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# LEAF CHLOROPHYLL CONTENT AS INFLUENCED BY GRADED DOSES OF POTASSIUM IN BLACK GRAM (VBN -3)

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## Abstract

A 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 a,chlorophyll b and total chlorophyll content in blackgram leaves. The different potassium 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 field 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

Black gram is an important grain legume of our country. Besides improving soil fertility through symbiotic N fixation, it is a cheap source of vegetable protein for direct human consumption and is known as poor man's meat. Having a wider adaptability, it is planted successfully both in irrigated as well as in rainfed areas twice a year in spring and autumn. In spite of being widely adapted crop, its $ha^{-1}$ yield is very low in India. One of the major causes of low yield could be poor fertility status of the soils, therefore, fertility management is imperative to ensure better crop production on exhausted soils. Application of Muraite of potash was found to increase 1000-grain weight, grain yield and protein and chlorophyll contents of various legumes particularly black gram (Rajendran *et al.,* 1974). This finding was further supported by the results reported by Subramanian and Radhakrishnan (1983) who claimed a significant increase in yield of black gram with the use of potassic fertilizers. Malik *et al.,* (1986) also reported that potassium was essential for having maximum yield of black gram, however N and P alone or in combination with other did not show significant positive response. But the literature also witnessed that K application showed beneficial effects on blackgram. (Raval and Yadav, 1986). So, the present study was formulated by keeping in view these results, it was contemplated to work out the optimum level of potash to be applied with constant rate of N and P for improving the chlorophyll content a, b and total chlorophyll in blackgram.

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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 12°38' North latitude and 80°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 29.8, 38.5, 28.4 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 Mg $m^{-3}$, 2.50 Mg $m^{-3}$, 8.50 $dsm^{-1}$, 0.81 $dsm^{-1}$ and 21.8 c mol $(p^+)$ $kg^{-1}$ respectively. Organic carbon content of the soil was 3.5 g $kg^{-1}$. Available N, P and K content of the soil were 187.0, 9.8 and 118 kg $ha^{-1}$ respectively and the exchangeable calcium, magnesium, potassium and sodium contents were 7.6, 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 and 45 DAS.

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

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

The results obtained from the present investigation as well as relevant discussion have been summarized.

### Chlorophyll a and chlorophyll b at 30 DAS

Increased levels of potassium in the form of MOP resulted in significant increase in chlorophyll a and chlorophyll b. The treatments $T_1$ recorded the lowest chlorophyll a and chlorophyll b of 0.28 and 0.26 mg $g^{-1}$ respectively and the treatment $T_6$ recorded the highest chlorophyll a and chlorophyll b (0.49 and 0.47 mg $g^{-1}$) respectively. However, the treatment $T_5$ and $T_8$ which recorded chlorophyll a and chlorophyll b of 0.43 and 0.40 mg $g^{-1}$, 0.45 and 0.40 mg $g^{-1}$ respectively were on par with each other. The other treatments $T_3$, $T_4$ and $T_7$ recorded chlorophyll a and chlorophyll b of 0.39, 0.36 mg $g^{-1}$, 0.45,0.39 mg $g^{-1}$ and 0.46, 0.41 mg $g^{-1}$ respectively which were found to be statistically significant. The treatment $T_2$ recorded a chlorophyll a and chlorophyll b contents of 0.37 and 0.33 mg $g^{-1}$ at 30 DAS.

### Chlorophyll a and chlorophyll b at 45 DAS

At 45 DAS the treatment $T_1$ recorded the lowest chlorophyll a and chlorophyll b of 0.49 and 0.45 mg $g^{-1}$ respectively and the treatment $T_6$ recorded the highest chlorophyll a and chlorophyll b of 0.89 and 0.86 mg $g^{-1}$ respectively. However, the treatment $T_5$ and $T_8$ which recorded chlorophyll a and chlorophyll b of 0.77 and 0.70 mg $g^{-1}$, 0.80 and 0.76 mg $g^{-1}$ respectively were on par with each other. The other treatments $T_3$, $T_4$ and $T_7$ recorded chlorophyll a and chlorophyll b of 0.62, 0.55 mg $g^{-1}$, 0.67, 0.59 mg $g^{-1}$ and 0.86, 0.81 mg $g^{-1}$ respectively

**Table 1:** Influence of graded levels of potassium on chlorophyll a and chlorophyll b at 30 DAS in black gram leaves.

| Treatments | Chlorophyll a | Chlorophyll b |
|---|---|---|
| $T_1$-Absolute control | 0.25 | 0.22 |
| $T_2$-Control (- K) | 0.34 | 0.31 |
| $T_3$-12.5 kg of $K_2O$ $ha^{-1}$ | 0.37 | 0.34 |
| $T_4$-25 kg of $K_2O$ $ha^{-1}$ | 0.40 | 0.37 |
| $T_5$-37.5 kg of $K_2O$ $ha^{-1}$ | 0.42 | 0.39 |
| $T_6$-50 kg of $K_2O$ $ha^{-1}$ | 0.48 | 0.45 |
| $T_7$-62.5 kg of $K_2O$ $ha^{-1}$ | 0.45 | 0.43 |
| $T_8$-75 kg of $K_2O$ $ha^{-1}$ | 0.41 | 0.38 |
| SED | 0.01 | 0.01 |
| CD (0.05) | 0.03 | 0.02 |

**Table 2:** Influence of graded levels of potassium on chlorophyll a and chlorophyll b at 45 DAS in black gram leaves.

| Treatments | Chlorophyll a | Chlorophyll b |
|---|---|---|
| $T_1$-Absolute control | 0.49 | 0.45 |
| $T_2$-Control (- K) | 0.57 | 0.52 |
| $T_3$-12.5 kg of $K_2O$ $ha^{-1}$ | 0.61 | 0.57 |
| $T_4$-25 kg of $K_2O$ $ha^{-1}$ | 0.67 | 0.62 |
| $T_5$-37.5 kg of $K_2O$ $ha^{-1}$ | 0.76 | 0.72 |
| $T_6$-50 kg of $K_2O$ $ha^{-1}$ | 0.87 | 0.83 |
| $T_7$-62.5 kg of $K_2O$ $ha^{-1}$ | 0.82 | 0.79 |
| $T_8$-75 kg of $K_2O$ $ha^{-1}$ | 0.77 | 0.73 |
| SED | 0.49 | 0.02 |
| CD (0.05) | 0.57 | 0.04 |

**Table 3:** Influence of graded levels of potassium on total chlorophyll content at 45 DAS in black gram leaves.

| Treatments | Total Chlrophyll Content | |
|---|---|---|
| | 30 DAS | 45 DAS |
| $T_1$-Absolute control | 0.48 | 0.95 |
| $T_2$-Control (- K) | 0.66 | 1.10 |
| $T_3$-12.5 kg of $K_2O$ $ha^{-1}$ | 0.72 | 1.19 |
| $T_4$-25 kg of $K_2O$ $ha^{-1}$ | 0.78 | 1.25 |
| $T_5$-37.5 kg of $K_2O$ $ha^{-1}$ | 0.82 | 1.49 |
| $T_6$-50 kg of $K_2O$ $ha^{-1}$ | 0.94 | 1.70 |
| $T_7$-62.5 kg of $K_2O$ $ha^{-1}$ | 0.88 | 1.61 |
| $T_8$-75 kg of $K_2O$ $ha^{-1}$ | 0.80 | 1.51 |
| Sed | 0.03 | 0.04 |
| CD (0.05) | 0.06 | 0.09 |

which were found to be statistically significant. The treatment $T_2$ recorded chlorophyll a and chlorophyll b content of 0.58 and 0.50 mg $g^{-1}$ respectively at 45 DAS.

**Total chlorophyll content**

Significant differences in total chlorophyll content were observed due to the application of potassium (MOP) in different treatments. The treatment $T_1$ recorded the lowest total chlorophyll content of 0.54 and 0.94 mg $g^{-1}$ respectively and the treatment $T_6$ recorded the highest total chlorophyll content of 0.96 and 1.75 mg $g^{-1}$ respectively at 30 and 45 DAS. However, the treatment $T_5$ which recorded total chlorophyll of 0.83 and 1.47 mg $g^{-1}$ was on par with treatment $T_8$ (0.85 and 1.56 mg $g^{-1}$). The other treatments, $T_3$, $T_4$ and $T_7$ recorded total chlorophyll of 0.75 and 1.17 mg $g^{-1}$, 0.84 and 1.26 mg $g^{-1}$, 0.87 and 1.67 mg $g^{-1}$ respectively which were found to be statistically significant. The treatment $T_2$ recorded total chlorophyll content of 0.70 and 1.08 mg $g^{-1}$ respectively at 45 DAS.

The chlorophyll content increased due to the application of potassium which Indicated with. Similar results were noted by Borse *et al.,* (2002) and Ibrahim *et al.,* (2012). Increase in protein content may be due to application of potassium might be attributed to the favorable influence of biological activity and it's stimulating effect on photosynthetic pigments and enzyme activity which in turn encourage vegetative growth, yield of plants, chlorophyll content and consequently protein content percent. These results are in agreement with the findings of Farhad *et al.,* (2010); Hussain *et al.,* (2011) and Ibrahim and Bassyuni (2012).

## Conclusion

Potassium is one of important nutrient elements and plays a major role in crop growth and development, modifies abundant enzyme activations, controls the cell osmoregulation and the stomatal movement of photosynthesis. It can be concluded that significantly highest chlorophyll a, chlorophyll b and total chlorophyll content increased significantly with potassium application.

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