

ASSESSING THE IMPACTS OF INTEGRATED PLANT NUTRIENT MANAGEMENT ON PERFORMANCES OF DIFFERENT MUNGBEAN (*Vigna radiate*) VARIETIES

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ABSTRACT

The experiment was carried out at Agronomy field laboratory, Bangladesh Agricultural University, Mymensingh, during the period from March to May 2018 to study response of different mungbean (*Vigna radiate*) varieties to integrated plant nutrient management. The experimental treatment consisted of three varieties, namely- BINA moog-8, BARI mung-8, BARI mung-6 and six levels of fertilizers treatment viz. control (no fertilizer), recommended dose of fertilizer (RDF), 75% RDF + 5 tha⁻¹ vermicompost, 75% RDF + 5 tha⁻¹ cowdung, 50% RDF + 10 tha⁻¹ vermicompost, 50% RDF + 10 tha⁻¹ cowdung. The experiment was laid out in a split plot design with three replications with varieties in main plots and fertilizers in sub-plots. The study noted that BARI mung-6 performed the best among the three mungbean varieties studied. In case of fertilizers treatment 50% RDF + 10 tha⁻¹ vermicompost performed the best and the highest grain yield was obtained from BARI mung-6 when fertilized with 50% RDF + 10 tha⁻¹ vermicompost combinations. However, further studies are necessary considering fertilizers treatment for general combination.

Key words: IPN, variety, performances, mungbean.

Introduction

Mungbean (*Vigna radiate* L.) is one of the important pulse crops of Bangladesh, as it is an excellent source of easily digestible protein, which complements the staple rice diet in the country. Its edible grain characterized by good digestibility, flavor, high protein content and absence of any flatulence effects. It contains 51% carbohydrate, 26% protein, 10% moisture, 4% mineral, and 3% vitamins (Kaul, 1982). Pulses are also considered as important source of minerals, micro and macro nutrients as well as health promoting secondary metabolites and the poor man's source of protein. As the legume crops, mungbeans have self nitrogen fixing capacity, hence their contribution has an added advantage in present day of fertilizer crises in the country. The productivity of this crop is very low because of its cultivation on marginal and sub marginal lands of low soil fertility where little attention is paying to adequate fertilization (Saravanan *et al.*, 2013). Although, chemical fertilizer are playing a crucial role to meet the nutrients need of the crop, the imbalance and continuous use of chemical fertilizers has adverse effect on soil physical, chemical and biological properties thus affecting the sustainability of crop production, besides causing environmental pollution (Virmani, 1994). Integration of organic manures and inorganic fertilizer materials has been found to be promising not only in maintaining higher productivity of crops and for providing stability in crop production, besides improving soil physical conditions (Verma *et al.*, 2012). A good soil should have at least 2.5% organic matter, but in Bangladesh most of the soils have less than 1.5% and some soils even less than 1% organic matter. Farmers generally use chemical fertilizers like nitrogen, TSP, and MP. The prices of these fertilizers are very high and they are often in short supply in the market at the time of need. For this reason, poor and marginal farmers cannot afford to apply balanced fertilizers. As a result, their crops don't produce the expected yield. The imbalanced application of chemical fertilizers is also detrimental to the environment. So, the use of integrated nutrient management in crop production is gaining importance now a day. Vermicompost is one of the rising organic fertilizers over the country. The beneficial effect of vermicompost was first highlighted by Darwin (1881). Vermicompost contains micro site rich in available carbon and nitrogen. Worm cast incorporated soils are also rich in water soluble Pand contained two to

three times more available nutrients than surrounding soils which encourages better plant growth. Vermicompost suppress parasitic attacks dramatically and also have shown to increase germination rates, growth etc in wide ranges of crops. On the other hand cow dung is a valuable resource in agriculture, primarily as an organic fertilizer and soil conditioner. It improves soil fertility, enhances nutrient availability for plants, and boosts crop yields. It also plays a role in improving soil structure, promoting beneficial microbial activity, and reducing the need for synthetic fertilizers. Considering above facts and vies the present investigation has been planned by taking mungbean varieties with following objectives: i) to find out the improvement of mungbean varieties due to integrated nutrient management and ii) to assess the effect of integrated nutrient management on yield attributes, yield and quality of mungbean.

Materials and Methods

A field experiment was carried out at Agronomy field laboratory, Bangladesh Agricultural University, Mymensingh, during the period from March to May 2018 to study response of different mungbean (*Vigna radiate*) varieties to integrated plant nutrient management. The site belongs to non calcareous dark grey floodplain soil under Old Brahmaputra Floodplain "AEZ-9". The land topography was medium high and the soil was sandy loam in texture with P^H 6.7 (UNDP and FAO, 1988). The experimental treatment consisted of three varieties, namely- BINA moog-8, BARI mung-8, BARI mung-6 and six levels of fertilizers treatment control (no fertilizer), recommended dose of fertilizer (RDF), 75% RDF+5 tha^{-1} vermicompost, 75% RDF+5 tha^{-1} cowdung, 50% RDF+10 tha^{-1} vermicompost, 50% RDF+10 tha^{-1} cowdung. The experiment was laid out in a split plot design with three replications with varieties in main plots and fertilizers in sub-plots. The size of each plot was 2.5m \times 2m. The recommended doses of fertilizer viz., Urea, TSP, MP were 40, 80, 30 $kg\ ha^{-1}$, respectively. Seeds were sown on 6 March 2018 in with seed rate of 20-25 kg/ha and finally plant to plant distance of 0.5m was maintained. Intercultural operations were done when necessary. Data on growth parameters and yield attributes were recorded. The collected data were analyzed statistically using the analysis of variance technique and the differences among treatment means were adjudged by Duncan's Multiple Range Test.

Results and Discussion

Effect of variety: Different mungbean varieties exhibit significant variations in growth and yield characteristics (Table 1). Factors like plant height, number of pods per plant and seed yield can differ considerably depending on the specific variety. For instance, some varieties may be taller, while others may produce more pods per plant or have higher seed yields. In the study the highest plant height, no. of branches per plant, no. of pods per plant, no. of seeds per plant, 1000 seed wt were produced by BARI mung-6. The varietal variation was highly significant on grain as well as straw yields. The highest grain as well as straw yields (1.80, 3.50 $t\ ha^{-1}$) was produced by BARI mung-6 variety. The lowest yields (1.50, 3.0 $t\ ha^{-1}$) was produced by BARI mung-8 variety. The study was agreed by Singh *et al.* (2007), where they conducted a field experiment with 6 mungbean cultivars (Pusa 9531, Pusa Vishal, Pant M5, MH 96-1, Samrat and SML 668) in Ludhiana, Panjab, India, during the summer of 2004. The 1000 seed weight was greatest in Pusa Viahah, Plant M5, SML 668 (5.28, 5.60, 5.64g). SML 668 had the highest grain yield (1318 kg/ha) and straw yield (4207 kg/ha). The study also noted that BARI mung-6 gave the highest (33.83%) harvest index (HI) whereas the lowest harvest index (33.15%) in BARI mung-8.

Effect of integrated fertilizers: Different Studies have shown that using biofertilizers alongside chemical fertilizers can have a synergistic effect, enhancing nitrogen fixation and nutrient availability for the crop. For example, applying a combination of farmyard manure, vermicompost, and chemical fertilizers has been shown to increase plant height, pod count and seed yield in mungbean. The highest plant height, no. of branches per plant, no. of pods per plant, no. of seeds per plant, 1000 seed wt were produced by 50% RDF + 10 tha^{-1} vermicompost and lowest in control treatment (Table 2). Similarly, the highest grain yield (2.09 tha^{-1}) was recorded from 50% RDF + 10 tha^{-1} vermicompost. The lowest grain yield (1.30 tha^{-1}) was recorded from control. In the same way, the highest straw yield (3.78 tha^{-1}) was also recorded from 50% RDF + 10 tha^{-1} vermicompost.

Table 1. Effect of variety on yield and yield contributing characters of mungbean (*Vigna radiata*)

Variety	Plant height (cm)	No. of branches plant ⁻¹	No. of pods plant ⁻¹	No. of seeds plant ⁻¹	1000 seed wt. (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	HI (%)
V ₁	44.98 b	2.744 b	8.778 b	10.43b	32.21b	1.70 b	3.30 b	33.82 a
V ₂	43.03 c	2.544 b	8.022 c	10.38b	24.27c	1.50 c	3.01 c	33.15 b
V ₃	48.74 a	3.011 a	9.467 a	11.13a	40.30a	1.80 a	3.50 a	33.83 a
S \bar{x}	0.455	0.065	0.147	0.134	0.064	0.007	0.011	0.122
Level of sig.	**	**	**	*	**	**	**	*
CV (%)	4.24	9.95	7.04	5.33	0.84	1.89	1.37	1.53

Table 2. Effect of fertilizer doses on yield and yield contributing characters of mungbean (*Vigna radiata*)

Fertilizer doses	Plant height (cm)	No. of branches plant ⁻¹	No. of pods plant ⁻¹	No. of seeds plant ⁻¹	1000 seed wt. (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	HI (%)
F ₁	34.9e	2.17c	6.42f	10.11d	32.11b	1.30 f	2.69 f	32.50 d
F ₂	42.69d	2.31c	7.40e	10.45cd	32.12b	1.43 e	2.93e	32.70 d
F ₃	47.20c	2.91b	9.00c	10.81abc	32.28ab	1.72 c	3.41c	33.59c
F ₄	45.44c	2.82b	8.11d	10.56bc	32.24ab	1.54 d	3.19d	32.57 d
F ₅	53.07a	3.42a	11.53a	11.06a	32.46a	2.09 a	3.78a	35.62 a
F ₆	50.13b	2.95b	10.07 b	10.89ab	32.34ab	1.91 b	3.61 b	34.61 b
S \bar{x}	0.772	0.065	0.121	0.136	0.077	0.015	0.033	0.286
Level of sig.	**	**	**	**	*	**	**	**
CV (%)	5.08	7.04	4.12	3.85	0.71	2.68	3.06	2.55

Table 3. Interaction effects of variety and fertilizer doses on growth and yield of mungbean (*Vigna radiata*)

Interaction variety x fertilizer)	Plant height (cm)	No. of branches plant ⁻¹	No. of pods plant ⁻¹	No. of seeds plant ⁻¹	1000 seed wt. (g)	Grain yield (t ha ⁻¹)	Straw yield (t ha ⁻¹)	HI (%)
V ₁ xF ₁	33.33j	1.80h	5.93 i	10.25	32.07	1.33hi	2.71i	32.89
V ₁ xF ₂	42.53gh	2.20g	7.20 gh	10.32	32.07	1.41h	2.90gh	32.71
V ₁ xF ₃	47.93cdef	3.06bc	9.40 d	10.48	32.27	1.73e	3.41d	33.66
V ₁ xF ₄	45.53efg	2.93cde	8.06 f	10.43	32.20	1.55g	3.25de	32.34
V ₁ xF ₅	50.47c	3.33b	11.73a	10.57	32.37	2.20a	3.87b	36.24
V ₁ xF ₆	50.07cd	3.13bc	10.33c	10.51	32.30	1.97c	3.65c	35.05
V ₂ xF ₁	36.53ij	2.13gh	5.60i	9.35	24.10	1.15j	2.50j	31.52
V ₂ xF ₂	39.13hi	2.13gh	7.00 h	10.05	24.13	1.30i	2.75hi	32.12
V ₂ xF ₃	43.87fg	2.60ef	8.13 f	10.69	24.23	1.61fg	3.15ef	33.82
V ₂ xF ₄	42.93gh	2.53f	7.93 f	10.21	24.23	1.40h	3.00fg	31.82
V ₂ xF ₅	50.07cd	3.20bc	10.60bc	11.21	24.53	1.83d	3.37d	35.19
V ₂ xF ₆	45.6defg	2.66def	8.86 de	10.79	24.37	1.72e	3.28de	34.40
V ₃ xF ₁	35.07j	2.60ef	7.73 fg	10.73	40.17	1.41h	2.85ghi	33.11
V ₃ xF ₂	46.4cdefg	2.60ef	8.00 f	10.97	40.17	1.57g	3.15ef	33.26
V ₃ xF ₃	49.80cde	3.06bc	9.46 d	11.27	40.33	1.83d	3.67c	33.28
V ₃ xF ₄	47.87cdef	3.00bcd	8.33 ef	11.05	40.30	1.68ef	3.33de	33.53
V ₃ xF ₅	58.67a	3.73a	12.27a	11.39	40.47	2.25a	4.10a	35.43
V ₃ xF ₆	54.67b	3.06bc	11.00b	11.39	40.37	2.04b	3.91b	34.39
S \bar{x}	1.33	0.113	0.210	0.236	0.133	0.026	0.058	0.495
Level of sig.	**	**	**	NS	NS	**	*	NS
CV (%)	5.08	7.04	4.12	3.85	0.71	2.68	3.06	2.55

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT); Level of sig.= Level of significance, ** =Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant

V₁ = BINA moog-8, V₂ = BARI mung-8, V₃ = BARI mung-6

F₁ = Control, F₂ = Recommended dose of fertilizer (RDF), F₃ = 75% RDF + 5 tha⁻¹ vermicompost, F₄ = 75% RDF + 5 tha⁻¹ cowdung, F₅ = 50% RDF + 10 tha⁻¹ vermicompost, F₆ = 50% RDF + 10 tha⁻¹ cowdung

The lowest straw yield (2.69 tha^{-1}) was recorded from control. The study also noted that the highest harvest index (35.62%) was obtained by 50%RDF + 10 tha^{-1} vermicompost combination. Control treatment gave the lowest HI (32.50%). The long term manurial studies conducted at many places have revealed the superiority of integrated nutrient supply system in sustaining crop productivity in comparison to chemical fertilizer alone. Singh *et al.* (2005) studied residual effect of INM in potato-moong cropping sequence and reported that highest value of all the yield attributes and grain yield of moong was observed with the residual effect of combined application of 100% RDF + FYM @ 15 tha^{-1} .

Interaction effects of variety and fertilizer: The no. of branches per plant and pods per plant, were significantly influenced by the application of integrated plant nutrient management (Table 3). Interaction effect was not significant for no. of seeds per plant and 1000 seed wt. The highest grain yield (2.25 t/ha) was obtained from BARI mung-6 with 50% RDF + 10 tha^{-1} vermicompost treatment. In the same way, the highest straw yield (4.10 t/ha) was obtained from BARI mung-6 with 50% RDF + 10 tha^{-1} vermicompost treatment. In respect of interaction, the highest harvest index (35.43%) was also obtained by BARI mung-6 and 50%RDF + 10 tha^{-1} vermicompost combination. Naeem *et al.* (2006) studied the effect of organic manures and inorganic fertilizers on growth and yield of green gram (*Vigna radiata* L.) and reported that grain yield was recorded highest (1104 kg ha^{-1}) with the application of the inorganic fertilizers @ 25:50:50 kg NPK ha^{-1} . Among organic sources, poultry manure @ 3.5 tha^{-1} was found the best followed by FYM @ 5 tha^{-1} . Ghulam *et al.* (2011) reported that different combinations of organic and inorganic fertilizers significantly affected the grain yield of green gram.

Conclusion

Based on the findings of the present study it may be concluded that BARI mung-6 performed the best among the three mungbean varieties studied. In case of fertilizers treatment 50% RDF + 10 tha^{-1} vermicompost performed the best and the highest grain yield was obtained from BARI mung-6 when fertilized with 50% RDF + 10 tha^{-1} vermicompost combinations. However, further studies are necessary considering fertilizers treatment for general combination.

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