet. The available medium and long duration pigeonpea cultivars grown under rainfed conditions were experiencing terminal drought at flowering due to cessation of the south west monsoon in October leading to lower productivity in India. The photo and thermo sensitivity of existing pigeonpea cultivars is also another drawback restricting the horizontal expansion to different cropping systems in varied agro-ecologies. The scope of yield maximization in pigeonpea could be possible through cultivation of photo and thermo in-sensitive super early pigeonpea types.

1. Introduction

Pigeonpea (*Cajanus cajan* L.) is the sixth most important grain legume in the world and second most important pulse crop after chickpea in India. Globally, pigeonpea is cultivated in 5.61 M ha area and 90 % of world area of pigeonpea is present in India with net cultivated area of 4.54 M ha and produces 3.83 MT with an average productivity of 842 kg ha^{-1} in India. Karnataka, Maharashtra, Uttar Pradesh and Telangana account for India's 73.1 % of the area and 70.3 % of the production. The highest productivity of pigeonpea is 1836 kg ha^{-1} in Philippines (FAOSTAT, 2019). Inspite of highest area (>90 %) exists in India, the productivity is low as pigeonpea is seldom grown as sole crop and non availability of fast growing, short duration, high yielding photo and thermo insensitive pigeonpea cultivars. The stifle due to terminal drought stress in available medium and long duration pigeonpea cultivars grown under rainfed

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conditions is hindering productivity of pigeonpea in India. The Photo and thermo sensitivity of traditional pigeonpea cultivars exists are, restricting the expansion to different areas and cropping systems. Traditional cultivars of pigeonpea are of different duration types viz., early (120 to 140 days), Medium (140 to 160 days) and long duration (> 160 days). Among these types medium and long duration groups were mostly cultivated and they cannot fit in preceding or succeeding crop situations of rainfed ecology due to limited growing period. Super early pigeonpea varieties developed from ICRISAT are of 100 days duration with yield potential of 1.0 to 1.5 tonnes ha^{-1} (Vales et al., 2012). Yield maximization of super early pigeonpea and its cropping system depends on selection of suitable super early cultivar and its adaptability in the agro climatic zone. The super early maturing lines developed by ICRISAT *i.e.,* ICPL 11242 and ICPL 20325 comes under non determinant type (NDT) group and ICPL 20338 and ICPL 11253 under determinate type (DT) group are found promising.

2. Scope of the Super Early Pigeonpea

The earliness of these lines provides number of opportunities for inclusion in the cropping systems and lays path in the expansion to non-traditional area like rice fallow and Fallow -early *rabi* crops (Groundnut, Mustard, Chickpea etc.,). Being hardy and early, fits in rice fallows, wheat-pulses and sugarcane-pulses intercropping system using residual moisture for growth and development (Hingane et al., 2018). This can be a remunerative option in the pigeonpea-wheat cropping system and provide sufficient time to undertake the cultivation of wheat in the same field and intern contribute to reduce environmental degradation. This can be attractive option to grow the crop on stored soil moisture through Zero till or minimal tillage. The earliness enables the crop to escape diseases, drought and pod borer attack. Response of super early pigionpea with different microbial consortia for releasing crop nutrients to crop was observed (Parimal et al., 2022). The uniformity in pod maturity and attractive stature opens the prospect of completed mechanization in super early pigeonpea (Ranjani et al., 2018). Compatibility with machinery like rotary mulcher, multi crop shredder and slasher can be used to chaff the small stalks into small pieces. This ecologically friendly method helps to soil health through addition of organic matter (Ramanjaneyulu et al., 2021).

Table 1. Comparison of super early pigeonpea with the tradition varieties

Sl. No.	Particular	Super early lines	Traditional line
1.	Crop duration	110-120 days in Sothern Telangana Zone	130 -180 days
2.	Photo and thermo sensitivity	Minimal	Exists
3.	Sowing time	Year round	Kharif and early Rabi
4.	Spacing	30-45 cm x 10-15 cm	90-120 cm x 30-45 cm
5.	Plant density	148148 to 333333 ha^{-1}	18518 to 37037 ha^{-1}
6.	Seed rate	20 to 30 kg ha^{-1}	2-6 kg ha^{-1}
7.	High density sowing	Possible	Barely possible
8.	Moisture conservation	Can be on residual soil moisture in rice fallows	Can't be without irrigation
9.	Mechanization	Uniform maturity might be the positive scope for mechanical harvesting	Possible with some loss
10.	Residue management	Thin and small stalk residues are suitable for residue incorporation with least wastage	Hardy and big stalks generated and can't be incorporat.
11.	Pest and disease incidence	Earliness induces pest and disease escape in these cultivars.	Escape is not possible
12.	Test weight	7 g	9g
13.	Yield (kg ha^{-1})	700-900 kg ha^{-1}	800-1200 kg ha^{-1}
14.	Test weight	6 to 7g per 1000 seed weight	9 to 10g 1000 seed weight
15.	Terminal drought stress	Minimal due to earliness	Exists
16.	Intensification of cropping system under rainfed scenario	It is possible Ex: Super early pigeonpea – Chickpea in heavy black soils	Not possible due long duration of the cultivars

3. Suitability of SEP for Diverse Cropping Systems in India

The photo and thermo insensitive ability and super early duration of these pigeonpea line enables to sow in round the year by which inclusion in existing cropping system could be possible in rainfed and irrigated ecology.

4. Advantages

1. Conserving time and natural resources like land, water, time capital.

2. Suitability of super early pigeonpea inclusion in different cropping systems rainfed and irrigated scenario and this enable to intensification with diversified crops in cropping system.

3. Uniform pod maturity and thin stems enables to mechanized harvesting.

4. Seed to seed mechanization is possible with this crop.

5. Low climatic risks and No terminal drought stress as crop harvested in 110 days.

6. High density planting system with pneumatic planter and other machinery is possible.

7. Being legume improves the soil physical condition and nutrient availability through N fixation.

5. Constraints

1. Seed availability for larger arears.

2. Market acceptance of seed as it is smaller than the traditional cultivars.

3. Awareness among the farming community

6. How to Overcome

1. Large scale field trials and front-line demonstration

Table 2: Suitable zones and cropping systems for SEP in India

S. No.	Cropping system	Suitable agro ecologies
1.	Pigeonpea – Super early pigeonpea	Hot subhumid ecoregion with red and black soils and hot subhumid ecoregion with alluvium derived soils.
2.	Cotton – Super early pigeonpea	Hot arid ecoregion with red and black soils, hot semi-arid ecoregion with alluvium derived soils and hot semi-arid ecoregion with shallow and medium (dominant) black soils.
3.	Super early pigeonpea – Maize	Hot semi-arid ecoregion with medium and deep black soils, hot subhumid (dry) ecoregion with alluvium derived soils, Warm subhumid to humid with inclusion of per humid eco region with brown forest and podozolic soils and warm perhumid ecoregion with red and laterite soils.
4.	Super early pigeonpea – Groundnut	Hot arid ecoregion with red and black soils, Hot semi-arid ecoregion with red loamy soils and hot subhumid to semi-arid ecoregion with coastal alluvium derived soils.
5.	Paddy – Zero till super early pigeonpea	Hot subhumid to semi-arid ecoregion with coastal alluvium derived soils and Hot humid to per humid ecoregion with red, laterite and alluvium derived soils.
6.	Super early pigeonpea – Chickpea	Hot subhumid to semi-arid ecoregion with coastal alluvium derived soils.
7.	Paddy – Paddy –Super early pigeonpea	Hot subhumid to semi-arid ecoregion with coastal alluvium derived soils and Hot humid to per humid ecoregion with red, laterite and alluvium derived soils.
8.	Super early pigeonpea – Mustard	Hot subhumid (dry) ecoregion with alluvium-derived soils.
9.	Rice- Wheat – Super early pigeonpea	Hot subhumid (dry) ecoregion with alluvium-derived soils, Hot subhumid ecoregion with red and black soils, Hot subhumid ecoregion with red and yellow soils and Hot subhumid (moist) eco region with alluvium derived soils.
10.	Super early pigeonpea – Wheat	Cold arid ecoregion and shallow skeletal soils, Hot semi-arid ecoregion with alluvium-derived soils, Hot semi-arid ecoregion with medium and deep black soils, Hot subhumid (dry) ecoregion with alluvium-derived soils, Hot subhumid ecoregion with red and black soils and Hot subhumid (moist) eco region with alluvium derived soils.

Figure 1: Field view of super early pigeonpea

Figure 2: Plant view of super early pigeonpea

should be organized under supervision of agricultural institutions and department for wider acceptability.

2. Government should intervene and support marketing of produce.

3. Capacity building.

Figure 3: Pod of super early pigeonpea

7. Conclusion

There are clear chances for adaptability of super early pigeonpea without additional input resources under rainfed and irrigated ecosystems in India. The performance of super early pigeonpea under intercropping situation is yet to be identified for improving land utilization efficiency. Continuous tapping of the potential of high yielding extra super early lines under different cropping systems is required.

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