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Study on the performance of mungbean varieties in the New Alluvial Zone of West Bengal

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ABSTRACT

A field experiment was conducted to study the performance of twelve green gram varieties during the summer season of 2014 and 2015 at the Jaguli Instructional Farm of BCKV, Nadia, West Bengal. The experiment was laid out in RBD with three replications. Among varieties, Meha exhibited the highest seed yield 1171.35 kg ha^{-1} while the lowest seed yield 760.05 kg ha^{-1} was obtained with PM 09-6 variety. The highest yield in Meha was characterized by more number of pods per unit area and higher dry matter accumulation. The results indicated that the variety Meha which was significantly superior to other mungbean varieties with harvest index 27.20%, and the Benefit-Cost ratio of 2.80. Therefore, it can be concluded that most of the mungbean varieties performed satisfactorily and gave good seed yield and variety Meha is the best option to be grown during summer season under the agro-climatic conditions of New Alluvial Zone of West Bengal.

***Keywords*:** Economics, mungbean, performance, varieties and yield

The world population is increasing day by day and obviously major population of the world is suffering due to the insufficient and imbalanced diet. The plant scientists are facing the challenge that how to meet the food requirement of this unchecked population (Thirtle *et al.,* 2003). As resources are squeezing and the population is increasing, therefore, crop scientists are focusing on improved management practices and advanced crop husbandry techniques (Lipton, 2001). In this acute context, pulses are the excellent option of dietary protein. Pulses when used as food with other cereals they definitely meet the requirement of a balanced diet. Pulses are used with zeal as delicious food in the poor countries and in the modern world they are utilized to maintain a proper health. Being leguminous crop, they maintain soil fertility by fixing atmospheric nitrogen in available form through symbiosis with rhizobial strains. Pulses are also an important component of animal feed and their dried straw is used as hay. In pulses, mungbean (*Vigna radiata* L.) is an important crop (Khattak *et al.,* 2004). This warm-season legume crop is a native to India and Southeast Asia and is still grown on a large acreage there. It often called green gram or golden gram in international publications; it is also cultivated in several countries of Asia, Africa, and South America. It is produced for both human consumption as well as fodder. Its seed contains 24.3 per cent protein and 0.67per cent fats (Lee *et al.,* 1997). Mungbean is usually grown at low to medium elevations in the tropics as a rainfed crop. It ranks second to drought resistance after soybean (Ali *et al.,* 2001). Mungbean can be grown as manure, hay, cover crop, and forage or intercropped in cereals, sugarcane, sunflower or jute. Green gram seed yield decreases when it is intercropped, but the total productivity of the system and land use efficiency markedly increases by intercropping (Ali, 1992). On an average, it fixes atmospheric nitrogen @ 300 kg ha^{-1} annually (Sharar *et al.,* 2001).

Among many other crop production techniques, appropriate varieties and inter-row spacing are the most important, which contribute substantially to the seed yield of mungbean (Khan *et al.,* 2001). Previous research studies also revealed that most of the growth and yield contributing attributes are significantly and positively correlated with the grain yield of many crop plants *viz*., chickpea (Arshad *et al.,* 2004), Mungbean (Siddique *et al.,* 2006), soybean (Malik *et al.,* 2007) and sunflower (Vahedi *et al.,* 2010). The whole scenario clearly reflects that due emphasis must be given to these parameters so that the threats to the management practices which reduce yield per unit area can be encountered. Therefore, the present study was initiated to find out the suitable variety of mungbean (*Vigna radiata* L.) under agro-climatic conditions of West Bengal.

The field experiment was conducted in humid sub-tropics of West Bengal at the Jaguli Instructional Farm of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia during the summer season of 2014. The experiment was laid out in Randomized Block Design (RBD). The experiment was replicated thrice using the net plot size of 5.0 × 3.0 m. The soil was *Gangetic* alluvial in nature (*Inceptisol*) and sandy

Short communication

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loam in texture. Sowing of mungbean vareties was carried out in respective plots in the second week of March 2014 according to the treatments. The whole N, P and K @ 20, 40 and 40kg ha^{-1}, respectively were side drilled as basal dose immediately after seeding. By thinning, the plant-to-plant distance was kept at 10 cm. All other agronomic practices were kept normal and uniform. The crop was harvested when 90 per cent pods were matured. Then harvested crop was properly dried in the sun before threshing. Various data collected and observation recorded during the course of the investigation were analysed statistically by using analysis of variance technique appropriate to randomized block design and valid conclusion were drawn as suggested by Panse and Sukhatme (1978).

The data pertaining to growth and yield parameters along with their statistical interpretations are presented and discussed

Plant height and number of branches plant^{-1}

The plant height was recorded at the successive growth stages from 20 days after sowing (DAS) up to crop maturity (60 DAS) are highlighted in table 1. In general, the plant height was enhanced by more than four times in all the variety with the advancement of plant growth from 20 DAS upto maturity stage. Among the 12 mungbean varieties, the plant height was found significantly at every stage of observation. The variety Meha attained maximum plant height 16.11, 46.25 and 60.02 cm at 20 , 40 and 60 DAS respectively followed by PM-5 variety (16.06, 43.62 and 55.39 cm). The varieties Pusa- 0932 and Sonali attained minimum plant height (44.48 and 45.63cm) at 60 DAS respectively. The variety Meha produced maximum no of branches per plant (5.97) followed by PM-5 (5.76). Whereas the variety Pusa-0932 produced minimum no of branches per plant was 3.87. The reason may be attributed to their genetic variability, varietal difference and environmental adaptability. Similar results were also reported by Goswami *et al.* (2010) and Samant (2014).

Dry matter accumulation and LAI

Data on the total dry weight increased continuously up to maturity stage (Table 1). Among the different mungbean varieties, Meha achieved the highest biomass (57.90, 200 and 307.70g m^{-2}) at 20, 40 and 60 DAS respectively, which was followed by PM-5 (54.49, 191.39 and 300.83g m^{-2}) variety. Pusa-0932 variety produced lowest efficient in biomass production 41.98, 168.24 and 257.12 g m^{-2} at 20, 40 and 60 DAS respectively and followed by Sonali (47.00, 171.18 and 263.58g m^{-2}). This might be due to the increase of metabolically active tissue and as obtained less to plant growth. The variety Meha was recorded maximum leaf area index (LAI) (4.09) followed by PM-5 (4.00), whereas the minimum LAI was 3.87 in Pusa-0932 variety followed by 3.93 in Sonali. This work is agreement with Manivasagaperumal *et al.* (2011).

Crop growth rate and harvest index

The crop growth rate was comparatively higher during 20-40 DAS in comparison to 40-60 DAS (Table 1). During 20-40 DAS, Meha variety had maximum CGR values 7.11 (g m^{-2} day^{-1}) followed by 6.85 (g m^{-2} day^{-1}) in PM-5, whereas Pusa-0932 variety had minimum crop growth rate 5.61 (g m^{-2} day^{-1}). During 40-60 DAS, Meha was the top rank of CGR value (5.48 g m^{-2} day^{-1}) and was followed by PM-5. Whereas, PM 09-6 variety was minimum growth rate (4.17 g m^{-2} day^{-1}). Similar kind of results was reported by Pramanik *et al.* (2013). The harvest index of mungbean varieties was found to deviate significantly as revealed from the fig. 1. The variety Meha has recorded the highest harvest index (27.20%), which was significantly higher over all other varieties and followed by PM-5(27.11%) and Samrat (26.32%). The increased harvest index in these varieties might be owing to the production of higher seed over its straw. Different green gram varieties exhibited great variations in the productivity parameters the lowest harvest index was noted in case of PM 09-6 (18.40) which was followed by Pusa 0932 (22.23%) and Sonali (22.54). This is an agreement with many research workers like Goswami *et al.* (2010), Verma *et al.* (2011) and Singh *et al.* (2011).

Nodules plant^{-1} and pods plant^{-1}

Nodulation is an important character of the crop which is directly related to the number pods formation per plant and ultimately the productivity of the crop. All the 12 varieties were found to differ significantly at 20 and 40 DAS with respect to the formation of nodules per plant. Among the varieties, Meha variety produced the maximum numbers of nodules plant^{-1} (14.07 and 37.59) at 20 and 40 DAS respectively followed by PM-5 variety (13.5 and 34.46) and the minimum numbers of nodules plant^{-1} was produced by variety Sonali (8.64 and 21.19) followed by Pusa 0932 (8.98 and 22.25) at 20 and 40 DAS respectively. The wide differences among the 12 mungbean varieties with respect to branches formation may be owing to the inheritance of genetic divergence of the varieties. The present findings have been

Table 1: Growth attributes of mungbean varieties in humid sub-tropics of West Bengal (pooled)

Treatments	Plant height (cm)			No of branches	LAI	Dry matter accumulation (g m^{-2})			CGR (g m^{-2} day^{-1})	
	20 DAS	40 DAS	60 DAS	plant^{-1}	60 DAS	20 DAS	40 DAS	60 DAS	20-40 DAS	60 DAS
T_1 : Sonali	11.09	36.60	45.63	3.93	3.44	47.00	171.18	263.58	6.21	4.62
T_2 :P usa 0932	11.21	38.22	44.48	3.87	3.28	41.98	168.24	257.12	6.31	4.44
T_3 : PM 09-6	15.00	43.11	52.20	4.94	4.05	51.21	163.34	246.77	5.61	4.17
T_4 : RMG 975	15.11	41.85	53.91	5.38	3.92	52.91	187.17	293.81	6.71	5.33
T_5 : IPM 2-3	14.52	41.08	50.55	5.08	3.83	51.40	184.01	288.49	6.63	5.22
T_6 : Pusa Vishal	11.97	39.91	48.69	4.84	3.61	49.05	176.47	274.97	6.37	4.92
T_7 : Pusa 1171	12.09	40.31	48.44	3.94	3.65	47.60	174.50	272.91	6.35	4.92
T_8 : PM – 5	16.06	43.62	55.39	5.76	4.00	54.49	191.39	300.83	6.85	5.47
T_9 : Pusa 9531	13.57	41.13	50.73	4.01	3.54	48.59	174.48	267.40	6.29	4.65
T_{10} : PM -2	13.39	41.54	50.19	4.93	3.84	50.84	181.73	282.53	6.54	5.04
T_{11} : Meha	16.11	46.25	60.02	5.97	4.09	57.90	200.00	307.70	7.11	5.38
T_{12} : Samrat	15.13	42.29	53.26	5.43	3.95	53.05	189.33	295.69	6.81	5.32
SEm (±)0.88	**0.87**	**1.51**	**0.08**	**0.03**	**1.24**	**2.70**	**2.05**	**0.16**	**0.16**	
LSD (0.05)	**2.60**	**2.57**	**4.46**	**0.23**	**0.10**	**3.65**	**7.98**	**6.04**	**0.47**	**0.47**

supported by many workers (Reddy *et al.*, 2003, Parameswarappa and Lamani, 2003, Rao *et al.*, 2006). The formation of number of pods plant^{-1} was found to be significant among the mungbean varieties as apparent from table 2. The variety Meha was found to be significantly higher pod producer (33.02 pods plant^{-1}) out of the 12 varieties under test. This was followed by PM-5 (16.21 pods plant^{-1}) and Samrat (28.95 pods plant^{-1}). Mungbean variety Pusa-0932 produced the minimum number of pods Sonali (19.29 pods plant^{-1}). The rest of the varieties had moderate no of pods. Similar results were obtained by Ali *et al.* (2010) and Samant (2014).

Seeds pod^{-1} and test weight

Number of seeds pod^{-1} the most important determinant of seed yield of pulses and were recorded at the time of picking. Among twelve mungbean varieties, Meha had maximum number of seeds pod^{-1} (11.24) followed by 10.19 seeds pod^{-1} in the variety PM-5, and a minimum number of seeds per pod^{-1} was obtained in PM 09-6 (6.97). The rest of the varieties were equivalent. Meha has recorded the maximum test weight (100 seed weight) of 41.79g, being significantly superior to all the remaining varieties. However, the second best variety was PM-5 recorded test weight up to 39.94 g. In contrast to these observations, the significantly lowest test weight 32.79g was noted in case of Pusa 0932 variety of mungbean followed by Sonali (35.50g). The rest of varieties had a moderate range of test weight. This may be due to their genetic variability. This finding remains at par with the observation made by Kumar *et al.* (2013).

Seed yield and stover yield

A significant increase in seed yield and straw yield of mungbean was observed in different varieties (Table 2). Out of 12 varieties, Meha was found highest yielder (1171.35 kg ha^{-1}), is significantly superior to all the other varieties under test. However, the second best variety was PM-5 which yielded 1124.03 kg ha^{-1}. The significantly lowest yield (760.05 kg/ha) was obtained by Pusa 0932 which was followed by Sonali (764.36 kg ha^{-1}). The productivity of the remaining varieties was found in the intermediate range. The stover yield per hectare was found to influence significantly due to different varieties of mungbean as revealed from the same table 2. Among the varieties, Meha produced significantly higher stover yield (2967.03 kg ha^{-1}) over all other varieties, which was followed by PM-5 (2932.11 kg ha^{-1}) and Samrat (2908.95 kg ha^{-1}). On the other hand, the lowest stover yield (2321.67 kg

Table 2: Performance of mungbean varieties on nodules plant^{-1}, pod yield, test weight, seed yield and stover yield (pooled)

Treatments	Nodule plant^{-1}		Pods plant^{-1}	Seeds pod^{-1}	Test weight	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})
	20 DAS	40 DAS					
T_1: Sonali	8.64	21.19	19.29	8.09	35.50	764.36	2378.15
T_2: Pusa 0932	8.98	22.25	13.24	6.97	32.79	760.05	2321.67
T_3: PM 09-6	12.05	28.90	16.21	7.95	36.80	825.37	2538.90
T_4: RMG 975	11.91	30.24	27.29	9.38	37.48	1026.76	2921.13
T_5: IPM 2-3	9.81	25.24	24.88	9.04	36.83	995.87	2883.39
T_6: Pusa Vishal	9.01	24.78	20.83	8.73	38.78	920.60	2762.24
T_7: Pusa 1171	8.98	22.89	20.21	8.47	37.85	869.85	2639.30
T_8: PM – 5	13.56	34.86	29.95	10.19	39.94	1124.03	2932.11
T_9: Pusa 9531	8.92	26.67	20.55	8.53	37.64	896.11	2737.31
T_{10}: PM -2	9.99	29.39	23.12	8.92	37.05	948.85	2716.10
T_{11}: Meha	14.07	37.59	33.02	11.24	41.79	1171.35	2967.03
T_{12}: Samrat	13.38	33.83	28.95	9.60	37.52	1055.17	2908.95
SEm (±)	**0.56**	**0.85**	**1.17**	**0.25**	**0.65**	**16.97**	**31.84**
LSD (0.05)	**1.66**	**2.51**	**3.46**	**0.73**	**1.91**	**50.09**	**93.97**

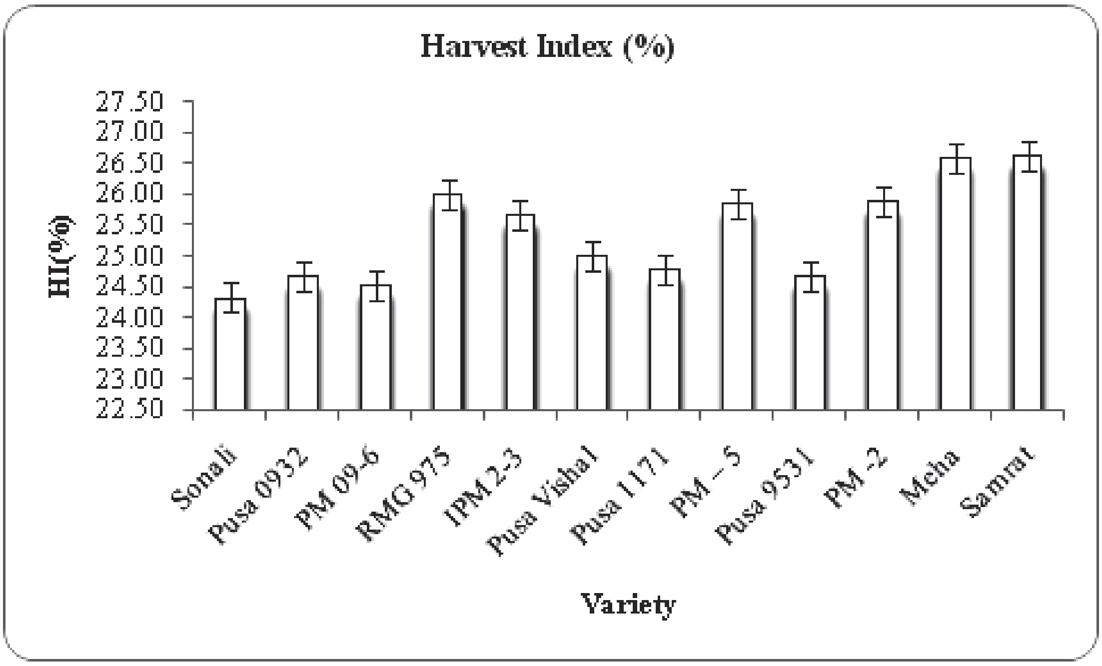

Fig. 1: Performance of different varieties on harvest index of mungbean

ha^{-1}) was produced by Pusa 0932 variety, being significantly lower to most of the remaining varieties and followed by Sonali (2378.15 kg ha^{-1}). The remaining varieties produced stover in the intermediate range. Attainments of particularly higher or lower yield attributing character among the different varieties are the genetically controlled phenomenon. Such variations in yield attributes among the mungbean varieties have also been observed by several research workers. (Santella *et al.*, 2001, Mahalashmi *et al.*, 2000, Verma and Garg 2003, Rao *et al.*, 2006, Sadeghipour , 2008).

Economics

The mungbean variety Meha recorded the maximum gross return and net profit of Rs. 70432.84 ha^{-1} and Rs. 45,275.84 ha^{-1}, respectively. The same variety had also maximum B.C ratio (2.64) due to its higher productivity which was followed by PM-5, Samrat which were equivalent. PM 09-6 recorded

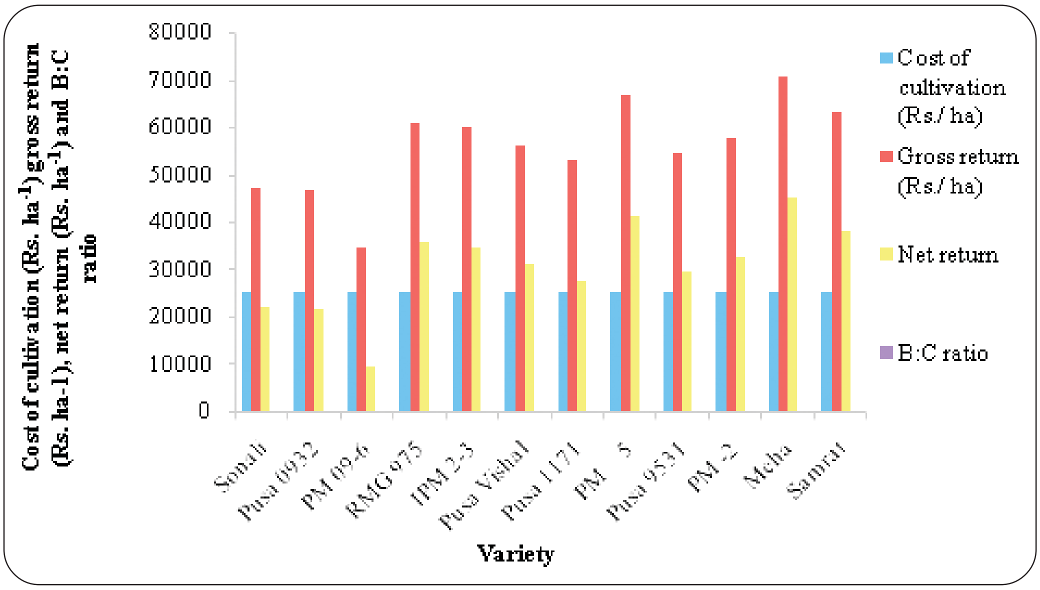

Fig 2. Economics of cultivating different mungbean varieties

lowest net return (Rs. 9,482.87 ha^{-1}) and B:C ratio (1.38) due to its less return (Fig. 2). These findings are similar with the findings of Patel *et al.* (2013).

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