



## Effect of different chemicals on growth and yield and nutrient uptake and post-harvest nutrient status of rainfed black gram to foliar fertilization of different chemicals

Kalaiyarasan C<sup>1\*</sup>, N Indianraj<sup>1</sup>, M V Sriramachandrasekharan<sup>2</sup>, K Suseendran<sup>1</sup>, S Jawahar<sup>1</sup>

<sup>1</sup>Department of Agronomy, Annamalai University, Annamalai Nagar, Tamil Nadu, India

<sup>2</sup>Department of Soil science and Agricultural Chemistry, Annamalai University, Annamalai Nagar, Tamil Nadu, India

### Abstract

Field Experiment was conducted during June-September-2018 with an objective to enhance growth, yield, nutrient uptake and post harvest nutrient status of rainfed black gram through foliar fertilization. The experiment was laid out in randomized block design with seven treatments and replicated thrice. The treatment details includes, T<sub>1</sub> – Control (Farmer practice), T<sub>2</sub> – Full RDF, T<sub>3</sub> - 50% RDF and foliar spraying of “Revive plus” @ 2 g litre<sup>-1</sup> twice at 25 and 50 DAS, T<sub>4</sub> - 50% RDF and foliar spraying of “Revive plus” @ 3g litre<sup>-1</sup> twice at 25 and 50 DAS, T<sub>5</sub> - 50% RDF and foliar spraying of “1% KCl” twice at 25 and 50 DAS, T<sub>6</sub> – 50% RDF and foliar spraying of “100ppm Salicylic acid” twice at 25 and 50 DAS, T<sub>7</sub> - 50% RDF and foliar spraying of “Orthosilicic acid” @ 2ml litre<sup>-1</sup> twice at 25 and 50 DAS. The results of the experiments revealed that foliar application of different chemicals significantly influenced the growth and yield attributes, yield, nutrient uptake and post-harvest nutrient status. Among the various treatments tried, T<sub>4</sub> - “Revive plus” @ 3g litre<sup>-1</sup> twice at 25 and 50 DAS recorded maximum values for growth and yield attributes viz., plant height, LAI, DMP, root length and chlorophyll content and yield attributes viz., number of pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup>, test weight, seed yield and haulm yield. This treatment also registered maximum values for NPK uptake. The lowest values for growth and yield attributes and yield were recorded in T<sub>1</sub> – Control treatment, but it recorded the highest post-harvest nutrient status of black gram.

**Keywords:** black gram, foliar nutrition, yield, nutrient uptake and availability

### Introduction

Drought has been a recurring feature of agriculture in India. In the past, India experienced twenty four large scale droughts in with increasing frequencies during the periods 1891-1920, 1965-1990 and 1999- 2012 (NRAA, 2013) [5]. Long-term rainfall data for India indicates that rainfed areas experience 3-4 drought years in every 10 year period. Of these, two to three are in moderate and one or two may be of severe intensity (Srinivasa Rao *et al.*, 2013). Occurrence of the drought is very frequent in the meteorological sub divisions like West Rajasthan, Tamilnadu, Jammu & Kashmir and Telengana (NRAA, 2013) [5]. The risk involved in successful cultivation of crops depends on the nature of drought (chronic and contingent), its duration, and frequency of occurrence within the season. The term rainfed agriculture is used to describe farming practices that solely depend on rainfall for water. It provides much of the food consumed by poor communities in developing countries. Rainfed crop cover more than 80% of global cropped area and account for 60-70% of global crop production, but production is frequently limited by drought and soil moisture stress (Wood *et al.*, 2000) [11]. In India around 65-70% of cultivated lands coming under rainfed drylands and they contributing about 45% of nation's food grain production. Most of the crops belongs to millets (>95%), oilseeds (90%) and pulses 90-95% are cultivated on these lands with low productivity.

The reasons attributed to low productivity may be inadequate rainfall, poor soil fertility, occurrence of dry spells drought during cropping season, high temperature, more PET than rainfall etc.,. Of these drought at critical

period crops season drastically reduces the crop yield. The effect of water stress was found to decrease significantly in photosynthetic rate (Hejank, 2003) transpiration rate (Gupta *et al.*, 2003) [3] chlorophyll stability index stomata conductance and relative water content (Gupta *et al.*, 2003) [3]. Crops such as millet, foxtail, sorghum and cowpea are also grown in the arid and semi-arid areas affected by drought stress at the reproductive stage (Emam and Zavorakh, 2004). The All India coordinated Research Project for Dryland Agriculture (AICRPDA) in association with state Agricultural universities, Technical Universities and Research Institutes of Indian council of Agricultural Research have developed location-specific rainfed technologies to cope with different drought situations. The key technologies for drought mitigation are in situ moisture conversation, rainwater harvesting and recycling, resilient crops and cropping systems including contingency crop plant, foliar spraying, integrated farming system etc., (Srinivasa Rao *et al.*, 2014). Among these dryland technologies foliar spraying of nutrients and anti-transpirants found to be effective in mitigating drought moisture stress during cropping seasons. Among these dryland technologies foliar spraying of nutrients and anti-transpirants found to be effective in mitigating drought moisture stress during cropping seasons. Indian agriculture has been achieved to some extent due to improved practices, better logistics and timely interventions from central and state government during drought years. However, rainfall aberrations including drought during south-west monsoon continue to be major factors contributing to instability in crops production in rainfed

areas. Hence, there is a need to make rainfed areas more resilient through adoption of drought proofing technologies.

### Materials and Methods

The Field Experiments were conducted during June-September-2018 at the farmer's field at Kunjaram village in Ulundurpet Taluk of Villupuram District, Tamil Nadu. The experimental site is situated at 11°41'26"N latitude, 79°17'30"E longitude with an altitude of 66 m above mean sea level. The texture of the experimental field soil is sandy loam which is low in available nitrogen, high in available phosphorus and high in available potassium content. Blackgram VBN5 variety was chosen for this study. The experiment consisted of seven treatments and was laid out in Randomized Block Design with three replications. The treatments imposed in the experiment with different chemicals viz., T<sub>1</sub>- Control (Farmer's practice), T<sub>2</sub> - RDF 40:20:0 Kgs of NPK ha<sup>-1</sup>, T<sub>3</sub> - 50% RDF and foliar spraying of Revive plus @ 2g litre<sup>-1</sup> at 25 DAS and 50 DAS, T<sub>4</sub> -50% RDF and foliar spraying of Revive plus @ 3g litre<sup>-1</sup> at 25 DAS and 50 DAS, T<sub>5</sub> -50% RDF and foliar spraying of 1% KCl at 25 DAS and 50 DAS, T<sub>6</sub> -50% RDF and foliar spraying of 100ppm Salicylic acid at 25 DAS and 50 DAS and T<sub>7</sub> -50% RDF and foliar spraying of Orthosilicic acid @ 2ml litre<sup>-1</sup> at 25 DAS and 50 DAS. The recommended dose of 12.5:25:12.5 kgs of NPK ha<sup>-1</sup> for blackgram varieties were applied in the form the urea (46 % N), DAP (18 % N and 46 % P<sub>2</sub>O<sub>5</sub>) and MOP (60% K<sub>2</sub>O) respectively. Fertilizers were applied fully as basal.

### Results and Discussion

#### Growth Attributes (Table 1)

Among the various foliar nutrition, foliar spray of Revive plus @ 3g litre<sup>-1</sup> (T<sub>4</sub>) registered the higher plant height, LAI, DMP, chlorophyll content and root length of blackgram and it was comparable with foliar spraying of Revive plus @ 2g litre<sup>-1</sup> (T<sub>3</sub>) but superior to other foliar fertilization. Increased in plant height might be due to enhanced level of nutrient availability in the Rhizo-ecosystem of the foliar applied nutrients resulting in better plant growth and development. Application of nutrients would have resulted in better vegetative growth as observed by taller plants, more branches and efficient nodulation. This favourable influence of foliar application of nutrients could be ascribed to more and quick access to nutrients by plants at seedling and early development stages.

Increased leaf area index and dry matter production might be due to increased availability of nutrients to plants leading to maximum plant growth in terms of plant height and leaf area which in turn contributed higher DMP production. During this study we examined that these results also resembled the findings of Uma Maheshwari and Karthik (2017) [10] and Deepak Kumar *et al.* (2018) [11]. The increased chlorophyll content might be due to the fact that of nitrogen is a constituent of chlorophyll molecule which is expected during rapid grain filling leaves. This was evidenced through the studies of Sritharan *et al.* (2006) [9].

**Table 1:** Effect of foliar fertilization of different chemicals on growth attributes of black gram

Treatments	Plant height(cm) At harvest stage	LAI at flowering stage	DMP (Kg ha <sup>-1</sup> ) at harvest stage	Chlorophyll content (mg g <sup>-1</sup> ) at flowering stage	Root length (cm) at harvest stage
T <sub>1</sub>	66.04	3.34	3318.87	42.69	27.1
T <sub>2</sub>	67.02	3.84	3445.54	43.95	28.0
T <sub>3</sub>	69.45	4.52	3609.61	45.88	28.9
T <sub>4</sub>	69.98	4.93	3654.25	46.06	29.1
T <sub>5</sub>	68.08	4.03	3512.24	44.65	28.4
T <sub>6</sub>	66.89	3.62	3399.8	43.28	27.5
T <sub>7</sub>	68.76	4.28	3585.80	45.02	28.6
SE.d	1.34	0.11	68.05	0.87	0.48
CD(p=0.05)	2.93	0.24	148.27	1.90	1.04

**Table 2:** Effect of foliar fertilization of different chemicals on yield and yield attributes of black gram

Treatments	No. of pods plant <sup>-1</sup>	No. of seeds pod <sup>-1</sup>	Test weight (g)	Seed yield (Kg ha <sup>-1</sup> )	Haulm yield (Kg ha <sup>-1</sup> )
T <sub>1</sub>	12.6	6.2	3.4	776.33	2342.66
T <sub>2</sub>	13.0	7.0	3.65	936.50	2517.33
T <sub>3</sub>	14.0	7.8	3.85	1057.66	2719.33
T <sub>4</sub>	14.2	8.0	3.90	1173.83	2787.33
T <sub>5</sub>	13.4	7.2	3.70	981.33	2597.33
T <sub>6</sub>	12.8	6.6	3.60	932.16	2449.33
T <sub>7</sub>	13.6	7.4	3.80	1014.16	2655.66
SE.d	0.33	0.16	0.07	22.73	52.16
CD (p=0.05)	0.72	0.36	0.16	49.53	113.65

**Table 3:** Effect of foliar nutrition of different chemicals on nutrient uptake and post-harvest nutrient status of black gram

Treatments	Nutrient uptake (Kg ha <sup>-1</sup> )			Post-harvest nutrient status (Kg ha <sup>-1</sup> )		
	N	P	K	N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
T <sub>1</sub>	50.18	8.49	53.93	82.45	34.19	81.65
T <sub>2</sub>	52.09	8.82	55.99	80.42	31.65	79.39
T <sub>3</sub>	54.57	9.24	58.65	77.09	28.46	76.46
T <sub>4</sub>	55.25	9.35	59.38	75.88	27.65	75.12
T <sub>5</sub>	53.10	8.99	57.07	79.20	30.43	78.42
T <sub>6</sub>	51.40	8.70	55.24	81.36	32.38	80.65

T <sub>7</sub>	54.21	9.17	58.26	78.17	29.12	77.38
SE.d	1.29	0.20	1.03	1.10	0.60	1.27
CD(p = 0.05)	2.81	0.44	2.25	2.41	1.31	2.78

### Yield Attributes and Yield (Table 2)

Among the various foliar nutrition tried, foliar spray of Revive plus @ 3g litre<sup>-1</sup> (T<sub>4</sub>) recorded the higher number of pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup>, test weight, seed yield and haulm yield for black gram. It is comparable with foliar spraying of Revive plus @ 2g litre<sup>-1</sup> (T<sub>3</sub>) but superior to other foliar fertilization. Increased pods plant<sup>-1</sup>, number of seeds pod<sup>-1</sup> and test weight with foliar nutrition might be due to balanced growth habit, which 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 foliar application of nutrients in pulses. The finding is in line with the results of Uma Maheshwari and Karthik (2017) [10].

### Nutrient Uptake (Table 3)

Nutrient status is an important and deciding factor in judging the total dry matter accumulation in plants. Nutrient uptake of black gram was significantly influenced through foliar fertilisation of different chemicals Among the foliar nutrition tried, maximum N, P and K uptake was registered under foliar spray of revive plus @3 g/litre over rest of treatments. The increased N uptake might be due to increased availability of nitrogen to the crop and higher biomass production and retarded the loss of chlorophyll and leaf nitrogen with increased photosynthesis and increase N supply during the flowering and pod filling stages. Similar trend was observed in case of P and K. This increase in uptake of Phosphorus and potassium has been attributed to the foliar spray of macro and micro nutrients and increased the uptake of nutrients from soil which improved the metabolic activity in the plant cell. This result was in close proximity with the work of Shashikumar *et al.* (2013).

### Post-Harvest Nutrient Status (Table 3)

Foliar nutrition of different chemicals on post-harvest nutrient status of black gram was significant among the different chemicals tried, control treatment recorded the maximum values for post-harvest available nutrient status in black gram. This might be due to poor nutrient uptake compared to rest of the treatments. Similar trend of result was earlier reported by Shashi kumar *et al.*, (2013).

### References

1. Deepak Kumar, Singh RP, Somasundaram J, Vidya Simaiya, Shweta Jamra. Effect of foliar application of nutrients on growth and development of blackgram (*Vigna mungo* (L.)Hepper) under rainfed Vertisols of Central India. Indian J. Chem. Studies,2018:6(1):609-613.
2. Emam A, Zavareh M. Drought tolerance in plants (Analysis of the physiological and molecular biology) (Translation). University publishing centre. Page. 75.
3. Gupta SK, Ritchey NA, Wilber AC, Whitlock CH, Gilbson GG, Stackhouse PWJ. A climatology of surface radiation budget derived from satellite data. J. of climate,2003:12(8):2691-2710.
4. Hejanak V. The effect of drought on production of dry matter in spraying barley (*Hordeum vulgare* L.). Scientia Agriculturae Bohemica,2003:34:121-128.
5. NRAA. "Contingency and compensatory agriculture plans for droughts and floods in India- 2012", Position paper No. 6. National Rainfed Area Authority, NASC Complex, New Delhi, India, 2013, 87.
6. Kumar Shashi R, Basavarajappa SR, Salakinkop M, Hebbar MP, Basavarajappa HY Patil. Influence of foliar nutrition on performance of blackgram (*Vigna mungo* L.). Nutrient Uptake and Economics under Dry Land Ecosystems Legume Research,2013:36(5):422-428.
7. Srinivasarao CH, Venkateswarlu B, Rattan Lal, Singh AK, Kundu S. "Sustainable management of soils of dryland ecosystems of India for enhancing agronomic productivity and sequestering carbon", In: Advances in Agronomy (Ed. Donald L. Sparks), Academic Press, Burlington,2013:121:253-329.
8. Srinivasarao CH, Rattan Lal, Sumanta Kundu MBB. Prasad Babu, Venkateswarlu B, Anil Kumar Singh. "Soil carbon sequestration in rainfed production systems in the semiarid tropics of India". Science Total Environ.,2014:487:587-603.
9. Sriharan N, Anitha R, Mallika Vanangamudi. Foliar spray of chemicals and plant growth regulator on growth attributes and yield of blackgram (*Vigna radiata* L.). Plant Archives,2006:7(1):353-355.
10. Uma Maheshwari M, Karthik A. Effect of Foliar Nutrition on Growth, Yield Attributes and Seed Yield of Pulse Crops. Adv. Crop Sci. Tech.,2017:5:1-3.
11. Wood S, Sebastian K, Scherr SJ. Pilot analysis of Global Ecosystems: Agroecosystems. World resource institute and International food policy research institute, Washington, DC, 2000.