Growth and yield improvement of blackgram (Vigna mungo (L.)) through foliar application of nutrients in southern zone of Tamil Nadu

SP Sangeetha and J Manohari

Abstract
A field experiment was conducted to study the effect of foliar nutrients on growth, yield and quality of blackgram (Vigna mungo (L.)) Hepper under rainfed condition during summer season 2018 at the research farm of Agricultural College and Research Institute, Kadumiyamalai, Pudukkottai district, Tamil Nadu. The experiment was laid out in Randomized Block Design with three replications having eight treatments namely T1: Control (No foliar spray), T2: Foliar spraying of DAP @ 2%, T3: Foliar spraying of NAA 40 ppm and 100 ppm Salicylic acid, T4: Foliar spraying of Panchagavya @ 3%, T5: Foliar spraying of Agniasthra @ 3%, T6: Foliar spraying of PPFM @ 1%, T7: Foliar spraying of TNAU Pulse wonder @ 5 kg ha⁻¹, T8: Foliar spraying of sea weed extract @ 1%. Growth and yield attributes were significantly influenced with different treatments and recorded higher value with the foliar spray of TNAU Pulse wonder @ 5 kg ha⁻¹ at flowering and 15 days later. Maximum grain yield (896 kg ha⁻¹), net return (₹ 30,648 ha⁻¹), higher grain protein and carbohydrate content was obtained with the application of TNAU Pulse wonder @ 5 kg ha⁻¹, which was at par with treatment of foliar spray of DAP @ 2%.

Keywords: Black gram, foliar spray, TNAU pulse wonder, DAP

1. Introduction
Pulses are wonderful gift of nature with unique ability of biological nitrogen fixation, deep root system, mobilization of insoluble soil nutrients and bringing qualitative changes in soil properties which make them known as soil fertility restores. India is the largest producer and consumer of pulses in the world, accounting for 33 per cent of world area and 22 per cent of world production of pulses. The area under pulses in India is around 25.28 million hectare with a production of 18.84 million tonnes and productivity of 745 kg ha⁻¹ (Agril stat, 2018) [1]. Blackgram [Vigna mungo (L.)] is one of the most important pulse crop of rainfed areas grown throughout the country. This crop is grown in different cropping system as a mixed crop, catch crop, sequential crop in the country. Blackgram seed contains 25-26% proteins, 60% carbohydrates, 1.5% fat and minerals combination, amino acid, and essential vitamins etc. It is used as nutritive fodder especially for milch cattle. It is also used as a green manuring crop. The per capita consumption of pulses in India is around 30-35 g as against the recommendation of Indian Council of Medical Research (ICMR) at 45 g and World Health Organization (WHO) at 80 g per day. The requirement of pulses for billion people as per ICMR recommendation would be 17.15 million tonnes, where as WHO’s recommendations for well nourishment the requirement must be 29.2 million tonnes (Kannaiyan, 2000) [6]. Grain legumes constitute an important part of human diet in many parts of the world. In Tamil Nadu, the total area under black gram is 4.06 lakh ha with a production 3.01 lakh tonnes during 2017-18 (GOI, 2018) [5]. The current level of production is well below the requirement, and future projected demand for 2022 also mounting high to 16.1 million tonnes respectively to meet the specified per capita requirement (Praduman Kumar et al., 2009) [9]. Potential of blackgram is very low because the fact that the crop is mainly grown in rainfed condition with poor management practices and also due to various physiological, biochemical as well as inherent factors associated with the crop. Apart from the genetic makeup, the physiological factor viz., insufficient portioning of assimilates, poor pod setting due to the flower abscission and lack of nutrients during critical stage of crop growth, coupled with a number of disease and pest
constitute the major constraints for the poor yield (Mahala et al., 2001) [7]. The poor production potential of pulses is attributed to poor photosynthetic of pods and seed setting, which may be improved through foliar application of macro and micronutrients and growth regulators. The nutrients when added in small amount by exogenous foliar application modify the natural growth regulatory system right from seed germination to senescence in several pulses. Moreover, foliar feeding practice would be more useful in early maturing crops, which could be combined with regular plant protection programmes. Besides, foliar application is credited with the treatments which was anient requirement to increase the 0.5% plant height, leaf area index (LAI), number of branches, and total dry matter production were influenced significantly by foliar application of nutrients (Table 1). Foliar spray of TNAU pulse wonder @ 5 kg/ha (T1) at flowering and 15 days later recorded significantly higher growth components viz., plant height (34.3 and 41.5 cm), number of branches plant-1 (2.8 and 6.1) at 45 DAS and harvest respectively and leaf area index (3.28) at flowering, which was on par with DAP 2% foliar spray (T2). At harvest, T1 (TNAU pulse wonder @ 5 kg/ha) recorded significantly higher total dry matter production (DMP) (3984 kg ha-1) over rest of the treatments which was on par with T2 (DAP 2% spray) (3856 kg ha-1). The productivity of blackgram is low due to poor management practices and various physiological and biochemical stress associated with the crop. Apart from the physiological factors viz., insufficient partitioning of assimilates, poor pod setting due to flower abscission and lack of supply of nutrient during critical stage of the crop. One of the easier ways is foliar application of nutrients for nutrient availability and supplementing the nutrient requirement to increase the productivity. The increase in growth components with the application of TNAU pulse wonder (T1) and DAP (T2) might be due to beneficial effect of foliar application of nutrients at flowering and pod development stage might have easily absorbed and better translocated in the plant and maintained constant requirement of N and P at the reproductive stage of the crop. Presence of growth regulators in pulse magic, which are known to influence a wide array of physiological parameters like alteration of plant architecture, assimilate partitioning, promotion of photosynthesis, uptake of nutrients (mineral ions), enhancing nitrogen metabolism, promotion of flowering, uniform pod formation, increased mobilization of assimilates to defined sinks, improved seed quality, induction of synchrony in flowering and delayed senescence of leaves (Sharma et al., 2013) [11].

2. Materials and Methods
A field experiment was conducted to study the effect of foliar nutrients on growth, yield and quality of blackgram (Vigna mungo (L.) Hepper during summer season 2018 at the research farm of Agricultural College and Research Institute, Kudumiyanmalai, Pudukkottai district is situated in the southern zone of Tamil Nadu state at 10°38' N latitude and 78°82' E longitude at a altitude of 99 m above mean sea level and receives fairly well distributed mean annual rainfall of 960 mm. The maximum and minimum temperature ranged from 42.38°C to 28.14°C was observed during the cropping period. The experimental site has a typical chromustert soil (Order: Vertisol). Composite soil samples from 0-30 cm depth were collected from the site before laying out the experiment and analyzed for various physical and chemical properties. The textural class of soil was red sandy loam with organic carbon of 0.51%, low in available nitrogen (154 kg ha-1), medium in phosphorus (12.6 kg ha-1) and potassium (172 kg ha-1). The soil pH is 5.9 and electrical conductivity is 12.9 dS m-1. The experiment was laid out in Randomized Block Design with three replications having eight treatments namely T1: Control (No foliar spray), T2: Foliar spray of DAP @ 2%, T3: Foliar spray of NAA 40 ppm + 100 ppm Salicylic acid, T4: Foliar spray of Panchagavya @ 3%, T5: Foliar spray of Agniasthra @ 3%, T6: Foliar spray of PPFM @ 1%, T7: Foliar spray of TNAU Pulse wonder @ 5 kg ha-1, T8: Foliar spray of sea weed extract @ 1%. The blackgram variety TNAU Blackgram (VBN) 6 was used for experiment. Foliar application was given once at 30 DAS and second at 45 DAS to all the treatments except T1. The spacing adopted was 30 x 10 cm. The data on growth parameters, yield attributes and yield were recorded. The quality parameters viz., grain protein and carbohydrate content was analysed.

3. Result and Discussion
3.1 Effect of foliar spray on growth characters
The growth characters of blackgram viz., plant height, leaf area index (LAI), number of branches, and total dry matter

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growth (flowering and pod development stage). The similar findings were also reported by Dixit and Elamathi (2007) and Mondal et al. (2011).

### Table 1: Effect of foliar nutrition on growth characters of blackgram

| Treatments                  | Plant height (cm) | Number of branches plant\(^{-1}\) | Leaf Area Index | DMP (kg ha\(^{-1}\)) |
|-----------------------------|-------------------|----------------------------------|-----------------|----------------------|
|                            | 45 DAS at harvest | 45 DAS at harvest | at flowering | at harvest |
| T\(_1\): Control           | 29.6              | 32.4                             | 1.6            | 4.8                  | 2.28                 | 2886          |
| T\(_2\): DAP @ 2%          | 34.0              | 40.5                             | 2.8            | 6.0                  | 3.23                 | 3856          |
| T\(_3\): NAA 40 ppm and 100 ppm Salicylic acid | 33.8              | 37.8                             | 2.7            | 5.9                  | 2.74                 | 3535          |
| T\(_4\): Panchagavaya @ 3% | 33.4              | 37.1                             | 2.6            | 5.8                  | 2.55                 | 3288          |
| T\(_5\): Agniasthara @ 3%  | 29.4              | 34.2                             | 2.2            | 5.4                  | 2.44                 | 3050          |
| T\(_6\): PPFM @ 1%         | 31.6              | 36.2                             | 2.4            | 5.6                  | 3.17                 | 3487          |
| T\(_7\): TNAU Pulse wonder @ 5 kg/ha | 34.3              | 41.5                             | 2.8            | 6.1                  | 3.28                 | 3984          |
| T\(_8\): Sea weed extract @ 1% | 30.5              | 35.9                             | 2.3            | 5.3                  | 2.47                 | 3126          |

### Table 2: Effect of foliar nutrition on yield attributes, yield and quality of blackgram

| Treatments                  | No. of pods plant\(^{-1}\) | No. of seeds pod\(^{-1}\) | Grain yield (kg ha\(^{-1}\)) | Haulm yield (kg ha\(^{-1}\)) | Grain protein (%) | Carbohydrate (%) |
|-----------------------------|-----------------------------|---------------------------|------------------------------|-----------------------------|-------------------|------------------|
| T\(_1\): Control            | 19.6                        | 6.80                      | 612                          | 1097                        | 22.3              | 55.4             |
| T\(_2\): DAP @ 2%           | 30.0                        | 7.63                      | 875                          | 1402                        | 24.5              | 58.4             |
| T\(_3\): NAA 40 ppm and 100 ppm Salicylic acid | 28.6                        | 7.28                      | 851                          | 1315                        | 24.6              | 58.0             |
| T\(_4\): Panchagavaya @ 3%  | 26.5                        | 7.12                      | 828                          | 1254                        | 23.4              | 57.3             |
| T\(_5\): Agniasthara @ 3%   | 25.2                        | 7.02                      | 815                          | 1245                        | 22.6              | 57.9             |
| T\(_6\): PPFM @ 1%          | 27.2                        | 7.21                      | 831                          | 1356                        | 23.5              | 57.6             |
| T\(_7\): TNAU Pulse wonder @ 5 kg/ha | 31.5                        | 7.70                      | 898                          | 1444                        | 24.8              | 58.7             |
| T\(_8\): Sea weed extract @ 1% | 24.5                        | 7.05                      | 825                          | 1289                        | 22.8              | 57.7             |

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### 4. Conclusion
The results of the present investigation indicated that, the reproductive efficiency of blackgram like the number of flowers formed, flower drop and fruit setting percentage were significantly influenced by various foliar spray treatments. However, application of TNAU pulse wonder @ 5 kg/ha significantly increased the plant growth, total number of branches, higher dry matter production compared to control and resulted in significant increase in number of pods formed, percentage of fruits set and grain yield. The foliar spray of DAP 2% spray showed similar results as that of TNAU pulse wonder @ 5 kg/ha.

### 5. References