



Manipulation of Source – Sink for Higher Yield through Foliar Nutrition in Black Gram (*Vigna mungo* (L). Hepper)

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Abstract: A field experiment was conducted at Agricultural College and Research Institute, Killikulam during November 2016 – January 2017 to study the effect of foliar nutrition on the alteration of higher yield in black gram (*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 in which DAP, Urea, TNAU Pulse Wonder, Borax, Ammonium molybdate, Salicylic acid, Triacontanol and Polyfeed. The results revealed that application of RDF + foliar spray of 1% TNAU Pulse Wonder recorded significantly higher yield attributes viz., number of pods per plant, number of seeds per pod and seed test weight and finally the grain yield of 692 kg ha⁻¹. It was followed by the application of RDF + foliar spray of 2% DAP. The grain yield increases with these two treatments were 22 % and 19 % over the sole application of RDF (449 kg ha⁻¹).

Introduction

Pulses are an integral part of many diets across the globe and they have great potential to improve human health, conserve our soils, protect the environment and contribute to global food security. The United Nations declared 2016 as “International Year of Pulses” (IYP) to heighten public awareness of the nutritional benefits of pulses as part of sustainable food production aimed at food security and nutrition.

Blackgram (*Vigna mungo* L.) is an important legume crop cultivated worldwide in tropical and sub-tropical regions of the world. India is the largest producer and consumer of blackgram in the world. Blackgram is one of the important pulse crop in Tamil Nadu which is grown under irrigated, rainfed and rice fallow conditions. Their cultivation also enriches the soil fertility by the addition of nitrogen and organic matter. Blackgram contains 60% carbohydrates, 24% protein, and 1.3% fat with higher phosphoric acid content than other pulses.



India accounts for 35% of the world area and 27% of the world production of pulses. Due to stagnant production, the per capita availability of pulses has come down from 60g/day in 1951 to 47.2 g/day in 2014, as against Indian Council of Medical Research (ICMR) recommendation of 65 g/day. Depending on the domestic shortfall in pulses production, India's net import of pulses has ranged from 1 to 3 mt and pulses shortfall may increase to 6.8 mt by 2020-21. Overall, the above figures indicate that India needs to increase domestic production of pulses either through increase in area or productivity.

The total area under pulses in India is 32.46 million hectares with a production of 19.59 million tonnes and a productivity of 604 kg ha⁻¹ (INDIASTAT, 2014-2015). In Tamil Nadu, blackgram is cultivated in 3.73 lakh hectares with the production of 3.58 lakh tonnes at an average productivity of 960 kg ha⁻¹ (TNSTAT, 2014-2015). This low yield is attributed to several reasons *viz.*, low yielding varieties, cultivating in marginal lands mostly as rainfed crops and poor management practices. The sluggish growth in pulse production in the country could be due to various physiological and biochemical as well as inherent factors associated with the crop (Mahala *et al.*, 2001).

Apart from the genetic makeup, the physiological factors *viz.*, insufficient partitioning of assimilates, poor pod setting due to the flower abscission and lack of nutrients during the critical stages of crop growth play a major role on pulse production. Several steps were made to boost the productivity of blackgram. Among them one of the easiest way is foliar application of the nutrients for increasing and exploiting genetic potential of the crop. This is considered as an efficient and economic method of supplementing the nutrient requirements. Application of foliar spray will also enhance the nutrient availability and in turn increase the productivity.

Hence, Proper nutrient management is an important factor to be considered for sustaining pulse productivity. Among them foliar application of major nutrients like DAP, Urea, TNAU Pulse Wonder, Borax, Ammonium molybdate, Salicylic acid, Triacotanol and Polyfeed are the potent force in improving the growth, flower initiation, pod setting, seed quality and yield of pulses.

Materials and Methods

Field experiment was carried out to study the Manipulation of source – sink for higher yield through foliar nutrition in blackgram (*Vigna mungo* L. Hepper) during November 2016 – January 2017 at Agricultural College and Research Institute, Killikulam. The texture of the texture of the surface soil (0 – 15cm) of the experimental field was sandy clay loam and initial soil pH, EC and organic carbon were 7.2, 0.25 dS m⁻¹ and 6.1 g kg⁻¹ respectively. The fertility status was low in available nitrogen, medium in



available phosphorus and potassium. A field experiment was conducted at Agricultural College and Research Institute, Killikulam during November 2016 – January 2017 to study the effect of foliar nutrition on the alteration of higher yield in black gram (*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- Recommended Dose of Fertilizer (RDF) alone, T₂ - RDF + foliar spray of 2% DAP on 30 and 45 DAS, T₃ - RDF + foliar spray of 1% Urea on 30 and 45 DAS, T₄ - RDF + foliar spray of 1% TNAU Pulse Wonder on 30 DAS, T₅ - RDF + foliar spray of 0.5% Borax on 30 and 45 DAS, T₆ - RDF + foliar spray of 0.05% Ammonium molybdate on 30 and 45 DAS, T₇ - RDF + foliar spray of 100 ppm Salicylic acid on 30 and 45 DAS, T₈ - RDF + foliar spray of 0.1% Triacontanol on 30 and 45 DAS, T₉ - RDF + foliar spray of 1% Polyfeed on 30 and 45 DAS. The yield attributing characters *viz.*, number of pods per plant, number of seeds per pod and seed test weight were recorded and the results are given below.

Results and Discussion

Yield attributes

The various yield attributing characters of blackgram significantly differ due to application of various foliar spray of nutrients. Application of RDF + foliar spray of 1% TNAU Pulse Wonder was found to be the best treatment which produced highest number of pods per plant (10.34). However it was on par with the application of RDF + foliar spray of 2% DAP (10.09) and application of RDF + foliar spray of 0.05% Ammonium molybdate (10.03). Whereas sole application of RDF recorded the lowest number of pods per plant (8.42).

The maximum number of seeds per pod (6.46) also influenced significantly when application of RDF + foliar spray of 1% TNAU Pulse Wonder (Table 1 & Fig. 1). The increase in yield attributes might be due to the supplementation of nutrients at the critical stage without any physiological stress. Foliar application of major and minor nutrients coupled with growth regulators enhanced the number of floral buds, prevented the floral shedding by maintaining optimum bio-physiological conditions in plants. Kalpana and Krishnarajan (2003) also reported higher number of pods per plant, number of filled seeds per pod, seed filling percentage and test weight in soybean through foliar application of macro and micro nutrients along with growth regulators.



Application of TNAU Pulse Wonder as foliar nutrition at 1 % significantly produced higher number of pods per plant and seeds per pod. Adequate and continuous nutrient availability through soil and foliar nutrition promotes the supply of assimilates to sink or yield container, thus enlarging the size of the yield structure. The findings of Hamayun and Chaudhary (2004) and Muhammad Hamayun *et al.*, (2011) have also confirmed the results of present study.

Grain, bhusa and haulm yield

Application of RDF along with foliar spray of nutrients significantly influenced the seed yield of blackgram. The seed yield was ranged from 775-945 kg ha⁻¹. Among the various treatments adopted, application of RDF + foliar spray of 1% TNAU Pulse Wonder significantly recorded highest grain yield of 945 kg ha⁻¹. The percentage of increase in seed yield was 22% over the sole application of RDF. It was followed by application of RDF + foliar spray of 2% DAP (925 kg ha⁻¹). (Table 2 & Fig. 2).

Among the various treatments adopted, application of RDF + foliar spray of 1% TNAU Pulse Wonder significantly recorded highest grain yield of 945 kg ha⁻¹. The percentage of increase in seed yield was 22% over the sole application of RDF. It was followed by application of RDF + foliar spray of 2% DAP (925 kg ha⁻¹) and application of RDF + foliar spray of 0.05% Ammonium molybdate (920 kg ha⁻¹). The percentage of yield increases was 19% and 18.7 % respectively over the sole application of RDF.

Whereas sole application of RDF recorded lowest seed yield of 775 kg ha⁻¹. The haulm yield was also enhanced due to Adoption of various foliar nutrition treatments significantly influenced the haulm yield of blackgram which was ranged from 2310-2835 kg ha⁻¹. Among the different treatments trialed, application of RDF + foliar sprays of 1% TNAU Pulse Wonder significantly recorded higher haulm yield of 2835 kg ha⁻¹. It was followed by the application of RDF + foliar spray of 2% DAP (2780 kg ha⁻¹) and application of RDF + foliar spray of 0.05% Ammonium molybdate (2730 kg ha⁻¹). These treatments were on par with each other. The lowest haulm yield of 2310 kg ha⁻¹ was recorded with the sole application of RDF.

The impact of the foliar nutrients (macro and micro) to meet the nutrient demand of the crop at the critical stage on-site, where they are needed without stress, would have resulted in better growth and development of the crop and ultimately the yield attributing characters and yield on one hand. 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

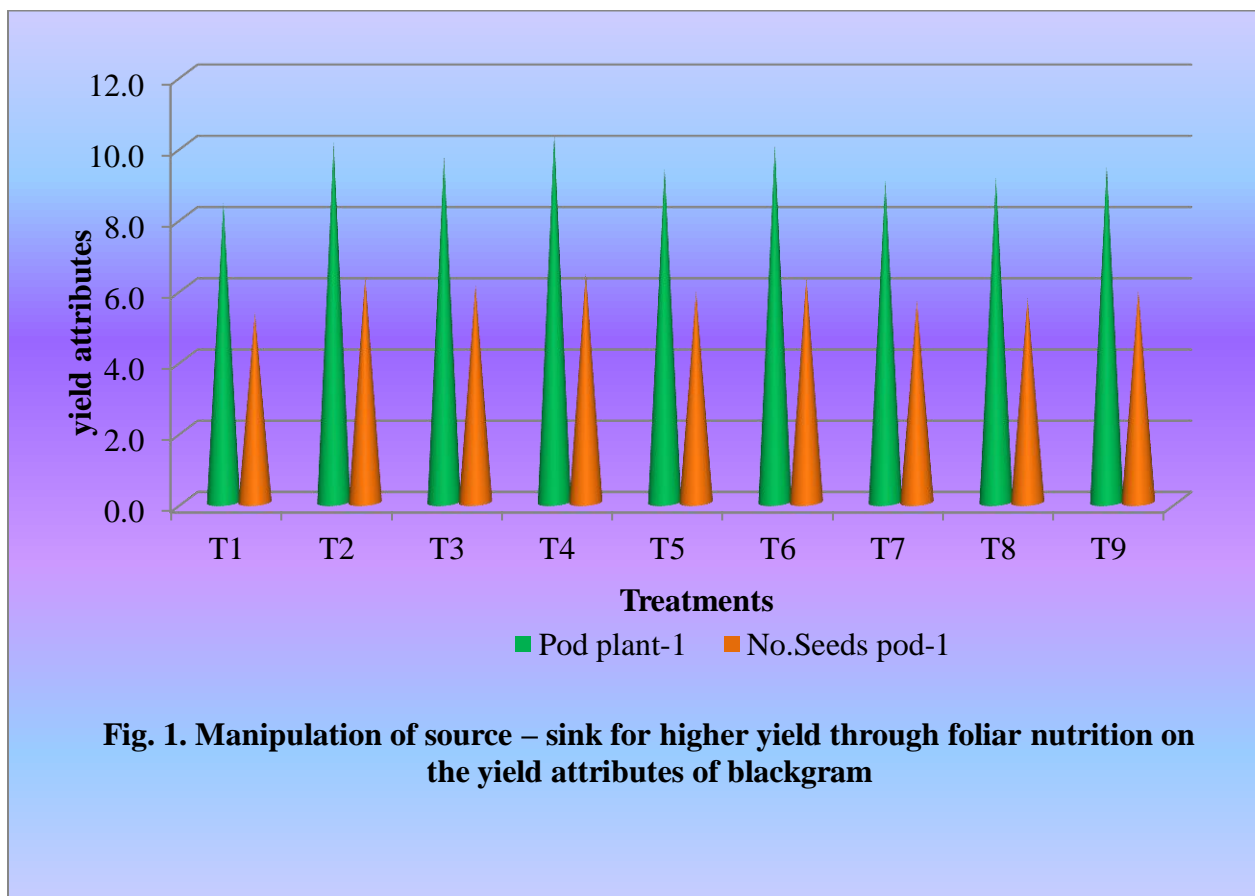


gradient of photosynthates translocation due to growth regulator on the other hand. The highest seed yield obtained in treatments might be due to higher nutrient mobility uptake and provided with all essential elements needed on time. These favourable effects might have attributed for higher yield of blackgram under the foliar spray of nutrients and growth regulators. This finding is in line with the results of Manivannan and Thanunathan (2003). Who recorded higher grain yield of blackgram through the foliar application of microsol (NPK + micronutrients). Similar results were also observed by Hamayun and Chaudhary (2004), Muhammad Hamayun *et al.* (2011) and Vinoth (2013).

In conclusion, from the field experiment, it was concluded that Application of RDF + foliar spray of 1 % TNAU Pulse Wonder increased the growth parameters, yield attributes and yield of blackgram. Among the different foliar nutrition treatments, application of RDF + foliar spray of 1 % TNAU Pulse Wonder registered was the best treatment which registered a grain yield of 945 kg ha⁻¹. Higher economics (Gross return, Net return and B: C ratio) of 3.05 was associated with the application of RDF + foliar spray of 1% TNAU Pulse Wonder. This was followed by the application of RDF + foliar spray of 2 % DAP (2.93) and application of RDF + foliar spray of 1% urea (2.88) compared to RDF alone (2.77).

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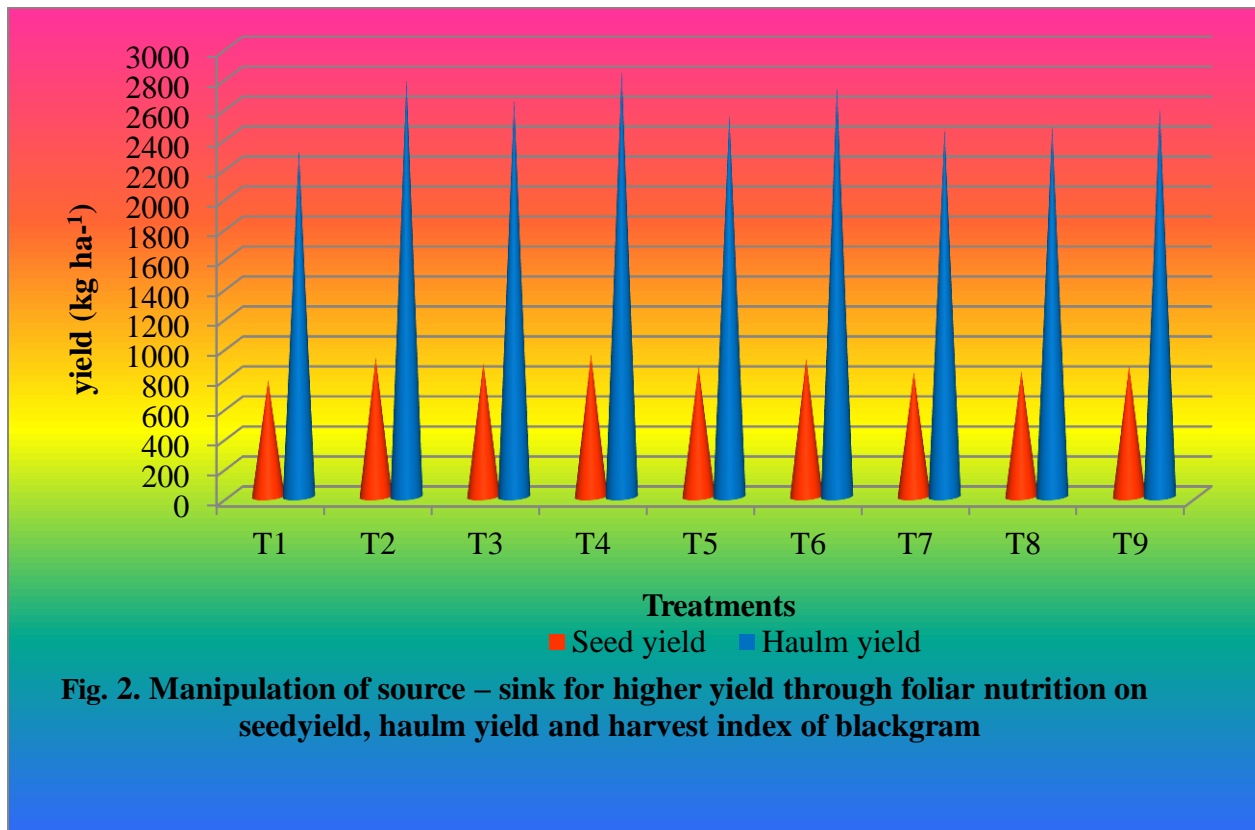




Table. 1. Manipulation of source – sink for higher yield through foliar nutrition on the yield attributes of blackgram

Treatments	No. of pods per plant	No. of seeds per pod	100 seed weight (g)
T ₁ RDF alone	8.42	5.33	5.66
T ₂ RDF + Foliar spray of 2% DAP on 30 and 45 DAS	10.09	6.35	5.87
T ₃ RDF + Foliar spray of 1% Urea on 30 and 45 DAS	9.71	6.12	5.81
T ₄ RDF + Foliar spray of 1% TNAU Pulse Wonder on 30 DAS	10.34	6.46	5.9
T ₅ RDF + Foliar spray of 0.5% Borax on 30 and 45 DAS	9.42	5.93	5.75
T ₆ RDF + Foliar spray of 0.05% AM on 30 and 45 DAS	10.03	6.32	5.84
T ₇ RDF + Foliar spray of 100 ppm SA on 30 and 45 DAS	9.04	5.67	5.69
T ₈ RDF + Foliar spray of 0.1% Triaccontanol on 30 and 45 DAS	9.12	5.73	5.72
T ₉ RDF + Foliar spray of 1% Polyfeed on 30 and 45 DAS	9.48	5.96	5.78
SEd	0.21	0.13	0.12
CD (P=0.05)	0.43	0.27	NS

AM – Ammonium molybdate

SA – Salicylic acid



Table 2. Manipulation of source – sink for higher yield through foliar nutrition on seed yield, haulm yield and harvest index of blackgram

Treatments	Seed yield (kg ha ⁻¹)	Haulm yield (kg ha ⁻¹)	Harvest index
T ₁ RDF alone	775	2310	0.251
T ₂ RDF + Foliar spray of 2% DAP on 30 and 45 DAS	925	2780	0.250
T ₃ RDF + Foliar spray of 1% Urea on 30 and 45 DAS	890	2645	0.252
T ₄ RDF + Foliar spray of 1% TNAU Pulse Wonder on 30 DAS	945	2835	0.250
T ₅ RDF + Foliar spray of 0.5% Borax on 30 and 45 DAS	865	2550	0.253
T ₆ RDF + Foliar spray of 0.05% AM on 30 and 45 DAS	920	2730	0.252
T ₇ RDF + Foliar spray of 100 ppm SA on 30 and 45 DAS	830	2450	0.253
T ₈ RDF + Foliar spray of 0.1% Triacantanol on 30 and 45 DAS	835	2470	0.253
T ₉ RDF + Foliar spray of 1% Polyfeed on 30 and 45 DAS	870	2585	0.252
SEd	21	63	0.005
CD (P=0.05)	44	131	NS

AM – Ammonium molybdate

SA – Salicylic acid