

Original Research Article

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Correlations and Path Analysis Studies on Yield and its Components in Mungbean (*Vigna radiata* (L.) Wilczek)

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ABSTRACT

Keywords

Mungbean, Correlation coefficient and path analysis.

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The present research work was carried out at Navsari Agricultural University, Navsari during the summer 2014 to study correlation among quantitative traits and their direct and indirect effect on seed yield in F₂ populations (Meha X Pusa Vishal, Meha X GM-4) of mungbean. Correlation analysis revealed that seed yield was significantly and positively correlated with pods per plants and harvest index in F₂ population of Meha X Pusa Vishal and with plant height, primary branches per plant, clusters per plant, pods per plant, straw yield per plant and harvest index in F₂ population of Meha X GM-4. It indicates that an association of two characters is not only due to genes but also due to their influence of the environment. The path coefficient analysis on phenotypic basis revealed that pods per plant, plant height, clusters per plant, seeds per pod, 100 seed weight, straw yield per plant and harvest index had positive direct effect and primary branches per plant had negative direct effects on seed yield in both the populations, indicated that pods per plant directly lead to increase in seed yield.

Introduction

Mungbean (*Vigna radiata* L. Wilczek) is a short duration legume crop cultivated primarily for their dry seeds. Annual mungbean production in India is around 1.61 million tonnes from about 3.38 million ha area (Anon., 2013-2014). The crops are utilized in several ways, where seeds, sprouts and young pods are consumed as sources of protein, amino acids, vitamins and minerals, and plant parts are used as fodder and green manure. Mungbean protein is easily digested without flatulence. They have ability to fix atmospheric nitrogen (N₂) in symbiosis with the soil bacteria *Rhizobium* spp. They can be grown successfully in extreme environments

(e.g., high temperatures, low rain fall, and poor soils) with few economic inputs (Das *et al.*, 2014). The quantitative characters are the best indicators of yield. Yield is a complex character which is affected by a number of component characters and the surrounding environments. Thus, selection for grain yield becomes difficult unless the associations between yield contributing characters are known. The statistics which measure the degree and direction of association between two or more variable is known as correlation. Measurement of correlation helps to identify the relative contribution of component characters towards yield (Panse, 1957).

Indirect selection through component character with high heritability is advantageous for polygenic character like yield. Correlation between different characters is an aspect which should be kept in mind for better planning of selection programs. Path analysis is carried out using the estimates of correlation coefficients. Path analysis gives idea about direct and indirect influences of each of the component characters towards dependent trait.

Materials and Methods

The present research work was carried out at Navsari Agricultural University, Navsari during the summer 2014. We included 2 F₂ populations of mungbean (Meha X Pusa Vishal, Meha X GM-4) in this study. Experiment was conducted in non-replicated trial as it was segregating material. Each row consisted of 20 plants with spacing of 45 cm x 15 cm inter and intra row spacing. Each F₂ was raised with minimum of 300 plant population and individual plant observations were recorded from 100 randomly selected plants. Observations were recorded for following traits *i.e.* Days to flowering, Plant height (cm), Days to maturity, Primary branches per plant, Clusters per plant, Pods per plant, Seeds per pod, 100-seed weight (g), Seed yield per plant (g), Straw Yield (g) and Harvest index (%). The simple correlations (phenotypic) between different characters were estimated according to Weber and Moorthy (1952) and path-coefficient analysis was carried out following Dewey and Lu (1959).

Results and Discussion

In the present study, seed yield per plant recorded significant and positive correlation with pods per plant and harvest index in F₂ population of Meha X Pusa Vishal (Table 1). These results are in close agreement with

earlier workers Khajudparn and Tantasawat (2011), Kumar *et al.*, (2010^b), Tabasum *et al.*, (2010), Srivastava and Singh (2012), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013), Javed *et al.*, (2014) for pods per plant and Singh *et al.*, (2009) for harvest index. While in F₂ population of Meha X GM-4 it showed significant and positive correlation with plant height, primary branches per plant, clusters per plant, pods per plant, straw yield per plant and harvest index (Table 2). There are in agreement with the results reported by Tabasum *et al.*, (2010) and Javed *et al.*, (2014) for plant height; Khajudparn and Tantasawat (2011), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013) for primary branches per plant; Tabasum *et al.*, (2010), Khajudparn and Tantasawat (2011), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013) for clusters per plant; Khajudparn and Tantasawat (2011), Kumar *et al.*, (2010), Tabasum *et al.*, (2010), Srivastava and Singh (2012), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013), Javed *et al.*, (2014) for pods per plant and (Singh *et al.*, 2009) for harvest index. It indicates that an association of two characters is not only due to genes but also due to their influence of the environment. Hence, simultaneous selection based on these characters could be suggested for improvement of yield in segregating populations.

Path coefficient analysis accommodates assistance for categorizing the total correlation into direct and indirect effects. The results of path analysis showed table 3 and figure 1 (F₂ of Meha X Pusa Vishal) and table 4 and figure 2 (F₂ of Meha X GM-4). In both the F₂ populations pods per plant had maximum and positive direct effect on seed yield. Some other characters like plant height, clusters per plant, seeds per pod, 100 seed weight, straw yield per plant and harvest index also had positive direct effect in both the population.

Table.1 Phenotypic correlation coefficients of seed yield per plant with other characters in F₂ population of Meha x Pusa Vishal in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	ST Y	HI	SY
DF	1.0000										
PH	0.2820**	1.0000									
PB	0.0775	0.1163	1.0000								
DM	0.6987**	0.4357**	-0.0249	1.0000							
CP	0.1745	0.2478*	0.4523**	0.0258	1.0000						
PP	0.0991	0.1069	-0.0296	-0.0361	0.0069	1.0000					
SP	-0.2102*	-0.1480	-0.1190	-0.1807	0.0056	-0.2343*	1.0000				
100 SW	-0.0326	0.0897	-0.0763	0.0658	0.0254	-0.0041	0.0198	1.0000			
ST Y	0.0584	0.0637	-0.1207	0.0269	-0.2206*	0.1359	-0.0571	0.1537	1.0000		
HI	-0.0059	-0.0559	0.0948	-0.0942	0.1692	0.3324**	0.0838	-0.1204	-0.7164**	1.0000	
SY	0.0644	0.1129	-0.0559	-0.0898	0.0739	0.8794**	-0.0427	0.0525	0.0804	0.4215**	1.0000

Table.2 Phenotypic correlation coefficients of seed yield per plant with other characters in F₂ population of Meha x GM-4 in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	ST Y	HI	SY
DF	1.0000										
PH	0.3434**	1.0000									
PB	-0.3373**	0.0138	1.0000								
DM	0.5884**	0.2164*	-0.3100**	1.0000							
CP	-0.2584*	0.0912	0.6479**	-0.1188	1.0000						
PP	-0.0576	0.2076*	0.3300**	-0.1291	0.3544**	1.0000					
SP	0.0369	-0.0998	-0.1117	-0.0040	-0.1460	-0.2476*	1.0000				
100 SW	0.1109	0.0289	-0.1318	0.1407	-0.1205	-0.0332	0.0041	1.0000			
ST Y	-0.0944	0.2902**	0.1551	-0.0628	0.3349**	0.3559**	0.0254	0.0182	1.0000		
HI	0.1154	-0.1811	0.0587	-0.0144	-0.1069	0.3544**	-0.0841	0.0813	-0.6212**	1.0000	
SY	-0.0307	0.2252*	0.3237**	-0.1009	0.3725**	0.9249**	-0.0182	0.1282	0.3868**	0.3538**	1.0000

Table.3 Path coefficient analysis of component characters towards seed yield per plant in F₂ population of Meha x Pusa Vishal in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	ST Y	HI	Phenotypic correlation with seed yield
DF	0.0356	0.0173	-0.0048	-0.0539	0.0117	0.0771	-0.0253	-0.0018	0.0101	-0.0016	0.0644
PH	0.0100	0.0612	-0.0072	-0.0336	0.0166	0.0831	-0.0178	0.0049	0.0110	-0.0153	0.1129
PB	0.0028	0.0071	-0.0617	0.0019	0.0302	-0.023	-0.0143	-0.0041	-0.0209	0.0260	-0.0559
DM	0.0249	0.0267	0.0015	-0.0772	0.0017	-0.0281	-0.0217	0.0036	0.0047	-0.0258	-0.0898
CP	0.0062	0.0152	-0.0279	-0.0020	0.0668	0.0053	0.0007	0.0014	-0.0382	0.0464	0.0739
PP	0.0035	0.0065	0.0018	0.0028	0.0005	0.7779	-0.0282	-0.0002	0.0235	0.0912	0.8794**
SP	-0.0075	-0.0091	0.0073	0.0140	0.0004	-0.1822	0.1202	0.0011	-0.0099	0.0230	-0.0427
100 SW	-0.0012	0.0055	0.0047	-0.0051	0.0017	-0.0032	0.0024	0.0541	0.0266	-0.0330	0.0525
ST Y	0.0021	0.0039	0.0074	-0.0021	-0.0147	0.1058	-0.0069	0.0083	0.1732	-0.1966	0.0804
HI	-0.0002	-0.0034	-0.0058	0.0073	0.0113	0.2585	0.0101	-0.0065	-0.1241	0.2744	0.4215**

** - Significant at 1.0 per cent level of probability, * - Significant at 5.0 per cent level of probability

Residual = 0.1642

Bold diagonal figures are the direct effects

Table.4 Path coefficient analysis of component characters towards seed yield per plant in F₂ population of Meha x GM-4 in mungbean

Characters	DF	PH	PB	DM	CP	PP	SP	100 SW	ST Y	HI	Phenotypic correlation with seed yield
DF	-0.0138	0.0199	0.0008	0.0018	-0.0242	-0.0466	0.0079	0.0161	-0.0156	0.0228	-0.0307
PH	-0.0047	0.0579	00.00	0.0007	0.0085	0.1680	-0.0213	0.0042	0.0478	-0.0358	0.2252*
PB	0.0047	0.0008	-0.0025	-0.0010	0.0606	0.2670	-0.0239	-0.0192	0.0256	0.0116	0.3237**
DM	-0.0081	0.0125	0.0008	0.0031	-0.0111	-0.1045	-0.0009	0.0205	-0.0103	-0.0029	-0.1009
CP	0.0036	0.0053	-0.0016	-0.0004	0.0935	0.2868	-0.0312	-0.0175	0.0552	-0.0211	0.3725**
PP	0.0008	0.0120	-0.0008	-0.0004	0.0331	0.8092	-0.0529	-0.0048	0.0586	0.0701	0.9249**
SP	-0.0005	-0.0058	0.0003	00.00	-0.0137	-0.2003	0.2137	0.0006	0.0042	-0.0166	-0.0182
100 SW	-0.0015	0.0017	0.0003	0.0004	-0.0113	-0.0269	0.0009	0.1455	0.0030	0.0161	0.1282
ST Y	0.0013	0.0168	-0.0004	-0.0002	0.0313	0.2880	0.0054	0.0026	0.1648	-0.1229	0.3868**
HI	-0.0016	-0.0105	-0.0001	00.00	-0.0100	0.2868	-0.0180	0.0118	-0.1024	0.1978	0.3538**

** - Significant at 1.0 per cent level of probability, * - Significant at 5.0 per cent level of probability

Residual = 0.0559

Bold diagonal figures are the direct effect

DF - Days to flowering

PB - Primary Branches per plant

SP - Seeds per pod

ST Y - Straw yield per plant (g)

PH - Plant height (cm)

CP - Clusters per plant

100 SW- 100-seed weight (g)

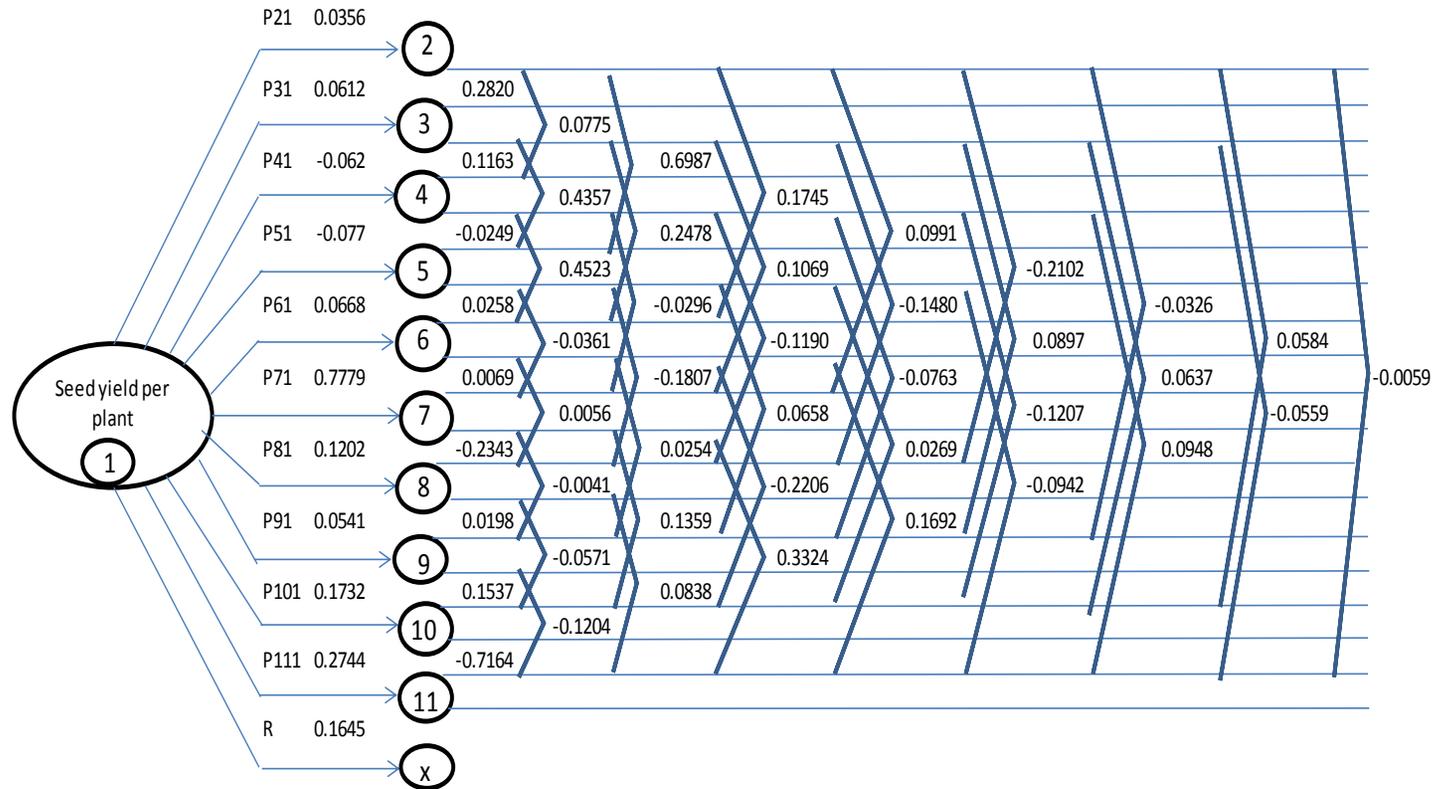
HI - Harvest index (%)

DM - Days to maturity

PP - Pods per plant

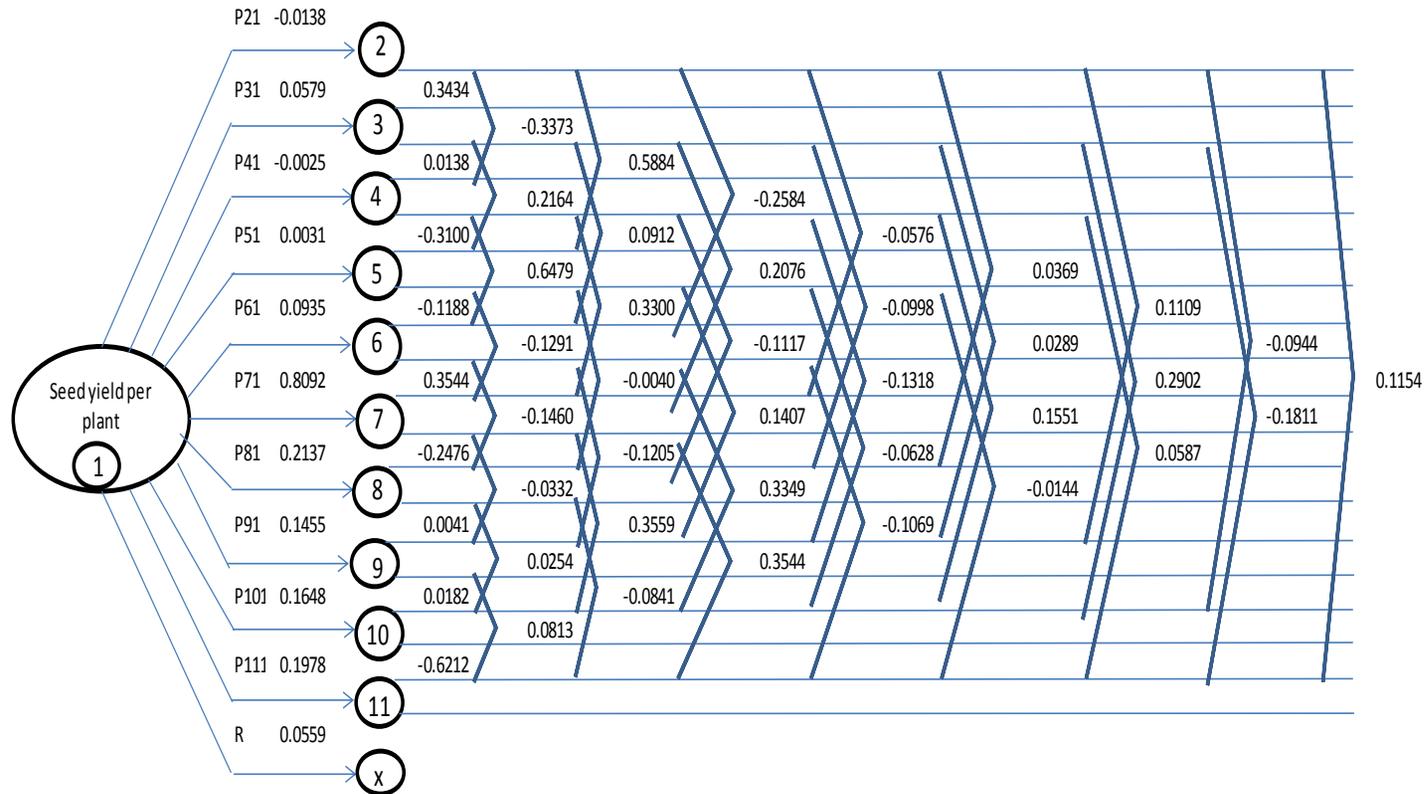
SY - Seed yield per plant (g)

Fig.1 Diagrammatic presentation of factors influencing seed yield in mungbean (F₂ generation of Meha x Pusa Vishal)



Single arrow represents direct effect, cross lines joining horizontal lines represent indirect effect and R represents residual effect.

Fig.2 Diagrammatic presentation of factors influencing seed yield in mungbean (F₂ generation of Meha x GM-4)



Single arrow represents direct effect, cross lines joining horizontal lines represent indirect effect and R represents residual effect.

The negative direct effects on seed yield by primary branches per plant in both the populations. The results are in accordance with Kumar *et al.*, (2010^b), Vyas (2010), Srivastava and Singh (2012), Prasanna *et al.*, (2013) for plant height; Tabasum *et al.*, (2010), Vyas (2010), Khajudparn and Tantasawat (2011), Prasanna *et al.*, (2013) for primary branches per plant; Singh *et al.*, (2009), Vyas (2010), Khajudparn and Tantasawat (2011), Gadakh *et al.*, (2013), clusters per plant; Kumar *et al.*, (2010), Tabasum *et al.*, (2010), Khajudparn and Tantasawat (2011), Srivastava and Singh (2012), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013) for pods per plant; Singh *et al.*, (2009), Kumar *et al.*, (2010^b), Khajudparn and Tantasawat (2011), Srivastava and Singh (2012), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013) for seeds per pod; Singh *et al.*, (2009), Tabasum *et al.*, (2010), Vyas (2010), Khajudparn and Tantasawat (2011), Srivastava and Singh (2012), Gadakh *et al.*, (2013), prasanna *et al.*, (2013) for 100 seed weight; Kumar *et al.*, (2010^b), Tabasum *et al.*, (2010), Vyas (2010), Gadakh *et al.*, (2013), Prasanna *et al.*, (2013) for harvest index. But days to flowering shows negative direct effect in F₂ of Meha X Pusa Vishal (Kumar *et al.*, 2010 and Prasanna *et al.*, 2013) and positive direct effect in F₂ of Meha X GM-4 (Singh *et al.*, 2009; Vyas, 2010; Srivastava and Singh, 2012 and Gadakh *et al.*, 2013) while for days to maturity shows positive direct effect in F₂ of Meha X Pusa Vishal (Kumar *et al.*, 2010 and Prasanna *et al.*, 2013) and negative direct effect in F₂ of Meha X GM-4 (Singh *et al.*, 2009 and Gadakh *et al.*, 2013). Path analysis revealed that number of pods per plant had high direct effect, therefore, simple selection for this character would be useful to maximum seed yield. Considering all the aspects together it is apparent from path analysis that maximum effects as well as appreciable indirect influences were exerted by pods per plant, clusters per plant, straw

yield per plant and harvest index. These characters also exhibited significant and positive association with seed yield per plant. Hence, they may be considered as the most important yield contributing characters and appropriate prominence should be placed on these components while breeding for high yielding types in mungbean.

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