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Study of foliar nutrient management on growth and yield of pigeonpea (*Cajanus cajan*)

Elumle Priyanka, Shrirame MD and Darade GA

Abstract
An experiment entitled "Study of foliar nutrient management in pigeonpea (*Cajanus cajan*)" was conducted at Agriculture Research Station, Badnapur (Maharashtra), Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the kharif season July, 2018-19 with the main emphasis to study the effect of foliar nutrition on growth, yield and economics of pigeonpea.
The experimental field was laid out in a Randomized Block Design with ten treatments and three replications and the variety was BDN-716. Results revealed that application of RDF + (2% DAP and Multimicronutrient @ 2ml/litre foliar spray) at 50% flowering of pigeonpea produced maximum plant height (150 cm), branches (14.33), no of functional leaves (96.67), dry matter accumulation (143.33), no of pods (73.67), weight of pods /plant(52.67 g), seed yield/plant (38.67 kg/ha), 100 seed weight (14 g), as well as maximum seed yield (1650 kg/ha), straw yield (4100 kg/ha), biological yield (5750 kg/ha), harvest index(28.69), maximum net returns (57199 kg/ha) and B:C ratio(3.10) followed by RDF + 2% urea + Multimicronutrient spray @ 2ml/litre.

Keywords: Pigeonpea, urea, DAP, Borax, multimicronutrient, $ZnSO_4$, foliar nutrient management

Introduction
Pigeonpea also known as red gram, arhar and tur [*Cajanus cajan* (L.) Millsp.] it is the most important *kharif* grain legume. It belongs to the family Leguminoseae, sub-family papilionaceae, originated from the Africa. It has the lowest harvest index 19% but a rich source of protein (21-24%) and amino acids like lysine, tryosine, cysteine and arginine It accounts for about 11.8% of the total pulse area and 17%of the total pulse production of the country. Maharashtra, Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat and Andhra Pradesh accounts for 87% area of the country and 83.8%of total production. Bihar has the highest productivity 1702 kg ha^{-1} (Anonymous, 2017) [1]. In India, the area under pigeonpea was 5.4 million hectares. Production and productivity were 4.78 million tones and 885 kg ha^{-1} respectively and in Maharashtra, the area under pigeonpea was 15.33 lakh hectares and production was 14.6 lakh tonnes and productivity is 951kg during the year 2017-18 (Anonymous, 2017) [1]. In Marathwada region area under pigeon pea was 5.95 lakh hectars. Production and productivity were 4.47 lakh ton and 759 Kg/ha.
Plant nutrition is key input to increase the productivity. Fertilizer is an important option that should be adopted in order to improve crop yield. Considering low yield, agronomic practices of pigeonpea are required to be standardized for realizing yield potential. Among the different agronomic practices, foliar spray of micronutrients is most important factor in determining the yield (Reddy *et al.* 2010). In almost all the pulses, flower drop determines the yieldand yield attributing characters. Retention of flowers produced by the plant helps to get more yield than expected

Materials and Methods
The present field experiment was conducted during kharif season of 2018-2019 at the Experimental Farm of Agronomy at Agriculture Research Station, Badnapur, Jalna (Maharashtra), Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani.
The soil of experimental was leveled, well drained and the soil was medium black in color with clayey, fairly deep, low in nitrogen, medium in available phosphorus, high in potash and alkaline in reaction. The experimental field was laid out in a Randomized Block Design with ten treatments and three replications and the variety was BDN-716. The treatments were Recommended dose of fertilizers (25:50:00 NPK kg/ha), RDF + 2% urea spray, RDF + 2% DAP spray, RDF + 0.5 % Borax spray, RDF + 1% urea spray + foliar spray of 0.25% $ZnSO_4$ + 0.25% borax spray, RDF + Multimicronutrient spray @ 2ml/litre, RDF+2% urea spray + Multimicronutrient spray @ 2ml/litre, RDF + 2% DAP spray + Multimicronutrient spray @

2ml/litre, RDF + soil application of $ZnSO_4$ @ 15kg/ha. An uniform dose of RDF was applied to all plots as basal.

Results and Discussion

Effect of different nutrients on growth characters of pigeonpea

The results regarding plant height, number of functional leaves, mean number of branches and mean total dry matter plant^{-1} were significantly influenced due to foliar spray. Amongst the treatments RDF+2%DAP+Multimicronutrient spray@2ml/litre (T_9) recorded maximum plant height, number of functional leaves, mean number of branches and total dry matter plant^{-1} at all growth stages, followed by RDF+ 2% urea spray + Multimicronutrient (T_8).

The better performance of RDF+2%DAP spray+ Multimicronutrient spray@2ml/litre (T_9) may be attributed to its better vegetative growth over RDF (T_1) respectively. These findings are well supported by *Muthal* (2016) [4] Foliar application of nutrients increased plant height it might be readily due to absorption of nutrients through foliar application. Increased plant height is due to the internodes elongation and the vigorous root system.The significant increase of dry matter accumulation was due to nitrogen increases chlorophyll content and effective root system by which absorption of solar energy and nutrition absorption capacity of plant increased and 2% DAP spray increased roots, flower growth and development, the multimicronutrient improves overall crop health.

Table 1: Effect of different nutrients on growth characteristics of pigeonpea

Treatment details	Plant Height (cm)	No. of branches plant^{-1}	No of functional leaves	Total dry matter	AGR for plant height	AGR for dry matter	RGR for dry matter
T_1:RDF (25:50;00)	116.33	9.53	79.66	80	0.01	0.08	0.0011
T_2:T1+2%urea spray	124.00	10.73	83	96.33	0.005	0.08	0.0009
T_3:T1+2%DAP spray	129.00	13.23	90.00	111.67	0.01	0.02	0.0002
T_4:T1+0.5% borax spray	124.00	10.43	84.33	111.00	0.003	0.41	0.0039
T_5:T1+0.5%$ZnSO_4$ spray	120.00	10.17	83.33	100.67	0.01	0.31	0.0032
T_6:T1+1%urea+0.25% $ZnSO_4$+0.25%borax	123.33	10.96	87.66	107	0.003	0.33	0.0032
T_7:T1+Multimicronutrient @2ml/litre	120.00	10.53	85.00	118.33	0.003	0.44	0.0039
T_8:T2+Multimicronutrient @2ml/litre	146.00	13.33	92.33	140.33	0.07	0.26	0.0019
T_9:T3+Multimicrontrient @2ml/litre	150.00	14.33	96.67	143.33	0.03	0.11	0.0007
T_{10}:T1+soilapplication of$ZnSO_4$@15kg/ha	123.00	9.66	83.33	121.66	0.05	0.61	0.0054
SE±	5.96	0.54	6.66	12.12	0.03	0.26	0.0024
CD at 5%	17.70	1.60	NS	36.03	0.01	0.08	0.0011
General Mean	127.57	11.39	86.53	113.03	0.005	0.08	0.0009

Table 2: Effect of different nutrients on yield and yield attributing characters of pigeonpea

Treatment details	No of Pods per plant	Weight of pods per plant (g)	Seed yield per plant (g)	No of Seeds per pod	Seed index	Seed yield kg/ha	Straw yield	Biological yield	Harvest index
T_1: RDF	53	37	24.33	3.03	11.9	1087	3100	4187	26.21
T_2: T1 + 2%urea spray	54	39.66	26.33	3	11	1200	3133	4333	27.66
T_3: T1 + 2%DAP spray	62.33	45.00	32.00	3.10	13.17	1308	3532	4840	27.59
T_4: T1 + 0.5% borax spray	61.33	41.00	27.33	3.07	13.00	1187	3047	4233	28.09
T_5:T1 + 0.5% $ZnSO_4$ spray	55.00	42.33	27.00	3.00	12.00	1220	3067	4287	26.56
T_6: T1 + 1% urea + 0.25% $ZnSO_4$ + 0.25% borax	59.33	42	28.33	3.06	12.06	1210	2990	4200	28.92
T_7:T1 + Multimicronutrient @2ml/litre	58.66	42.66	28.66	3.13	13	1170	3299	4469	26.44
T_8:T2 + Multimicronutrient @ 2ml/litre	69.00	48.00	35.67	3.17	13.50	1456	3690	5145	28.35
T_9: T3 + Multimicrontrient @ 2ml/litre	73.67	52.67	38.67	3.13	14.00	1650	4100	5750	28.69
T_{10} : T1 + soil application of $ZnSO_4$ @ 15kg/ha	55.33	40.33	25	3.06	12.33	1168	2965	4133	28.35
SE ± m	4.06	2.10	2.54	0.11	0.57	56.88	233	236	1.61
C.D. at 5%	12.05	6.25	7.56	NS	NS	169	695	703	NS
General Mean	60.17	43.07	29.33	3.08	12.60	1087	3292	4558	27.69

In relation of yield and yield contributing attributes which were significantly influenced by different treatments are presented in table 2. The treatment RDF + 2% DAP + Multimicronutrient (grade2) spray (T_9) recorded significantly maximum number of pods plant $^{-1}$ (73.67), weight of pods (52.67 g), seed yield plant^{-1} (38.67), seed yield (1650 kg ha^{-1}), straw yield (4100 kg ha^{-1}) and biological yield (5750 kg ha^{-1}) which was found significantly superior over the rest of treatments. The next best treatment was application of T_8(RDF+2%urea spray +Multimcironutrient (grade2) @2ml/litre. Better yield attributes in case of RDF+2%DAP+Multimicronutrient spray@2ml/litre (T_9) might be attributed to better growth attributes particularly number of functional leaves plant^{-1} and number of branches plant^{-1} which reflected into better source-sink relationship as compared to RDF(25:50:00NPK). These results are in accordance with the results reported by Singh *et al*. (2015) [7] Pigeonpea crop fertilized with RDF alongwith 2%DAP + Multimicronutrient spray@2ml/litre (T_9) produced significantly higher grain yield (1650 kg/ha) mainly due to the increased nutrient supply and reduced nutrient losses. It perhaps helped in quick absorption of N, P & Micronutrients,

at the time of reproductive stage where the nutrient demand is at the peak due to indeterminate growth habit of the crop. Hence it reduced the flower drop and ultimately enhanced the pod setting and resulted in higher seed yield. As pod number is considered to be the major yield determinant in pulses, foliar feeding of N through as urea source, P through 2% DAP and other micronutrients was able to increase the pod number in this experiment. It was also reported by Barik and Rout (1990) [2] where foliar application of nutrients at flowering and pod development stage might have been easily absorbed and better translocated in the plant and maintained constant requirement of nutrients at the reproductive stage of the crop.The increase in straw yield is directly related mainly to increase in the vegetative growth of the plant. It was mainly due to the maximum plant height. Higher supply of nutrients at 50%flowering of crop growth might have caused efficient translocation of photosynthesis from source to sink. Flower drop decreased due to foliar spray of RDF+2% DAP+Multimicronutrient @ 2ml/litre (T_9). The DAP helps in flower development and increased number of pods per plant. Pod number plays an important role in yield determination.

It might be due to continuous supply of nutrients as basal and as nutrient spray which in turn increased the leaf area and dry matter accumulation resulting in higher straw yield. This is also attributed to the higher nutrient uptake throughout the crop growth period. Similar finding is confirmed with the report by Mondal *et al*., (2012) [3]

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