

### **Improving yield potential of pigeonpea through foliar nutrition**

#### **ABSTRACT**

A field experiment was conducted in research farm at Department of Pulses, Tamil Nadu Agricultural University during *kharif* season of 2018 to 2021 to assess the effect of foliar nutrition to enhance the productivity of pigeonpea under rainfed condition. The experiment was laid out in randomized block design with three replications and eight treatments. Treatments consist of foliar application with urea 2%, MAP 1%, All nineteen 0.5%, Pulse magic 1%, ZnSO<sub>4</sub> 0.5 %, FeSO<sub>4</sub> 0.5 % and ZnSO<sub>4</sub> 0.5 % + FeSO<sub>4</sub> @ 0.5 % along with no foliar nutrition spray. 100% recommended dose of fertilizer (25:50:25:20 kg NPKS ha<sup>-1</sup>) was applied to all treatments. The yield parameters such as number of pods per plant and number of seed per pods were significantly influenced by foliar nutrition. All the foliar spray treatments recorded higher seed yield as compared to control (without foliar spray). Among the different foliar nutrition, 0.5% all nineteen recorded significantly higher seed yield of 1138 kg ha<sup>-1</sup>. Result concluded that retention of flowers is possible through foliar application of macronutrients during flower initiation stage and it helps to enhance the productivity of pigeonpea under rainfed situation.

**Key word:** Foliar nutrition, yield potential, seed yield and pigeonpea

#### **Introduction**

In the tropics and subtropics, Pigeonpea [*Cajanus cajan* (L.)] is one of the major grain legume crops endowed with several unique characteristics. In India, after chickpea, pigeonpea is the second most important pulse crop in the country and accounts for about 11.8% and 17% of the total pulse area and production of the country respectively. It is a rich source of protein and also rich in iron, iodine, essential amino acids like lysine, tyrosine, cystine and arginine. Through atmospheric nitrogen fixation, restore the nitrogen to the soil and improve the soil fertility (Tiwari

and Shivhare, 2016). True yield potential of pigeonpea was limited by a number of biotic and abiotic factors. Abiotic constraints cause more economic loss in pigeonpea production than that from biotic constraints. In India, pigeonpea is mainly cultivated in rainfed areas. Frequent droughts in the low-rainfall areas and water logging in the high-rainfall areas are the major abiotic constraints to enhancing productivity and production. Apart from its cultivation in sub-marginal lands, poor crop management and nutrient stress at critical growth stages, such as flowering and pod development which causes significant reduction in grain yield (Pandey *et al.*, 2013).

Pigeonpea is basically indeterminate growth habit, vegetative and reproductive stages occurs side by side and hence always there is a competition for available assimilates between vegetative and reproductive sinks. The major physiological constraints limiting pigeonpea's yield potential are flower drop and its genetic makeup. According the research workers carried out in different crops, there is possibility to overcome these constraints by agronomic interventions such as foliar feeding of nutrients during critical stages.

Nitrogen and phosphorus (Solaiappan *et al.*, 2002) and macro and micronutrients (Jayabal *et al.* 1999) as foliar spray at critical stages of the crop have been effectively absorbed and translocated to the developing pods resulting in more number of pods per plant. Flower drop percentage in green gram may reduced by the foliar application of nutrient and growth regulator at pre flowering and flowering stages (Ganapathy *et al.* 2008). From these views, to realize and enhance the yield potential of pigeonpea crop present investigations were carried out to study the effect of foliar application of different sources of nutrient on yield and economics of pigeonpea under rainfed condition.

## **MATERIALS AND METHODS**

### **Experimental site and conditions**

Field experiments were conducted during *kharif* season of 2018-19 to 2020-21 continuously at Department of Pulses, Tamil Nadu Agricultural University, Coimbatore located in the north western agro climatic zone of Tamil Nadu at 11°N

latitude 77°E longitude at an altitude of 426 m above the mean sea level. The soil type in the experimental field was reddish brown, slightly calcareous, sandy clay loam that belongs to the soil series Palladam (*TypicUstropept*). The nutrient status of experiment field was low in available N (185 kg ha<sup>-1</sup>), medium in available P (12 kg ha<sup>-1</sup>) and high in K (445 kg ha<sup>-1</sup>).

### **Experimental design and crop management**

The experiment was laid out with eight treatments in a Randomized Block Design (RBD) replicated thrice to study the effect of foliar application of multi nutrients on productivity of pigeonpea. The experiment consists of eight treatments viz., foliar application with urea 2%, MAP 1%, All nineteen (19:19:19) 0.5%, Pulse magic 1%, ZnSO<sub>4</sub> 0.5 %, FeSO<sub>4</sub> 0.5 % and ZnSO<sub>4</sub> 0.5 % + FeSO<sub>4</sub> @ 0.5 % along with no foliar spray. 100% recommended dose of fertilizer (25:50:25:20 kg NPKS /ha) were applied as basal in treatments. Pigeonpea variety CO8 was sown at 120 x 30 cm spacing in all three years of experimentation.

### **Plant sampling and yield measurement**

The growth parameters likes plant height, branches / plant, stem girth, yield attributes (pods / plant and seeds / pod) and seed yield of pigeonpea were recorded at harvest. Observation on growth and yield attributes were taken in five tagged plants in each plot and then averaged was calculated. For biological yield, crop was harvested in net plot area from each plot, sun dried and calculated biological yield was converted into kg ha<sup>-1</sup>. The seed yield of pigeonpea was estimated from the weight of sun-dried seeds (12% moisture content) obtained from each plot after threshing and cleaning.

### **Statistical analysis**

The experimental data pertaining to each parameter of the study were subjected to statistical analysis by using the technique of analysis of variance and their significance was tested by “F” test (Gomez and Gomez, 1984). The standard error of means (SEm±) and critical difference (CD) at 5% probability were worked out to evaluate the differences between treatment means for each parameter studied.

## RESULTS AND DISCUSSION

### Effect of foliar nutrition on yield parameters of pigeonpea

Number of pods plant<sup>-1</sup> is the most important yield attribute of pigeonpea. All foliar nutrition treatments had increased number of pods plant<sup>-1</sup> than control (without foliar spray). This would be due to the foliar application of nutrients at critical stage allows adequate nutrient supplementation essential for enhancing the number of floral buds, prevented the floral shedding by maintaining optimum bio - physiological conditions.(Maheswari and Karthik, 2017). Among the different foliar nutrition, all nineteen (19:19:19) spray along with basal application of 100% RDF had higher number of pods plant<sup>-1</sup>. Foliar application of nutrients enhanced the number of floral buds, prevented the floral shedding by maintaining optimum bio - physiological conditions. Pod number is considered to be the major yield determinant in pigeonpea; all macro nutrient viz., N, P and K through all nineteen was able to increase the number of pods than other nutrient sources tried in these experiments. These results are in conformity with the earlier findings of with Yasari *et al.*, 2012.

Table 1 Effect of foliar spray of nutrient on yield attributes and yield of Pigeonpea (pooled mean of 3 years data)

Treatments		No. of pods / plant	No. of seed /pod	Seed yield (kg /ha)
T <sub>1</sub>	RDF only	90	3.0	<b>784</b>
T <sub>2</sub>	RDF + foliar spray of 19:19:19 @0.5%	143	3.4	<b>1138</b>
T <sub>3</sub>	RDF + foliar spray of MAP @ 1%	133	3.3	<b>1052</b>
T <sub>4</sub>	RDF + foliar spray pulse magic @1%	111	3.3	<b>968</b>
T <sub>5</sub>	RDF + foliar spray of urea @2%	99	3.1	<b>910</b>
T <sub>6</sub>	RDF + foliar spray of ZnSO <sub>4</sub> @0.5%	115	3.1	<b>895</b>
T <sub>7</sub>	RDF + foliar spray of FeSO <sub>4</sub> @0.5%	108	3.1	<b>869</b>

T <sub>8</sub>	RDF + foliar spray of ZnSO <sub>4</sub> @0.5% + FeSO <sub>4</sub> @0.5%	126	3.3	<b>938</b>
	<b>SEm±</b>	2.76	0.33	29.8
	<b>CD(p=0.05)</b>	6.79	0.66	83.9

Table 1(Cont.) Effect of foliar spray of nutrient on yield attributes and yield of pigeonpea (pooled mean of 3 years' data)

<b>Treatments</b>		<b>Net return (Rs. /ha)</b>	<b>BCR</b>
T <sub>1</sub>	RDF only	25682	2.13
T <sub>2</sub>	RDF + foliar spray of 19:19:19 @ 0.5%	53723	3.19
T <sub>3</sub>	RDF + foliar spray of MAP @ 1%	48361	2.98
T <sub>4</sub>	RDF + foliar spray pulse magic @ 1%	34925	2.42
T <sub>5</sub>	RDF + foliar spray of urea @ 2%	30594	2.23
T <sub>6</sub>	RDF + foliar spray of ZnSO <sub>4</sub> @ 0.5%	34315	2.42
T <sub>7</sub>	RDF + foliar spray of FeSO <sub>4</sub> @ 0.5%	32549	2.33
T <sub>8</sub>	RDF + foliar spray of ZnSO <sub>4</sub> @ 0.5% + FeSO <sub>4</sub> @ 0.5%	39643	2.69

#### ***Number of seeds per pod***

Number of seeds pod<sup>-1</sup> of pigeonpea was significantly influenced by foliar application of multi-nutrients. Compared to all other treatments, foliar application of 0.5% 19 : 19:19 spray recorded the higher number of seeds pod<sup>-1</sup>. This could be due to the higher availability of nutrients supplied through supplemental foliar feeding at critical growth stage that retarded senescence and resulted in larger pod filling period leading to greater seed yield plant<sup>-1</sup>. These results are in conformity with earlier findings of Venkatesh *et al.*, 2012.

#### ***Hundred Seed weight***

Foliar applications of multi- nutrients showed the significant effect on hundred seed weight of pigeonpea. Foliar spray of all nineteen @ 0.5% along with soil application of 100% RDF resulted in significantly higher 100 seed weight but it remained at par with foliar spray of 1% MAP. This could be attributed due to the activity of cytokine predominantly takes place in the root tips and play an active role in cell division. Thus enhanced root activity under foliar fertilization might have increased cytokine synthesis resulting increased vegetative and reproductive growth of plants. These observations are in line with the findings of with Yasari *et al.*, 2012.

### **Seed yield**

Seed yield of pigeonpea was significantly influenced by the foliar spray of nutrient. Foliar application of macro or micro nutrients at critical stage along with basal application of 100% RDF increased the seed yield of pigeonpea as compared to basal application of 100% RDF alone. Among the different foliar spray, all nineteen @ 0.5% recorded significantly higher grain yield of 1138kg ha<sup>-1</sup> but it was on par with foliar spray of MAP @ 1%. Foliar spray of all nineteen at flowering stage increased the supply of the essential macro nutrient *viz.*, Nitrogen, Phosphorus, Potassium to crop and it perhaps helped in quick absorption of nutrients at the time of reproductive stage where the nutrient demand is at the peak due to the indeterminate growth habit of crop. The increased seed yield was due to higher yield attributes. It might be due to continuous supply of nutrients as basal and as foliar spray which in turn reduced the flower drop and ultimately enhanced the pod setting and resulted in higher seed yield. Fakeerappa and Amit (2015) and Meena *et al.*, (2020) reports are in close conformity of the present findings.

### **Economics**

The major consideration with the farmers for the adoption of any production technology is economics. With regard to economics, application of 0.5% all nineteen (19:19:19) on flowering recorded higher net income and B :C ratio o f Rs. 53723 /- and 3.19, respectively. This was followed by application of 1.0% Mono Ammonium

Phosphate (MAP). The economics was increased due to increased yield by application of water soluble fertilizer (Sivakumar *et al.* 2021).

### **Conclusion**

Foliar application of nutrients at critical stages of crop growth has been an effective means for improving nutrient uptake as well as its utilization. Foliar spray all nineteen @ 0.5% on 50 per cent flowering stage of pigeonpea (125 days) increases the yield parameters *viz.*, number of pods per plant, number of seeds per pod and 100 seed weight resulting in higher seed yield, net income and B:Cratio under rainfed condition. Maximum outcome of pigeonpea can be possible if it is provided supplemental nutrient through foliar feeding at critical stages *i.e* flowering period along with basal application of 25:50:25:20 kg NPKS ha<sup>-1</sup> and it enhances the productivity and profitability of pigeonpea under rainfed condition.

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