



E-ISSN: 2278-4136  
P-ISSN: 2349-8234  
JPP 2018; 7(4): 69-72  
Received: 11-05-2018  
Accepted: 15-06-2018

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## Influenced of soil moisture stress on yield and yield attributes of pigeonpea genotypes

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### Abstract

Present investigation was carried out in rainout shelter at PGI, Field, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar (Maharashtra) Fifty genotypes were evaluated in Randomized Block Design with two replications in two separate experiments one under moisture stress only one irrigation and another control three irrigation condition. The studies revealed that the water stress had a strong influence on the growth and yield character of pigeonpea genotypes under study. Significant differences were observed amongst the genotypes for mean values of dry matter production observations and yield under moisture stress and control conditions. Under control condition the genotypes *viz.*, PT-04-292, PT-04-164, PT-04-382 and PT-04-251 found to be promising for yield and yield contributing characters. The performance of genotypes *viz.*, PT-0012, PT-011-6, PT-04-378 and PT-04-259 were found better for most of the morphological characters and yield contributing attribute under moisture stress condition. The genotypes PT-0012, PT-011-6, PT-04-378 and PT-04-259 exhibited higher value dry matter production and grain yield per hector. Therefore, these genotype can be used as a donar for drought tolerance in further breeding programme for developing the drought tolerance varieties in pigeonpea.

**Keywords:** pigeonpea, soil moisture and yield

### 1. Introduction

Pigeonpea (*Cajanus cajan* (L.) Millsp) belonging to the family leguminaseae and sub-family papilionaceae holds prestigious position among all the legume crops and it plays an important role in food security and balanced diet (Saxena *et al.*, 2002) [3]. It is mainly used as 'dhal' (Dry, dehulled split seeds) and it virtually an indispensable item in kitchen. Pigeonpea is known by several vernacular names as Red gram, Arhar, Angola pea, Congo pea etc. Pigeonpea is predominantly a self pollinated crop although cross pollination occur upto 40 percent (Singh, 2003) [2]. Pigeonpea has an inherent ability to withstand environmental stresses especially drought. Pigeonpea is an important component of farming system because of its ability to fix atmospheric nitrogen (Singh, 2003) [2]. Its deep root system improves physical properties of soil and allows extraction of moisture from deep layer of soil. With an unprecedented increasing world population and declining food productivity due to various abiotic stresses like water, it has become imperative to search for avenues of sustaining productivity while minimizing losses due to vagaries of monsoon. Drought is a situation when the actual seasonal rainfall is deficit by more than twice the mean deviation (Ramdas, 1960) [1]. Relevant definition of agricultural drought appears to be a period of dryness during the crop season, sufficiently prolonged which adversely affect the crop yield. The extent of yield loss depends on the crop growth stage and degree of stresses. Drought is the major constraint which reduces the productivity of crop. It is known that pigeonpea thrives well under drought prone condition. However, there is a great variability for yield performance of different pigeonpea genotypes under drought condition. Attempts to measure the degree of tolerance with a single parameter have limited value because of the multiplicity of the factors and their interactions contributing to drought tolerance under field conditions.

### 2. Materials and Method

A field experiment on pigeonpea was conducted at in Rainout shelter at Post Graduate Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar. The present investigation was undertaken during the *Kharif* season. The field experiment was consisting of Fifty genotypes were evaluated in Randomized Block Design with two replications in two separate experiments one under moisture stress only one irrigation and another control three irrigation condition. The studies revealed that the water stress had a strong influence on the growth, yield and physiological character of pigeonpea genotypes under study. Under control condition the genotypes *viz.*, PT-04-292, PT-04-164, PT-04-382 and PT-04-251 found to be promising for yield and yield contributing characters.

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The performance of genotypes *viz.*, PT-0012, PT-011-6, PT-04-378 and PT-04-259 were found better for most of the morphological characters and yield contributing attribute under moisture stress condition. Therefore, these genotype can be used as a donar for drought tolerance in further breeding programme for developing the drought tolerance varieties in pigeonpea.

### 3. Results and Discussion

#### 3.1 Yield and yield contributing character

##### 3.1.1 Number of Pods per plant

The genotype PT-0012 recorded significantly the highest number of pods (29) which was at par with PT-04-175 (27.5) under moisture stress conditions. The genotype PT-04-31 recorded significantly the highest number of pods (80.95) which was at par with PT-011-16 (78.1) under control condition. The genotype PT-04-221 and PT-04-329 recorded significantly the lowest number of pods (17) which was at par with PT-04-312 (17.5) under moisture stress condition. The genotype PT-04-221 recorded significantly the lowest number of pods (52) which was at par with PT-04-312 (55.5) under control condition.

##### 3.1.2 Number of seeds per pod

The genotypes PT-011-6 recorded significantly the highest number of seeds per pods (4.96) which was at par with PT-04-312 (3.99) and PT-04-212 (3.99) under stress moisture condition. Genotype PT-03-148 recorded significantly the highest number of seeds per pod (4.56) which was at par with PT-04-212 (4.09) and PT-011-34, ICPL-87 and PT-04-212 (4.09) under control condition. The genotypes PT-04-360-1 recorded significantly the lowest number of seeds per pod (2.83) which was at par with PT-04-138 (2.86) under moisture stress. Genotype PT-04-175 recorded significantly the lowest number of seeds per pod (3.06) which was at par with PT-04-217 and PT-04-360-1 (3.07) and PT-04-221 (3.07) under control condition.

##### 3.1.3 Pod weight per plant (g)

The genotype PT-04-261 recorded significantly the highest Pod weight (12.61 g) which was at par with PT-04-175 (12.48 g) and PT-011-18 (12.48 g) under moisture stress condition. Genotype PT-03-175 recorded significantly the highest pod weight (14.45 g) which was at par with PT-04-292 (14.43 g) under control condition. The genotypes PT-04-169 recorded significantly the lowest pod weight (8.42 g) which was at par with PT-04-194 (8.45 g) under moisture stress condition. Genotype PT-04-356 recorded significantly the lowest pod weight (10.54 g) which was at par with PT-04-336 (11.05 g) control condition.

##### 3.1.4 Weight of 100 seed (g)

The genotype PT-04-261 recorded significantly the highest 100 seed weight (9.70 g) which was at par with PT-04-175 (9.6 g) and PT-011-18 (9.6 g) under moisture stress condition. Genotypes PT-04-175 recorded significantly the highest 100 seed weight (11.12 g) which was at par with PT-04-292 (11.10 g) under control conditions. Genotypes PT-04-356, PT-04-336, PT-04-169 and PT-04-194 recorded significantly the lowest 100 seed weight (6.5 g) which was at par with PT-04-312 (6.6 g) under moisture stress conditions. The genotypes PT-04-336 and PT-03-148 recorded significantly the lowest 100 seed weight (8.5 g) which was at par with PT-04-356 (8.11 g) under control condition.

##### 3.1.5 Grain yield per hectore

The grain yield per hectare was higher under control condition than moisture stress condition the yield per hectares ranged between 17.92 to 32.32 (q) per hectares under control condition. The genotypes PT-04-292 and PT-4-221 recorded highest and lowest yield under control condition. The genotype PT-04-169 and PT-0012 recorded the lowest and highest yield per hectare. (4.93) and (9.59 q) under moisture stress condition respectively.

##### 3.1.6 Biological yield per plant (g)

The genotype PT-0012 recorded significantly the highest total dry matter production (82.5 g) which was at par with PT-03-62 (77.6 g) under moisture stress condition. Genotype PT-0012 recorded significantly the highest total dry matter production (106.00 g) which was at par with PT-011-21 (105.10 g) under control condition. Genotype PT-04-264 recorded significantly the lowest total dry matter production (69.15 g) which was at par with PT-04-138 (70.2 g) under moisture stress condition. Genotype PT-04-378 recorded significantly the lowest total dry matter production (97.75 g) which was at par with PT-04-264 (98.65 g) under control condition.

##### 3.1.7 Harvest Index

The genotype PT-04-378 recorded significantly the highest harvest index (11.13%) which was at par with PT-0012 (10.46%) under moisture stress condition. Genotypes PT-04-292 recorded significantly the highest harvest index (29.25%) which was at par with PT-04-382 (26.22%) under control conditions. PT-04-194 recorded significantly the lowest harvest index (6.02%) which was at par with PT-011-16 (6.05%) under moisture stress condition. Genotypes PT-04-221 recorded significantly the lowest harvest index (16.04%) which was at par with PT-04-169 (16.72%) under control condition.

**Table 1:** Number of pod per plant, number of seed per pod and pod weight per plant of pigeonpea genotypes

| Genotypes   | Number of pod plant <sup>-1</sup> | Number of SeedPod <sup>-1</sup> | Pod Weight Plant <sup>-1</sup> (g) | 100 - seed weight (g) |
|-------------|-----------------------------------|---------------------------------|------------------------------------|-----------------------|
| PT-78-04    | 25.00                             | 3.96                            | 9.75                               | 7.50                  |
| PT-04-138   | 25.50                             | 2.86                            | 11.00                              | 8.50                  |
| PT-04-164   | 23.00                             | 3.45                            | 9.70                               | 7.50                  |
| PT-04-175   | 27.50                             | 2.86                            | 12.48                              | 9.60                  |
| PT-04-267   | 24.50                             | 2.91                            | 9.69                               | 7.50                  |
| PT-04-360-1 | 22.00                             | 2.83                            | 11.21                              | 8.60                  |
| PT-04-365   | 23.00                             | 3.30                            | 10.53                              | 8.10                  |
| PT-03-62    | 27.00                             | 3.96                            | 9.93                               | 7.60                  |
| PT-03-124   | 22.00                             | 3.97                            | 11.21                              | 8.60                  |
| PT-04-169   | 25.50                             | 2.95                            | 8.42                               | 6.50                  |
| PT-04-194   | 22.00                             | 2.95                            | 8.45                               | 6.50                  |
| PT-04-217   | 24.00                             | 2.96                            | 12.30                              | 9.50                  |

|                |       |      |       |      |
|----------------|-------|------|-------|------|
| PT-04-221      | 17.00 | 2.96 | 11.18 | 8.60 |
| PT-04-230      | 20.00 | 3.96 | 10.99 | 8.50 |
| PT-04-259      | 25.00 | 3.97 | 10.01 | 7.70 |
| PT-04-261      | 24.50 | 2.95 | 12.61 | 9.70 |
| PT-04-264      | 19.50 | 2.98 | 9.91  | 7.60 |
| PT-04-292      | 20.50 | 3.98 | 11.25 | 8.70 |
| PT-04-312      | 17.50 | 3.99 | 8.61  | 6.60 |
| PT-04-316      | 23.50 | 3.86 | 9.75  | 7.50 |
| PT-04-321      | 25.50 | 2.87 | 9.75  | 7.50 |
| PT-04-329      | 17.00 | 2.95 | 11.05 | 8.50 |
| PT-04-336      | 22.00 | 3.88 | 8.45  | 6.50 |
| PT-04-356      | 25.00 | 3.91 | 8.45  | 6.50 |
| PT-04-373      | 25.50 | 2.96 | 9.75  | 7.50 |
| PT-04-378      | 22.00 | 3.97 | 10.53 | 8.10 |
| PT-04-382      | 22.00 | 3.98 | 11.05 | 8.50 |
| PT-04-386      | 25.00 | 3.48 | 9.43  | 7.30 |
| PT-04-391      | 23.50 | 3.89 | 10.01 | 7.20 |
| PT-04-257-1    | 23.00 | 3.87 | 11.05 | 8.50 |
| PT-04-281      | 20.00 | 3.90 | 10.40 | 8.00 |
| PT-04-348-2    | 24.00 | 2.90 | 11.35 | 8.70 |
| PT-04-415-1    | 25.00 | 2.89 | 11.05 | 8.50 |
| Khirpuri Local | 21.50 | 3.90 | 9.75  | 7.50 |
| PT-011-6       | 22.00 | 4.96 | 10.40 | 8.00 |
| PT-011-14      | 21.50 | 3.95 | 9.75  | 7.50 |
| PT-011-15      | 24.50 | 2.86 | 11.05 | 8.50 |
| PT-011-16      | 21.00 | 2.95 | 9.75  | 7.50 |
| PT-011-18      | 21.50 | 3.00 | 12.48 | 9.60 |
| PT-011-21      | 25.00 | 3.87 | 9.75  | 7.50 |
| PT-011-23      | 25.00 | 3.87 | 9.75  | 7.50 |
| PT-011-34      | 20.00 | 3.86 | 9.75  | 7.50 |
| PT-04-212      | 24.00 | 3.99 | 8.45  | 6.50 |
| PT-04-343      | 25.00 | 2.87 | 12.35 | 9.50 |
| PT-03-129-2    | 21.00 | 3.87 | 10.05 | 7.50 |
| PT-04-273      | 23.00 | 2.91 | 9.75  | 7.50 |
| PT-03-148      | 26.00 | 3.10 | 8.45  | 6.50 |
| PT-04-31       | 24.00 | 3.87 | 8.45  | 6.50 |
| ICPL-87        | 21.50 | 3.00 | 9.79  | 7.00 |
| PT-0012        | 29.00 | 3.88 | 10.01 | 7.70 |
| Mean           | 23.07 | 3.47 | 10.21 | 7.83 |
| SE ( $\pm$ )   | 1.92  | 0.21 | 0.53  | 0.49 |
| CD at (5%)     | 5.49  | 0.62 | 1.52  | 1.40 |

**Table 2:** Drought tolerance Efficiency, Biological yield, Harvest index and Grain Yield of pigeonpea genotypes.

| Genotypes   | Drought tolerance Efficiency (%) | Biological yield (g plant <sup>-1</sup> ) | Harvest index (%) | Grain yield (q/ha) |
|-------------|----------------------------------|---|-------------------|--------------------|
| PT-78-04    | 16.48                            | 72.50                                     | 10.46             | 8.43               |
| PT-04-138   | 13.04                            | 70.20                                     | 8.96              | 6.98               |
| PT-04-164   | 16.50                            | 73.25                                     | 8.81              | 7.18               |
| PT-04-175   | 14.96                            | 73.05                                     | 9.56              | 7.76               |
| PT-04-267   | 11.58                            | 73.85                                     | 6.87              | 5.64               |
| PT-04-360-1 | 13.39                            | 72.00                                     | 7.73              | 6.19               |
| PT-04-365   | 14.66                            | 72.85                                     | 9.27              | 7.45               |
| PT-03-62    | 16.76                            | 77.60                                     | 9.36              | 8.07               |
| PT-03-124   | 16.91                            | 74.65                                     | 10.25             | 8.50               |
| PT-04-169   | 10.67                            | 72.55                                     | 6.11              | 4.93               |
| PT-04-194   | 10.92                            | 74.70                                     | 6.02              | 5.01               |
| PT-04-217   | 12.62                            | 74.80                                     | 7.35              | 6.16               |
| PT-04-221   | 10.67                            | 75.60                                     | 6.88              | 5.78               |
| PT-04-230   | 15.42                            | 72.75                                     | 9.81              | 7.93               |
| PT-04-259   | 15.96                            | 72.30                                     | 10.58             | 8.52               |
| PT-04-261   | 12.66                            | 71.15                                     | 9.26              | 7.33               |
| PT-04-264   | 11.52                            | 69.15                                     | 7.11              | 5.47               |
| PT-04-292   | 17.13                            | 70.95                                     | 7.27              | 5.73               |
| PT-04-312   | 12.80                            | 72.65                                     | 7.43              | 6.00               |
| PT-04-316   | 14.48                            | 76.50                                     | 9.63              | 8.20               |
| PT-04-321   | 11.12                            | 77.00                                     | 6.36              | 5.44               |
| PT-04-329   | 11.35                            | 72.60                                     | 6.63              | 5.36               |
| PT-04-336   | 13.65                            | 75.15                                     | 7.64              | 6.38               |
| PT-04-356   | 13.56                            | 73.00                                     | 8.35              | 6.77               |

|                |       |       |       |      |
|----------------|-------|-------|-------|------|
| PT-04-373      | 11.15 | 72.00 | 7.14  | 5.73 |
| PT-04-378      | 15.74 | 70.80 | 11.13 | 8.76 |
| PT-04-382      | 16.92 | 73.70 | 10.04 | 8.21 |
| PT-04-386      | 15.65 | 72.95 | 8.28  | 6.73 |
| PT-04-391      | 16.64 | 74.05 | 10.31 | 8.47 |
| PT-04-257-1    | 16.38 | 74.35 | 8.64  | 7.13 |
| PT-04-281      | 15.86 | 72.35 | 9.67  | 7.76 |
| PT-04-348-2    | 13.09 | 72.85 | 8.65  | 7.00 |
| PT-04-415-1    | 12.50 | 71.70 | 8.04  | 6.41 |
| Khirpuri Local | 14.52 | 73.75 | 8.67  | 7.10 |
| PT-011-6       | 16.93 | 76.85 | 10.76 | 9.20 |
| PT-011-14      | 14.92 | 71.20 | 9.52  | 7.53 |
| PT-011-15      | 13.14 | 74.00 | 7.55  | 6.22 |
| PT-011-16      | 11.09 | 74.70 | 6.05  | 5.02 |
| PT-011-18      | 14.43 | 73.70 | 9.26  | 7.59 |
| PT-011-21      | 16.20 | 75.60 | 9.40  | 7.89 |
| PT-011-23      | 15.17 | 72.10 | 8.72  | 7.00 |
| PT-011-34      | 14.36 | 72.20 | 8.99  | 7.22 |
| PT-04-212      | 14.72 | 71.30 | 9.24  | 7.33 |
| PT-04-343      | 13.07 | 71.60 | 8.40  | 6.69 |
| PT-03-129-2    | 15.62 | 72.30 | 9.41  | 7.55 |
| PT-04-273      | 11.15 | 73.15 | 6.38  | 5.20 |
| PT-03-148      | 14.51 | 74.50 | 7.26  | 6.03 |
| PT-04-31       | 14.59 | 75.45 | 7.62  | 6.35 |
| ICPL-87        | 15.98 | 74.00 | 8.09  | 6.65 |
| PT-0012        | 16.88 | 82.50 | 10.46 | 9.59 |
| Mean           | 14.19 | 73.84 | 8.50  | 6.95 |
| SE ( $\pm$ )   | 1.32  | 1.70  | 0.82  | 0.65 |
| CD at (5%)     | 3.76  | 4.84  | 2.33  | 1.85 |

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