Plant Archives Vol. 20 Supplement 1, 2020 pp. 1124-1126 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

INFLUENCE OF POTASSIUM ON CHLOROPHYLL CONTENT OF BLACKGRAM(VBN-3) GROWN IN COASTAL REGIONS OF TAMILNADU

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Abstract

The field experiment was conducted at farmer's field in Sivapuri village, Chidambaram taluk, Cuddalore district, Tamilnadu, to study the effect of different levels of potassium on chlorophyll content of blackgram (VBN-3). The treatments were T_1 - Absolute control, T_2 - Control (-K), T_3 - 12.5 kg of K_2O ha^{-1}, T_4 - 25 kg of K_2O ha^{-1}, T_5 -37.5 kg of K_2O ha^{-1}, T_6 - 50 kg of K_2O ha^{-1}, T_7 - 62.5 kg of K_2O ha^{-1}, T_8 - 75 kg of K_2O ha^{-1}. The results of the experiment indicated that application of T_6 – 50 kg ha^{-1} of K_2O significantly enhanced the higher chlorophyll a, chlorophyll b, and total chlorophyll content of blackgram.

Key Words: Blackgram, chlorophyll a, chlorophyll b, total chlorophyll content

Introduction

Blackgram [*Vigna mungo* L. Hepper] is the third important pulse crop of India which is cultivated over a wide range of agro-climatic zones of the country. It grows well in both abnormal and normal weather situation. It occupies about 3.25 million ha area in the country producing 1.5 million tones of seed with average productivity of 462 kg/ha (AICRP, 2013)[1]. Kota district of Rajasthan occupies 13441 ha area with average productivity of 800 kg/ha of urd which is slightly higher against the Rajasthan average productivity of 516 kg/ha (GOR, 2012)[2]. In Tamil Nadu, it is cultivated in 4.56 lakh hectares of area with a production of 2.36 lakh tonnes and the average productivity is 518 kg ha^{-1}. The average productivity of pulses in Tamilnadu is very low when compared to India's average of 610kg ha^{-1}. Production of black gram is low in general due to poor management and low soil fertility status. Madhya Pradesh, Maharashtra, Uttar Pradesh, Tamil Nadu, Orissa and Gujarat are the main black gram growing states of India. The productivity potential of pulses is not realized and the reasons for low productivity of blackgram are large scale cultivation under rainfed and marginal lands and may be under low input conditions (Rathore, 2002)[3]. Potassium is also essential for photosynthesis, protein synthesis and regulation of stomatal movement and it is the major cation in maintenance of cation-anion balances (Marschner, 1995)[4]. Significantly highest chlorophyll, carotenoids content as a result of foliar K nutrition could be attributed to the mode of action of macro elements in enhancing the photosynthetic activity Doss *et al.,* (2013)[5].

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Materials and Methods

Field experiment was conducted in the farmer's field at Sivapuri village near Chidambaram, Cuddalore district, Tamil Nadu. The experimental farm is geographically situated at 11°38' North latitude and 79°70' East longitude and at an altitude of ±5.79 m above mean sea level and 6 km away from Bay of Bengal. It is characterized by tropical climate with a mean annual rainfall of 1500 mm distributed over 57 rainy days. Out of these, 22.97 percent (344.55 mm) is received during South-West monsoon (June-September), 69.13 percent (1036.95 mm) during North-East monsoon (October-December), 3.9 percent (58.50 mm) during winter season (January- February) and the remaining 4 percent (60.00 mm) during summer months (March-April). The maximum temperature ranges from 30.1°C to 39.2°C with a mean of 34.2°C, the minimum temperature ranges from 18.9°C to 28.6°C with a mean of 24.2°C and relative humidity ranges from 79 to 90 percent. The experimental design adopted in the

study was randomized block design with three replications and eight treatments. The treatments were T_1 - Absolute control, T_2 - Control (-K), T_3 - 12.5 kg of K_2O ha^{-1}, T_4 – 25 kg of K_2O ha^{-1}, T_5 – 37.5 kg of K_2O ha^{-1}, T_6 - 50 kg of K_2O ha^{-1}, T_7 – 62.5 kg of K_2O ha^{-1}, T_8 - 75 kg of K_2O ha^{-1}.The soils of Sivapuri village was found to contain soil separates of 29.2, 39.4, 30.5 percent sand, silt and clay respectively. The soils are classified under the textural class clay loam. The bulk density, particle density, pH, electrical conductivity and cation exchange capacity of the soil were 1.38 Mgm^{-3}, 2.50 Mg m^{-3}, 7.60 dsm^{-1}, 0.86 $dsm^{-1}$and 22.4 c mol (p^+) kg^{-1} respectively. Organic carbon content of the soil was 3.9 g kg^{-1}. Available N,P and K content of the soil were 235.0, 14.0 and 170 kg ha^{-1} respectively, available sulphur content was 8.5 mg kg^{-1} and the exchangeable calcium, magnesium, potassium and sodium contents were 8.8, 8.2, 3.8 and 0.9 c mol (p^+) kg^{-1} respectively. Five plants from each plot were selected as random and also plants from each pot were tagged for the data collection. Data were collected at 30, 45 DAS and harvest stage. The sample plants were cut down to ground level prior to harvest and dried properly in the sun.

From one gram of fresh leaf of the plant, total chlorophyll is extracted is 80 per cent acetone and the adsorption at 663 nm and 645 nm were recorded in spectrophotometer (Arnon, 1949)[6].

Chlorophyll 'a' = 20.2 ´ Value at 645 nm ´ 100/1000 mg g^{-1}

Chlorophyll 'b' = 8.02 ´ Value at 663 nm ´ 100/1000 mg g^{-1}

Total chlorophyll = Chlorophyll 'a' + Chlorophyll 'b'

Results and Discussion

Chlorophyl a, chlorophyll b and total chlorophyll content at 30 DAS

The results obtained from the present investigation as well as relevant discussion have been summarized**.** The treatments T_1 recorded the lowest chlorophyll a and chlorophyll b of 0.25 and 0.22 mg g^{-1} and the treatment T_6 recorded the highest chlorophyll a and chlorophyll b 0.48 and 0.45 mg g^{-1}.However the treatment T_5 and T_8 which recorded chlorophyll a and chlorophyll b of 0.42 and 0.39 mg g^{-1}, 0.41 and 0.38 mg g^{-1} was on par with each other. The other treatments T_3,T_4 and T_7 recorded chlorophyll a and chlorophyll b of 0.37,0.34 mg g^{-1}, 0.40,0.37 mg g^{-1} and 0.45,0.43 mg g^{-1} which were found to be statistically significant. The treatment T_2 recorded a chlorophyll a and chlorophyll b of 0.34 and 0.31 mg g^{-1} at 30 DAS.

The treatment T_1 recorded the lowest total chlorophyll 0.48 mg g^{-1} and the treatment T_6 recorded the highest total chlorophyll 0.94 mg g^{-1}.However the treatment T_5 which recorded total chlorophyll of 0.80 mg g^{-1} was on par with treatment T_8 0.82 mg g^{-1}. The other treatments T_3,T_4 and T_7 recorded total chlorophyll of 0.72 mg g^{-1},0.78 mg g^{-1} ,0.88 mg g^{-1} which were found to be statistically significant. The treatment T_2 recorded total chlorophyll of 0.66 mg g^{-1} at 30 DAS.

Chlorophyl a, chlorophyll b and total chlorophyll content at 45 DAS:

The treatments T_1 recorded the lowest chlorophyll a and chlorophyll b of 0.49 and 0.45 mg g^{-1} and the treatment T_6 recorded the highest chlorophyll a and chlorophyll b 0.87 and 0.83 mg g^{-1}. However the treatment T_5 and T_8 which recorded chlorophyll a and chlorophyll b of 0.76 and 0.72 mg g^{-1}, 0.77 and 0.73 mg g^{-1} was on par with each other. The other treatments T_3,T_4 and T_7 recorded chlorophyll a and chlorophyll b of 0.61,0.57 mg g^{-1},0.67,0.62 mg g^{-1} and 0.82,0.79 mg g^{-1}which were found

Table 1: Chlorophyll a, chlorophyll b and total chlorophyll content at 30 DAS (mg g^{-1}).

Treatments	30 DAS		
	Chlorophyll a	Chlorophyll b	Total Chlorophyll
T_1-Absolute control	0.25	0.22	0.48
T_2-Control(- K)	0.34	0.31	0.66
T_3-12.5 kg of K_2O ha^{-1}	0.37	0.34	0.72
T_4-25 kg of K_2O ha^{-1}	0.40	0.37	0.78
T_5-37.5 kg of K_2O ha^{-1}	0.42	0.39	0.82
T_6-50 kg of K_2O ha^{-1}	0.48	0.45	0.94
T_7-62.5 kg of K_2O ha^{-1}	0.45	0.43	0.88
T_8-75 kg of K_2O ha^{-1}	0.41	0.38	0.80
SEd	0.01	0.01	0.03
CD(0.05)	0.03	0.02	0.06

Table 2: Chlorophyll a, chlorophyll b, and total chlorophyll content at 45 DAS(mg g^{-1}).

Treatments	45 DAS		
	Chlorophyll a	Chlorophyll b	Total Chlorophyll
T_1-Absolute control	0.49	0.45	0.95
T_2-Control(- K)	0.57	0.52	1.10
T_3-12.5 kg of K_2O ha^{-1}	0.61	0.57	1.19
T_4-25 kg of K_2O ha^{-1}	0.67	0.62	1.25
T_5-37.5 kg of K_2O ha^{-1}	0.76	0.72	1.49
T_6-50 kg of K_2O ha^{-1}	0.87	0.83	1.70
T_7-62.5 kg of K_2O ha^{-1}	0.82	0.79	1.61
T_8-75 kg of K_2O ha^{-1}	0.77	0.73	1.51
SEd	0.02	0.02	0.04
CD(0.05)	0.05	0.04	0.09

to be statistically significant. The treatment T_2 recorded a chlorophyll a and chlorophyll b of 0.57 and 0.52 mg g^{-1} at 45 DAS. The treatment T_1 recorded the lowest total chlorophyll 0.95 mg g^{-1} and the treatment T_6 recorded the highest total chlorophyll 1.70 mg g^{-1}. However, the treatment T_5 which recorded total chlorophyll of 1.49 mg g^{-1} was on par with treatment T_8 1.51 mg g^{-1}. The other treatments T_3,T_4 and T_7 recorded total chlorophyll of 1.19 mg g^{-1},1.25 mg g^{-1} ,1.61 mg g^{-1} which were found to be statistically significant. The treatment T_2 recorded total chlorophyll of 1.10 mg g^{-1} at 45 DAS.

Adequate supply of potassium nutrient increase chlorophyll content in plants. These results are found to be similar with the results from Fletcher *et al.,* (1982)[7], Mfillage *et al.,* (2014)[8], Zhao *et al.,* (2001)[9]. Significantly highest chlorophyll, carotenoids content as a result of foliar K nutrition could be attributed to the mode of action of macro elements in enhancing the photosynthetic activity Doss *et al.,* (2013)[10].

Conclusion

It can be concluded that significantly highest chlorophyll a, chlorophyll b and total chlorophyll content was deliberated with treatment of fertilizer consisting of recommended dose of fertilizer with 50kg ha^{-1} of potassium application. Application of potassium in the form of muriate of potash significantly increased the chlorophyll content of the black gram.

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