Effect of different drip fertigation levels on growth and yield of short duration pigeon pea varieties

R Jeyajothi and S Pazhanivelan

Abstract

Field experiment was conducted at Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore during 2015 and 2016 with the objective of Growth and yield of short duration Pigeon pea (Cajanus cajan L.) varieties under Drip fertigation system. The experiment was laid out in strip plot design with three replications. The main plot treatments were allotted with three varieties viz., Co (Rg) 7, APK 1 and VBN 3. The sub plot treatments comprised of three drip fertigation levels viz., 75%, 100% and 125% RDF @ 25:50:25 kg NPK ha$^{-1}$ through WSF with Azophosmet and foliar spray of PPFM and drip fertigation at 100% RDF through WSF alone along with surface irrigation with conventional fertilizers. The effect of varieties and nutrient application methods (drip fertigation and soil application) the highest plant height, Leaf area index and dry matter production during Kharif 2015 and Summer 2016 DMP of (7042 and 6235 kg ha$^{-1}$ during Kharif 2015 and Summer 2016). The grain yield 1992 and 1758 kg ha$^{-1}$were significantly observed under drip fertigation with125% RDF through WSF with Azophosmet and foliar spray of 1% PPFM. Among the pigeonpea varieties, Co (Rg) 7 performed well compared to APK 1 and VBN 3 varieties.

Keywords: Pigeonpea, drip fertigation, varieties, leaf area index, dry matter production

Introduction

Pulses have great potential to improve human health as an integral part of many diets across the globe and them, conserve our soils, protect the environment and contribute to global food security. Pigeonpea plays an important role in food security, balanced diet and alleviation of poverty, since it is used in diverse ways as a source of food, feed, fodder (Robertson et al., 2002) [3], fuel wood, rearing lac insects (Zhenghong et al., 2001) [12], hedges, windbreaks, soil conservation, green manuring and roofing. Pigeonpea enriches soil through symbiotic nitrogen fixation and provides farmers with valuable organic matter and micronutrients. It has a special mechanism to release soil-bound phosphorus to meet its own needs as well as those of subsequent crops. It is a major source of protein to about 20% of the world population (Thu et al., 2003) [11] and is an abundant source of minerals, vitamins and amino acids (Saxena et al., 2002) [9].

Pigeonpea (Cajanus cajan (L.) Millspaugh) is a grain legume belonging to the Cajaninae sub-tribe of the economically important leguminous tribe Phaseoleae (Greilhuber and Obermayer, 1988) [11]. Pigeonpea is known by different names all over the world viz., arhar, tur, kandulu, payaru, tuvar and tuvarai. The crop can be described as unique, because it is a legume and a woody shrub. It has an inherent ability to withstand drought (Okiror, 1986) [4] and its deep root system breaks the hard pans, hence called as “biological plough”, extracts moisture from deeper layers of the soil and produces biomass including protein-rich grain, utilizing residual moisture (Nene and Sheila, 1990) [8]. Effective management of irrigation water is an important issue in crop production, since irrigation is a precondition for crop growth, development and production per mm of water and productivity per unit area. Shortage of water for irrigation is being increasingly felt due to pressures from depleting groundwater levels, rising alternative demands, water quality degradation and economics. Therefore, farmers are switching over to drip irrigation to improve irrigation efficiency and water productivity (Ravikumar et al., 2011) [8].

Materials and Methods

Field experiment was conducted at Millet Breeding Station at Tamil Nadu Agricultural University, Coimbatore. Pigeonpea varieties viz. Co (Rg)7 (V1), APK1 (V2) and VBN3 (V3) were selected. As per the treatments schedule, 75 percent of recommended dose of water soluble fertilizers (V1F3, V2F3 and V3F3), 100 percent of recommended dose of water
soluble fertilizers (V1F2, V2F2 and V3F2 and V1F4, V2F4 and V3F4) and 125 percent of recommended dose of water soluble fertilizers (V1F5, V2F5 and V3F5) were applied through the drip as per the fertigation schedule. The recommended doses of inorganic fertilizers @ 25:50:25 NPK kg ha⁻¹ were applied through drip as per the fertigation schedule in the form of water soluble fertilizers viz., Mono Ammonium Phosphate (12:61% N and P), Urea (46% N), Poly feed (19:19:19% NPK) and Sulphate of potash (50% K). The fertilizer solution was prepared by dissolving the required quantity of fertilizer with water in 1:5 ratio and injected into the irrigation system through venturi assembly. Fertilization interval was scheduled once in 7 days interval. The other usual common package of practices was followed time to time and periodical growth observations were recorded at an interval of 30 days interval.

### Table 1: Effect of different fertigation levels on growth, yield attributes and harvest index of short duration pigeon pea varieties

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>DMP (kg/ha)</th>
<th>No. of branches/plant</th>
<th>LAI</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varieties</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V₁-Co(Rg) 7</td>
<td>145.8</td>
<td>143.6</td>
<td>5850</td>
<td>5130</td>
<td>8.88</td>
</tr>
<tr>
<td>V₂-AKP 1</td>
<td>104.3</td>
<td>100.0</td>
<td>4665</td>
<td>4154</td>
<td>4.79</td>
</tr>
<tr>
<td>V₁-VBN 3</td>
<td>122.4</td>
<td>117.2</td>
<td>3876</td>
<td>3433</td>
<td>5.66</td>
</tr>
<tr>
<td>SEd</td>
<td>3.2</td>
<td>3.1</td>
<td>117</td>
<td>158</td>
<td>0.16</td>
</tr>
<tr>
<td>CD (0.05)</td>
<td>9.0</td>
<td>8.8</td>
<td>324</td>
<td>438</td>
<td>0.45</td>
</tr>
<tr>
<td>F₁</td>
<td>105.8</td>
<td>100.2</td>
<td>3341</td>
<td>2997</td>
<td>5.17</td>
</tr>
<tr>
<td>F₂</td>
<td>128.4</td>
<td>126.0</td>
<td>5053</td>
<td>4478</td>
<td>6.55</td>
</tr>
<tr>
<td>F₃</td>
<td>118.6</td>
<td>115.8</td>
<td>4401</td>
<td>3915</td>
<td>6.00</td>
</tr>
<tr>
<td>F₄</td>
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<tr>
<td>F₅</td>
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<td>131.9</td>
<td>5886</td>
<td>5079</td>
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<tr>
<td>SEd</td>
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<td>1.6</td>
<td>117</td>
<td>124</td>
<td>0.32</td>
</tr>
<tr>
<td>CD (0.05)</td>
<td>10.7</td>
<td>3.8</td>
<td>270</td>
<td>287</td>
<td>0.75</td>
</tr>
</tbody>
</table>

**Results and discussion**

The observation on the plant growth parameters and yield which were recorded have been tabulated, statistically computed and the same are presented here under the appropriate headings.

### Plant height

Growth in terms of plant height at all the stages of development showed significant variation due to different varieties and levels of fertigation during Kharif 2015 and Summer 2016. Among the varieties, Co(Rg) 7 (V₁) significantly recorded tallest plants to a height of 42.7, 95.3, 131.9 and 145.8 cm in Kharif 2015 and 40.6, 90.3, 126.3 and 143.6 cm in Summer 2016 at 30, 60, 90 DAS and at harvest stage respectively. The other two varieties viz., APK 1 (V₂) (23.0, 68.0, 91.7 and 104.3 cm, and 21.0, 64.8, 87.4 and 100.0 cm) and VBN 3 (V₃) (31.0, 84.9, 115.3 and 122.4 cm, and 28.3, 81.5, 108.6 and 117.2 cm) recorded shortest plants in both the years at all the stages respectively. The interaction effect of fertigation levels and varieties significantly influenced the plant height of pigeonpea at 30, 60, 90 DAS and at harvest in both the seasons. Irrespective of different varieties, Co (Rg)7 along with drip fertigation with 125% RDF through WSF + Azophosmet and foliar spray of 1% PP3FM (V₁F₅) significantly recorded highest plant height 48.4, 104.1, 148.5 and 167.6 cm, and 46.2, 99.7, 142.7 and 162.2 cm at 30, 60, 90 DAS and harvest stage during Kharif 2015 and Summer 2016 respectively. This was comparable with drip fertigation with 100 per cent RDF through WSF + Azophosmet and foliar spray of 1% PP3FM (V₁F₅) with a height of 45.1, 100.3, 141.6 and 159.2 cm, and 43.5, 94.6, 135.1 and 156.3 cm at 30, 60, 90 DAS and harvest stage during Kharif 2015 and Summer 2016 respectively. The highest increase in vegetative growth under drip fertigation might be due to the availability of soil moisture at optimum level (Pattanaik et al., 2003) [5].

### Number of branches per plant

In both the years 2015 and 2016, the number of primary branches per plant varied significantly due to different varieties. Among the different short duration pigeonpea varieties, Co(Rg)7 (V₁) recorded the higher number of primary branches per plant over other varieties. The variety Co(Rg)7 produced more primary branches registering 4.02,
7.60 and 8.88, and 3.71, 6.63 and 7.75 per plant at 30, 60 and 90 DAS during Kharif 2015 and Summer 2016 respectively. This was perhaps due to the higher production of number of leaves with more number of branches, which was in conformity with the findings of Kumar et al., 2009 [3].

**Leaf area index**
The leaf area index of pigeon pea was significantly influenced by different fertigation levels. Among the fertigation levels, application of 125 per cent of recommended dose of fertilizer through WSF + Azophosmet biofertigation + 1% PPFM foliar spray (F5) recorded significantly higher values of leaf area index registering 0.82, 1.86, 2.83 and 2.49, and 0.78, 1.63, 2.60 and 2.09 at all the stages during Kharif 2015 and Summer 2016 respectively. This was comparable with 100 per cent of RDF through WSF + Azophosmet and foliar spray of 1% PPFM (V4F4), which recorded a dry matter production of 72 per cent in drip system over surface irrigation.

**Dry matter production**
The interaction effect of fertigation levels and varieties was significant. Irrespective of different varieties, the variety Co(Rg)7 under drip fertigation with 125% RDF through WSF + Azophosmet and foliar spray of 1% PPFM (V1F5) significantly recorded higher dry matter production of 801, 2907, 5692 and 7042 kg ha⁻¹ and 705, 2560, 5081 and 6235 kg ha⁻¹ during Kharif 2015 and Summer 2016 at different stages respectively. This was followed by the variety Co(Rg)7 under drip fertigation with 100 per cent RDF through WSF + Azophosmet and foliar spray of 1% PPFM (V1F4), which recorded a dry matter production of 754, 2677, 5294 and 6512 kg ha⁻¹, and 661, 2367, 4691 and 5739 kg ha⁻¹ during Kharif 2015 and Summer 2016 respectively. The lowest dry matter production of 391, 1381, 2771 and 3341 kg ha⁻¹, and 365, 1266, 2464 and 2997 kg ha⁻¹ was observed in conventional fertilizer application with surface irrigation in both seasons. Rajasekaran (2007) [6] reported higher dry matter production under 125 per cent RDF followed by 100 per cent in drip irrigated sugar beet.

Drip fertigation at 125 per cent RDF through WSF with Azophosmet and 1% PPFM foliar spray followed by 100 per cent RDF through conventional fertilizer alone during Kharif 2015 and Summer 2016 as compared to surface irrigation with soil application of fertilizers. This was mainly due to optimum moisture supply and timely nutrient application which could have enhanced the assimilatory efficiency resulting in increased number of leaves per plant, better branching and LAI which contributed for higher dry matter production as well as promoted the activity of photosynthesis and simultaneous accumulation of dry matter.

**Fig 1:** Effect of drip fertigation levels on leaf area index of short duration pigeon pea varieties

**Conclusion**
It was concluded that the Pigeonpea cultivar Co (Rg) 7 showed statistically significant variations in all plant growth and yield characters observed in this study. The increase in pigeonpea grain yield in fertigation at 125 per cent RDF through WSF with Azophosmet and 1% PPFM foliar spray was 72 per cent in drip system over surface irrigation.

**References**