



Foliar Application of Water Soluble Fertilizer on Growth and Yield of Rainfed Blackgram (*Vigna mungo* (L). Hepper)

J.Sakthi*; **K.Ramya**; **M.Srinivasan**; **J. Sridhar**; **R.Kumar**

Department of Agronomy, The Indian Agriculture College, Radhapuram, Tirunelveli- 627 111

*Corresponding Author's Email: gunasakthi01@gmail.com

Abstract: Field experiment was conducted at The Indian Agriculture college, Radhapuram during December 2019 – February 2020. To evaluate the effect of foliar application of water soluble fertilizer on growth and yield of blackgram under rainfed conditions. Nine treatments were tested in randomized block design with three replications. Among the treatments, application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS proved its superiority through highest dry matter production (DMP) of 795, 2517 and 4670 kg ha⁻¹ over the other treatments on 30, 45 DAS and harvest respectively. Significantly higher grain yield (733 kg ha⁻¹) was recorded in application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 on 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS.

Keywords: Black gram, foliar spray, DMP and Grain yield.

Introduction

Foliar spray of nutrients is the fastest way to boost up crop growth because, nutrients are available to plants in critical stages and the nutrients will reach the site of food synthesis directly leading to no wastage and quick supply of food, thereby reduce the requirement of fertilizers. Foliar application resulted in efficient absorption and usage which is economical in respect to other methods of fertilization. It is also known that active nodulation of blackgram or any pulse crop stops 45-50 days after sowing and at that time for legume plants if supply nutrients through foliar spray found to have beneficial effects on enhancing growth, increasing seed yield and quality parameters. Most of the pulses leaf senescence starts much before completion of pod maturity and which breaks source sink relationship finally lead to unfilled pods and pods with shriveled seeds are major drawbacks in Blackgram which can be managed through foliar application of nutrients. Nutrient spray at later stages has been found to delay leaf senescence and improved yield. Several strategies have been initiated to boost the productivity of blackgram. One among them is foliar application of nutrients for exploiting genetical potential of the crop. This is considered to be an efficient and economic method of supplementing part of the nutrient requirement at critical stages. Nutrients play a pivotal role in



increasing the seed yield in pulses (Chandrasekhar and Bangarusamy, 2003). Therefore, in the present study was carried out by application of nutrients through foliar spray for maximising the productivity of blackgram.

Material and Methods

A field experiment was conducted at The Indian Agriculture college, Radhapuram during December 2019 – February 2020 to study the effect of foliar application of water soluble fertilizer on growth and yield of rainfed blackgram (*Vigna mungo* (L). Hepper). Blackgram CO6 was used as the test variety. The experiment was laid out in Randomized block design (RBD) with three replications. It consisted of nine treatments *viz.*, T1- RDF alone, T2- RDF + Foliar spray of 0.5% 19:19:19 on 15, 30 and 45 DAS, T3- RDF + Foliar spray of 0.5% 12: 61:0 on 15, 30 and 45 DAS, T4-RDF + Foliar spray of 0.5% 13:0:45 on 15, 30 and 45 DAS, T5-RDF + Foliar spray of 0.5% 19:19:19 on 15 DAS + Foliar spray of 0.5% 12: 61:0 30 DAS + Foliar spray of 0.5% 13:0:45 on 45 DAS, T6-RDF + Foliar spray of 1% 19:19:19 on 15, 30 and 45 DAS, T7-RDF + Foliar spray of 1% 12: 61:0 on 15, 30 and 45 DAS, T8-RDF + Foliar spray of 1% 13:0:45 on 15, 30 and 45 DAS, T9-RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS. Blackgram variety CO6 was sown under rainfed condition. Water soluble fertilizers were applied as per the treatment schedule. Number of pod plant⁻¹, number of seeds pod⁻¹, seed test weight and yield of blackgram were recorded.

Results and Discussion

Plant Height

The plant height is a direct index to measure the growth and vigour of plants. In general, the plant height gradually increased from initial stage to harvest stage (Siddaraju *et al.*, 2010). Adoption of different foliar nutrition of water soluble fertilizer application practices produced distinct variations on the height of plants at all the stages (Table 1). In the present investigation, application of RDF along with foliar nutrition significantly increased the plant height of blackgram. Application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS exhibited highest plant height on 30,45 DAS and harvest stage (23.9 cm, 31.7cm , 38.4 cm). It might be due to its indeterminate growth habit with additional supply of major nutrients through foliar spray. This result corroborate with the findings of Takankhar *et al.*, (2017) and Jadhav *et al.*, (2017).



Dry Matter Production

Increase in dry matter is one of the criteria for crop growth. The biomass accumulation was slower in early growing period but dry matter accumulation in latter part of growing period was higher and hence more crop growth rate which eventually led to higher seed yield. Combination of foliar application with macro and micronutrients on crop growth and development could improve the dry matter accumulation (Table 2). The present study also indicated that Application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS proved its superiority through highest dry matter production of 795, 2517 and 4670 kg ha⁻¹ over the other treatments on 30, 45 DAS and harvest respectively. Increased dry matter production is due to balanced proportion of macro nutrients in the foliar fertilization which resulted in better crop growth and photosynthetic activity which has lead to better supply of photosynthesis ultimately resulted in higher dry matter production per plant. The results are in confirmation with the findings of Sharifi *et al.*, (2018) and Jahid Ahmad *et al.*,(2019).

Leaf Area Index

Leaf area index was significantly influenced by different water soluble fertilizer foliar application practices (Table 3). The treatments imposed had significant influence on the LAI of blackgram on 30 and 45 DAS. Among all the treatments, application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS significantly recorded the highest LAI (1.91 and 3.21 on 30DAS and 45 DAS respectively). Leaf area index was directly attributed to the higher leaf area. The formation of optimum photosynthetic stage for longer period was essential for increasing yield which was met through the foliar nutrients applied to the soybean crop. On the other side, improved photosynthetic capacity was influenced by the foliar fertilization of major nutrients viz., N, P and K. The synergistic effect of macro nutrient help in rapid growth and development of plants as they help in photosynthesis and various biochemical processes which responds towards growth Jasim Iqbal *et al.*, (2016) and Sharifi *et al.*, (2018).

Yield Attributes

The grain yield of blackgram was mainly determined from the contribution of yield components like number of pods plant⁻¹, number of seeds pod⁻¹ and test weight (Table. 4).

In the present study, adoption of different foliar application practices significantly influenced the yield attributes of rainfed blackgram. Application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS



+ Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS recorded highest values for yield attributing characters *viz.*, number of pods per plant (35.60), number of seeds per pod (6.41) and 100 seed weight (5.53g) than the other foliar spray treatments. Foliar spray thrice during vegetative stage, flowering stage and pod filling stage might be due to enhanced photosynthetic activity and higher uptake of nutrients and thereby increased plant dry matter production in the pod setting phase which might have improved the pod development and number of pods per plant. Earlier findings by Sharifi *et al.*, (2018) and Jahid Ahmad *et al.*, (2019) agreed with the present findings.

Table 1. Effect of foliar application of water soluble fertilizer on plant height (cm) of blackgram

Treatments	30 DAS	45 DAS	At Harvest
T ₁ RDF alone	18.5	24.8	30.2
T ₂ RDF + Foliar spray of 0.5% 19:19:19 on 15, 30 and 45 DAS	19.9	26.6	32.4
T ₃ RDF + Foliar spray of 0.5% 12: 61:0 on 15, 30 and 45 DAS	19.8	26.8	32.2
T ₄ RDF + Foliar spray of 0.5% 13:0:45 on 15, 30 and 45 DAS	20.8	27.8	33.9
T ₅ RDF + Foliar spray of 0.5% 19:19:19 on 15 DAS + Foliar spray of 0.5% 12: 61:0 30 DAS + Foliar spray of 0.5% 13:0:45 on 45 DAS	22.5	30.1	36.4
T ₆ RDF + Foliar spray of 1% 19:19:19 on 15, 30 and 45 DAS	21.1	28.2	34.0
T ₇ RDF + Foliar spray of 1% 12: 61:0 on 15, 30 and 45 DAS	20.8	27.8	33.8
T ₈ RDF + Foliar spray of 1% 13:0:45 on 15, 30 and 45 DAS	22.3	29.8	35.9
T ₉ RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS	23.9	31.7	38.4
SEd	0.6	0.7	0.9
CD (P=0.05)	1.1	1.5	1.8

Table 2. Effect of foliar application of water soluble fertilizer on dry matter production (kg ha⁻¹) of blackgram

Treatments	30 DAS	45 DAS	At Harvest
T ₁ RDF alone	608	1921	3569
T ₂ RDF + Foliar spray of 0.5% 19:19:19 on 15, 30 and 45 DAS	679	2118	3843
T ₃ RDF + Foliar spray of 0.5% 12: 61:0 on 15, 30 and 45 DAS	654	2086	3814
T ₄ RDF + Foliar spray of 0.5% 13:0:45 on 15, 30 and 45 DAS	690	2235	4081



T ₅	RDF + Foliar spray of 0.5% 19:19:19 on 15 DAS + Foliar spray of 0.5% 12: 61:0 30 DAS + Foliar spray of 0.5% 13:0:45 on 45 DAS	759	2395	4449
T ₆	RDF + Foliar spray of 1% 19:19:19 on 15, 30 and 45 DAS	714	2259	4159
T ₇	RDF + Foliar spray of 1% 12: 61:0 on 15, 30 and 45 DAS	709	2247	4128
T ₈	RDF + Foliar spray of 1% 13:0:45 on 15, 30 and 45 DAS	751	2375	4397
T ₉	RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS	795	2517	4670
SEd		17	55	104
CD (P=0.05)		35	115	218

Table 3. Effect of foliar application of water soluble fertilizer on leaf area index (LAI) of blackgram

Treatments		30 DAS	45 DAS
T ₁	RDF alone	1.26	1.84
T ₂	RDF + Foliar spray of 0.5% 19:19:19 on 15, 30 and 45 DAS	1.42	2.15
T ₃	RDF + Foliar spray of 0.5% 12: 61:0 on 15, 30 and 45 DAS	1.37	2.07
T ₄	RDF + Foliar spray of 0.5% 13:0:45 on 15, 30 and 45 DAS	1.51	2.38
T ₅	RDF + Foliar spray of 0.5% 19:19:19 on 15 DAS + Foliar spray of 0.5% 12: 61:0 30 DAS + Foliar spray of 0.5% 13:0:45 on 45 DAS	1.83	3.07
T ₆	RDF + Foliar spray of 1% 19:19:19 on 15, 30 and 45 DAS	1.57	2.49
T ₇	RDF + Foliar spray of 1% 12: 61:0 on 15, 30 and 45 DAS	1.54	2.43
T ₈	RDF + Foliar spray of 1% 13:0:45 on 15, 30 and 45 DAS	1.77	2.96
T ₉	RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS	1.91	3.21
SEd		0.03	0.06
CD (P=0.05)		0.07	0.13



Table 4. Effect of foliar application of water soluble fertilizer on the yield attributes of blackgram

Treatments	No. of pods per plant	No. of seeds per pod	100 seed weight (g)
T ₁ RDF alone	21.40	5.22	5.08
T ₂ RDF + Foliar spray of 0.5% 19:19:19 on 15, 30 and 45 DAS	24.40	5.42	5.22
T ₃ RDF + Foliar spray of 0.5% 12: 61:0 on 15, 30 and 45 DAS	23.90	5.40	5.11
T ₄ RDF + Foliar spray of 0.5% 13:0:45 on 15, 30 and 45 DAS	26.90	5.60	5.26
T ₅ RDF + Foliar spray of 0.5% 19:19:19 on 15 DAS + Foliar spray of 0.5% 12: 61:0 30 DAS + Foliar spray of 0.5% 13:0:45 on 45 DAS	31.30	6.07	5.37
T ₆ RDF + Foliar spray of 1% 19:19:19 on 15, 30 and 45 DAS	28.20	5.67	5.30
T ₇ RDF + Foliar spray of 1% 12: 61:0 on 15, 30 and 45 DAS	27.80	5.62	5.27
T ₈ RDF + Foliar spray of 1% 13:0:45 on 15, 30 and 45 DAS	30.90	5.96	5.35
T ₉ RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS	35.60	6.41	5.53
SEd	1.2	0.06	0.23
CD (P=0.05)	2.4	0.13	NS



Table 5. Effect of foliar application of water soluble fertilizer on seed yield, haulm yield (kg ha⁻¹) and harvest index of blackgram

Treatments	Seed yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Harvest index
T ₁ RDF alone	463	1361	0.238
T ₂ RDF + Foliar spray of 0.5% 19:19:19 on 15, 30 and 45 DAS	530	1587	0.237
T ₃ RDF + Foliar spray of 0.5% 12: 61:0 on 15, 30 and 45 DAS	515	1560	0.235
T ₄ RDF + Foliar spray of 0.5% 13:0:45 on 15, 30 and 45 DAS	580	1746	0.237
T ₅ RDF + Foliar spray of 0.5% 19:19:19 on 15 DAS + Foliar spray of 0.5% 12: 61:0 30 DAS + Foliar spray of 0.5% 13:0:45 on 45 DAS	697	2132	0.236
T ₆ RDF + Foliar spray of 1% 19:19:19 on 15, 30 and 45 DAS	621	1886	0.236
T ₇ RDF + Foliar spray of 1% 12: 61:0 on 15, 30 and 45 DAS	610	1845	0.237
T ₈ RDF + Foliar spray of 1% 13:0:45 on 15, 30 and 45 DAS	668	2039	0.236
T ₉ RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS	783	2390	0.238
SEd	21	66	0.006
CD (P=0.05)	44	136	NS

Yield

In the case of foliar spray, application of RDF + Foliar spray of 1% 19:19:19 on 15 DAS + Foliar spray of 1% 12: 61:0 30 DAS + Foliar spray of 1% 13:0:45 on 45 DAS recorded significantly higher grain yield as well as haulm yield (783 and 2390 kg ha⁻¹, respectively) of blackgram as compared to other treatments (Table 5). Balanced growth habit, induced more flower and fruiting body production with timely supply of nutrients through foliar spray, might have reduced shedding of flowers and fruits, which led to a positive source-sink gradient of photosynthates translocation due to growth regulator on the other hand. The highest seed yield obtained in treatments might be due to higher nutrient mobility uptake and provided with all essential elements needed on time. These favourable effects might have attributed for higher yield of blackgram under the foliar spray of major nutrients. This finding is in line with the results of Takankhar *et al.*, (2017) and Jadhav *et al.*, (2017).



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