

Pigeonpea - A unique jewel in rainfed cropping systems

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Abstract: Pigeonpea is a crop for rainfed environments endowed with several features to thrive harsh climate. It adapts well in sole crop and inter cropped conditions (with cereals, millets, oils seeds and pulses) by enhancing the system productivity and net income to the small and marginal farmers across the globe. The range of maturity duration in the crop allows it to grow in diversified cropping systems and patterns in varied ecoregions of the world. Development of cytoplasmic male sterility based hybrids provided an opportunity for enhancing the yields under marginal environments. With recent interventions in addressing the photo sensitivity and maturity have led to evolving super early varieties with less than 100 days duration, provided a scope for horizontal expansion of the crop in different agro ecological systems.

Key words: cropping systems, pigeonpea, rainfed

Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp.) is an important legume crop of the semi-arid tropics of Asia and eastern and southern Africa. Due to its high protein (21% - 25%)

(5), it complements cereals for a balanced diet. Pigeonpea has multiple uses, its dry split pea used as dhal, green seeds and pods can be consumed as vegetable. This is ideal crop for sustainable agriculture as it fixes atmospheric nitrogen and releases bound phosphorous in the soil to available form. Because of its deep (3 m - 4 m) root system can thrive low moisture conditions and also helps to improve soil structural and physical properties. It also plays a greater role in control of soil erosion (1).

Crop duration

Pigeonpea landraces and cultivars have wide range for maturity duration from 90 days to 300 days. The crop can be classified in to eleven district maturity groups (Table 1) based on days to attain flowering and maturity (7). Temperature, photo and thermo period sensitivity greatly influence the specificity of adaptation of pigeonpea cultivars in different ecoregions of the

globe. This has given scope for the cultivation of the crop in early, medium and late maturing groups across the world. Agro ecological cropping patterns decide the sole crop/ inter cropped situations in pigeonpea. Majority of the area of the crop falls under medium duration (from 160 days to 180 days) and limited area under early (between 120 and 140 days) and long duration (> 210 days).

Cropping systems

Owing to variable climate (vagaries in rainfall pattern and distribution) in rain-fed situations (6), pigeonpea has become a crop of minimum assurance to the small holder farmers of subsistence agriculture. It is an integral component of various rainfed cropping situations and the system productivity under inter-cropping provides assured income to the farmers. The unique cropping systems of pigeonpea are briefly presented in the next paragraphs.

Table 1. Major pigeonpea maturity groups, ICRIAT, Patancheru, Telangana, India

Maturity group	Maturity classification	Days to 50% flowering	Reference cultivars
00	Super-early	< 50	MN5
0	Extra-short	51-60	ICPL 88039
I	Extra-short	61-70	Prabhat
II	Short	71-80	UPAS 120 and ICPL 87
III	Short	81-90	Pusa Ageti and T 21
IV	Short	91-100	ICP 6
V	Short-medium	101-110	BDN 1 and Maruti
VI	Medium	111-130	Asha
VII	Medium	131-140	ICP 7035
VIII	Medium-long	141-160	ICP 7065 and Bahar
IX	Long	> 160	NP (WR) 15 and MAL 13

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Figure 1. Pigeonpea + soybean followed by wheat (after harvesting soybean rows)



Figure 2. Cotton + pigeonpea intercropping system (10:1 ratio)



Figure 3. Super early pigeonpea

1) *Sole crop*. About 20% of farmers prefer sole crop of pigeonpea particularly in sandy loams and medium to heavy clay soils. Under intensive cultivation with better adoption of integrated crop management technologies farmers are realizing 2 t ha⁻¹ to 2.5 t ha⁻¹. This system also created avenues for innovative interventions like transplanting (with drip irrigation) by which the full exploitation of genetic yield potential (up to 4 t ha⁻¹) of the varieties and hybrids was achieved.

2) *Intercropping*. Majority of the area of pigeonpea falls under this category where in sorghum (*Sorghum bicolor* (L.) Moench), maize (*Zea mays* L.), cotton (*Gossypium hirsutum* L.), soybean (*Glycine max* (L.) Merr.), sunflower (*Helianthus annuus* L.), castor (*Ricinus communis* L.) and other cultivated species are intercropped (Fig. 1 and Fig. 2). In rainfed areas of semi-arid tropics pigeonpea as integral component of the cropping systems provides farmers additional income from the unit land and it also serves as insurance by providing some income under vagaries of monsoon particularly drought. Pigeonpea synergizes well with majority of the crops by enhancing system productivity and cost benefit ratio in small and marginal farming situations.


3) *Pigeonpea-wheat rotation*. Development of early duration varieties which mature in 120 days (ICPL 88039) has given scope for pigeonpea followed by wheat cropping system in north western areas of India. It has led to replacement of cereal-cereal cropping system which is not environmentally sustainable in long run (4).

4) *Rice-fallows*. Development of super early varieties which mature in less than 100 days, has addressed the issue of photo and thermo period sensitivity and specificity of adaptation in the crop (Fig. 3). These super early varieties are day neutral and photo insensitive and can be grown in any part of the year. There is tremendous potential to explore the non-traditional areas and new niches like proceeding rice fallow situations for cultivation of pigeonpea. Efforts are in progress to develop suitable agronomic package under zero tillage conditions. Presently rice fallow areas are increasingly occupied by maize and sorghum crops. This is not long term soil sustainable system owing to nutrient mining from the cereal-cereal cropping.

5) *High-altitudes*. This is an opportunity for extending pigeonpea cultivation to new niches. Photo insensitive cultivars have shown adaptation to latitudes ranging from the equator (Kenya) to 46°N (Prosser, USA) and 45°S in New Zealand. Pigeonpea cultivars ICPLs 85010, 85030 and 83105 produced 1.5 t ha⁻¹ - 2.5 t ha⁻¹ grain yield at Prosser (3). In China also the medium-duration varieties like ICP 7035 and ICPL 87119 were exhibited better performance in slopes of the hills.

6) *Post-rainy pigeonpea*. The post-rainy season pigeonpea is more beneficial than is rainy season crop in the coastal areas of South India (2). The variety ICPL 85063 has been released for cultivation post-rainy season and this variety produced up to 3500 kg ha⁻¹ yield and farmers can intercrop with black gram (*Vigna mungo* (L.) Hepper), soybean or groundnut (*Arachis hypogaea* L.). Due to agronomic dwarfing post rainy season crop facilitates easy control of pests particularly *Helicoverpa armigera* Hübner. Under supplemental irrigation and modified package of practices post rainy yields are economical in the crop.

Summary

Pigeonpea crop is poor man's crop. Its versatility in adaptation, multiple uses ensures some income to farmer under harsh climate. The economics in inter-cropping with varieties/hybrids is risk free to farmers because income earned on pigeonpea is a bonus many times and in the event of failure of main crop this income is lifesaving to farmers. 

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