Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
www.phytojournal.com
JPP 2020; 9(6): 136-139
Received: 11-09-2020
Accepted: 12-10-2020

**Y Pavan Kumar Reddy**
Scientist, Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Ananthapuramu, Andhra Pradesh, India

**B Sahadeva Reddy**
Principal Scientist (Dryland Agriculture) & Head, Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Ananthapuramu, Andhra Pradesh, India

**A Malleswara Reddy**
Scientist, Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Ananthapuramu, Andhra Pradesh, India

**C Radha Kumari**
Senior Scientist, Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Ananthapuramu, Andhra Pradesh, India

**B Ravindranatha Reddy**
Associate Dean, Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Ananthapuramu, Andhra Pradesh, India

**Corresponding Author:**
**Y Pavan Kumar Reddy**
Scientist, Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Ananthapuramu, Andhra Pradesh, India

# Irrigation management in Pigeonpea under rainfed *Alfisols*

**Y Pavan Kumar Reddy, B Sahadeva Reddy, A Malleswara Reddy and C Radha Kumari and B Ravindranatha Reddy**

**DOI:** https://doi.org/10.22271/phyto.2020.v9.i6b.13435

**Abstract**
Pigeonpeais one of the major crops and grown in an area of 67,547 ha in drought prone Ananthapuramu district. However due usage of the long duration traditional Pigeonpea varieties and continuous failure of the NE monsoon coincides with the crop critical stages (Flower bud initiation, flowering, pod development in the district are the major drawbacks for the declined productivity. An attempt was done at Agricultural Research Station, Ananthapuramu on different options available for the irrigation to the pigeonpea crop during *kharif*,2016. Experimental results revealed that growth parameters like plant height and stem girth were higher with continuous irrigations whereas higher yield and yield attributing parameters were registered with flooding (irrigation at all five critical stages irrigations). Flood irrigation at 5 critical stages registered the highest additional net income of Rs 1,10,300 $ha^{-1}$ which was closely followed by Drip irrigation at flowering and pod development stages with an additional net income of Rs 94,100, However higher BC ratio (7.63) was obtained with Drip irrigation at flowering and pod development stages. Drip irrigation at Flowering and Pod development registered higher water use efficiency (3.68 kg $ha^{-1}mm^{-1}$) on mean basis.

**Keywords:** Irrigation management, Pigeonpea, rainfed *Alfisols*

## Introduction
Rainfed agriculture constitutes 55% of net sown area in the country, occupying a very predominant position in Indian agriculture. Out of the 67.19 lakh ha of cultivated area in Andhra Pradesh, rainfed agriculture constitutes 58.2%, i.e., occupied in 39.11 lakh ha area. The productivity of rainfed crops is always dictated by the quantity and pattern of rainfall received during the crop season. Farmer's livelihood is invariably linked with rain, particularly in drought-prone arid districts of Andhra Pradesh. Low and erratic rainfall causing consecutive droughts is the biggest challenge during the crop growth period leads to the moisture stress in the critical growth stages leads to the poor yields in the rainfed crops. Pigeonpea is one of the major crops was grown to an extent of 67,547 ha and cultivating across the length and breadth of Andhra Pradesh as a rainfed majorly as sole crop and intercrop. The area of sole crop in Ananthapuramu district was around 30000 ha (Crop Seasonal condition Report, 2016). Even under certain conditions it can be grown as a contingent crop too under delayed onset monsoon conditions. However, the rainfall is low, intensity is high, and causing prolonged dry spells during the crop growth period, thereby reducing the yields of rainfed pigeonpea. Pigeonpea sowing window opens in the first week of the June and withdraws by the first FN of the August in particular to the Ananthapuramu district as outlined herewith under.

**Table 1:** Sowing window of pigeonpea in Ananthapuramu district as a sole and Intercrop

| Date of sowing | Area in Hectares |
|---|---|
| 29-06-16 | 7,065 |
| 06-07-16 | 11,876 |
| 13-07-16 | 13,742 |
| 20-07-16 | 4,397 |
| 27-07-16 | 13,231 |
| Frist FN of August | 17,236 |
| Total | 67,547 |

The yields of the Pigeonpea are very dramatic and peculiar to rainfed areas based on the rainfall pattern and distribution and ranging the yields from 0 to 700 kg/ha.

Being a long day plant, it comes to flowering by the end of the October to the first week of the November where monsoon withdraws as the flowering initiates.

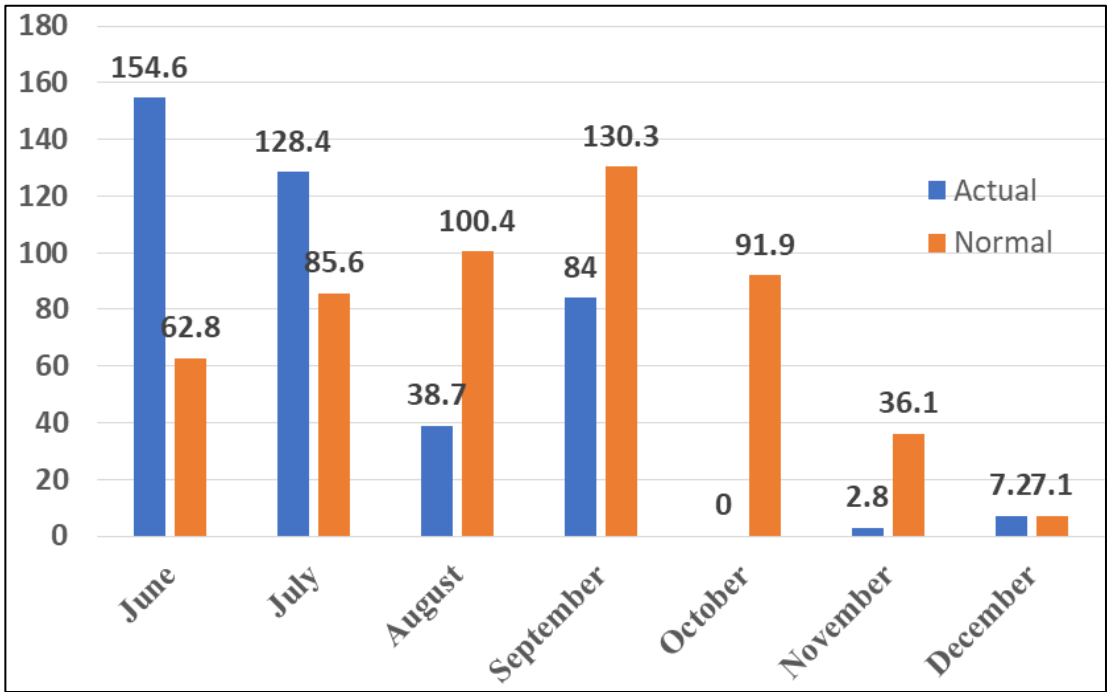
**Table 2:** Phenophase wise pigeonpea duration during *kharif*, 2016

| Phenophases | Date of Sowing | |
|---|---|---|
| | June 2nd FN sown crop | July 2nd FN sown crop |
| | Days | Days |
| Sowing - Emergence | 7-10 | 7-10 |
| Emergence- 50% Flowering | 133-142 | 120-127 |
| 50% Flowering - Pod initiation | 150-158 | 129-139 |
| Pod initiation - Seed formation | 157-167 | 145-152 |
| Seed formation - Maturity | 197-203 | 179-185 |

An attempt was done at Agricultural Research Station, Ananthapuramu on different options available for the irrigation to the pigeonpea crop during *kharif*, 2016 including the supplemental irrigation too. Supplemental irrigations at 50 days after sowing, flowering initiation and pod development higher the grain yields (Venkat rao *et al.*, 2016) [11]. To come out of this issue an attempt was made at Agricultural Research station to study the impact of the supplemental irrigation through raingun.

## Materials and Methods

Field experimentations were conducted at Agricultural Research station, Ananthapuramu research farm during the *kharif*, 2016 respectively. The site selected for the experimentation is sandy loam with slightly alkaline pH. During the*kharif*,2016 the annual rainfall during the crop season (From June to December) is 415.7mm with the monthly distribution 154.6mm, 128.4mm, 38.7mm, 84mm, 0mm, 2.8mm and 7.2mm from June to December respectively. The crop was sown with PRG-176 variety (medium duration- 160 days) on 21-07-2016 with the receipt of 17.2mm rainfall through tractor drawn Ananta Pigeonpea planter with 90 cm X 20 cm spacing. The crop was grown luxuriantly with the available soil moisture received by the succeeding rains after sowing with an objective to impose four different irrigation treatments in non-replicated as quoted herewith viz., continuously irrigated (12 irrigations of 50 mm each), flooding (irrigation at all critical stages of 5 irrigations of each 50mm in Toto), drip irrigation at flowering and pod development of 20 mm each and control treatment with no irrigation too. For the drip irrigation treatment pigeonpea entered the flowering stage in the first week of October with the severe moisture stress. The treatments viz., one and two supplemental irrigations were imposed with the 20 days intervals i.e., 15th October and 5th November with the respect to crop at flowering and Pod formation stages respectively. (No rain was received since 1st October to end of the crop expect on 1st November recorded 2.8mm). The source of the irrigation was through the farm pond water harvested during the runoff events noticed during the 11th (31.4mm) and 29th (25.4mm) September, 2016 for the supplemental irrigation through drip irrigation. Whereas flooding through the borewell water for the other treatments. The biometric and yield parameters were recorded to study the variations in the yield as tabulated in the tables 1,2,3 as enclosed here under.




Rainfall during crop growth period

## Results and Discussion

### Biometric Parameters

Different irrigation methods showed remarkable influence on growth. Higher values of growth parameters like plant height and stem girth were noted with continuous irrigations. Despite higher yield and yield attributes were noted with Flooding (irrigation at all 5 Critical stages irrigations. this might be due to continuous irrigations resulted in profound vegetative growth rather than attributing to yield. Facilitating soil moisture availability through need-based irrigation helped them to uptake more nutrients from the soil which resulted in higher yield and yield attributing parameters. Similar favourable effect of irrigation on yield components of pigeonpea was recorded by Basu and Bandyopadhyay (2009) [1]. Mahalakshmi *et al.* (2011) [4] reported that pigeonpea under drip irrigation with 0.8 Epan throughout the crop period recorded higher plant height (61.6 cm), LAI (2.04) and total dry matter production (3731 kg ha$^{-1}$) at harvest.

**Table 1:** Impact of different Irrigation methods on biometric parameters of Pigeonpea during *kharif*, 2016

| Treatments | Plant height (cm) | Stem girth (mm) | No of branches | No of pods/ plant | plant population / $m^2$ | Yield (Kg/ha) |
|---|---|---|---|---|---|---|
| Continuous irrigated -12 irrigations | 165.6 | 21.016 | 7.8 | 91.8 | 5 | 1910 |
| Flooding (irrigation at all Critical stages irrigations)- 05 | 152.2 | 19.74 | 11 | 288 | 5 | 3625 |
| Drip irrigation at Flowering and Pod development | 144.8 | 21.966 | 7 | 54 | 5 | 1805 |
| Control (No Irrigation) | 138.25 | 15.24 | 3 | 25 | 5 | 120 |

## Yield and Yield Attributes

A perusal of data presented in Table 2 revealed that flooding (irrigation at all five critical stages irrigations) resulted in enhancing redgram yield by 94.35% (3625kg $ha^{-1}$) over the crop grown continuous irrigated with 12 irrigations (1910 kg $ha^{-1}$). This might be due to fact that the moisture stress affects translocation of photosynthates from leaves to grain thus resulting in smaller grains a smaller number of pods and seeds which might have influenced in decreased grain yield. Moisture stress at critical crop growth stages results in pre mature closure of stomata to reduce water loss, might have caused in decreasing carbon dioxide diffusion in to leaves, there by affecting photosynthesis. Reddy *et.al.*, 2017 revealed that, application of 20mm at flowering and pod development stages through raingun enhances the yield advantage of 88% (619 kg/ha) over the control (60 kg/ha). Pramod (2007) [7] reported that seed yield of pigeonpea (16.51 q $ha^{-1}$) with two irrigations was significantly higher than one irrigation (14.33 q $ha^{-1}$) and control (10.96 q $ha^{-1}$) with protective irrigation under Raichur condition.

Irrigation treatments also influenced the water use efficiency. Drip irrigation at Flowering and Pod development registered higher water use efficiency (3.68 kg $ha^{-1}mm^{-1}$) on mean basis (Table 2). These findings indicate that the impact of supplemental irrigation is more pronounced on yield and contributed to higher WUE. The irrigation cycle under continuous irrigations and flooding consisted of a short period of infiltration followed by a long period of redistribution, evaporation and extraction of water by growing plants starting from field capacity moisture content down towards permanent wilting point. It was well documented that during this transition phase in soil moisture variation, it becomes increasingly difficult for the crop plants to extract water with every passing day since progressive decrease in soil-water content increases soil water tension. Suresh *et al.* (2013) [10] also registered higher WUE with increased level of irrigations in pigeonpea. Lowest water use efficiency was registered under non irrigated treatment. Raskar and Bhoi (2001) found 20 to 30 per cent increase in cane yield and 42 to 52 per cent total water savings with drip irrigation. The water use efficiency ranged from 1.017 to 1.403 t ha $cm^{-1}$ in drip irrigation compared to 0.48 to 0.60 t ha $cm^{-1}$ in surface method.

**Table 2:** Yield and Water Use Efficiency of different Irrigation methods on biometric parameters of Pigeonpea during *kharif*,2016

| Treatments | Yield (kg/ha) | % Yield Increase | WUE (RWUE+IWUE) |
|---|---|---|---|
| Continuous irrigated -12 irrigations | 1910 | 93.72 | 1.88 |
| Flooding (irrigation at all Critical stages irrigations)- 05 | 3625 | 94.35 | 3.20 |
| Drip irrigation at Flowering and Pod development | 1805 | 93.35 | 3.68 |
| Control (No Irrigation) | 120 | -- | 0.29 |

## Economics

Flood irrigation at 5 critical stages registered the highest additional net income of Rs 1,10,300 $ha^{-1}$ which was closely followed by drip irrigation at flowering and pod development stages registering an additional net income of Rs 94,100, However higher B:C ratio (7.63) was obtained with drip irrigation at flowering and pod development stages due to lower cost of cultivation than continuous irrigation and without irrigation. Pigeonpea also well respond to time of irrigation and this method requires less irrigation water with increased irrigation efficiency and ensure uniform distribution of water as compared to surface methods. This leads to increase in yield and economic returns.

**Table 2:** Cost economics of different Irrigation methods on biometric parameters of Pigeonpea during *kharif*, 2016

| Treatments | Cost of Cultivation (Rs/ha) | Cost of Irrigation (Rs/ha) | Total Cost of Cultivation (Rs/ha) | Gross Returns (Rs/ha) | Net Returns (Rs/ha) | B:C ratio |
|---|---|---|---|---|---|---|
| Continuous irrigated -12 irrigations | 12,200 | 12,000 | 24,200 | 1,14,600 | 90,400 | 4.74 |
| Flooding (irrigation at all Critical stages irrigations)- 05 | 12,200 | 5,000 | 17,200 | 1,27,500 | 1,10,300 | 7.41 |
| Drip irrigation at Flowering and Pod development | 12,200 | 2,000 | 14,200 | 1,08,300 | 94,100 | 7.63 |
| Control (No Irrigation) | 12,200 | 0 | 12,200 | 7,200 | -5,000 | 0.59 |

## Conclusion

From this experiment, it is concluded that among different irrigation practices Flood irrigation at 5 critical stages was found to be the promising agronomic practice for enhancing growth, physiological and productivity of redgram. From the foregoing results and discussion, it can be concluded that a lifesaving irrigation to redgram during critical stages helped in enhancing the yield particularly in a drought year than in normal year. Under limited irrigation water availability impact of supplemental irrigation at critical stages is more pronounced on yield and contributed to higher WUE in pigeonpea.

## References

1. Basu TK, Bandyopadhyay SR. Productivity of *rabi* pieonpea (*Cajanus cajan* L. Milsp.) as influenced by scheduling of irrigation. Journal of Crop and Weed. 2009;5(2):90-91.

2. Crop seasonal condition report, *Kharif*, Dept of Agriculture. Govt. of Andhra Pradesh 2016.
3. Krishna A, Ramanjaneyulu AV. Impact of Land Configuration, Life Saving Irrigation and Intercropping on Yield and Economics of Major Rainfed Crops in Southern Telangana Zone of Andhra Pradesh, India. International Journal of Bio-resource and Stress Management 2012;3(3):317-323.
4. Mahalakshmi K, Avil kumar K, Reddy MD, Uma Devi M. Response of *rabi* pigeonpea [*Cajanus cajan* (L.)] to different levels of drip irrigation. Journal of Research ANGRAU. 2011;39(4):101-103.
5. Michael AM. Irrigation Theory and Practice, 2nd edition. Vikas Publishing House, Delhi.
6. Pavan Kumar Reddy Y, Madhusudan Reddy K, Sahadeva Reddy B, Radha Kumari C, Ravindranatha Reddy B. Effect of supplemental irrigation in rainfed redgram. Presented in National seminar on trends in farm mechanization and engineering interventions for sustainable agriculture ANGRAU, RARS, Nandyal 2017, 31
7. Pramod G. Response of Pigeonpea (*Cajanus cajan* (L.) Millsp.) Genotypes to Planting Geometry Under Different Protective Irrigation. Karnataka Journal of Agricultural Sciences 2007;2(4):22-24.
8. Pramod G, Pujari BT, Basavaraja MK, Vijay Mahantesh, Venkate Gowda. Yield, yield parameters and economics of pigeonpea (*Cajanus cajan* (L.) Millsp) as influenced by genotypes, planting geometry and protective irrigation. International Journal of Agricultural Sciences. 2010;6(2):422-425.
9. Reddy YPK, Reddy KMS, Sahadeva Reddy B, Ravindranatha Reddy B, Padmalatha Y. Impact of the supplemental irrigation with raingun in rainfed redgram of scarce rainfall zone, Andhra Pradesh. Presented in National seminar "Agronomic Approaches for Climate Resilience in Agriculture" at ANGRAU, RARS, Nandyal. 2017, 21
10. Suresh K, Rao VP, Srinivas A, Siva Sankar A, Govardhan V. Effect of varied plant densities and irrigation levels of pigeonpea on soil moisture status. Journal of Research ANGRAU. 2013;41(4):25-31.
11. Venkata Rao P, Subbarami Reddy A, Sateesh Babu J, Ramana MV. Effect of Sowing Time and Supplemental Irrigation on Yield and Economics of rabi Pigeonpea. International Journal of Research in Agricultural Sciences 2016;3(6):2348-3997.
www.apagris.net