

Nutrient fortification

in rainfed blackgram for economic optimization

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Blackgram (Vigna mungo L.) is a widely grown grain legume, having considerable importance from the point of food and nutritional security in the world. It is an important short-duration pulse crop typically grown in rainy (kharif) season in India. Balanced nutrition is of utmost importance to escalate its economic yield potential. A 2-year experiment was conducted at Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal to find out the effect of cobalt (Co), potassium (K) and boron (B) on growth, yield, quality and production economics of autumn sown blackgram under Gangetic alluvium soil with application of Co in soil and foliar nutrition of K and B. It was found that soil incorporation of Co at 4 kg/ha combined with foliar spray of 1.25% K + 0.2% B facilitated substantial growth and yield in a cost-effective way in eastern India. This unique nutrient combination may be a cost-effective option for the resource poor farmers to harness higher production in autumn grown rainfed blackgram.

Keywords: Blackgram, Economic production, Nutrient Fortification, Rainfed

AMONG the various pulse crops grown in India, blackgram holds the 3rd most important position right after chickpea and pigeonpea. It is native to India and grown preferably during rainy (*kharif*) season under rainfed situation. In West Bengal, it is cultivated in 72,348 ha producing 50,091 tonnes of grains with the average productivity of 692 kg/ha. The crop has an excellent capacity to maintain soil fertility as it has a unique capability of symbiotic nitrogen fixation. Blackgram seeds are excellent source of protein, carbohydrate, fat, fibre, vitamin and minerals. It has a great potential for significant contribution in the national food and nutritional security with minimal input requirements and excellent adjustability under various cropping systems of different agro-ecological conditions.

Blackgram has a sluggish growth because of the poor nutrition. The nutrients like cobalt (Co), potassium (K) and boron (B) helps in overall growth of pulse crops. Cobalt (Co)

is involved with vital physiological and biochemical functions, and nitrogen fixation, and K and B helps in seed development of pulse crops. Soil and foliar applications are the most prevalent methods of nutrient addition. At the initial phases of seed germination, nutrients are mobilized from endosperm or cotyledon, while further phases required nutrients from soil or some other means. At initial stages seedling can not absorb nutrient from soil hence nutrient seed treatments, which include seed fortification and seed coating or pelleting, are an attractive and easy alternative.

We studied the effects of Co, K and B in improving growth, yield, quality and production economics of autumn sown blackgram under Gangetic alluvium of eastern India. We also observed that these nutrient elements gracefully help in overall growth of blackgram crop.

Status of blackgram cultivation in India

Blackgram is an annual legume, native to India and is grown

preferably during rainy (*kharif*) season under rainfed situation. It is also cultivated in winter (*rabi*) and spring-summer as well. In fact, the crop has an accomplishment of higher yield potential particularly during spring-summer season. In general, blackgram is a crop of warm weather preferably grown under an optimum temperature range between 25–32°C with an annual rainfall about 600–1000 mm. It has been reported to contribute around 13% in total pulse growing area and about 11% in total production of pulse crops cultivated in India. Its cultivation is normally practised in the states including Andhra Pradesh, Madhya Pradesh, Karnataka, Bihar, West Bengal, Maharashtra, Uttar Pradesh, Punjab and Haryana.

Nutritional aspects

Blackgram is very much popular for its use as seed for culinary purposes in human diet by virtue of the higher nutritive values and excellent digestibility since ancient times. Because of this fact,

blackgram has been regarded as one of the highly remunerated pulse crops. Blackgram seeds are almost three times richer in quality protein than that of cereals, containing about 26.2% crude protein. Besides, the seeds are also consisted of carbohydrate (56.6%), fat (1.2%), Ca (185 mg/100 g seeds), Fe (8.7 mg/100 g seeds), P (345 mg/100 g seeds) and vitamins [retinol (A), thiamine (B₁), riboflavin (B₂), niacin (B₃), ascorbic acid (C)] with higher calorific values (347 calories/100 g of seeds). Dry seeds are one of the good sources of phosphorus. About 78–80% nitrogen in blackgram seed has been found as albumin and globulin.

Green pods of blackgram are considered as a highly nutritious vegetable. Seeds can be consumed after boiling or frying. They are also used as dal after splitting the cotyledons. Crushed seeds are used as flour to prepare curries, porridge, sweets, snacks or bread and biscuits in bakeries. Popular south Indian foods items like dosa and idly are prepared by mixing the flours from rice grains and blackgram seeds. Notably, the blackgram seeds possess several types of medicinal properties regarding curing diabetes, nervous disorders, digestive system dysfunctions, rheumatic afflictions and hair related disorders. Also, both the hull (outer covering of seed) and stover are used as nutritive feed for cattle.

Production constraints

Blackgram production has been found to be adversely affected by a number of environmental factors, especially abiotic stresses like excess soil moisture in autumn season, lack of soil moisture during spring-summer and winter seasons and heat stress during pod filling stage leading to a huge yield-gap. Its cultivation is generally carried out in soils of marginal and sub-marginal lands with poor crop management practices under rainfed situation. Because of this fact, a stagnant yield potential of blackgram crop has been observed. Besides, this crop suffers with several physiological drawbacks like inappropriate canopy structure, photo-thermo

sensitivity, imbalanced partitioning of photo-assimilates and lower photosynthesizing capacity, premature flower and pod abscission and poor pod set etc. On the top of this, various diseases and pest infestations give rise to drastic loss of seed yield of blackgram.

A study was carried out at Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal to find out the effect of nutrients on growth, yield, quality and production economics of autumn sown blackgram (variety PU 31). The crop was raised in 4 m × 3 m plot with 30 cm × 10 cm spacing and 25 kg/ha seed rate. The seeds were treated with *Rhizobium* @20 g/kg seed. N, P and K @20:40:40 were applied along with 4 kg/ha of Co. Foliar spray of 1.25% K and 0.2% B was given at flower initiation stage. The weeds in the field were managed with 1 hand weeding at 25–30 DAS and no irrigation was provided during the crop growth. The crop was grown in a rainfed condition. For managing the pest chlorantraniliprole 18.5 SC @0.2 ml/litre of water at 25 DAS and fungicide SAAF (mancozeb + carbendazim) @2.5 g/litre of water at 45 DAS were sprayed.

Cobalt, potassium and boron as yield enhancers in blackgram

When Co was applied along with foliar K+B, it significantly increased the plant growth and yield. Nutrients fortification through



Mixture of cobalt fertilizer with soil foliar spray operation

Co and combined K+B separately improved the seed protein contents of blackgram (Table 1). The combined spray of K @1.25% and B @0.2% helped in improving the pod formation and seed development, which later on resulted in higher seed yield and protein content. Thus, experiment might have justified the general beneficial roles of these 3 nutrient elements in a compact way.

Economic benefit

The unique nutrient schedule including Co, K and B also fetched higher net return with improve benefit-cost ratio in each of the cases. We recorded a benefit-cost ratio of 2.49 with Co application, while it was only 2.22 without the use of Co. Accordingly, foliar K in combination with B achieved this ratio to the tune of 2.67 in comparison with 2.08 in case of no spray. Proper balance of nutrients invariably enhanced the production of autumn sown blackgram which subsequently attributed to overall improvement in its production economics.

Way forward

Although, India has come up to be the largest producer and consumer of blackgram in the world, still our country lags its optimum production to successfully meet the domestic consumption demand of the current population. In this regard, adoption of improve agronomic managements is extremely imperative to enhance the productivity of blackgram for meeting the per capita requirement of the nation. Blackgram crop suffers with several physiological drawbacks, to address these issues, balanced nutrition is of prime importance to achieve higher economic production. Modern agronomic interventions like micronutrients seed priming and foliar nutrition in collaboration with recommended dose of fertilizers may be a fantastic way outs to improvise physiological efficiency of legume crops like blackgram including the photosynthetic ability irrespective of soil conditions leading to productivity enhancement. In view of the welfare of the farming community from

Table 1. Effect of nutrient managements on blackgram

Treatment	Height (cm)	Total dry matter (g/m ²)	Number of pods per plant	Seed yield (kg/ha)	Protein (%)	Net return (₹/ha)	Benefit-cost ratio
<i>Soil application of nutrients (S)</i>							
No cobalt	52.47	243.12	38.13	1297.81	22.43	53792	2.22
Co	55.04	252.68	44.27	1424.83	25.24	67739	2.49
<i>Foliar spray (F)</i>							
No spray	49.08	231.77	28.00	1101.27	21.20	46966	2.08
Tap water	51.08	240.52	33.67	1223.92	22.02	52138	2.17
K @1.25%	54.27	249.33	40.67	1373.92	23.82	62312	2.32
B @0.2%	55.88	255.17	48.67	1492.88	25.53	72201	2.53
K + B	58.45	262.72	55.00	1614.62	26.62	84711	2.67



Experimental field of autumn blackgram (variety PU 31)

economic perspectives, the scientific community should be more focussed on identifying the shortcomings

of the package of practices applied and replace it with a more profitable one. These findings from the current



Blackgram pods in the experimental field

research are not only applicable for a particular confined zone, but can also be justified outside the locality of the experimental site with respect to the prevailing soil and weather conditions.

SUMMARY

Blackgram is a widely grown pulse crop assuming considerable importance of food and nutritional security in India. To improve its growth, symbiotic efficiency, physiological activities, yield potential, quality and production economics, we need to take into concern its internal nutritional balance to a greater extent. From our study, it was evident that soil applied Co @4 kg/ha in addition to recommended dose of fertilizers and foliar applied 1.25% K + 0.2% B at flower initiation stage significantly improved the growth, seed yield, quality and production economics. Thus, this combined nutrient schedule may be recommended as an economically profitable option for the resource poor farmers to harvest higher production in autumn grown rainfed blackgram from global aspect.

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**Plant trees, Conserve water,
Protect environment.**

