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Effect of biofertilizers and inorganic nutrition on blackgram (*Phaseolus mungo*) grown in rice fallows

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ABSTRACT

A field study was conducted during summer season of 1997–98 at Maruteru, to study the effect of biofertilizers and inorganic nutrition on blackgram (*Phaseolus mungo* L.) grown in rice fallows. All the treatments except mere inoculation of biofertilizers exerted conspicuous effect on yield and other growth parameters. The increase in seed yield due to spraying of urea (2%) at pre-flowering and pod-filling stages and DAP (4%) spray at pod-filling stage was 40.2, 34.2 and 31.1% respectively over unfertilized treatment. Addition of 50 kg P_2O_5/ ha alone or along with VAM inoculation enhanced the seed yield by 25.2% and 30.8% respectively. Starter N @ 20 kg/ha also showed significant beneficial effect on yield and other physiological parameters. Urea and DAP sprays at reproductive phase had a conspicuous effect on the phenophase, greenness prolongation, root length, phytomass and other yield-attributing traits like pods/ plant and seeds/pod.

Key words : Biofertilizers, Inorganic fertilizer, Blackgram yields

In the coastal belt of Andhra Pradesh, the fields are vacant for about 3 months after the harvest of winter rice. Relay cropping of blackgram a week before harvesting of rice is a practice in some parts of coastal districts. Although it is a novel strategy of multiple cropping in traditional lowland rice fields to maximize pulse production, the yield level is very low due to water and nutrient stresses during reproductive phase of crop.

Blackgram being non-traditional crop for the Godavari delta, an information on response to biofertilizers and inorganic fertilizers is lacking in summer fallow situation. Therefore an attempt was made to develop fertilizer technology for blackgram to boost up the yields.

MATERIALS AND METHODS

A field experiment was conducted on Vertisols (Vertic Chromusterts) of Maruteru (16.38°N, 81.44°E and 5 m above mean sea-level) during summer season of 1997 and 1998 under residual moisture, using 'LBG 20' blackgram. The soil is near neutral in reaction (pH 6.8), low in available N (170.4 kg/ha) and P (9.3 kg/ha), but

high in available K (320 kg/ha). The treatments (Table 1) were laid out in randomized block design with 3 replications. Seeds were broadcast @ 40 kg/ha, 7 days before rice harvest, when the soil water regime is under saturated condition. Starter nitrogen, basal phosphorus and VAM inoculation were applied a day after seed sowing. Data were recorded on 10 random plants on yield attributes, seed and haulm yields from net plot, treatment-wise. The field capacity and permanent wilting point of 0–90 cm soil profile were 27.5% and 7.1% respectively. The rainfall received in 1997 and 1998 was 26 mm and 40 mm respectively. Blackgram was sown in the last week of March and harvested at the end of May.

RESULTS AND DISCUSSION

Morphological and phenological parameters

The first flush of floral initiation appeared 26 days after sowing in all treatments (Table 1). However, spraying of urea (2%) and diammonium phosphate (DAP) at preflowering and pod-filling stages caused another flush of flowering after 41 days. This may be ascribed to activation of morpho-physiological and biochemical functions of the plant due to foliar feeding of N when the soil is unable to supply these minerals. The foliage of urea and DAP sprayed plants turned from light yellow to dark green within 2 days after application. The lush green colour was maintained up to 57 days in these plots. In fact, spraying with inorganic fertilizer-N hastened the availability of N in the plant system and resulted in more chlorophyll synthesis and greater accumulation of protein in plants and ultimately in seeds (Devlin, 1990). Besides, the sprays might have improved the turgidity of plant cells

Table 1. Morphological and phenological parameters of blackgram as affected by various fertilization treatments (Mean data of 2 years)

Treatment	Days to floral initiation (DAS)		Greenness prolongation*	Root length (cm)	Phyto-mass (g/plant)	Harvest Index (%)
	First flush	Second flush				
No fertilization	26	0	45	13.10	137	20.8
Rhizobium inoculation (0.5 kg/ha)	26	0	45	13.63	145	18.9
Vesicular-arbuscular micorrhiza (VAM) (5 kg/ha)	26	0	45	14.73	140	17.3
Rhizobium + VAM	26	0	45	16.36	149	18.2
50 kg P_2O_5/ha	26	0	45	25.10	168	18.8
VAM + 50 kg P_2O_5/ha	25	0	45	26.56	176	20.1
Urea spray (2%) at pre-flowering	26	41	57	20.9	185	20.7
Urea spray (2%) at pod-filling	26	41	57	19.2	170	22.1
DAP (4%) spray at pre-flowering	26	41	57	20.6	172	20.6
CD (P = 0.05)			2.6	2.9	16.9	

DAS, Days after flowering

Table 2. Yield components and yield of blackgram as affected by various fertilization treatments (mean data of 2 years)

Treatment	Fruiting branches/ plant	Pods/ plant	Seeds/ pod	Haulm yield (kg/ha)	Seed yield (kg/ha)			Marginal benefit: cost ratio (Rs)
					1997	1998	Mean	
No fertilization	5.15	24.5	5.00	2,724	630	808	719	
Rhizobium inoculation (0.5 kg/ha)	6.02	32.5	5.60	3,430	662	943	802	20.7:1
Vesicular-arbuscular micorrhiza (VAM) (5 kg/ha)	5.34	35.4	6.03	3,718	694	865	779	12:1
Rhizobium + VAM	6.21	35.6	6.53	3,686	712	1,019	820	11.2:1
50 kg P_2O_5/ha	6.32	42.1	7.03	4,135	760	1,164	962	2.6:1
VAM+ 50 kg P_2O_5/ha	6.40	42.3	7.24	4,139	781	1,298	1,039	3.2:1
Starter nitrogen (20 kg N/ha)	6.10	39.5	6.96	4,197	853	1,057	955	10.6:1
Urea spray (2%) at pre-flowering stage	8.14	44.1	7.13	4,325	848	1,760	1,204	71.3:1
Urea spray (2%) at pod-filling stage	7.42	38.2	6.76	3,846	822	1,365	1,043	40.5:1
DAP (4%) spray at pre-flowering stage	7.25	37.5	6.83	4,007	827	1,260	1,043	40.5:1
CD (P = 0.05)	0.43	5.8	0.59	429	125	247	235	

DAP, 18 N : 46 P_2O_5

which is most important during summer when the soil moisture nearing the wilting point. Plants seldom received fertilizer sprays lost their greenness 12 days before than those received sprayed treatments.

Phosphate fertilization had strong impact on root growth. Application of 50 kg P_2O_5/ha alone and along with VAM augmented the root length by 47.8% and 50.7% respectively over the control. The possible reason that could be ascribed for better root growth was due to its role in cell-division, energy production, and construction of various cellular components. Moreover, P ions help in active transport of nutrients by over-riding the opposing forces of osmotic equilibrium (Wallingford, 1991). Deep roots augment the extraction of more nutrient and water which reflected on crop growth and yield. Inoculation of crop with rhizobium and VAM did not influence the root growth like other treatments.

Highest phytomass (185 g/plant) was registered in the plots sprayed with 2% urea at pre-flowering, followed by pod-filling stage. The increase was 25.9 and 24.3% respectively over the control. Biofertilizer inoculation and mere P fertilization did not show marked effect on this attribute.

Yield and Yield-contributing characters

All the treatments except mere inoculation of biofertilizers exerted conspicuous effects on yield and its attributing characters. The highest seed yield was obtained under urea spraying (2%) at preflowering, followed by foliar feeding at pod-filling stage. The increase in seed yield due to spraying of urea at preflowering, pod-filling stages and DAP spray at pod-filling stage was 40.2, 40.2 and 31.1% respectively over the control. This increase was owing to favourable effect on yield attributes of blackgram due to fertilizer spraying. The findings confirm the results of Srivastava and Varma (1982).

Addition of phosphorus @ 50 kg P_2O_5/ha alone or in combination with VAM inoculation increased the seed yield by 25.2% and 30.8% respectively. The cumulative effect of yield attribute was responsible for increase in yield. The results are in accordance with those reported by Akhtar *et al.* (1986).

Starter N @ 20 kg/ha also increased the seed yield by 24.7% over the control. In fact, pulses usually suffer with N starvation up to 20 days after sowing due to non-formation of nodules and synthesis of biological-N (Negi and Sekhar, 1993).

Monetary returns

On the basis of benefit : cost ratio, highest monetary returns were obtained with urea spray at pre-flowering, followed by foliar feeding of urea at pod-filling stage and DAP spray (4%) at pre-flowering stage. Least monetary returns were realized with P fertilization owing to high input cost.

Thus spray of urea and DAP fertilizers and addition of P improve and sustain productivity in blackgram during the summer season.

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