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Influence of foliar application of nutrients and plant growth regulators on yield and yield components in Pigeonpea (*Cajanus cajan* L.)

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Abstract
Pigeon pea is most important pulse crop in Kalaburagi district of Karnataka. Yield of pigeon pea is decreasing due to flower drop and pod setting in climatic vulnerability situation. Field experiment was conducted to study source and sink relationship in pigeon pea (*Cajanus cajan* L.) as influenced by nutrients and plant growth regulators. The results in this investigation noticed that among all the treatments pulse magic spray on pigeon pea variety TS3R have significantly increased the yield (1442 kgha^{-1}) compared to the control (1182 kgha^{-1}) which increased the yield by 22% over control by improving the yield components such as number of pods per plant (212.91), pod length (5.63 cm), test weight (12.48 g) and harvest index (27.80). Pulse magic is a combi product, released by university of agricultural sciences, Raichur as it contains major nutrients, micro nutrients and PGR which helped the crop to achieve maximum yield potential.

Keywords: Yield, harvest Index, Pod length

Introduction
Pulses are popularly known as “poor man’s meat” and “rich man’s vegetable” (Singh and Singh, 1992) [14]. Pulses are excellent sources of proteins (25-40 per cent), carbohydrates (50-60 per cent), fats, minerals and vitamins. In addition to this they contain enzyme inhibitors, lectins, phytates, oxalates, polyphenols, saponins and phytosterols. Pulses contain two to three times more protein than cereals ranging approximately between 20 to 40 per cent (Arora, 1989) [3]. India is the largest producer, importer and consumer of pulses in world, which account 25 per cent of the global production and 27 per cent of total consumption. As sizeable population in the country depends on vegetarian diets to meets its protein requirement. The country produces a variety of pulses to the tune of 14 mt annually from an area of 22 mha with an average productivity of 637 kg ha^{-1}. This production level still falls short of the domestic requirement of 18.33 mt, which is increasing consistently with growing population. The widening gap in demand and supply has led to soaring prices of pulses during the past two years (Ali and Gupta, 2012) [1]. Pigeonpea [*Cajanuscajan* (L.) Millsp.] is the fifth prominent pulse crop in the world and in India after chickpea. In India, pigeonpea is being cultivated over an area of 3.90 million hectares with an annual production of 3.17 million tonnes and a productivity of 813 kg per hectare. Karnataka occupies second place next to maharastra in production (0.729 MT) with a productivity of 824 kg/ha which is nearer to the national average of 909 kg per hectare (Anon., 2017) [2]. Pigeonpea also acts as a soil ameliorant and known to provide several benefits to the soil in which it is grown. The seeds and immature pods used by humans and leaves and husk is used as feed for animals and stem portion used for vermicomposting as fuel purpose. Pigeonpea enhances soil fertility through leaf litter and biological nitrogen fixation (Udhaya *et al.*, 2015) [18]. Mineral nutrient deficiencies limit nitrogen fixation by the legume-rhizobium symbiosis, resulting in low legume yields. Nutrient limitations to legume production result from deficiencies of not only major nutrients but also micronutrients such as Molybdenum (Mo), Zinc (Zn), Boron (B) and Iron (Fe). Application of recommended doses of fertilizers (RDF), the major, secondary and micronutrients, to pigeonpea is essential for higher yield under rainfed conditions (Bhuiyan *et al*., 1999) [4].

Plant growth regulators can improve the physiological efficiency including photosynthetic ability and can enhance the effective partitioning of accumulates from source to sink in the field crops (Dhashora and Jain., 1994; Solamani *et al*., 2001) [6]. PGRs more so when applied at flowering stage, hence flower and pod drop may be reduced to some extent by spraying various growth regulators (Ramesh and Thirumuguran., 2001) [12], which prove that yield and quality parameters in food legumes may be enhanced by suitable application of PGRs. In turn, the nutrients are known to alter the various physiological and biochemical functions which finally influences on the yield of the crop. Sometimes, soil applied nutrients are insufficient for crop to meet out their nutrient requirement and it may be due to non-availability of nutrients due to abrupt soil conditions, exhausted soil condition or nutrient losses through leaching and many more things which can hinder the availability of nutrients to plants and cease the plant growth, which ultimately affect the yield and quality of the crop produce. So the foliar application of nutrients at critical stages of crop growth is most appropriate and accurate method of correcting the nutrient deficiencies and helps to attain maximum potential yield of the crop and ultimately sufficient plant nutrition is absolutely essential for improving their productivity (Thakur *et al*., 2017) [17]. Keeping the above background, the present investigation was taken up on growth and yield of pigeonpea as influenced by nutrients and plant growth regulators.

Material and methods

The field experiment was conducted during *kharif* 2017 at Agricultural Research Station, Kalaburagi, UAS, Raichur under rain fed condition. It is situated at a latitude of 17° 34' North, longitude of 76^0 79' East and an altitude of 478 meters above mean sea level. The soil of the experiment site is clayey (Soil pH 8.3; EC 0.21 dSm^{-1}). The available soil nitrogen, phosphorus and potassium were 241, 14.9 and 280 kg ha^{-1}, respectively. The experiment was laid out in Randomized Complete Block Design (RCBD) with 10 treatments. The treatments *viz*., foliar spray of 2.0% 19:19:19 mixture (T1), 20ppm 6BA (T2), 100ppm Salicyclic acid (T3), 10g/l Pulse magic (T4), 2% MAP (T5), 0.5% $ZnSO_4$ (T6), 0.01% Boric acid (T7), Water spray (T8), Control (T9), Absolute control (T10) with 3 replications using TS3-R variety with spacing of 90×30 cm. Pulse magic is a biproduct developed and released by UAS, Raichur for increasing the yield of pulse crops. It contains 10 percent nitrogen, 40 percent phosphorous, 3 percent micronutrient and 20 PPM plant growth regulator. The two sprays were taken up at 2 stages *viz.*, at 50% flowering stage and at 15 days after first spray. Basal dosage of fertilizer 25:50 kg N: P_2O_5 ha^{-1} was applied to all plots except absolute control. Five plants were tagged at random in net plot area for recording various yield components like number of pods per plant, pod length, 100-seed weight (g), seed yield (kg ha-1) was computed by threshing pods from net plot, cleaned and the seed weight was recorded and also harvest index was calculated.

Results and Discussion

The data on yield components, seed yield, number of pods per plant, pod length, 100-seed weight (g) and harvest index are presented in table-1. The average seed yield 1442 kg ha^{-1} of pigeon pea TS3R variety under pulse magic sprayed plot was found significantly higher seed yield compared to control 1182 kg ha^{-1}. It was 22 % higher seed yield in pulse magic sprayed plot over the control. Increased seed yield in pulse magic sprayed plot may be due to supplying essential nutrients to plants at reproductive stages. It was increased the pod setting and reduced the flower drop in pigeon pea. This was due to the higher in yield components *viz*., number of pods per plant, pod length, seed yield per plant, 100-seed weight. Foliar application of combination major nutrients, minor nutrients and plant growth regulators at 50 % flowering stage and 15 days after first spray would have helped for reducing flower drop and contributed more for reproductive parts resulting in increased number of pods plant^{-1}. Increased seed yield of pigeon pea due to yield parameters like number of pods per plant, pod length, 100-seed weight and harvest index &it was presented in table 1. The higher number of pods per plant (212.91), pod length (5.63 cm), 100 seed weight (12.48 g) and harvest index (27.80) noticed in pulse magic sprayed plot compared to control (120.82, 3.61 cm, 9.45 g and 18.76 respectively). These results of decreasing flower drop percentage due to foliar spray of Pulse magic are similar to the findings of J.R. Patil *et al*. (2018) [11] in green gram, Vijaysingh Thakur (2017) [19] in black gram and Teggelli *et al.* (2016) [16] in pigeonpea. Further, the results are in agreemented with those of Chittapur *et al*. (1994) [5] in pigeonpea, Mondal *et al*. (2011) [10] in mungbean, Lateef *et al*. (2012) [8] in mungbean, Marimuthu and Surendran (2015) [9], Kuttimani and Velayutham (2011) [7] in greengram and by Shashikumar *et al.* (2013) [13] in blackgram.

Table 1: Yield and yield components of pigeonpea as influenced by foliar application of major nutrients, minor nutrients and plant growth regulators

Treatments	Number of pods plant^{-1}	Pod length (cm)	Test weight (g)	Seed yield (kg ha^{-1})	Harvest index
T_1 - Foliar application of NPK(19:19:19) mixture @ 2%	183.74	4.77	10.93	1372	24.51
T_2 - Foliar application of 6BA @ 20ppm	142.72	3.85	9.92	1205	20.01
T_3 – Foliar application of Salicylic acid @ 100ppm	182.56	4.71	10.92	1352	24.16
T_4 - Foliar application of Pulse magic @ 10g/l	212.91	5.63	12.48	1442	27.80
T_5 - Foliar application of MAP @ 2%	180.36	4.53	10.81	1328	23.20
T_6 - Foliar application of Zinc sulphate @ 0.5 %	171.26	3.98	10.44	1282	21.98
T_7 - Foliar application of Boric acid @ 0.1 %	170.54	3.92	10.30	1270	21.65
T_8 - Water spray	126.84	3.78	9.66	1186	19.78
T_9 – Control (RDF)	120.82	3.61	9.45	1182	18.76
T_{10} - Absolute control	109.94	3.35	9.24	982	10.33
S.Em(±)	8.98	0.16	0.36	34	1.01
C.D. at 5%	26.68	0.48	1.06	102	3.01

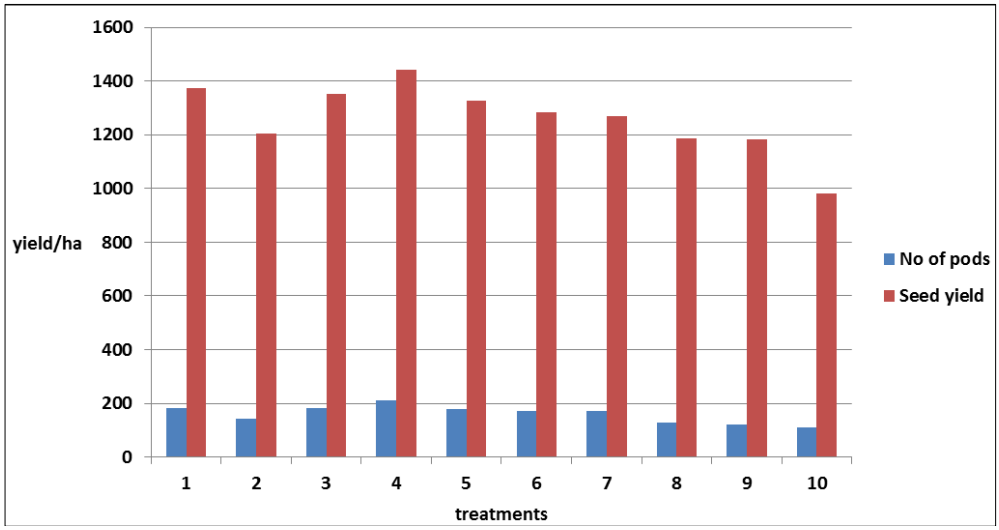

Fig 1: Yield and yield components of pigeonpea as influenced by foliar application of major nutrients, minor nutrients and plant growth regulators

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