



Refinement of Nutrient Management Techniques for Growth, Yield and Nutrient Uptake of Rice Fallow Blackgram

P. Geetha* and A.Velayutham

Department of Agronomy,
Tamil Nadu Agricultural University, Coimbatore- 641 003

Field experiment was conducted during September, 2002 to April, 2003 at the Wetlands of Tamil Nadu Agricultural University, Coimbatore in split plot design with three replications for improving the yield of rice fallow blackgram. The treatments consist of three fertilizer applications viz. recommended dose of fertilizer to preceding rice crop, recommended dose of fertilizer (last split through DAP based on N equivalent) to the preceding rice crop and basal application of fertilizer to blackgram of N and P @ 12.5:25 kg ha⁻¹ (10 days prior to harvest of rice crop) formed the main plot treatments and nutrient foliar sprays viz., control, 1% urea, 2% DAP, 1% KCl and 2% DAP + 1% KCl twice at flowering and pod filling stages of crop growth constituted the subplot treatments. The results revealed that basal application of N and P fertilizers @ 12.5:25 kg ha⁻¹ (10 days prior to harvest of rice crop) to blackgram favoured plant height, leaf area index, dry matter production, net assimilation rate, crop growth rate, relative growth rate and nutrient uptake. In general, all the growth parameters, NPK uptake and yield were significantly influenced when foliar spray of 2% DAP + 1% KCl was given at flowering and pod filling stages of crop growth. Interaction between fertilizer application and foliar spray was significant for growth parameters, DMP, and yield.

Keywords: Blackgram, DAP, KCl, nutrients, growth and yield parameters

Pulses are the major sources of dietary protein in the vegetarian diet in our Country. India is the largest producer and consumer of pulses in the world accounting for 37 per cent of world area and 28 per cent of production (Hariprasanna, and Jayant Bhatt, 2002). Cultivation of pulses under rice fallows as relay cropping is a unique system. The rice fallow pulses survive entirely on residual moisture and fertility left over by the preceding crop of rice. Besides, pulses are low yielder because of excessive vegetative growth with poor partitioning efficiency, photo and thermo sensitivity and indeterminacy. These results in low harvest index and grain yield. Crop yield enhancement without adding fertilizers is impossible. Hence, it is highly imperative to develop improved agro-techniques to exploit the yield potential of pulses under rice fallow condition.

Materials and methods

A field experiment was conducted during September, 2002 to April, 2003 at wetlands of Tamil Nadu Agricultural University, Coimbatore during *rabi* and rice fallow seasons of 2002- 2003 (September 2002-April, 2003). The soil of the experimental field was moderately drained clay loam with a pH of 7.2 and EC 0.5 dSm⁻¹. Regarding the fertility status, the soil was classified as medium in available nitrogen (227kg/ha) and phosphorus [16.8kg/ha] and high in available potassium [615kg/ha]. Rice (*Oryza sativa*) variety ADT 38 was raised as preceding crop. The blackgram (*Vigna mungo*) variety TMV 1 was used as rice fallow crop. The experiment was laid out in split-plot design with three replications.

Three fertilizer application practices viz. recommended dose of fertilizer to preceding rice crop (M₁), recommended dose of fertilizer (last

*Corresponding author

split through DAP based on N equivalent) to the preceding rice crop (M_2) and basal application of fertilizer to blackgram of N and P @ 12.5:25 kg ha^{-1} (10 days prior to harvest of rice crop) (M_3) formed the main plot treatments and nutrient foliar sprays viz., control (S_1), 1% urea (S_2), 2% DAP (S_3), 1% KCl (S_4) and 2% DAP + 1% KCl (S_5) twice at flowering and pod filling stages of crop growth constituted the subplot treatments.

Field layout was done before transplanting of preceding rice and the main plot treatments were imposed. The relay sowing was done prior to the harvest of rice adopting a seed rate of 25 Kg/ha. The basal dose of fertilizer @ 12.5:25 kg/ha was applied uniformly to M_3 plots. Foliar application was done at flowering and pod filling stages of crop growth.

Results and discussion

The growth parameters, yield and nutrient uptake were significantly influenced by the nutrient management practices for rice fallow blackgram (Table 1, 2 & 3).

Leaf area index

Basal application of N and P @ 12.5:25 kg ha^{-1} to blackgram (M_3) registered the highest LAI

of 2.21 at 45 DAS. This was followed by the recommended dose of fertilizer with last split application of N through DAP based on N equivalent to rice (M_2). The lowest LAI was recorded in the plots which received only the recommended dose of fertilizer (M_1). With regard to foliar application of nutrients, 2% DAP + 1% KCl twice at flowering and pod filling stages registered significantly higher LAI of 2.55 at 45 DAS while the control registered significantly lower LAI of 1.75. This might be due to increase in leaf number, branches, leaf length and breadth.

Dry matter production

The dry matter production of blackgram was higher (2131 kg/ha) with basal application of fertilizer @ 12.5:25 kg NP ha^{-1} (M_3) at harvest. (Table 1) The lowest DMP was recorded in the control plot (M_1) and it was on par with M_2 . Foliar spraying of 2 % DAP + 1 % KCl twice at flowering and pod filling stages (S_5) had resulted in significantly higher DMP of 2225 kg ha^{-1} . Foliar spray of 2% DAP twice (S_3) was found to be the next best in the order. Whereas the control plot (S_1), produced lesser DMP of 1903 kg ha^{-1} . This

Table 1. Effect of nutrient management techniques on growth attributes of rice fallow blackgram

Treatments	Plant height at harvest	LAI at 45 DAS	DMP at harvest (Kg/ha)
Main plots			
M_1	37.71	2.01	2005
M_2	38.83	2.12	2105
M_3	39.90	2.21	2131
CD(P=0.05)	2.94	0.10	23
Sub plots			
S_1	32.03	1.75	1903
S_2	35.85	1.92	2013
S_3	41.17	2.24	2143
S_4	38.17	2.10	2118
S_5	46.84	2.55	2225
CD(P=0.05)	2.92	0.14	20

Table 2. Effect of nutrient management techniques on the grain yield (kg/ha) of blackgram

Treatment	Grain yield (kg/ha)			
	M ₁	M ₂	M ₃	Mean
S ₁	656	683	697	674
S ₂	697	816	823	788
S ₃	842	932	967	914
S ₄	826	922	940	896
S ₅	959	1026	1037	1007
Mean	796	878	891	-
		SEd	CD (P=0.05)	
	M	6	17	
	S	9	19	
	M at S	16	34	
	S at M	16	33	

might be due to more availability of nutrients without any harmful effect on plant leading to improved plant growth in terms of plant height and leaf area might have contributed for DMP increase (Saxena *et al.*, 1996).

Grain yield

The fertilizer application methods followed in the preceding rice crop did exert significant variation in the grain yield of succeeding blackgram crop. Black gram applied with a basal dose of fertilizer N and P @ 12.5:25 kg ha⁻¹ (M₃) recorded the highest grain yield of 891 kg ha⁻¹. The percentage of yield increase due to fertilizer application to blackgram was 12 per cent over application of the recommended dose of fertilizer to preceding rice crop.

Foliar application of nutrient caused significant variation in the grain yield of blackgram. The control plot where no foliar spray was done registered the lowest yield of 674 kg ha⁻¹. Foliar application of 2% DAP and 1% KCl at flowering and pod filling stages (S₅) resulted in highest grain yield of 1007 kg ha⁻¹. It was followed by application of 1% KCl spray at flowering and 15 days after first spray (896 kg ha⁻¹). The percentage increase in grain yield under S₅ was 32.8 over control. This might be

due to enhancement in growth and yield parameters as well as uptake of nutrients by crop. Obviously, the cumulative effects of these parameters might have contributed to increased grain yield potential of the crop. This is in line with the earlier report of Raju and Reddy, (1998) and Pandian *et al.* (2001).

Nutrient uptake

Nutrient uptake viz., N, P and K by blackgram was analyzed at harvest and is presented in the table 3.

Nitrogen

The uptake of N by blackgram was significantly influenced by fertilizer application and at harvest. Application of 12.5:25 kg NP ha⁻¹ as a basal dose to blackgram recorded significantly higher N uptake (53.96 kg ha⁻¹ at harvest). Among the foliar spray of nutrients tried, foliar spray of 2% DAP + 1% KCl twice one at flowering and at 15 days after first spray (S₅) registered highest N uptake of 64.64 kg ha⁻¹ at harvest. This might be due to increased supply of nutrients and good response of the plants to them. Increased NPK uptake due to foliar application was observed by Krishnamoorthy *et al.* (1987), Manu and Wahab (2002).

Table 3. Effect of nutrient management techniques on nutrient uptake (kg ha⁻¹) by blackgram

Treatment	NPK uptake at harvest (kg ha ⁻¹)		
	Nitrogen	Phosphorous	Potassium
M ₁	44.16	6.40	42.89
M ₂	48.75	6.60	43.26
M ₃	53.69	6.79	44.85
SEd	1.33	0.17	1.10
CD (P=0.05)	3.70	NS	NS
S ₁	30.46	6.45	41.46
S ₂	37.21	6.60	42.78
S ₃	57.85	6.65	43.89
S ₄	54.17	6.54	43.69
S ₅	64.64	6.75	46.51
SEd	1.42	0.21	1.47
CD (P=0.05)	2.93	NS	3.04
M at S			
SEd	2.57	0.37	2.52
CD (P=0.05)	NS	NS	NS
S at M			
SEd	2.45	0.36	2.55
CD (P=0.05)	NS	NS	NS

Phosphorus and Potassium uptake

Phosphorus and Potassium uptake were not influenced by both main and sub-plot treatments.

From the investigation, it is clear that, for getting higher yield and economic returns in rice fallow blackgram, basal application of fertilizer N and P @ 12.5:25 kg ha⁻¹ just before the harvesting of preceding rice crop along with foliar spray of 2% DAP + 1% KCl at flowering and pod filling stages can be practiced.

Reference

- Hariprasanna, K. and Jayant Bhatt. 2002. Pulses production looking at constraints and prospects. *Agriculture Today*, p. 48-53.
- Krishnamoorthy, Sathyanarayana Rao, J.V. Hanumantha Rao, G.V. and Rajendra Prasad, B. 1987. Effect of pyrites and organic matter on the solubilization of P. *The Andhra Agric. J.*, **14**: 109-111.
- Manu, M. and Wahab, K. 2002. Nutrient uptake and nodulation as influenced by irrigation and DAP spray in rice fallow blackgram cv. ADT 5. *Plant Archives*, **2**: 55-57.
- Pandian, B.J., Anand Kumar, S., Veerabadrar, V. and Ravichandran, V.K. 2001. Growth and yield of rice fallow greengram as influenced by methods of sowing, stubble management and nutrient application in Tambiraparani Command Area. *Madras Agric. J.*, **88**: 406-409.
- Raju, R.A. and Reddy, M.N. 1998. Establishment techniques, seed rate and fertilizer application to summer blackgram (*Phaseolus mungo*) in rice (*Oryza sativa*) fallows. *Indian. J. Agron.*, **43**: 41-413.
- Saxena, K.K., Verma, H.R. and Saxena, H.K. 1996. Effect of phosphorus and potassium on greengram (*Phaseolus radiatus*). *Indian. J. Agron.* **41**: 84-87.

Manuscript number : 174-175/08
Date of receipt : September 23, 2008
Date of acceptance : April 4, 2009