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Effect of Foliar Application of Nutrients and PGRS on Biophysical, Biochemical Parameters and Yield of Pigeon Pea

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Abstract

Pigeon pea is most important pulse crop in Kalburgi 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.Foliar application of Pulse magic @ 10 g/l (29.7 µ mol $CO_2m^{-2}s^{-1}$) recorded highest photosynthetic rate as compared to control (24.44 µ mol $CO_2m^{-2}s^{-1}$)and also highest transpiration rate was recorded with Pulse magic @ 10g/l (25.30 m mol H_2O $m^{-2}s^{-1}$as compared to control(18.59 m mol H_2O $m^{-2}s^{-1}$). Higher chlorophyll a/b ratio (3.498) was obtained with foliar spray of Pulse magic 10 g/l followed by 19:19:19 @ 2% (3.258) and the lower (2.917) was obtained with control.pulse magic treated plots have significantly increased the yield (1442 $kgha^{-1}$) compared to the control (1182 $kgha^{-1}$). Pulse magic is a product developed and released by UAS, Raichur for increasing the yield of pulse crops.

Keywords : *Photosynthetic rate, transpiration rate, seed yield.*

Introduction

Pigeon pea [*Cajanus cajan* (L.) Millsp.] is the fifth prominent pulse crop in the world and in India after chickpea. In India, pigeon pea 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 Maharashtra in production (0.729 MT) with a productivity of 824 kg/ha which is nearer to the national average of 909 kg per hectare (1). Pigeon pea 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. Pigeon pea enhances soil fertility through leaf litter and biological nitrogen fixation (2).

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) (3). Application of recommended doses of fertilizers (RDF), the major, secondary and micronutrients, to pigeon pea is essential for higher yield under rainfed conditions (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 (5, 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 (7), 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 (8). Keeping the above background, the present investigation was taken up on growth and yield of pigeon pea as influenced by nutrients and plant growth regulators.

Materials and Methods

The field experiment was conducted during *kharif* 2017 at Agricultural Research Station, Kalburgi, UAS, Raichur under rain fed condition. It is situated at a latitude of 17^{o} 34' North, longitude of 76^{0} 79' East and an altitude of 478 meters above mean sea level. The soil of the experiment

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Table-1 : Influence of foliar application of nutrients and PGRs on biophysical, biochemical parameters and yield of pigeonpea.

Treatments	Photosynthetic rate (μ mol CO_2 $m^{-2}s^{-1}$)	Transpiration rate (m mol H_2O $m^{-2}s^{-1}$)	Total chlorophyll content (mg g^{-1} fr. wt.)	Seed yield (kg ha^{-1})
T_1 - Foliar application of NPK(19:19:19) mixture @ 2%	27.29	21.86	3.258	1372
T_2 - Foliar application of 6-BAP @ 20 ppm	25.1	19.39	3.084	1205
T_3 - Foliar application of Salicylic acid @ 100 ppm	26.8	21.70	3.249	1352
T_4 - Foliar application of Pulse magic @ 10 g/l	29.7	25.30	3.498	1442
T_5 - Foliar application of MAP @2%	26.5	20.96	3.213	1328
T_6 - Foliar application of Zinc sulphate @ 0.5%	26.27	19.82	3.160	1282
T_7 - Foliar application of Boric acid @ 0.1%	25.18	19.57	3.109	1270
T_8 - Water spray	24.93	19.20	2.996	1186
T_9 - Control (RDF)	24.44	18.59	2.917	1182
T_{10} - Absolute control	21.63	16.32	2.894	982
S.Em (±)	0.81	1.15	0.06	34
C.D. at 5%	2.37	3.41	0.17	102

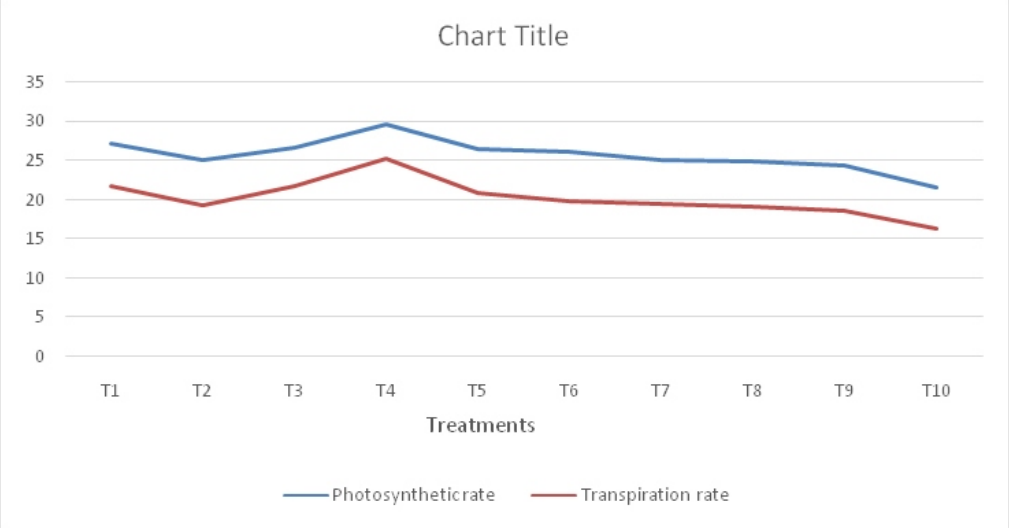

Fig.-1 : Photosynthetic rate and transpiration rate of pigeon pea as influenced by foliar application of major nutrients, minor nutrients and plant growth regulators.

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 (T_1), 20ppm 6BA (T_2), 100ppm Salicylic acid (T_3), 10g/l Pulse magic (T_4), 2% MAP (T_5), 0.5% $ZnSO_4$ (T_6), 0.01% Boric acid (T_7), Water spray (T_8), Control (T_9), Absolute control (T_{10}) 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 biophysical and biochemical parameters such as Photosynthetic rate (μ mol CO_2 $m^{-2}s^{-1}$), Transpiration rate (m mol H_2O $m^{-2}s^{-1}$), Total chlorophyll content (mg g^{-1}fr. wt.) and also recorded the seed yield (kg/ha) and compared to the control.

Results and Discussion

The data on photosynthetic rate, transpiration rate, total chlorophyll content and seed yield 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. In the present experiment, higher photosynthetic rate (29.7 μ mol CO_2 $m^{-2}s^{-1}$) and transpiration rate (25.30 m mol H_2O $m^{-2}s^{-1}$) was observed

in foliar spray of Pulse magic as compared to control (24.44 µ mol CO_2 $m^{-2}s^{-1}$, 18.59 m mol H_2O $m^{-2}s^{-1}$ respectively) and it is due to supplying the combination of various nutrients and plant growth regulator (PGR) which may enhances the development of chloroplast by utilizing nutrients especially nitrogen and hence more photosynthetic rate. These findings are similar to the results of (9) and by (10) in broad bean due to influence of nitrogen.

Among various biochemical parameters leaf chlorophyll content plays an important role in crop productivity as it helps in harvesting sunlight and transforming its energy into biochemical energy essential for life on earth. Due to this nature it has been designated as “Pigments of life” and it also an indicator of vigor of the plant.

In our present studies, the highest chlorophyll content was observed with foliar application of Pulse magic (3.498 mg g^{-1}fr. wt) as compared to control (2.917 mg g^{-1}fr. wt). The variation in chlorophyll content due to foliar spray may be attributed to decreased chlorophyll degradation and increased chlorophyll synthesis. This increase in chlorophyll content may be due to presence of nitrogen and various micro nutrients as they are integral component of chlorophyll content and they also acts as a precursor for chlorophyll bio synthesis and regulates the chlorophyll content of the leaves. Our results are in conformity with the findings of chlorophyll content due to foliar application of combination of various nutrients was reported by (11) in soybean and (12) in groundnut.

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