Indian Journal of Agronomy 44 (3) : 576–580 (September 1999)

Effect of fertilizer application and weed management practices on nutrient uptake by summer blackgram (*Phaseolus mungo*) and associated weeds under rainfed condition

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Received: May 1998

ABSTRACT

The results of the field experiment carried out during summer seasons of 1994 and 1995 at Kharagpur, revealed that N,P, K uptake by blackgram (*Phaseolus mungo* L.) and weeds were sinificantly higher under N_{20} P_{50} K_{30} levels of fertilizer than N_{10} N_{25} K_{15}. Adoption of weed management practices significantly enhanced NPK uptake by blackgram and reduced removal of nutrients by weeds as compared to that of unweeded check, and saving of 29.1 to 52.3% N, 26.8 to 56.6% P and 16.9 to 54.3% K was achieved. Hand weeding and chemical weed control treatments gave higher grain yield of 0.73 and 0.62 t/ha respectively. The removal of nutrients *by Digitarla sanguinalis, Enhydra fluctuans and Physalis minima* were considerably high during both the years.

Key words : Fertilizer, Weed management, Nutrient uptake, Blackgram

Application of fertilizer is essential for crop production but it also favours the associated weeds of the crop. Weeds which are efficient competitors deprive crop for its major requirements of nutrients, moisture, light and space, thereby create adverse environment which results in poor crop growth and yield. Moody (1981) reported that weed usually grow faster than crop plants and thus absorb the nutrients earlier resulting in lack of nutrients for growth of crop plants. Use of high level of fertilizer to realize high yield in the absence of suitable weed management often harms the crop by favouring weed growth. In eastern India, with the help of pre-monsoon rains, a short duration crop like blackgram can be sown in dry season. But, during this season the available nutrients are limited, therefore warrant their judicious use for obtaining greater efficiency which is possoble only by adoption of weed management practices. The present studies were therefore undertaken to find out the effect of fertilizer

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Table 1. Effect of fertilizer application and weed management practices on grain yield, nutrient uptake by crop and weeds

Treatment	Grain yield (t/ha)		Dry matter of weeds (g/m^2)		Nutrient uptake by crop (kg/ha)						Nutrient removal by weeds (kg/ha)					
					N		P		K		N		P		K	
	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995	1994	1995
Fertility level																
$N_{10}P_{25}K_{15}$+ 1 t FYM/ha	0.49	0.43	107.4	153.8	28.7	36.9	1.9	1.7	4.7	2.6	14.6	14.1	1.5	1.7	6.3	6.7
$N_{20}P_{50}K_{30}$+ 2 t FYM/ha	0.52	0.50	125.1	196.2	34.7	48.4	2.5	2.5	6.1	3.2	20.0	25.1	2.3	3.2	9.4	12.0
$N_{10}P_{25}K_{15}$	0.44	0.45	83.4	145.5	26.4	38.6	1.8	2.2	4.7	2.7	13.0	16.1	0.5	1.4	6.0	6.7
$N_{20}P_{50}K_{30}$	0.54	0.55	99.5	212.6	33.5	51.1	2.5	2.8	6.4	3.4	17.3	26.8	1.1	3.1	8.9	10.9
CD (P = 0.05)	0.05	0.06	8.3	21.2	1.3	5.2	0.06	0.17	0.25	0.18	1.3	1.8	0.09	0.23	0.52	0.7
Weed management																
UC	0.19	0.14	195.4	303.7	9.1	14.0	0.6	0.6	1.5	1.0	24.1	28.0	2.2	3.3	14.1	14.2
HW	0.69	0.79	33.1	83.9	49.7	68.0	3.5	3.8	8.9	4.7	8.0	16.0	0.8	1.7	2.7	5.5
MW	0.45	0.41	104.3	205.5	24.3	35.2	1.8	1.6	4.5	2.1	17.2	22.8	1.5	2.7	9.3	10.5
CW	0.63	0.61	82.4	114.4	40.3	57.3	2.8	3.2	7.1	4.0	15.6	15.4	0.9	1.8	4.6	6.2
CD (P = 0.05)	0.04	0.04	8.8	18.6	1.2	2.99	0.12	0.10	0.25	0.12	1.6	1.4	0.14	0.16	0.65	0.66

Details of treatments are given under Materials and Methods

application and weed management practices on the availability of nutrients in the summer blackgram crop and also the removal of nutrients by associated weeds.

MATERIALS AND METHODS

A field experiment was carried out during February to May of 1994 and 1995 at Department of Agricultural and Food Engineering, IIT, Kharagpur. The soil was sandy loam acid lateritic having pH 5.6. It was low in nitrogen (228 kg/ha), medium in phosphorus (10.2 kg/ha) and high in potassium (392 kg/ha). The experiment was laid out in split plot design with 3 replications. Seeds of blackgram 'T 9' were drilled in rows 20 cm apart at a seed rate of 20 kg/ha. The treatments consisted of 4 levels of fertilizer, namely $F_1 = N_{10} P_{25} K_{15}$ (inorganic + 1 t/ha FYM), $F_2 = N_{20} P_{50} K_{30}$ (inorganic + 2 t/ha FYM), $F_3 = N_{10} P_{25} K_{15}$ (inorganic only) and $F_4 = N_{20} P_{50} K_{30}$ (inorganic only), and four weed management practices, i.e. UC = unweeded check, HW = hand weeding (30 DAS), MW = mechanical weeding (30 DAS) and CW = chemical weed control (pre-emergence application of pendimethalin @ 1.0 kg/ha). The fertilizer levels were assigned to main plots and weed management practices to subplots. Full dose of fertilizer was applied as basal. The P and K were applied in the form of P_2O_5 and K_2O. Weed samples were taken at the time of harvest for analysis.

RESULTS AND DISCUSSION

The predominant weeds included *Digitaria sanguinalis* (L.) Scop., *Echinochloa colonum;* (L.) Link, *Enhydra fluctuans* Lour, *Physalis minima* L. and *Cyperus iria* L. In general, the weed infestation was relatively higher during 1995 than 1994.

Dry matter of weeds

The dry matter production of weeds was significantly higher under $N_{20}P_{50}K_{30}$ than $N_{10}P_{25}K_{15}$ fertilizer level. Different weed and management practices significantly reduced the dry matter of weeds and minimum was observed under hand weeding, followed by chemical and mechanical weeding treatments (Table 1).

Grain yield

There was significant increase in grain yield under $N_{20}P_{50}K_{30}$ than $N_{10}P_{25}K_{15}$ fertilizer level. There was no significant variation in grain yield due to sources of fertilizer because the crop faced fairly high crop-weed competition due to high dry matter production of weeds. It was maximum in HW and minimum in UC treatments. Chemical weed control and mechanical weeding also increased the grain yield over UC treatment (Table 1).

Nutrient uptake by blackgram

The uptake of N, P and K by blackgram was higher under $N_{20}P_{50}K_{30}$ than $N_{10}P_{25}K_{15}$ treatment. In general, sources did not improve the uptake of nutrient by the crop. However, significant effect of addition of FYM was noticed in N and P uptake by crop during first year only. Among the weed management practices, HW was found to be the most effective method in increasing the nutrient uptake followed by CW and MW. The uptake of N, P and K were significantly superior under these treatments over UC (Table 1).

Table 2. Effect of fertilizer application and weed management practices on N, P and K removal (kg/ha) by different weeds species

Treatment	Weed species																	
	EF			DS			PM			EC			CD			CI		
	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K	N	P	K
								1994										
Fertility levels																		
$N_{10}P_{25}K_{15}$ + 1 t FYM/ha	3.75	0.33	1.24	4.45	0.56	2.44	1.70	0.19	1.39	1.54	0.18	0.55	2.24	0.24	0.78			
$N_{20}P_{50}K_{30}$ + 2 t FYM/ha	5.97	0.64	4.67	5.31	0.98	2.28	2.61	0.25	2.41	3.04	0.35	1.21	0.98	0.32	1.25			
$N_{10}P_{25}K_{15}$	5.42	0.15	2.17	3.97	0.24	2.90	1.22	0.06	0.84	0.69	0.04	0.42	0.38	0.05	0.31			
$N_{20}P_{50}K_{30}$	8.03	0.29	2.89	4.68	0.30	3.47	1.49	0.11	1.09	0.95	0.09	0.72	2.07	0.11	0.71			
Weed management																		
UC	5.10	0.46	3.22	8.65	0.01	6.74	4.30	0.44	4.19	1.84	0.22	1.28	3.09	0.29	1.10			
HW	0.00	0.00	0.01	5.05	0.45	1.44	0.00	0.00	0.00	2.24	0.26	0.62	0.00	0.00	0.00			
MW	5.58	0.35	2.46	4.72	0.61	4.57	2.72	0.17	1.54	2.13	0.19	0.98	1.44	0.16	0.47			
CW	11.49	0.60	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.16	0.26	1.49			
								1995										
Fertility levels																		
$N_{10}P_{25}K_{15}$ + 1 t FYM/ha	3.89	0.48	1.46	2.29	0.46	1.85	5.66	0.33	1.84	2.21	0.41	1.67	0.31	0.04	0.18	0.32	0.06	0.06
$N_{20}P_{50}K_{30}$ + 2 t FYM/ha	6.44	0.85	2.07	3.52	0.68	2.24	10.74	1.18	4.67	3.39	0.31	2.54	0.60	0.09	0.38	0.19	0.08	0.07
$N_{10}P_{25}K_{15}$	5.02	0.56	2.49	7.44	0.42	3.00	0.09	0.02	0.06	3.31	0.41	0.96	0.26	0.01	0.17	0.18	0.08	0.09
$N_{20}P_{50}K_{30}$	7.84	0.98	3.41	11.04	1.30	5.87	0.20	0.02	0.08	7.57	0.76	1.34	0.26	0.05	0.11	0.00	0.00	0.00
Weed management																		
UC	5.61	0.42	1.90	7.69	1.05	5.66	9.74	1.00	3.26	5.90	0.89	3.29	0.11	0.01	0.11	0.12	0.04	0.01
HW	4.21	0.84	1.32	3.54	0.53	2.37	0.29	0.04	0.36	3.49	0.25	0.99	0.99	0.09	0.45	0.00	0.00	0.09
MW	5.87	0.96	3.33	6.18	0.82	4.00	4.79	0.05	1.56	5.64	0.29	1.50	0.12	0.05	0.14	0.18	0.03	0.09
CW	7.70	1.14	2.67	2.91	0.27	1.44	1.87	0.13	0.87	2.45	0.16	0.74	0.22	0.03	0.13	0.40	0.05	0.13

EF = Enhydra fluctuans, DS = Digitaria sanguinalis, PH = Physalis minima, EC = Echinochloa colonum
CD = Cynodon dectylon, CI = Cyperus iria

Nutrient removal by weeds

Significantly higher removal of N, P and K nutrients by weeds was observed under $N_{20}P_{50}K_{30}$ than $N_{10}P_{25}K_{15}$ fertilizer level. There was marginal difference in nutrients removal due to application of different sources of fertilizer. All the weed management practices significantly minimized the nutrient removal by weeds as compared to UC. Minimum removal of 12.0, 1.3 and 4.1 kg N, P and K/ha respectively (average of 2 years) was observed in HW treatment (Table 1).

Similar findings were also reported by Rammorthy (1991), who observed greater removal of nutrients by weeds under UC treatment. Of the total nutrient removal, weeds shared more under UC treatment, which led to reduced grain yield of crop. The uptake of N, P and K by weeds was estimated to be 69.3, 82.1 and 91.9%, respectively of the total removal (weed + crop) in the unweeded treatment and only 16.9, 25.5 and 37.6% in HW; 40.2, 55.3 and 75.0% in MW; and 24.0, 31.0 and 48.3% in CW treatments. Thus, a saving of 29.1 to 52.3% N, 26.8 to 56.6% P and 16.9 to 54.3% K could be obtained by the adoption of weed control methods. The removal of nutrients by weeds was reduced by various weed control methods and was minimum in HW plots. Similar findings were also reported by Singh *et al.* (1987).

Table 2 shows that irrespective of fertilizer and weed control treatment *Enhydra fluctuans, Digitaria sanguinalis* and *Physalis minima* recorded higher removal of N, P and K than *Echinochloa colonum, Cynodon dactylon* and *Cyperus iria*. Greater removal by these weeds occurred under higher level of fertilizer application. Considerable variation in nutrient removal by weed species was observed under different weed management practices. During 1994, *Enhydra fluctuans* showed considerably high removal of nutrients in UC, MW and CW treatments. It was also noted that during 1995, P removal by *Enhydra fluctuans* was higher under HW, MW and CW treatments as compared to UC. In the same year, K removal by this weed under MW and CW treatments was more as compared to UC and HW treatments.

The uptake of NPK by crop and weeds could be mainly attributed to the extent of their dry matter production. It is apparent from Table 1 that whenever the removal of nutrients by weeds was more, the corresponding uptake by the crop was less and vice versa. Therefore, for efficient utilization of applied nutrients, the weeds should be kept under control. The total nutrients uptake by crop (grain + stover) was significantly higher in HW followed by CW and MW.

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