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RESEARCH NOTE

Effect of soil and foliar application of micro nutrients and fertilizers on growth and yield of pigeonpea [*Cajanus cajan* (L.) Millsp.]

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A field experiment was conducted at Agricultural Research Station, Malnoor, University of Agricultural Sciences, Raichur on vertisols during late *kharif* season to study the effect of soil and foliar application of micro nutrients and fertilizers on the growth and yield of pigeonpea. The experiment consisted of eleven treatments comprised of soil and foliar application of zinc sulphate, seed treatment of cobalt nitrate and foliar application of ammonium molybdate, ammonium borate, DAP, micronutrient mixture (Agromin) and water soluble fertilizer (19:19:19 NPK). The data revealed that foliar application of 19:19:19 @ 4 per cent recorded the highest grain yield and B:C of 1388 kg/ha and 3.11, respectively closely followed by seed treatment of cobalt nitrate (500 mg. kg) that recorded 1383 kg/ha and 2.93, respectively.

Key words : Fertilizers, Pigeonpea, Micro nutrients

Pigeonpea [*Cajanus cajan* (L.) Millsp.] is the second most important pulse crop next to chick pea and 91 per cent of the world's pigeonpea is produced in India. It has occupied an area of 4.42 million hectares with a production of 2.89 million tonnes and average productivity of 655 kg ha^{-1} (Ali Masood *et al*., 2012). Karnataka is one among the important states having an area of 6.80 lakh ha with a production of 4.80 lakh tonnes and productivity is 712 kg ha^{-1} (Anon., 2011). In Karnataka pigeonpea is largely gown in Hyderabad –Karnataka region comprises of six districts *viz.*, Koppal. Bellary, Raichur, Yadgir, Gulberga and Bidar. The crop is cultivated in rainfed situation and it is very erratic now a days. Generally pigeonpea is sown in the month of June to July. But due to erratic and delayed rains, its sowing is postponed to August where it is sure to get rains in the first week of August. Pigeonpea is a photosensitive crop and under late sown conditions shortens the vegetative growth period. So there will be low source to fill the sink , thus reduces the yield. Further more, the low yield of pigeonpea is also attributed to their cultivation on poor soils with inadequate and imbalanced nutrient application, nil application of organic manures and micronutrients. (Srikanth Banu *et al.*, 2012). To overcome this situation, foliar application of micronutrients and water soluble fertilizers may boost up the vegetative growth and help in supply of photosynthetes to reproductive part and increases the yield. In this direction, a detailed research on the effect of micro nutrients and fertilizers was undertaken to maximize the pigeonpea yields.

A field experiment was conducted at Agricultural Research Station, Malnoor, University of Agricultural Sciences, Raichur on vertisols during late *kharif* seasons of 2010-11 and 2011-12 to study the effect of soil and foliar application of micro nutrients and fertilizers on the growth and yield of pigeonpea. The experiment was laid out in randomized block design with three replications. The soil was black clay loam with pH of 8.1. The available N, P_2O_5 and K_2O contents were 243, 34 and 292 kg/ha, respectively. The experiment consisted of eleven treatments comprised of soil and foliar application of zinc sulphate, seed treatment of cobalt nitrate and foliar application of ammonium molybdate, ammonium borate, DAP, micronutrient mixture (Agromin) and water soluble fertilizer (19:19:19 NPK). Soil application was done on the day of sowing and foliar spray was done at the time of 1st flower initiation. The pigeonpea genotypes TS-3R (short duration, red and bold seeded variety which matures in 145 to 150 days. It is resistant to both wilt and sterility mosaic. It is high yielding and has wide adaptability) sown on 22-09-2010 and 18-10-2011 by giving a spacing of 45 cm x 10 cm. All the recommended package of practices were followed. The pooled yield and yield attributes *viz.*, pod length, pods/plant, seeds/pod, and 100 seed weight were recorded at harvest. The economics were calculated on the prevailing rates at harvest and pooled data over years is presented in Table 1.

Foliar application of nutrients for increasing and exploiting genetic potential of the crop is considered as an efficient and economic method of supplementing the nutrient requirement. In the present investigation, application of micro nutrients and water soluble fertilizers increased the grain yield over control (water spray). Among these different treatments, foliar application of 19:19:19 @ 0.4 % recorded significantly higher grain yield (1388 kg/ha) closely followed by seed treatment of cobalt nitrate @ 500 mg/kg of seeds (1383 kg/ha), foliar application of ammonium molybdate @ 5ppm (1285 kg/ha), foliar application of zinc sulphate @ 0.5% (1198 kg/ha), foliar application of DAP @ 2% (1198 kg/ha) and foliar application of agromin (1197 kg/ha). These treatments were on par with each other but significantly superior over control (657 kg/ha). On the other hand, soil application of zinc sulphate @ 15 kg/ha was not as efficient as that of foliar application. This may be due to the fact that there was less moisture in the soil to absorb zinc sulphate and utilize by the plant when required. Significance of foliar application of 19:19:19 @ 0.4 % was also reported by Mukund Gowda *et al*., (2015). Sharma *et al.* (2010) suggested foliar spray of 2% N at flower initiation along with chemical fertilizers and FYM. Manomani and Srimathi (2009) reported that foliar application of major and minor nutrients shall be more effective than soil application and also avoiding the depletion of these nutrients in leaves, thereby resulting in an increased photosynthetic rate, better translocation of these nutrients from the leaves to the developing grains. Foliar application is credited with the advantage of quick and efficient utilization of nutrients, eliminating losses through leaching, and fixation and helps in regulating the uptake of nutrients by

Table 1. Yield, its attributes and economics of pigeon pea as influenced by application of micronutrients and foliar fertilizes (pooled)

Treatments	Pod length (cm)	Pods/ plant	Seeds/ pod	100 seed weight (g)	Grain yield (kg/ha)	Net returns (₹/ha)	B:C
T_1 Soil application of $ZnSO_4$ @15kg/ha	3.10	157	3.49	9.33	1002	23355	2.41
T_2 Foliar application of $ZnSO_4$ @ 0.5%	3.43	152	3.95	9.49	1198	24800	2.61
T_3 Foliar application of Amm. Molybdate (5 ppm)	3.80	169	3.88	9.73	1285	31848	2.93
T_4 Foliar application of Amm. Molybdate (10 ppm)	3.70	151	3.47	9.40	1071	23247	2.19
T_5 Foliar application of Amm. Borate (200 ppm)	3.60	151	3.40	9.13	1020	21203	1.84
T_6 Foliar application of Amm. Borate (300 ppm)	3.63	129	3.04	9.12	1090	23936	2.22
T_7 Seed treatment of cobalt nitrate (500 mg/kg)	3.90	165	3.68	9.80	1383	34238	2.93
T_8 Foliar application of DAP 2%	3.97	171	4.14	10.09	1198	28268	2.44
T_9 Foliar application of micronutrient mix (Agromin) @ 3g/l	3.95	166	4.06	10.08	1197	27849	2.39
T_{10} Foliar application of 19:19:19 @ 0.4 %	4.20	169	4.23	10.07	1388	36370	3.11
T_{11} Control (water spray)	2.70	127	3.00	9.20	657	10763	1.36
S.Em ±	0.14	7	0.12	0.18	94	4188	0.20
P (0.05)	0.40	20	0.36	0.54	278	12354	0.60

plants. These treatments (T_{10}, T_7, T_3, T_2, T_8 and T_9) increased the pod length there by accommodated high number of seeds per pod. These treatments reduced flower dropping and retained more flowers in the inflorescence thus increased the pods per plant. The 100 seed weight was considerably increased in these treatments and over all there was shift in the grain yield.

The economics followed similar trend to that of gain yield. Foliar application of water soluble fertilizer (19:19:19 NPK) @ 0.4 % produced the highest net returns (₹ 36, 370/-) followed by seed treatment of cobalt nitate @ 5 ppm (₹ 34, 238/-) and foliar application of ammonium molybdate @5ppm (₹ 31848/-) and they recorded B:C of 4.20, 3.9 and 3.8, respectively. Mamathashree (2014) reported that application of 19:19:19 @ 0.2% recorded the highest pigeon pea yield of 1272 kg/ha. while Mukund Gowda *et al*., (2015) recorded higher net returns with the application of 19:19:19 @ 0.4 per cent.

It was concluded that foliar application of 19:19:19 @ 0.4 per cent or seed treatment of cobalt nitrate (500 mg/kg) was found optimum to obtain higher grain yield and net returns in pigeon pea.

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