www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277- 7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2021; 10(10): 431-433

www.thepharmajournal.com
Received: 07-08-2021
Accepted: 23-09-2021

**Waghmare YM**
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**Gokhale DN**
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**AK Gore**
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

**Corresponding Author:**
**Waghmare YM**
Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

# Effect of irrigation and plant geometry on quality attributes and economics of pigeonpea (*Cajanus cajan* (L.) Millsp.)

**Waghmare YM, Gokhale DN and AK Gore**

**Abstract**
A field experiment was conducted at Agronomy Farm, College of Agriculture, Parbhani during *kharif* season of 2012-13 and 2013-14. The experiment was laid out in split plot design with three main plot treatments and four sub plot treatments. The main plot treatments were irrigation schedules as rainfed (no irrigation), two irrigations (at bud initiation and pod development stage) and three irrigations (at bud initiation, flowering and pod development stage). Sub plot treatments were four plant geometries i.e. 120 x 45 cm, 60-120 x 60 cm, 75-150 x 45 cm and 90-180 x 45 cm. Gross monetary returns (Rs ha-1), net monetary returns (Rs ha-1)and benefit to cost ratio were significantly higher with application of three irrigation ($I_2$) treatment than two irrigation ($I_1$) and rainfed pigeonpea ($I_0$). Gross monetary returns (Rs ha-1), net monetary returns (Rs ha-1)and benefit to cost ratio were higher with plant geometry of 75-150 x 45 cm than any other due to higher plant population ha$^{-1}$. Different plant geometries did not show any significant impact on quality parameters like protein content (%) and test weight (g) during both the years of experimentation. Treatment combination of three irrigations ($I_2$) with 75-150 x 45 cm plant geometry recorded significantly higher net monetary returns (Rs ha-1)and benefit to cost ratio during both the years.

**Keywords:** Pigeonpea, plant geometry, irrigation, paired row planting

## Introduction
Pigeonpea (*Cajanus cajan* (L.) Millsp, 2n = 22) commonly known as redgram or arhar or tur in India originated in South Africa in the areas of Angola and Nile river. Pigeonpea is short day; often cross pollinated avenue crop belongs to family leguminosae. The ability of pigeonpea to produce economic yield in soil characterized by moisture deficit makes it an important crop of dryland agriculture. India is producing 14.76 million tons of pulses from an area of 23.63 million hectare, which is one of the largest pulses producing countries in the world. However, about 2-3 million tons of pulses are imported annually to meet the domestic consumption requirement accounting 21.50 per cent of total food imports. Thus there is need to increase production and productivity of pulses in the country by more interventions (Anonymous, 2013). In paired row planting system each third row is removed and crops are grown in paired row cropping system. It is suitable for dryland region and objective is to conserve soil moisture and account for higher yield. It is different from skip cropping where a line is left unsown in the regular row series of sowing. Hence, it is essential to standardize a paired row planting system at a particular spacing in pigeonpea.

Water is the most important inputs essential for the production of crops. Plants need it continuously during their life and in huge quantities. It profoundly influences photosynthesis, respiration, absorption, translocation and utilization of mineral nutrients. Both its shortage and excess affects the growth and development of a plant directly. The rainfall of our country is dependent on the monsoons. In order to grow food crops and agricultural products in large quantities to feed the growing millions, intensive farming with extensive irrigation is essential. Lack of irrigation facilities and improper planting patterns are the major constraints attributing to lower productivity of pulses especially pigeonpea. As a long durational crop, its reproductive growth occurs on residual moisture and lack of moisture at reproductive and terminal stages affects the stability of the yield resulting in lower productivity. In view of the above facts the present investigation was undertaken to assess the interaction effect of paired row planting systems in increasing and stabilizing the yield of BSMR-736, a wilt and sterility resistant variety of pigeonpea released by Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani under different irrigation schedules.

The knowledge of row spacing in paired row planting under different irrigation schedules will help the farmers to enhance the productivity of pigeonpea by adopting appropriate combination.

## Materials and Methods

The field experiments were conducted at the Research Farm, Department of Agronomy, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* seasons of 2012-13 and 2013-14. The experiment was laid out in split plot design with three main plot treatments and four sub plot treatments. The main plot treatments were irrigation schedules as rainfed (no irrigation), two irrigations (at bud initiation and pod development stage) and three irrigations (at bud initiation, flowering and pod development stage). Sub plot treatments were four plant geometries i.e. 120 x 45 cm, 60-120 x 60 cm, 75-150 x 45 cm and 90-180 x 45 cm. Seeds of pigeonpea variety (BSMR-736) released by Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani were used for experimental purpose. The seeds were sown by dibbling as per treatments at 120 cm x 45 cm, 60-120 cm x 60 cm, 75-150 cm x 45 cm and 90-180 cm x 45 cm spacing during 2012-13 and 2013-14 respectively, under rainfed conditions. The fertilizers were applied as per standard dose of 25: 50 (N: P) kg ha$^{-1}$. As pigeonpea is a leguminous crop, full dose of fertilizer was applied as basal dose. The sources of nutrients were urea (46% N) and di-ammonium phosphate (18% N, 46% $P_2O_5$).

## Results and Discussion

### Irrigation

### Quality studies

Protein content in per cent was not influenced significantly with the application of irrigation at various stages of crop during both the years. So, the differences found among treatments were non-significant though the higher per cent of protein observed with three irrigation treatment followed by two irrigation treatment. Least protein content was observed with rainfed pigeonpea during both the years of study. Similar findings are related with Kapur *et al.* (1987) [2].

### Economic studies

Three irrigations given at bud initiation, flowering and pod development stage recorded significantly higher gross monetary returns (Rs ha-1), net monetary returns (Rs ha-1)and benefit cost ratio over two irrigation treatment given at bud initiation and pod development stage. Rainfed treatment recorded significantly lower values during both the year and in pooled results. The comparative economic analysis revealed that irrigation to pigeonpea was found economically viable with higher net returns and benefit cost ratio than rainfed condition. It might be attributed to maximum seed yield and straw yield in irrigated pigeonpea finally reflected in higher net returns and benefit cost ratio compared to rainfed pigeonpea. In this context, increased net returns and benefit cost ratio due to irrigation in pigeonpea were reported by Kaswala *et al.* (1998) [3] and Reddy *et al.* (2008) [7].

### Plant geometries

Experimental findings regarding effect of plant geometries on growth, yield attribute7s, yield, quality parameters and economic studies have been discussed under different heads.

### Quality studies

Protein content (%) was not influenced significantly due to different plant geometries during 2012-13 and 2013-14. It might be due to quality parameters are governed by genetic makeup of variety and these cannot be differed by different plant densities.

### Economic studies

The trend of increased seed yield (q ha$^{-1}$) in plant geometry of 75-150 x 45 cm was also observed in gross monetary returns (Rs ha-1), net monetary returns (Rs ha-1) and benefit cost ratio. The gross monetary returns (65399, 76131 and 70765 ` ha$^{-1}$), net monetary returns (41453, 51124 and 46288 ` ha$^{-1}$) and benefit cost ratio (1.71, 2.01 and 1.86) were significantly higher in plant geometry of 75-150 x 45 cm compared to other plant geometries during 2012-13, 2013-14 and in pooled analysis, respectively. Lowest values for GMR, NMR and benefit cost ratio were recorded by 60-120 x 60 cm plant geometry during both the year and in pooled analysis. Similar results were reported by Meena *et al.* (2013) [4] Pavan *et al.* (2011) [5] Zote *et al.* (2010) Islam *et al.* (2008) and Ravikumar *et al.* (2013) [6].

**Table 1:** Mean weight of pods plant$^{-1}$ (g), seed yield plant$^{-1}$ (g) and test weight (g) of seeds of pigeonpea as influenced by different treatments during 2012-13 and 2013-14

| Treatments | 2012-13 | | | 2013-14 | | |
|---|---|---|---|---|---|---|
| | **Weight of pods plant$^{-1}$ (g)** | **Seeds yield plant$^{-1}$ (g)** | **Test weight (g)** | **Weight of pods plant$^{-1}$ (g)** | **Seeds yield plant$^{-1}$ (g)** | **Test weight (g)** |
| Irrigation (I) | | | | | | |
| $I_0$- Rainfed | 87.75 | 55.71 | 102.19 | 105.04 | 66.68 | 103.68 |
| $I_1$- Two irrigations | 135.89 | 84.93 | 103.68 | 150.30 | 93.93 | 104.93 |
| $I_2$- Three irrigations | 168.40 | 104.05 | 104.67 | 180.68 | 111.90 | 105.78 |
| S.E. + | 1.27 | 1.37 | 0.91 | 1.45 | 1.95 | 2.84 |
| C.D. at 5% | 3.79 | 4.08 | NS | 4.31 | 5.81 | NS |
| Plant geometries(S) | | | | | | |
| $S_1$ - (120 X 45) | 125.55 | 78.43 | 103.51 | 139.54 | 87.20 | 104.98 |
| $S_2$ - (60-120 X 60) | 115.01 | 71.50 | 103.49 | 128.10 | 80.04 | 104.71 |
| $S_3$ - (75-150 X 45) | 135.77 | 84.83 | 103.52 | 150.85 | 94.28 | 104.92 |
| $S_4$ - (90-180 X 45) | 146.39 | 91.48 | 103.53 | 162.87 | 101.82 | 104.59 |
| S.E. + | 4.94 | 2.94 | 3.47 | 5.60 | 3.66 | 2.55 |
| C.D. at 5% | 14.68 | 8.73 | NS | 16.62 | 10.87 | NS |
| Interaction (I x S) | | | | | | |
| S.E. + | 8.57 | 5.09 | 6.01 | 9.70 | 6.34 | 4.41 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS |
| General mean | 130.68 | 81.56 | 103.51 | 145.34 | 90.84 | 104.80 |

**Table 2:** Mean seed yield (q ha$^{-1}$) of pigeonpea as influenced by different treatments during 2012-13, 2013-14 and in pooled analysis

| Treatments | Seed yield (q ha$^{-1}$) | | |
|---|---|---|---|
| | 2012-13 | 2013-14 | Pooled analysis |
| Irrigation (I) | | | |
| $I_0$- Rainfed | 9.44 | 11.52 | 10.48 |
| $I_1$- Two irrigations | 14.79 | 16.52 | 15.66 |
| $I_2$- Three irrigations | 18.34 | 19.81 | 19.07 |
| S.E. + | 0.30 | 0.34 | 0.15 |
| C.D. at 5% | 0.91 | 1.03 | 0.47 |
| Plant geometries (S) | | | |
| $S_1$ - (120 X 45) cm | 13.80 | 15.51 | 14.66 |
| $S_2$ - (60-120 X 60) cm | 12.58 | 14.19 | 13.38 |
| $S_3$ - (75-150 X 45) cm | 16.04 | 17.98 | 17.01 |
| $S_4$ - (90-180 X 45) cm | 14.34 | 16.12 | 15.23 |
| S.E. + | 0.52 | 0.60 | 0.45 |
| C.D. at 5% | 1.54 | 1.79 | 1.41 |
| Interaction (I x S) | | | |
| S.E. + | 0.90 | 1.04 | 0.78 |
| C.D. at 5% | NS | NS | NS |
| General mean | 14.19 | 15.95 | 15.07 |

**Table 3:** Mean protein content in seeds of pigeonpea as influenced by different treatments during 2012-13 and 2013-14

| Treatments | Protein content | |
|---|---|---|
| | 2012-13 | 2013-14 |
| Irrigation (I) | | |
| $I_0$- Rainfed | 18.50 | 18.11 |
| $I_1$- Two irrigations | 19.26 | 19.15 |
| $I_2$- Three irrigations | 20.17 | 19.88 |
| S.E. + | 0.39 | 0.47 |
| C.D. at 5% | NS | NS |
| Plant geometries (S) | | |
| $S_1$ - (120 X 45) cm | 19.75 | 19.43 |
| $S_2$ - (60-120 X 60) cm | 19.15 | 18.93 |
| $S_3$ - (75-150 X 45) cm | 18.90 | 18.66 |
| $S_4$ - (90-180 X 45) cm | 19.44 | 19.17 |
| S.E. + | 0.52 | 0.49 |
| C.D. at 5% | NS | NS |
| Interaction (I x S) | | |
| S.E. + | 0.91 | 0.85 |
| C.D. at 5% | NS | NS |
| General mean | 19.31 | 19.05 |

**Table 4:** Gross monetary returns (Rs ha$^{-1}$), Net monetary returns (Rs. ha$^{-1}$) and B:C ratio of pigeonpea as influenced by different treatments during 2012-13, 2013 - 14 and in pooled analysis

| Treatments | Gross Monetary Returns (Rs ha-1) | | | Net Monetary Returns (Rs ha-1) | | | B:C ratio | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2012-13 | 2013-14 | Pooled | 2012-13 | 2013-14 | Pooled | 2012-13 | 2013-14 | Pooled |
| Irrigation (I) | | | | | | | | | |
| $I_0$- Rainfed | 38852 | 49187 | 44020 | 18248 | 28157 | 23202 | 0.88 | 1.33 | 1.10 |
| $I_1$- Two irrigations | 60404 | 70020 | 65212 | 36379 | 45118 | 40748 | 1.52 | 1.80 | 1.66 |
| $I_2$- Three irrigations | 74288 | 83686 | 78987 | 48186 | 56021 | 52104 | 1.85 | 2.03 | 1.94 |
| S.E. + | 1213.3 | 1479.1 | 245.23 | 1338.0 | 1470.1 | 519.86 | 0.07 | 0.06 | 0.06 |
| C.D. at 5% | 3599.3 | 4388.1 | 762.14 | 3969.4 | 4361.3 | 1615.6 | 0.22 | 0.17 | 0.20 |
| Plant geometries (S) | | | | | | | | | |
| $S_1$ - (120 X 45) cm | 56420 | 65800 | 61110 | 33017 | 41418 | 37218 | 1.37 | 1.66 | 1.51 |
| $S_2$ - (60-120 X 60) cm | 51494 | 60260 | 55877 | 28248 | 36228 | 32238 | 1.17 | 1.48 | 1.33 |
| $S_3$ - (75-150 X 45) cm | 65399 | 76131 | 70765 | 41453 | 51124 | 46288 | 1.71 | 2.01 | 1.86 |
| $S_4$ - (90-180 X 45) cm | 58079 | 68333 | 63206 | 34365 | 43626 | 38996 | 1.42 | 1.74 | 1.58 |
| S.E. + | 2235.0 | 2564.2 | 263.74 | 2372.5 | 2507.2 | 395.16 | 0.09 | 0.08 | 0.03 |
| C.D. at 5% | 6630.4 | 7606.9 | 819.66 | 7038.4 | 7437.9 | 1228.1 | 0.28 | 0.25 | 0.11 |
| Interaction (I x S) | | | | | | | | | |
| S.E. + | 3871.1 | 4441.2 | 456.81 | 4109.3 | 4342.6 | 684.44 | 0.18 | 0.17 | 0.07 |
| C.D. at 5% | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| General mean | 57848 | 67631 | 62740 | 34271 | 43099 | 38685 | 1.42 | 1.72 | 1.57 |

## Conclusion

Application of irrigation at three important critical growth stages (bud initiation, flowering and pod development) of pigeonpea proved most advantageous as compared to irrigation at two critical growth stages (bud initiation and pod development) and rainfed pigeonpea.

Plant geometry with paired row spacing of 75-150 x 45 cm significantly increased seed yield (q ha$^{-1}$), straw yield (q ha$^{-1}$), gross monetary returns (₹ ha$^{-1}$) and net monetary returns (₹ ha$^{-1}$) as compared to 90-180 x 45, 120 x45 and 60-120 x 60 cm plant geometries. It is therefore suggested to adopt the plant geometry of 75-150 x 45 cm for pigeonpea.

## References


1. Anonymous. First advance estimated released on 14/09/2012 by Directorate of Economic and Statistics, Department of Agriculture and Cooperation 2013.
2. Kapur R, Satija DR, Dahiya BS. Influence of plant population on agronomic traits in pigeonpea varieties. Agricultural Sci. Digest 1987;7(3):159-162.
3. Kaswala RR, Maliwal GL, Raman S, Parmar HC, Patel ML, Parmar BR. Influence of irrigation and phosphorus on yield and economics of pigeonpea. Gujarat Agril. Univ. Res. J 1998;24(1):89-91.
4. Meena BK, Hulihalli UK, Sumeriya HK. Effect of fertility levels and planting geometry on growth and yield of medium duration pigeonpea hybrid ICPH-2671. Crop Res 2013;46(1/3):79-83.
5. Pavan AS, Nagalikar VP, Pujari BT, Halepyti AS. Influence of planting geometry on the growth characters, seed yield economics transplanted pigeon pea. Karnataka J Agric. Sci 2011;24(3):390-392.
6. Ravikumar Bhavi, Desai BK, Vinodkumar SN. Effect of planting geometry on the yield, nutrient availability and economics of pigeonpea genotypes. Trends in Biosciences 2013;6(6):773-775.
7. Reddy MM, Padmaja B, Rao LJ. Response of rabi pigeonpea to irrigation scheduling and weed management in Alfisols. J Food Legumes 2008;21(4):237-239.
8. Zote AK, Zote KK, Karanjikar PN. Effect of row spacings and planting patterns on pigeonpea yield. J Maharashtra Agril. Univ 2011;36(1):175-177.