Bangladesh Agron. J. 2018, 21(2): 67-71

RESPONSE OF MUSTARD TO SOIL TEST BASED FERTILIZER MANAGEMENT

M. H. Hossain[1], S. K. Bhowal[2*], M. M. H. Bhuiyan[3], A. K. M. S. Haque[4], A. S. M. M. R. Khan[5]

[1]Principal Scientific Officer, On- Farm Research Division, Bangladesh Agricultural Research Institute, Cumilla, Bangladesh
[2 & 3]Scientific Officer, On- Farm Research Division, Bangladesh Agricultural Research Institute, Cumilla, Bangladesh
[4]Principal Scientific Officer, ARS, Bangladesh Agricultural Research Institute, Cumilla, Bangladesh
[5]Chief Scientific Officer, On- Farm Research Division, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh
*Corresponding author, E-mail: shamal.bau@gmail.com

(**Received**: 13 January 2019, **Accepted:** 9 May 2019)

Keywords: STB fertilizer Management, Mustard Yield, Cost and Return Analysis

Abstract

A field experiment was carried out at Sonapur of Muradnagar upazilla in Cumilla district under the Debidwar MLT (Multi-Location Testing) site during the rabi season of 2013-15. The experiment was conducted in the Old Meghna Estuarine Floodplain (AEZ-19) soil. The experiment was laid out in randomized complete block design (RCBD) with 3 replications. The treatments were: T_1= Soil Test Based (STB) Fertilizer dose (FRG 2012), T_2= T_1+ 15% STB, T_3= T_1+ 30% STB, T_4= 80% STB from inorganic fertilizer + 20% STB from CD/PM, T_5= Farmers' Practice and T_6= Control. Among the treatments, T_4 gave the maximum seed yield (1385.56 kg ha^{-1}) which was at par with T_1, T_3 and T_2 treatments. The lowest seed yield (450.20 kg ha^{-1}) was obtained from T_6 (Control).

Introduction

Mustard is one of the major oilseed crops in Bangladesh that occupies 78% of the oilseed area and contributes nearly 62% of the total oilseed production in Bangladesh (BBS, 2009). In Cumilla region, a vast area is used for mustard cultivation in between T. Aman and Boro (Anonymous, 2014). They also cultivate mustard as a mixed crop with boro rice (Haider et al., 2015). Bangladesh Agricultural Research Institute (BARI) developed several high yielding mustard varieties and these varieties may out yielded the local variety in terms of increased yield per unit area (Mondal *et al.,* 2014). Among high yielding mustard varieties, BARI Sarisha-14 is found to produce a higher yield in plain land and char land areas without hampering the next crop (Islam *et al.,* 2011). On the other hand, farmers generally do not use organic fertilizer or use a higher dose of chemical fertilizers or indiscriminately use chemical fertilizers for mustard cultivation (Bhowal, *et al.* 2014). They have no knowledge or have little knowledge about soil test based fertilizer application. So, the higher yield gap exists in the farmer's field. Now, it is essential to find out the optimum dose for soil test based of fertilizer recommendation for higher yield and economic return of mustard.

Materials and Methods

The experiment was conducted at Sonapur of Muradnagar upazilla in Cumilla district under the Debidwar MLT site during 2014-15. The experimental site was situated in AEZ-19 (Old Meghna Estuarine Floodplain). Soil samples were collected from the experimental plots and analyzed. The soil was sandy loam in texture with pH 6.5. The physiochemical properties of the initial soil of the experimental field were presented in Table 1. Initial nutrients content values were used in calculating soil test based fertilizer dose. The experiment was laid out in randomized complete block (RCB) design with 3 replications. The unit plot size was (4 x 3) m^2. Row to row distance was 30 cm and seeds of mustard var. BARI sarisha-14 were sown on 11 November, 2014 continuously. The treatments were T_1 = Soil Test Based (STB) Fertilizer dose (FRG 2012), T_2 = T_1+ 15% STB, T_3 = T_1 + 30% STB, T_4 = 80% STB from inorganic fertilizer + 20% STB from CD/PM, T_5 = Farmers' Practice, T_6= Control. Fertilizers were applied as per treatment. Half of the nitrogen and full quantity of cow dung, P, K, S and B were applied at the time of final land preparation. Urea, TSP, MoP, gypsum and Boric acid were used as a source of N, P, K, S and B, respectively. The remaining half of nitrogen was applied as a top dress at the flowering stage (25 days after seeding) and covered with soil followed by irrigation. Intercultural operations like weeding, mulching were done as and when necessary. Yield components like a number of siliqua $plant^{-1}$, seeds $siliqua^{-1}$ and 1000 seed weight were taken from randomly selected 10 plants from each plot. The crop was harvested at 75 days after sowing. Seed yields were taken from the whole plot. Data on yield and yield components were analyzed statistically by Statistix 10 program and the means were adjusted using LSD test at 5% level of significance (Statistix 10, 2013).

Table 1. Physio-chemical Properties of Initial Experimental Soil at farmer's field, Ghorashal, Muradnagar, Cumilla

Location	pH	K	Total N (%)	P	S	B
		Meq100 ml^{-1}		μg ml^{-1}		
Muradnagar, Cumilla	6.5	0.046	0.04	6.0	38	0.18
Critical Level	-	0.12	-	7. 0	10	0.20
Interpretation	Slightly acidic	Very low	Very low	Low	Very high	Low

Results and Discussion

Yield and yield attributing Characteristics

Yield components and yield of BARI Sarisha-14 under different fertilizer management practices are presented in Table 2. From the findings, it was found that there is no significant difference among T_1, T_2, T_3 and T_4 treatments regarding the plant height. The lowest plant height (80.90 cm) was recorded in T_6 treatment. The maximum number of the primary branch (3.6) was found in T_4 treatment where 80% STB from inorganic fertilizer + 20% STB from CD was used but it was statistically similar with T_1 and T_3, respectively. A number of siliqua $plant^{-1}$ (9.93 – 39.40) differed significantly under different soil test based fertilizer managements. It increased with different soil test based fertilizer management levels. A maximum number of siliqua per plant was recorded from T_4 treatment that was followed by T_1, T_3 and T_2 treatments and minimum in T_6 treatment. It was observed that higher number of pods per plant (39.40), 1000 seeds weight (2.97 g) and seed yield (1385.33 kg ha^{-1}) was found in T_4 treatment that was statistically similar with T_2 and T_3 treatments (Fig. 1 and Fig. 2). Datta *et al.* (2011) also reports that the significant variation in 1000-seed weight of BARI Sarisha-11 under different fertilizer managements may be

attributed to different growth rate, dry matter accumulation and variable rate of translocation of assimilates towards seeds. On the other hand, the lowest seed yield (450.20 kg ha^{-1}) was obtained from T_6 (control). The variation in seed yield of mustard was also observed by Mandal and Sinha (2004) and explained that it may be attributed to the total dry matter production and it's partitioning to different yield contributing organs.

Cost and Return Analysis

From cost and return analysis it was revealed that the gross return varies with different soil test based fertilizer management practices (Table 3) and the highest gross return (Tk. 48,487 ha^{-1}) was recorded in T_4 treatment due to increase in yield of mustard where 80% STB from inorganic fertilizer + 20% STB from CD i.e N-P-K-S-B (96-36-56-0-0.72) kg ha^{-1} + 20% from cow dung were used. Cost of production increased mainly with increasing fertilizers levels in different fertilizer management packages.

Table 2. Effect of different fertilizer packages on yield contributing characters of mustard at Muradnagar, Cumilla (pooled data of 2013-14 and 2014-15)

Treatments	Plant height (cm)	Branch $plant^{-1}$ (no.)	Pods $plant^{-1}$ (no.)	Weight of seed $plant^{-1}$ (g)
T_1	114.93	3.27	36.73	14.13
T_2	114.07	2.53	36.33	19.87
T_3	107.80	3.53	35.53	19.27
T_4	114.13	3.60	39.40	21.89
T_5	120.67	2.77	33.47	17.87
T_6	80.90	1.63	9.93	8.87
CV (%)	5.35	7.64	8.64	8.62
$LSD_{(0.05)}$	10.53	0.40	5.12	2.66

Note:T_1= Soil Test Based (STB) Fertilizer Dose (FRG 2012) i.e N-P-K-S-B (120-45-70-0-0.9) kg ha^{-1}, T_2= T_1+15% STB i.e N-P-K-S-B (138-51.75-80.5-0-1.04) kg ha^{-1} , T_3= T_1+30% STB i.e N-P-K-S-B (156-58.5-91-0-1.17) kg ha^{-1}, T_4=80% STB from Inorganic fertilizer+20% STB from CD/PM i.e N-P-K-S-B (96-36-56-0-0.72) kg ha^{-1}+20% from cow dung, T_5= Farmers Practice i.e N-P-K(170-95-100) kg ha^{-1}, T_6= Control i.e No fertilizer Used.

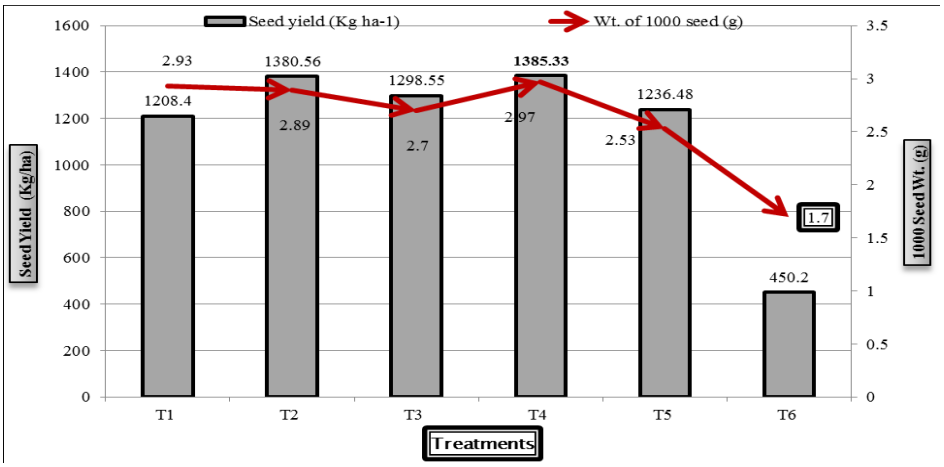

Fig. 1. Relationship of different packages of STB fertilizers with seed weight and yield of mustard

The maximum cost of production was recorded in T_3 treatment (Tk. 30,500 ha^{-1}) and the lowest in control (Tk. 12,000 ha^{-1}). The gross margin and benefit-cost ratio (BCR) also varies towards different soil test based fertilizer management and it followed a trend similar to that of gross return. The highest gross margin (Tk.

18,987 ha^{-1}) and BCR (1.64) were obtained from T_4 treatment where 80% STB from Inorganic fertilizer + 20% STB from CD i.e N-P-K-S-B (96-36-56-0-0.72) kg ha^{-1} + 20% from cow dung were used. Banerjee *et al.* (2010) also agree with the above findings and stated the impact of different combined doses of fertilizers with plant growth regulators on growth, yield attributes and yield of mustard (*Brassica campestris* cv. B9).

Table 3. Economic analysis of mustard var. BARI Sarisha-14 at Muradnagar, Cumilla (pooled)

Treatments	Gross Return (Tk. ha^{-1})	Total Cost of Cultivation (Tk. ha^{-1})	Gross Margin (Tk. ha^{-1})	BCR
T_1	42294	28499	13795	1.48
T_2	48319	29773	18546	1.62
T_3	45449	30500	14949	1.49
T_4	48487	29500	18987	1.64
T_5	43277	29600	13677	1.46
T_6	15757	12000	5757	1.31

Note:T_1= Soil Test Based (STB) Fertilizer Dose (FRG 2012) i.e N-P-K-S-B (120-45-70-0-0.9) kg ha^{-1}, T_2= T_1+15% STB i.e N-P-K-S-B (138-51.75-80.5-0-1.04) kg ha^{-1} , T_3= T_1+30% STB i.e N-P-K-S-B (156-58.5-91-0-1.17) kg ha^{-1}, T_4=80% STB from Inorganic fertilizer+20% STB from CD/PM i.e N-P-K-S-B (96-36-56-0-0.72) kg ha^{-1}+20% from cow dung, T_5= Farmers Practice i.e N-P-K(170-95-100) kg ha^{-1}, T_6= Control i.e No fertilizer Used, Price of Mustard @ 35 Tk kg^{-1}

Farmers' Opinion

Farmers' opined that they did not know the soil test based fertilizer application method and amount of fertilizer required for mustard cultivation. They are happy with the result of the experiment and express their opinion on over dose chemical fertilizers. The experiment may be helpful for other mustard growers in this block or area.

Fig. 2. Pictorial view of the experimental field at Muradnagar, Cumilla, Bangladesh with individual treatment

Conclusion

Based on the experimental result it was clearly revealed that fertilizers application especially soil test based fertilizer application had the effect on plant growth, yield and yield contributing characters of mustard. Among the different soil test based fertilizer management packages, 80% STB from Inorganic fertilizer + 20% STB from CD i.e N-P-K-S-B (96-36-56-0-0.72) kg ha^{-1} + 20% from cow dung is the best considering yield and economic benefit in Cumilla region.

References

Anonymous, 2014. Annual research report. On- Farm Research Division, Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh. 276 p.

BBS (Bangladesh Bureau of Statistics). 2009. Statistical Yearbook of Bangladesh. Statistical Division, Ministry of planning, Government of the People's Republic of Bangladesh.

Banerjee, A., J. K. Datta and N. K. Mondal. 2010. Impact of different combined doses of fertilizers with plant growth regulators on growth, yield attributes and yield of mustard (*Brassica campestris* cv. B9) under old alluvial soil of Burdwan, West Bengal, India. *Front. Agric. China* **4**(3): 341-351.

Bhowal, S. K, M. M.U. Chowdhury, M. S. Bhuiyan, A. H. M. A. Faisal, I. S. M. Farhad and S.K. Bhowmik. 2014. Yield and Yield Attributes of Lentil (*Lens Esculenta*) as a Mixed Crop with Mustard (*Brassica Campestris*). *Sci. Agri.* 8 (2), 2014: 76-79 © PSCI Publications

Datta, J.K., A. Banerjee, M. Saha Sikdar, S. Gupta and N.K. Mondal. 2011. Impact of combined exposure of chemical, fertilizer, bio-fertilizer and compost on growth, physiology and productivity of *Brassica campestries* in old alluvial soil. *J. Environ. Biol.* **30**(5): 797-800.

FRG. 2012. Fertilizer Recommendation Guide, Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka1215. 274p

Islam, M.N., M. Akhteruzzaman, F. Ahmed, M.S.A. Khan and S. Begum. 2011. Performance of mustard, lentil and hybrid maize varieties in charland of Kushtia district. *J. Expt. Biosci.* **2**(1):01-04.

Mandal, K.G., and A.C. Sinha. 2004. Nutrient management effects on light interception, photosynthesis, growth, dry matter production and yield of Indian mustard (*Brassica juncea). J. Agronomy Crop Sci.* **190**: 119-129.

Mondal, M. R. I., M. K. Sultan, S. Nour, M. J. U. Sarkar, M. S. Alam, M. H. H. Rahman, (2014 Edited), KRISHI PROJUKTI HATBOI (Handbook on Agro-technology), 6th edition, BARI, Gazipur 1701, Bangladesh

Statistix 10, 2013. User's Manual, Copyright © 1985-2013. Analytical Software. Email to support@statistix.com