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Effect of variety, date of planting and level of phosphorus on shoot dry matter and yield of mungbean

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Abstract: The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during September to December 2009 to study the effect of date of planting and level of phosphorus on the shoot dry matter and yield of different varieties of mungbean. The experiment consisted of three mungbean varieties viz. BARIMung-5, BARIMung-6 and BINAMung-6, three planting dates viz. 15 September, 30 September and 15 October and three levels of phosphorus viz. 0, 40, and 80 kg P_2O_5 ha^{-1}. The experiment was laid out in 3 factor randomized complete block design with three replications. Among the varieties BARIMung-6 produced the highest seed yield (1.10 t ha^{-1}), which was similar to BARIMung-5. The lowest seed yield (0.99 t ha^{-1}) was obtained in BINAMung-6. Among the dates of planting, the highest seed yield (1.17 t ha^{-1}) was obtained on 15 September and the lowest one was obtained on 15 October. The highest seed yield (1.13 t ha^{-1}) was obtained in 80 kg P_2O_5 ha^{-1} followed by 40 kg P_2O_5 ha^{-1} and the lowest seed yield (0.98 t ha^{-1}) was obtained in control (no phosphorus application) treatment. In case of interaction, the variety BARIMung-6 planted on 15 September with 80 kg P_2O_5 ha^{-1} was superior in relation to shoot dry matter and seed yield compared to other varieties, which resulted in the highest seed yield. Seed yield of mungbean was found to have a significant positive correlation (r= 0.813) with shoot dry matter. In contrast, the lowest shoot dry matter and seed yield were found in variety BINAMung-6 planted on 15 October with control (no phosphorus application) treatment.
Key words: Varieties, date of planting, level of phosphorus, shoot dry matter, yield.

Introduction

Protein malnutrition is a serious health problem in Bangladesh. Pulses play a vital role to meet the demand of protein in human diet. Pulses are considered as poor men's meat as it is the cheapest source of protein (Mian, 1976). Pulses contain a good amount of vitamins and minerals. But at present, pulses are beyond the reach of the poor people because of its high price and acute shortage. In Bangladesh, daily per capita consumption of pulses is only 10.96g (BBS, 2007), while the World Health Organization (WHO) of United Nations (UN) recommended 45 g per day per capita for a balance diet (BARI, 1998).

Mungbean (*Vigna radiata*) is an important component in the intensive crop production system for its short life cycle and is one of the leading pulse crops of Bangladesh. The agro-ecological condition of Bangladesh is favorable for growing this crop. It is a drought tolerant crop and can be grown with a minimum supply of nutrients. The pulse crops are not only the food crops but also the soil building one as they belong to the family leguminosae. Cultivation of mungbean can improve the physical, chemical and biological properties of soil as well as it is capable of fixing atmospheric nitrogen by symbiotic process with the help of micro-symbioant (Rhizobium). Mungbean has good digestibility and flavor. Mungbean contains 51% carbohydrate, 26% protein, 10% moisture, 4% minerals and 3% vitamins (Kaul, 1982). Hence, on nutritional point of view, mungbean is considered the best of all other pulses. It is like other pulses widely used as 'Dal' in the country.

The climatic conditions of Bangladesh favor mungbean cultivation almost throughout the year. In general, mungbean is grown on marginal lands of poor fertility and low soil moisture status and under poor management conditions. In spite of the many advantages of mungbean, the area coverage and the production are in declining trend (BBS, 2001).This trend is mainly because the pulses in general cannot compete with HYV cereals is terms of production and economic return, and they are being pushed to marginal lands where nutrient limitations are severe.

Yield potential of mungbean is generally lower than other seed legumes. The average yield of mungbean in this country is lower than that of other country. The average yield is about 0.85 m t ha^{-1} (BBS, 2010). The probable reason for low yield of seed legumes is mostly due to low yielding potentiality of local varieties. Use of high yielding variety could overcome the low yield to some extent. There are about ten HYV's of mungbean which are released by the Bangladesh Agricultural Research Institute (BARI) and the Bangladesh Institute of Nuclear Agriculture (BINA). All of these varieties are not well extensively cultivated all over the country. The farmers are still using the low yielding local varieties. Therefore, research is essential to find out suitable varieties for establishing mungbean as a profitable crop in different regions of Bangladesh.

Planting time, a non- monetary input, is an important factor to influence yield. Mungbean is also very sensitive to planting time. So, determination of optimum planting time for mungbean is very important. Optimum time of planting of mungbean may vary with variety and season due to variation in agro-ecological conditions. Optimum time of planting should, therefore, be determined especially in winter season for different varieties and locations to obtain the highest yield. Phosphorus fertilization up to 60 kg per hectare significantly enhanced the growth and yield parameters of mungbean and also increased the seed and straw protein (Ahmed *et al*. 1986).

Keeping the above points in view, the present investigation was, therefore, undertaken to find out the effect of variety, date of planting and level of phosphorus on the shoot dry matter and yield of mungbean.

Materials and Methods

The experiment was conducted at the Agronomic Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period of September to December 2009. The experiment was conducted in 3 factor randomized complete block design with three replications. The unit plot size was 4m x 2.5m. There were 81 plots in the experiment. Initially, the experimental area was divided into three blocks to represent three replications.

Each replication contained 27 plots. Twenty seven treatment combinations were randomly assigned in each replication. Block to block and plot to plot distance was 1m and 0.5m respectively. The layout of the experiment was done on 10 September 2009. The land was opened with a power tiller on 1 September 2009. Later on,ploughing and cross ploughing were done with country plough followed by laddering. Weeds, stubble and crop residues were removed. The corners of the field were spaded and large clods were broken. Land preparation was completed on 3 September 2009. Urea and muriate of potash were applied at the rate of 50 and 35 kg ha^{-1} respectively, during final land preparation at each planting date as a basal dose. Phosphorus was applied in the form

of TSP following the treatment specification of the experiment as basal dose. Mungbean seeds were treated with rhizobium inoculums at the laboratory of BINA. Inoculum was mixed with molasses and then seeds were treated with this mixture early in the morning immediately before planting in the field. The inoculum was mixed at the rate of 3 g kg^{-1} of seeds. Seeds were planted on the specified dates at the rate of 45 kg ha^{-1} for all varieties viz. BARIMung-5, BARIMung-6 and BINAMung-6 varieties in 30 cm apart rows. In each row plant to plant distance of 10 cm was maintained finally by thinning out of excess plants. Weeding and thinning were done at 20 days after planting of mungbean seeds. First weeding was done at the time of first thinning and second weeding and thinning were done at 35 days after planting of mungbean seeds. No irrigation was applied during the experimental period as there was no symptom of moisture stress.The experimental plots were frequently observed to notice any change in plant character and attack of pests and disease on the crop. The crop was attacked by pod borer which was controlled successfully by applying Diazinon 60 EC @ 1.7 L ha^{-1}. When 80% of the pods turned brown in colour, the crop was assessed to attain maturity. The data on the shoot dry matter and seed yield of mungbean were collected at 10 days interval starting from 20 days after planting (DAT) up to 60 DAT. The collected data were analyzed statistically using the analysis of variance technique and the differences among the treatment means were adjudged by Duncan's Multiple Range Test (Gomez and Gomez, 1984). A correlation study was carried out to find out the relationship between shoot dry matter production and seed yield of mungbean.

Results and Discussion

Variety exerted significant influence on shoot dry matter $plant^{-1}$ and Seed yield at all sampling dates. BARIMung-6 gave the highest shoot dry matter $plant^{-1}$(10.26g) at 60 days after transplanting and the highest seed yield (1.10 t ha^{-1}) which was similar with BARIMung-5 .The lowest shoot dry matter $plant^{-1}$ (6.87 g) at 60 days after planting and seed yield (0.99 t ha^{-1}) were obtained in BINAMung-6 (Table 1). Mungbean cultivars had significant variation in dry matter accumulation in stem, leaf, seed and husk. Cultivar "1'9 accumulated maximum dry matter in stem and seed which were more apparent than that in leaves and husk (Chaudhary *et al.* 1989).

Variety	Shoot dry matter (g)					Seed yield (t ha^{-1})
	20DAT	30DAT	40DAT	50DAT	60DAT	
BARIMung-5	0.245b	1.200b	2.990b	6.063b	8.82b	1.07 a
BARIMung-6	0.284a	1.277a	4.786a	7.279a	10.26a	1.10 a
BINAMung-6	0.198c	0.965c	2.268c	4.985c	6.87c	0.99 b
Level of Sig.	**	*	*	*	**	**
$S\bar{x}$	.00192	.0265	.0086	.0438	.108	5.477

Table 1. Effect of variety on shoot dry matter and yield of mungbean

Table 2. Effect of dates of planting on shoot dry matter and yield of mungbean

Date of planting	Shoot dry matter (g)					Seed yield (t ha^{-1})
	20DAT	30DAT	40DAT	50DAT	60DAT	
15 September (D_1).	.37a	1.58a	5.33a	10.3a	14.09a	1.17 a
30 September (D_2).	.20b	1.44b	3.10b	6.44b	7.75b	1.02 b
15 October (D_3).	.15c	0.41c	1.60c	1.53c	4.11c	0.97 c
Level of Significance	**	*	*	*	**	**
$S\bar{x}$	.00192	.0265	.0086	.0438	.108	5.477

Table 3. Effect of levels of phosphorus on shoot dry matter and yield of mungbean

Levels of P (Kg P_2O_5 ha^{-1})	Shoot dry matter (g)					Seed yield (t ha^{-1})
	20DAT	30DAT	40DAT	50DAT	60DAT	
0 (P_0)	.22c	1.04c	3.2c	5.5b	8.7	0.98 c
40 (P_1)	.24b	1.13b	3.3b	6.2a	8.8	1.05 b
80 (P_2)	.27a	1.26a	3.6a	6.5a	9.3	1.13 a
Level of Significance	**	*	*	*	NS	**
$S\bar{x}$	.00192	.0265	.0086	.143	.108	5.477

In a column, figures having similar letter (s) or without letter do not differ significantly whereas figures bearing dissimilar letters differ significantly as per DMRT. *= 5% Level of Significance, **= 1% Level of Significance, NS= Not significantly different.

Table 4. Interaction effect of variety, date of planting and level of phosphorus on the shoot dry matter and yield of mungbean

Variety X Date of planting X Level of P	Shoot dry matter (g)					Seed yield ($t\ ha^{-1}$)
	20DAT	30DAT	40DAT	50DAT	60DAT	
V_1 x D_1 x P_0	.37	1.48	5.08	9.2c	10.3d	1.13 bcdf
V_1 x D_1x P_1	.403	1.59	5.22	10.2b	11.6c	1.18 bc
V_1 x D_1x P_2	.411	1.86	6.64	10.8b	12.4b	1.3 a
V_1 x D_2 x P_0	.17	1.43	2.60	6.5ef	7.3h	0.96 hi
V_1 x D_2x P_1	.174	1.58	2.68	7.0e	7.9g	1.01fghi
V_1x D_2x P_2	.234	1.70	2.7	7.4e	8.1g	1.06 defgh
V_1x D_3x P_0	.116	.341	.06	1.0j	4.2k	0.95 hi
V_1x D_3x P_1	.15	.388	.592	1.12i	4.8j	0.99 fghi
V_1x D_3x P_2	.178	.425	.777	1.2i	5.7i	1.04 efgh
V_2x D_1x P_0	.42	1.52	5.92	10.2b	11.4c	1.16 bcd
V_2x D_1x P_1	.438	1.64	6.38	11.8a	12.5a	1.2 b
V_2x D_1x P_2	.464	1.92	6.76	11.8a	13.a	1.33 a
V_2x D_2x P_0	.199	1.45	4.30	6.9e	8.3g	0.98 ghi
V_2x D_2x P_1	.246	1.61	4.34	8.2d	9.5f	1.10 bcdef
V_2x D_2x P_2	.251	1.83	4.67	8.1d	10.0e	1.16 bcd
V_2x D_3x P_0	.137	.441	3.53	1.8i	5.2i	0.96 hi
V_2x D_3x P_1	.173	.482	3.55	2.8h	5.4i	1.0 fghi
V_2x D_3x P_2	.229	.572	3.61	3.5g	3.9k	1.03 efghi
V_3x D_1x P_0	.272	1.09	3.91	9.1c	11.5d	1.0 fghi
V_3x D_1x P_1	.265	1.48	4.01	9.4c	10.2d	1.08 cdefg
V_3x D_1x P_2	.332	1.62	4.02	10.4b	10.4d	1.16 bcd
V_3x D_2xP_0	.167	1.27	2.10	4.1f	5.7i	0.92 i
V_3x D_2x P_1	.170	1.06	2.13	4.9f	6.1i	0.96 hi
V_3x D_2x P_2	.214	1.06	2.41	4.6f	6.2i	1.05 defgh
V_3x D_3x P_0	.104	.329	.504	.7k	1.7n	0.81 j
V_3x D_3x P_1	.124	.355	.598	.71k	2.8m	0.98 ghi
V_3x D_3x P_2	.132	.403	.706	.83j	3.0lm	1.03 efghi
Level of significance	NS	NS	NS	*	**	*
$S\bar{x}$	-	-	-	.429	0.290	16.43

Planting date had significant influence on shoot dry matter plant^{-1} and seed yield (Table 2). Numerical data shows that the highest shoot dry matter plant^{-1} (14.09 g) and seed yield (1.17 t ha^{-1}) were produced on15 September planting and the lowest shoot dry matter plant^{-1} (4.11 g) and seed yield (0.97 t ha^{-1}) were found on 15 October planting. Mungbean yield reduced drastically due to delay in planting beyond March 16 and yield declined up to May 16 planting (Islam, 1995). For determining the effect of' planting time of mungbean on its seed growth and subsequent storability. Mungbean (cv. Kanti) was planted on different dates viz. 15 August, 15 September, 15 February planting and the lowest from 15 March planting. Crop planted in March experienced heavy rainfall during flowering, grain filling and consequently produced the lowest yield.(BARI, 1989).

Phosphorus had a significant effect on shoot matter plant^{-1} and seed yield at all sampling dates (Table 3), except 60 days after planting. The highest shoot dry matter plant^{-1} (6.5g) and seed yield (1.13 t ha^{-1}) were produced from the application of 80 kg P_2O_5 ha^{-1}.The lowest shoot dry matter plant^{-1} and seed yield (0.98 t ha^{-1}) were found with the control treatment. Plants treated with 40 kg P_2O_5 ha^{-1} gave the second highest shoot dry matter plant^{-1} and seed yield. Mungbean yield was higher with 60 kg P_20_5 ha^{-1} than with the lower and higher levels of P (Singh *et al.* 2006).

The interaction among variety, date of planting and phosphorus level had a significant effect on shoot dry matter plant^{-1} at 60 days after planting and seed yield. From Table 4, it was found that the highest shoot dry matter plant^{-1} (18.4g) and seed yield (1.33 t ha^{-1}) were produced by BARIMung-6 in 15 September planting with the application of 80 kg P_2O_5 ha^{-1} and the lowest shoot dry matter plant^{-1}(1.7g) and seed yield were produced by BINAMung-6 in 15 October planting with control treatment.

Relationship between shoot dry matter and seed yield

It has been observed that seed yield of mungbean has a higher significant positive correlation with shoot dry matter ($r = 0.813^*$) (Fig.1). This relationship indicated that higher shoot dry matter was one of the most important factors in producing higher yield in mungbean. An increase in the plant dry matter will ultimately lead to an increase in seed yield of mungbean.

From the result it is concluded that BARIMung-6 can be planted on 15 September treated with 80 kg P_2O_5 ha^{-1} for obtaining highest shoot dry matter and seed yield.

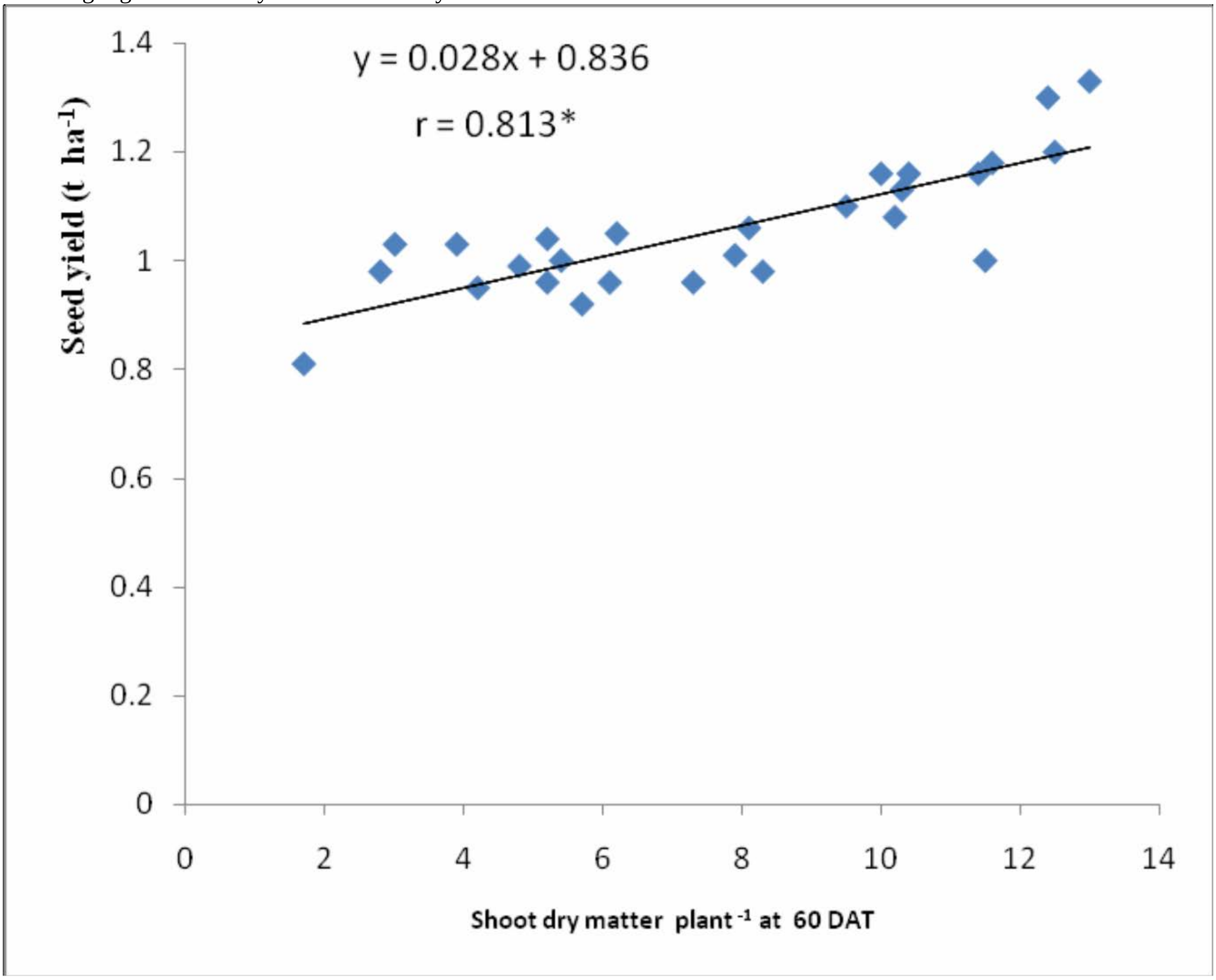

Fig.1. Relationship between shoot dry matter $plant^{-1}$ at 60 DAT and seed yield of mungbean

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