Bangladesh Agron. J. 2018, 21(1): 89-94

DEVELOPMENT OF FERTILIZER RECOMMENDATION FOR BLACKGRAM IN CHARLAND OF PABNA, BANGLADESH

M. Maniruzzaman[1*], M. R. Alam[1], M.S. Islam[1], M.Z. Islam[1], M.S.H. Molla[2] and M.A. Islam[3]

[1]On-farm Research Division, Bangladesh Agricultural Research Institute, Pabna
[2]On-farm Research Division, Bangladesh Agricultural Research Institute, Rangpur
[3]On-farm Research Division, Bangladesh Agricultural Research Institute, Shampur, Rajshahi
[*]Corresponding author, E-mail: maniruzzaman.bari@yahoo.com

(Received: 21 December 2017, **Accepted:** 23 March 2018)

Keywords: Charland, AEZ, Pulse, Blackgram,Yield, Cost and return

Abstract

The experiment was conducted at charland of Charsadipur in Pabna district under AEZ-11 during *Khrif* season of 2014 and 2015 to determine appropriate fertilizer dose for enhancing yield of blackgram as well as to increase farmers' income. The experiment was laid out in a randomized complete block design with four dispersed replications. Eight fertilizer packages, viz.T_1: $N_{20}P_{15}K_6S_9Zn_2$ kg ha^{-1}(STB), T_2: $N_{25}P_{15}K_6S_9Zn_2$kg ha^{-1}, T_3: $N_{25}P_{19}K_6S_9Zn_2$ kg ha^{-1}, T_4: $N_{25}P_{15}K_8S_9Zn_2$ kg ha^{-1}, T_5: $N_{20}P_{19}K_8S_9Zn_2$ kg ha^{-1}, T_6: $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}, T_7: $N_{15}P_{11}K_5S_7Zn_{1.5}$kg $ha^{-1}$and T_8: Native nutrients (control) were tested on blackgram. Fertilizer package of $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1} (T_6) enhanced crop growth and yield of blackgram in both the years. Maximum seed yield of blackgram (1.43t ha^{-1} in 2014 and 0.97 t ha^{-1} in 2015) was obtained with $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1} (T_6), which was 80 and 147% more than the control in 2014 and 2015, respectively. The highest gross return (Tk. 82815 ha^{-1} in 2014 and Tk. 65200 ha^{-1} in 2015) and gross margin (Tk. 51125 ha^{-1} in 2014 and Tk. 32020 ha^{-1} in 2015) were also recorded from the same treatment in both the years. The results revealed that fertilizer package of $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1} might be recommended for getting higher seed yield of blackgram and economic return as well under charland condition of Pabna district

.

Introduction

Pulses are vital legume crops in Bangladesh and used as food, feed and fodder. It is rich in protein. It also contains amino acid and lysine which are generally deficient in food grains (Elias *et al*., 1986). Pulses play an important role in sustaining soil health. They are generally grown without fertilizer since they can meet their nitrogen requirement by symbiotic fixation of atmospheric nitrogen in the soil (Senanayake *et al*., 1987; Zapata *et al*., 1987; Fried and Middleboe, 1977). The per capita consumption of pulse in Bangladesh is only 12 g day^{-1}, which is much lower than WHO recommendation of 45 g day^{-1} (Afzal *et al*., 1999).

Blackgram (*Vigna mungo* L.), one of the major pulse crop, stands fourth both in acreage and production in Bangladesh. Blackgram provides about 10.5% of the total pulse produced in Bangladesh and its seed contains about 25% protein (BARI, 1998). It is mainly grown for human consumption, though widely used as fodder for cattle and green manuring crop to improve soil fertility.

In Bangladesh the char lands of char area are not suitable for all types of crop. In Pabna, there is a vast area of charland under AEZ-11. Soil of charland is coarse textured having low water holding capacity, low nutrient and organic matter content. Farmers of charland in Pabna generally grow local variety of blackgram with no or limited fertilizers. For this reason, the

yield of blackgram in this region ismuch lower than that of potential yield. Balanced fertilization can play a major role toenhance the present yield level. Experimental evidences reveal that the crop is highly responsive to different fertilizers and its yieldcan be increased remarkably through judicious fertilization (BARI, 1988; Mohamed, 1984; Roy and Singh, 1986; Kazi *et al*., 2002). Fertilizer recommendation solely based on crop response data often fails to show economic viability. In this context, Perrin *et al*. (1979) reported that response of yield should be supported by economic evaluation for judicious fertilizer recommendation. Therefore, judicious application of fertilizer along with economic evaluation is important for blackgram. But very limited information is available in this regard in Bangladesh context. Hence, the present study was undertaken to determine the optimum fertilizerdose for getting higher economic benefit for blackgram in charland of Pabna district.

Materials and Method

The experiment was conducted at charland of Charsadipur in Pabna district during the *Khrif-II* season of 2014 and 2015. Soil series of the experimental site was Gopalpur belonging to the High Ganges River Floodplain Soils (AEZ-11). Before sowing, initial soil samples (0-15 cm depth) were collected from the experimental plots and were analyzed. The analytical results indicated that soil was sandy loam with verylow organic matter content (0.78%) and slightly alkaline in nature. N content of soil was very low and P, S and Zncontent were also low. K content of the soil was medium (Table 1). The experiment was laid out in randomized complete block (RCB) design with three dispersed replications. The unit plot size was 5m x 4m.

Table 1. Nutrient status of initial soil sample (0-15 cm depth) of experimental plots at Charsadipur, Pabna.

Soil properties	Values	Interpretation
Soil pH	8.1	Slightly alkaline
Organic matter content (%)	0.78	Very low
Total N (%)	0.05	Very low
Available P (µgg^{-1} soil)	11.6	Low
Available S (µgg^{-1} soil)	9.3	Low
Available Zn (µgg^{-1} soil)	0.56	Low
Exchangeable K (meq%)	0.18	Medium

T_1: $N_{20}P_{15}K_{12}S_9Zn_2$ kg ha^{-1} (STB), T_2: $N_{25}P_{15}K_{12}S_9Zn_2$kg ha^{-1}, T_3: $N_{25}P_{19}K_{12}S_9Zn_2$kgha^{-1}, T_4: $N_{25}P_{15}K_{15}S_9Zn_2$kgha^{-1}, T_5: $N_{20}P_{19}K_{15}S_9Zn_2$kgha^{-1}, T_6: $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1}, T_7: $N_{15}P_{11}K_9S_7Zn_{1.5}$ kg ha^{-1} and T_8: native nutrient (control).

Full amount of all fertilizers were applied as basal according to treatments. Seeds of blackgram were broadcasted in each plot on 15-20 August maintaining the seed rate of 35 kg ha^{-1} in both the year . The variety used this trial was BARI Mash-3. Two weedings were done at 25 and 40 days after sowing (DAS) for better growth of the crop. Ripcord 50 EC was applied at 35 DAS to control leaf feeding insect. Other intercultural operations were done when required. The above ground part of blackgram was harvested on 10-15 November in both the year. Data on days to 50% flowering, days to 80% maturity were taken from all plots. Plant height, pods plant^{-1},seeds pod^{-1}and 1000-seed weight were collected from randomly selected 10 plants at maturity stage from each plot. Seed yield and stover yield were taken from whole plot. All collected data were analyzed statistically by using MSTAT package and the means were adjudged by LSD test at 5% level of significance. Cost and return analysis of different treatments were also done .

Results and Discussion

Phenological characters

Phenological characters ofblackgram have been presented in Table 2. Significant variation in days to 50% flowering, days to 80% maturity and plant height were observed due to execution of different treatments. Maximum days to 50% flowering (53 in 2014 and52 in 2015) and days to 80% maturity (74 in 2014and 83 in 2015) were recorded from $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1}(T_6) which was statistically different from all other fertilizer packages while minimum days to 50% flowering (46.67 in 2014 and 45.67 in 2015) and days to 80% maturity (70.67 in 2014 and 77.67 in 2015) were recorded from control plot (T_8). The highest plant height (38.0 cm in 2014 and 50.3 cm in 2015) was measured from $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1} (T_6) and the lowest plant height (33.43 cm in 2014 and 38.62cm in 2015) was recorded in control plot (T_8).

Table 2. Phenological parameters of blackgram as affected by different levels of nutrients during *kharif* season of 2014 and 2015 at Charsadipur, Pabna

Treatment	Days to 50% flowering (no.)		Days to 80% maturity (no.)		Plant height (cm)	
	2014	2015	2014	2015	2014	2015
T_1: $N_{20}P_{15}K_{12}S_9Zn_2$ kg ha^{-1} (STB)	48.33	47.33	72.00	80.33	36.27	38.95
T_2: $N_{25}P_{15}K_6S_9Zn_2$ kg ha^{-1}	50.33	49.33	72.33	82.00	37.23	39.99
T_3: $N_{25}P_{19}K_6S_9Zn_2$ kg ha^{-1}	50.67	49.67	73.00	81.67	37.63	43.66
T_4: $N_{25}P_{15}K_{15}S_9Zn_2$ kg ha^{-1}	51.33	50.33	73.00	81.33	36.20	45.30
T_5: $N_{20}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	51.00	50.00	72.67	80.67	35.67	43.68
T_6: $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	53.00	52.00	74.00	83.00	38.00	50.30
T_7: $N_{15}P_{11}K_9S_7Zn_{1.5}$ kg ha^{-1}	47.67	46.67	71.67	79.33	36.40	42.34
T_8: Control	46.67	45.67	70.67	77.67	33.43	38.62
$LSD_{(0.05)}$	0.908	0.90	1.186	0.84	1.415	5.92
CV(%)	6.04	5.06	8.67	6.60	7.60	6.38

Yield contributing characters

Yield contributing characters of blackgram are presented in Table 3. Significant variation in number of pods $plant^{-1}$, number of seeds pod^{-1}, and 1000 -seed weight were observed due to execution of different treatments. Maximum number of pod $plant^{-1}$ (24.47 in 2014 and 18.17 in 215) was found from $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1} (T_6) in both the year while minimumnumber of pods $plant^{-1}$ (17.27 in 2014 and 14.23 in 2015) was recorded from control plot (T_8). In case of number of seeds pod^{-1}, no significant difference was found among the treatments except control. Significantly higher 1000-seed weight was observed from in all the fertilizer packages over control in both the years and the lowest 1000 -seed weight (33.63 g in 2014 and 34.67g in 2015) from control plot (T_8).

Table 3. Yield contributing parameters of blackgram as affected by different levels of nutrients during *kharif*season of 2014 and 2015 at Charsadipur, Pabna

Treatments	Pods $plant^{-1}$ (no.)		Seeds pod^{-1} (no.)		1000-seed weight (g)	
	2014	2015	2014	2015	2014	2015
T_1: $N_{20}P_{15}K_{12}S_9Zn_2$ kg ha^{-1} (STB)	19.44	16.73	6.850	6.32	34.77	34.90
T_2: $N_{25}P_{15}K_6S_9Zn_2$ kg ha^{-1}	20.04	16.97	6.900	6.37	34.80	34.93

T_3: $N_{25}P_{19}K_6S_9Zn_2$ kg ha^{-1}	21.07	18.07	7.010	6.53	34.90	34.97
T_4: $N_{25}P_{15}K_{15}S_9Zn_2$ kg ha^{-1}	19.30	17.63	7.060	6.50	35.27	35.13
T_5: $N_{20}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	20.81	17.83	6.830	6.77	35.17	35.47
T_6: $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	24.47	18.17	6.767	6.83	35.40	35.90
T_7: $N_{15}P_{11}K_9S_7Zn_{1.5}$ kg ha^{-1}	18.04	15.67	6.50	6.00	34.73	35.00
T_8: Control	17.27	14.23	6.37	5.67	33.63	34.67
LSD $_{(0.05)}$	3.24	2.125	0.65	0.53	0.896	1.088
CV (%)	9.25	5.17	5.49	2.45	1.47	1.77

Yield and percent yield increase over control of blackgram have been presented in Table 4.Maximum stover yield of blackgram (1.77 t ha^{-1} in 2014 and 1.4 t ha^{-1} in 2015) was found from $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1} ($T_6$) treatment and minimum stover yield (0.97 t ha^{-1} in 2014 and 1.0 t ha^{-1} in 2015) was found from control plot (T_8). The highest seed yield (1.43 t ha^{-1} in 2014 and 0.97 t ha^{-1} in 2015) was obtained from $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1}($T_6$) which was significantly higher than other treatments. On the contrary, control (T_8) treatment provided the lowest seed yield (0.58 t ha^{-1}in 2014 and 0.54 t ha^{-1} in 2015). The cumulative contribution of yield components might be the reason for higher seed yield in $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1}($T_6$). In contrast, poor crop growth and lower yield components resulted the lowest seed yield in control treatment (T_8). Yield increase over control (147% in 2014 and 80% in 2015) was more in $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1} ($T_6$). The overall results indicated that 100% soil test based fertilizer package plus 25% additional nutrients specially N, P and K that is fertilizer dose of $N_{25}P_{19}K_{15}S_9Zn_2$kg ha^{-1} ($T_6$) enhance plant growth and produced higher yield in blackgram. This result is supported by the findings of Kumar and Singh (2009), Mondal *et al.* (2010); Bhuiyan *et al.* (2008) and Singh *et al.* (2004) in case of lentil.They reported that balanced application of N, P, K, S, Zn and B significantly increased yield of lentil over control.

Cost and return analysis

Cost and return analysis demonstrated that maximum gross return (Tk. 94,650 ha^{-1} in 2014 and Tk. 65,200 ha^{-1} in 2015) and gross margin (Tk. 62,960 ha^{-1} in 2014 and Tk. 32020 ha^{-1} in 2015) was obtained from $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}(T_6) followed by T_4 and T_5 fertilizer packages (Table 5). Higher production in this treatment resulted in higher economic return. Total variable cost in different treatments varied mainly due to involvement of fertilizer cost. Minimum gross margin (Tk. 12,500 ha^{-1} in 2014 and Tk. 8,650 in 2015 ha^{-1}) was recorded in control plot (T_8) might be due to lower yield.

Table 4. Seed yield of blackgram as affected by different levels of nutrients during the *kharif*season of 2014 and 2015 at Charsadipur, Pabna

Treatments	Stover yield (t ha^{-1})		Seed yield (t ha^{-1})		Seed yield increase over control (%)	
	2014	2015	2014	2015	2014	2015
T_1: $N_{20}P_{15}K_{12}S_9Zn_2$ kg ha^{-1}(STB)	1.22	1.23	0.80	0.68	38	26
T_2: $N_{25}P_{15}K_6S_9Zn_2$ kg ha^{-1}	1.33	1.29	0.86	0.77	48	43
T_3: $N_{25}P_{19}K_6S_9Zn_2$ kg ha^{-1}	1.37	1.25	0.96	0.67	67	24
T_4: $N_{25}P_{15}K_{15}S_9Zn_2$ kg ha^{-1}	1.37	1.30	1.10	0.83	90	54
T_5: $N_{20}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	1.40	1.24	1.27	0.69	119	28
T_6: $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	1.77	1.40	1.43	0.97	147	80
T_7: $N_{15}P_{11}K_9S_7Zn_{1.5}$ kg ha^{-1}	1.20	1.08	0.74d	0.66	28	22
T_8: Control	0.97	1.00	0.58	0.54	-	-
LSD $_{(0.05)}$	0.33	0.39	0.236	0.21	-	-
CV (%)	10.31	18.48	9.70	19.72	-	-

Table 5. Cost and return analysis of blackgram influenced by fertilizer packages at Charsadipur, Pabna as affected by different levels of nutrients during *Kharif* season of 2014 and 2015

Treatments	Gross return (Tk. ha^{-1})		Total variable cost (Tk. ha^{-1})		Gross margin (Tk. ha^{-1})	
	2014	2015	2014	2015	2014	2015
T_1: $N_{20}P_{15}K_{12}S_9Zn_2$ kg ha^{-1} (STB)	54100	46950	30780	32294	23320	14656
T_2: $N_{25}P_{15}K_6S_9Zn_2$ kg ha^{-1}	58250	52650	30980	32470	27270	20180
T_3: $N_{25}P_{19}K_6S_9Zn_2$ kg ha^{-1}	64450	46450	31530	33020	32920	13430
T_4: $N_{25}P_{15}K_{15}S_9Zn_2$ kg ha^{-1}	72850	56300	31140	32630	41710	23670
T_5: $N_{20}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	83200	47600	31490	33004	51710	14596
T_6: $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1}	94650	65200	31690	33180	62960	32020
T_7: $N_{15}P_{11}K_9S_7Zn_{1.5}$ kg ha^{-1}	49800	45000	29875	31400	19925	13600
T_8: Control	39650	37400	27150	28750	12500	8650

Market Price (Tk. kg $^{-1}$)**:** Blackgram: Grain 60.00, Straw 5.00

Conclusion

The results revealed that fertilizer packages exerted significant effect on growth and yield of blackgram. Blackgram grown with $N_{25}P_{19}K_{15}S_9Zn_2$ kg ha^{-1} produced the highest yield and gave the maximum economic benefit at charland area of Pabna district, Bangladesh.

References

Afzal, M. A., M. A. Bakr and M. L. Rahman. 1999. Lentil cultivation in Bangladesh. Lentil, Blackgram and Mungbean Development Pilot Project, Pulses Research Station, BARI, Gazipur-1701.

BARI (Bangladesh Agricultural Research Institute). 1988. Annual Report 1988-89, pp. 136-142. BARI, Joydebpur, Gazipur-1701, Bangladesh.

Bhuiyan, M.A.H., D. Khanam, N.E. Ali, M.K. Zaman and M.S. Islam. 2008. Response of lentil to bio fertilizer and chemical fertilizers in the farmers' field. Annual Research Report, 2007-2008, Soil Science Division, BARI, Gazipur.

Elias. S.M., M.S. Hossain, F.S. Sikder, J. Ahmed and M. R.Karim. 1986. Identification of constraints to pulse production with special reference to present farming systems. Annual Report of Agricultural Economic Division, BARI, Joydebpur.p-1.

Fried, M. and V. Middelboe. 1977. Measurement of amount of nitrogen fixed by legume crop. Plant and Soil 47: 713-715.

Kazi, B. R., F. C.Oad, and A. Lakho. 2002.Effect of irrigation frequencies on growth and yield of soybean. Pakistan J. Appl. Sci. 2 (6): 661-662.

Kumar, S. and M. Singh . 2009. 25 Years of Pulses Research at IIPR, 1984-2009. Indian Institute of Pulses Research, Kanpur 208024, India.

Mohamed, S. A. 1984. Effect of irrigation water and fertilization on yield and water use efficiency of corn plants in Fayoum Governorate. Moshtohor, Egypt Annual Agric. Sci. 20(2): 221-235.

Mondal, R.H., B. Anwar, M. Rafiuddin and M.A. Hossain. 2010. Integrated nutrient management f or sustaining soil fertility and yield of Lentil-Mungbean-T.Aman cropping pattern. Annual Research Report, 2009-2010, Pulses Research Centre, BARI, Gazipur.

Perrin, R. K., D. L.Winkelmen, E. R. Moscardi, andJ. R. Anderson. 1979.Economic Training Manual. Information Bulletin No. 27. CIMMYT, Mexico. 5 p.

Roy, R. K. and K. S. P. Singh. 1986. Response of pop-corn (*Zea mays*) to plant population and nitrogen. Indian J. Agron. 31(1): 87-92.

Senanayake. L., D.P. Knievel, S.E. Stevena. 1987. Nodulation and symbiotic nitrogen fixation of cowpea (*Vigna unguiculata* L.). Plant and Soil 99: 435-439.

Singh, S.K., S.C. Varmaand and R.P. Singh. 2004. Residual effect of organic and inorganic sources of nutrients in lowland rice on succeeding lentil. Indian J. Agric. Res., 38(2): 121-125

Zapata. F., S.K.A. Danso, G. Hardarson and M. Fried. 1987. Nitrogen fixation and translocation in field-grown fababean. Agron. J. 79: 505-509.