Optimization of foliar nutrition and nipping for quality of pigeonpea [*Cajanuscajan* (L). Millsp.]

ABSTRACT

A field experiment was conducted in red sandy clay loam soil at UAS, GKVK, Bengaluru during *kharif* to know the influence of foliar nutrition and nipping on crop growth, seed yield and quality in pigeonpea. The experiment replicated six times in split plot design with treatments of foliar spray of water soluble fertilizer (WSF)with three different concentration F_0 (100 % RDF), F_1 (75 % RDF + 25 % WSF (19: 19:19), F_2 (75 % RDF + 12.5 % WSF (19: 19:19) in combination with nipping (N_1) and no nipping (N_0). The results revealed thatseed quality parameters *viz.*,germination (85.75 %) mean seedling length (48.28 cm), mean seedling dry weight (47.33 mg), seedling vigour index-I (4137), seedling vigour index -II (4112), lower electrical conductivity (1.07 mS ppt^{-1}), total dehydrogenase activity (3.30 A_{480nm}) and total soluble protein (23.19 %)recordedhigher in F_2N_1 (75 % RDF + 12.5 % WSF (19: 19:19) + nipping) over control (81.42 %, 44.59 cm, 41.67 mg $seedling^{-1}$, 3724, 3346, 1.44 mS ppt^{-1}, 2.22 A_{480nm}, 20.22 %,) respectively.

Keywords: Foliar nutrition, nipping, pigeonpea, water soluble fertilizer,

Introduction

Pulses are the wonderful gift of nature. They provide vital protein and vitamins in the diet. Pulse form a cheapest and major source of dietary protein especially for vegetarians who form a major part of our population. The UN general assembly declared 2016 as the '**International Year of Pulses**'. This reflects the importance of pulses in global concerns regarding food security, preserving cultural heritage and sustainable development. It provides unprecedented opportunity to raise awareness and to celebrate the role of beans, chickpea, pigeonpea and other pulses in feeding the world. Pigeonpea[*Cajanuscajan*(L.) Millsp.]is a perennial crop native to Africa, belongs to family *Fabaceae*. It is also known as no-eye pea, gungo pea in Jamaica, tropical green pea and arhar in India (Anon., 2017)[1].It is one of the protein rich legumes of the semi-arid tropics grown predominantly under rainfed conditions. It is cultivated throughout the tropical and sub-tropical regions of the world, between 30^{o}N and 35^{o}S latitudes. However, major area under pigeonpea in India is lying between 14^{o} and 28^{o} N latitudes.Pigeonpeaaccounts for about 11.8 % of the total pulse area and 17 % of total pulse production in the country. In India the total area coverage and production of pigeonpea were 38.35 lakh hectares and 29.92 lakh tonnes respectively.

Seed replacement rate (SRR) is a criterion to assess the use of certified and/or quality seed of a crop and gives an indication of area under quality seeds. The SRR in pigeonpea is 50 % lower than recommended in 2014-15. So, it is important to intensify the SRR that helps in enhancing productivity of the crop. Which has been suggested that 40 % SRR would be appropriate for achieving higher productivity in pulses(Chauhan *et al.*, 2016)[2].The treatment foliar spray of water soluble fertilizer in combination nipping can increase the production of quality seeds and can help to provide sufficient quality seeds to the farmer.

Application offoliar nutrients along with soil application has several benefits in supplementing the nutritional requirements to crops. Foliar nutrient spray is designed to exclude the problems like immobilization and fixation of nutrients. Hence, foliar nourishment recognized as an important method of fertilization in modern-day agriculture. This method provides for exploitation of nutrients more efficiently and for correcting deficiencies rapidly. Foliar spray of macronutrients is most important factor in determining the yield (Reddy *et al.*, 2010)[3]. In almost all the pulses, flower drop determines the yield and yield attributing characters. Retention of flowers that are produced by the plant helps realize higher yield than expected.

Nipping of young tender top shoots though traditionally practiced by the farmer but its associated beneficial effects are not scientifically documented. Apical bud nipping is known to alter the source-sink relationship by arresting the vegetative growth and hastening the reproductive phase. It also helps in production of more pod bearing branches with luxuriant foliage thus, enhances the photosynthetic activity, accumulation of more photosynthates, ultimately resulting in better seed quality with higher seed yield (Thakral*et al.*, 1991)[4].

Material and method

The field experiment was carried out during *kharif*at Zonal Agricultural Research Station (ZARS), University of Agricultural Sciences, GKVK, Bengaluru. The experiment consist of six treatment combinations they are as follows F_0N_0: Recommended dose of fertilizer 25: 50: 25 kg NPK ha^{-1} (100 % RDF) + No nipping, F_1N_0: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75 % RDF) + 25 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS + No nipping, F_2N_0: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75 % RDF) + 12.5 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS + No nipping, F_0N_1: Recommended dose of fertilizer 25: 50: 25 kg NPK ha^{-1} (100 % RDF) + Nipping, F_1N_1: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75 % RDF) + 25 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS + Nipping, F_2N_1: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75 % RDF) + 12.5 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS + Nipping, laid out in split plot design with six replications. The following parameters were recorded 100 seed weight, Seed moisture (%), Seed Germination (%), Mean seedling length (cm), Mean seedling dry weight per seedling (mg), Seedling Vigour Index-I, Seedling Vigour Index- II, Electrical conductivity (mS ppt^{-1}), Total dehydrogenase activity (TDH) ($A_{480\ nm}$), Total soluble seed protein (%).

Result and discussion

The data pertaining to the quality of seed as effected by foliar spray of water soluble fertilizer and nipping represented in table 1. Significant difference was recorded among the treatments of foliar application and nipping for quality parameter. Higher hundred seed weight (12.99, 12.91 g), Seed Germination (84.63, 85.03%), Mean seedling length (47.61, 47.34 cm), Mean seedling dry weight per seedling (45.33, 45.03 mg), Seedling Vigour Index-I (4000, 4016), Seedling Vigour Index-II (3785, 3887),Total dehydrogenase activity (3.10, 3.21 $A_{480\ nm}$), Total soluble seed protein (22.61, 22.20 %), lower Electrical conductivity (1.07, 1.08 mS ppt^{-1}) recorded in foliar application of 12.5 % WSF and nipped plants respectively and lower in control hundred seed weight (12.30, 12.45 g), Seed Germination (82.63, 82.72%), Mean seedling length (45.34, 45.84 cm), Mean seedling dry weight per seedling (42.67, 45.84 mg), Seedling Vigour Index-I (3795, 3805), Seedling Vigour Index-II (3512, 3441),Total dehydrogenase activity (2.66, 2.58 $A_{480\ nm}$), Total soluble seed protein (21.22, 21.28 %), higher Electrical conductivity (1.27, 1.21 mS ppt^{-1}). No significant difference was recorded for seed moisture.

Significant difference was recorded in interaction of foliar application and nipping for hundred seed weight(13.08 g), germination (85.75 %), mean seedling length (48.28 cm) and mean seedling dry weightseedling^{-1} (47.33 mg). seedling vigour index-I (4137), seedling vigour index-II (4112) and total soluble protein (23.19 %) recorded higher in $F_2N_1$and lower in F_0N_0 (11.96 g, 81.42 %, 44.59 cm, 41.67 mg,3724, 3346, 20.72 %)respectively. However, lower electrical conductivity was recorded in F_2N_1 (1.07 mS ppt^{-1}) and higher in control (1.44 mS ppt^{-1}). And it was inverse with Total Dehydrogenase Activity i.e. higher recorded in F_2N_1 (3.30$A_{480\ nm}$) and lower in control (2.22$A_{480\ nm}$).

The higher seed quality parameters noticed with nipping at proper stage and foliar nutrition may be due to increased photosynthetic area leading to higher photosynthetic rate, better assimilation and accumulation of more photosynthates that might resulted in better seed development as evident with higher test weightVijaysingh*et al.*, (2017)[5]. The better development of seed owing to greater accumulation of storage reserves, which inturn have utilized for germination and seedling growth resulted in maximum seedling length. As there has been better seedling growth, which might have lead to increased in mean seedling dry weight Sudeep Kumar (2010)[6] in fieldbean. The higher nitrogen supply through foliar application at different crop growth stages resulted in enhancement of protein content of seeds, suggesting that hydrocarbons synthesized during photosynthetic process are diverted to form more proteins and nipping also helps to divert photosynthates to the sink and might increasedthe protein content of the seeds.Venkata Reddy *et al.* (1997)[7] andSajjan*et al.* (2003)[8] in okra, Sudarshan (2004) [9] in fenugreek.

Table 1: Influence of foliar nutrition and nipping on 100 seed weight, seed moisture germination, mean seedling length and mean seedling dry weight in pigeonpea cv. BRG-2

Treatments	100 seed weight	Seed moisture (%)	Germination (%)	Mean seedling length (cm)	Mean seedling dry weight seedling^{-1} (mg)
Main plot (nutrient management)					
F_0	12.30	8.84	82.63	45.34	42.67
F_1	12.75	8.93	84.38	46.82	43.33
F_2	12.99	8.96	84.63	47.61	45.33
S.Em±	0.06	0.03	0.44	0.51	0.59
CD (p=0.05)	0.17	NS	1.29	1.51	1.73
Sub plot (nipping)					

N_0	12.45	8.87	82.72	45.84	42.50
N_1	12.91	8.95	85.03	47.34	45.06
S.Em±	0.05	0.03	0.47	0.36	0.52
CD (p=0.05)	0.19	NS	1.70	1.322	1.87
Interaction					
F_0N_0	11.96	8.83	81.42	44.59	41.67
F_1N_0	12.51	8.83	83.25	45.99	42.50
F_2N_0	12.89	8.93	83.50	46.94	43.33
F_0N_1	12.65	8.85	83.83	46.09	43.67
F_1N_1	13.00	9.03	85.50	47.65	44.17
F_2N_1	13.08	8.98	85.75	48.28	47.33
Different levels of F means at the same or different levels of N					
S.Em±	0.08	0.05	0.62	0.72	0.83
CD (p=0.05)	0.24		1.83	2.14	2.45
Different levels of F means at the different levels of N					
S.Em±	0.09	0.05	0.69	0.69	0.85
CD (p=0.05)	0.28	NS	2.25	2.18	2.73
CV (%)	1.60	1.33	2.36	3.81	4.65

Main plot treatment (nutrient management)

F_0: Recommended dose of fertilizer 25: 50: 25 kg NPK ha^{-1} (100 % RDF).

F_1: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75 % RDF) + 25 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS.

F_2: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75% RDF) + 12.5 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS.

Sub plot treatments (nipping)

N_0: No nipping

N_1: Nipping at 45-60 DAS

Table 2: Influence of foliar nutrition and nipping on SVI-I, SVI-II, Electrical Conductivity, Total dehydrogenase activity and Total Soluble Seed Proteincontent in pigeonpea cv. BRG-2

Treatments	SVI-I	SVI-II	Electrical Conductivity (mS ppt^{-1})	Total dehydrogenase activity	Total Soluble Seed Protein (%)
Main plot (nutrient management)					
F_0	3795	3512	1.27	2.66	21.22
F_1	3937	3694	1.10	2.92	21.39
F_2	4000	3785	1.07	3.10	22.61
S.Em±	44.35	50.26	0.02	0.03	0.29
CD (p=0.05)	130.8	148.3	0.05	0.10	0.85
Sub plot (nipping)					

N_0	3805	3441	1.21	2.58	21.28
N_1	4016	3887	1.08	3.21	22.20
S.Em±	40.08	34.08	0.03	0.03	0.09
CD (p=0.05)	145.7	123.9	0.09	0.11	0.33
Interaction					
F_0N_0	3724	3346	1.44	2.22	20.72
F_1N_0	3829	3519	1.11	2.62	21.07
F_2N_0	3863	3458	1.08	2.89	22.04
F_0N_1	3865	3678	1.10	3.10	21.73
F_1N_1	4045	3869	1.09	3.22	21.70
F_2N_1	4137	4112	1.07	3.30	23.19
S.Em±	62.72	71.07	0.03	0.05	0.41
CD (p=0.05)	185.02	209.6	0.08	0.14	1.20
S.Em±	65.03	67.3	0.04	0.05	3.44
CD (p=0.05)	208.7	210.3	0.12	0.16	1.03
CV (%)	4.35	4.75	4.98	4.04	4.58

Main plot treatment (nutrient management)

F_0: Recommended dose of fertilizer 25: 50: 25 kg NPK ha^{-1} (100 % RDF).

F_1: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75 % RDF) + 25 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS.

F_2: 18.75: 37.5: 18.75 kg NPK ha^{-1} (75% RDF) + 12.5 % Foliar spray of water soluble fertilizer (19: 19: 19) at 45 and 75 DAS.

Sub plot treatments (nipping)

N_0: No nipping

N_1: Nipping at 45-60 DAS

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