

Research Article

Association analysis for seed yield and component traits in segregating populations of blackgram (*Vigna mungo* (L.) Hepper)

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Abstract

The present research work on blackgram (*Vigna mungo*(L.) Hepper) was carried out at National Pulses Research Centre, Vamban during *kharif* 2017 to assess the association among yield attributes in F₂ population of five crosses *viz.*, VBN(Bg) 4 x Mash 114, VBN(Bg) 4 x Mash 1008, VBN 8 x Mash 114, VBN 8 x Mash 1008 and VBN 8 x VBG11-053. Correlation analysis revealed that seed yield was positively correlated with plant height, number of branches per plant, number of clusters per plant, number of pods per cluster, total number of pods, pod length, number of seeds per pod and 100- seed weight in VBN(Bg) 4 X Mash 1008 and VBN 8 x Mash 1008 cross combinations. Same trend was observed in the crosses VBN(Bg) 4 x Mash 114, VBN 8 x Mash 114 except for plant height and in VBN 8 x VBG 11-053 except for pod length. The path coefficient analysis showed that, in all the five populations studied, number of clusters per plant, number of pods per plant, number of seeds per pod and 100 seed weight had positive direct effect on yield. Blackgram seed yield can be significantly improved with the selection of plants with more number of pods, number of clusters per plant and 100 seed weight in the segregating populations as these traits were positively associated with the seed yield.

Keywords

Blackgram , F₂ population, correlation analysis, path analysis, seed yield

Introduction

Blackgram (*Vigna mungo*(L.) Hepper, 2n = 22) is an important legume crop occupying peculiar position in Indian agriculture. It is the affordable source of protein for the poor and has long been known as the poor men's meat (Mian, 1976). The pulse crops, in general, give lower yield than the cereal crops as they are generally cultivated in marginally poor soils, mostly in rainfed conditions (Suguna *et al.*, 2017). Yield is a complex character collectively influenced by various components. Association studies gives information about the contribution of different characters towards seed yield. The study on inter-relationship between the component traits and seed yield will formulate an effective and viable breeding programme for improvement of seed yield in a short time. The present study aimed to assess the correlation and path coefficients in order to formulate selection criteria for evolving high yielding genotypes.

Material and Methods

The present research work was carried out at the National Pulses Research Centre, Vamban during the *kharif* 2017. Five different cross combinations in F₂

generation *viz.*, VBN (Bg) 4 x Mash 114, VBN (Bg) 4 x Mash 1008, VBN 8 x Mash 114, VBN 8 x Mash 1008 and VBN 8 x VBG11053 in F₂ along with their parents formed the basic genetic material for the present study. In each F₂ cross combinations a minimum of 200 plants were maintained. Observations were recorded on plant height (cm), number of branches per plant, number of clusters per plant, number of pods per cluster, total number of pods, pod length (cm), number of seeds per pod, 100 seed weight (g) and seed yield per plant (g). Observations were recorded in all the single plants in each cross combinations. The TNAUSTAT software (Manivannan, 2014) was used to analyze the correlation and path coefficients.

Results and Discussion

Knowledge on the association of component characters with yield has great importance to plant breeders, as it helps in the selection with more precision and accuracy. The degree of relationship and association of these components with yield can be measured by correlation coefficients. But selection based on correlation without taking into

consideration of the interactions between the component characters may sometimes be misleading (Codawat, 1980).

The simple correlation coefficient between seed yield and yield component characters in F₂ generation of five cross combinations are presented in Table 1. The results revealed that, the seed yield per plant had significant and positive correlation with plant height, number of branches per plant, number of clusters per plant, number of pods per cluster, total number of pods, pod length, number of seeds per pod and 100 seed weight in the crosses viz., VBN (Bg) 4 x Mash 1008 and VBN 8 x Mash 1008. Plant height in crosses VBN (Bg) 4 x Mash 114 and VBN 8 x Mash 114 and pod length in the cross VBN 8 x VBG 11053 had non significant association with seed yield (Table 1). These results are in close agreement with findings of Parveen *et al.*(2011), Mehra *et al.*(2016) and Singh *et al.*(2016) for plant height. Chand and Rao (2002), Konda *et al.* (2008) and Sharma (2015) reported same finding for number of branches per plant. Bharti *et al.*(2013), Kumar *et al.* (2015) and Sushmitharaj *et al.*(2018) for number of clusters per plant; Chauhan *et al.*(2007), Shivade *et al.*(2011) and Bharti *et al.*(2013), for number of pods per cluster; Reni *et al.*(2013), Patidar and Sharma (2017) for total number of pods per plant; Miah *et al.* (2016) and Sohail *et al.*(2016) observations recorded for pod length; Singh *et al.*(2016) and Suguna *et al.*(2017), for number of seeds per pod Konda *et al.*(2008) and Netam *et al.*(2010) for 100-seed weight also reported similar findings.

Correlation values provide only nature and degree of relationship of yield contributing characters on seed yield. Path coefficient analysis is a statistical technique to split the observed correlation coefficients into direct and indirect effects of independent variables on the dependent variable. If the correlation between seed yield and a character is due to the direct effects of character, it reflects true relationship between them. Hence, selection can be practiced for such a character in order to improve yield. However, if correlation is due to indirect effect of the character through another component trait, the breeder has to select for the latter trait through which indirect effect is exerted. The direct and indirect effect of yield components on seed yield per plant was presented in Table 2. In the present study, number of pods per plant had high and positive direct effect on seed yield in all the five populations. Hundred seed weight and number of clusters per plant had moderate or low and positive direct effect on seed yield in most of the crosses.

The results are in accordance with Chand and Rao (2002), Chauhan *et al.*(2007) and Reni *et al.*(2013) for number of pods per plant, number of seeds per pod, number of clusters per plant and 100 seed weight.

Among various traits, number of pods per plant alone showed high to moderate and positive indirect effect for most of traits. Bharti *et al.*(2013) reported positive and indirect effect on seed yield per plant via clusters per plant, number of pods per cluster and number of seeds per pod. Patidar and Sharma (2017) for plant height and number of pods per plant and Miah *et al.*(2016) reported high and positive indirect effects for 100 - seed weight, number of branches per plant on seed yield per plant.

Hence, based on the results of correlation and path analysis, it may be concluded that the traits, number of pods per plant, 100 seed weight and number of pods per cluster, can be considered as selection indices for seed yield improvement programme in blackgram.

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Table 1. Simple correlation coefficient between yield and yield attributes in F₂ generation of various crosses in blackgram.

Characters	Crosses	PH	NPB	NCPP	NPPC	NPPP	PL	NSPP	HSW
Number of branches per plant (NPB)	VBN(Bg) 4 X Mash 114	0.37**							
	VBN(Bg) 4 X Mash 1008	0.20**							
	VBN 8 X Mash 114	0.37**							
	VBN 8 X Mash 1008	0.13**							
	VBN 8 X VBG 11053	0.26**							
Number of cluster per plant (NCPP)	VBN(Bg) 4 X Mash 114	0.32**	0.62**						
	VBN(Bg) 4 X Mash 1008	0.27**	0.46**						
	VBN 8 X Mash 114	0.32**	0.62**						
	VBN 8 X Mash 1008	0.26**	0.55**						
	VBN 8 X VBG 11053	0.32**	0.55**						
Number of pods per cluster (NPPC)	VBN(Bg) 4 X Mash 114	0.12*	0.31**	0.22**					
	VBN(Bg) 4 X Mash 1008	0.17*	0.20**	0.38**					
	VBN 8 X Mash 114	0.12*	0.31**	0.22**					
	VBN 8 X Mash 1008	0.18**	0.34**	0.25**					
	VBN 8 X VBG 11053	0.11*	0.31**	0.13**					
Number of pods per plant (NPPP)	VBN(Bg) 4 X Mash 114	0.29**	0.65**	0.85**	0.53**				
	VBN(Bg) 4 X Mash 1008	0.27**	0.54**	0.90**	0.43**				
	VBN 8 X Mash 114	0.29**	0.65**	0.85**	0.53**				
	VBN 8 X Mash 1008	0.32**	0.55**	0.86**	0.29**				
	VBN 8 X VBG 11053	0.31**	0.57**	0.86**	0.31**				
Pod length (cm) (PL)	VBN(Bg) 4 X Mash 114	0.16**	0.14**	0.18**	-0.01	0.16**			
	VBN(Bg) 4 X Mash 1008	0.27**	0.16*	0.33**	0.28**	0.32**			
	VBN 8 X Mash 114	0.16**	0.14**	0.18**	-0.01	0.16**			
	VBN 8 X Mash 1008	0.08	0.02	0.12**	0.40**	0.05			
	VBN 8 X VBG 11053	0.12**	0.13**	0.12**	0.04	0.10*			
Number of seeds per pod (NSPP)	VBN(Bg) 4 X Mash 114	0.20**	0.32**	0.30**	0.24**	0.36**	0.38**		
	VBN(Bg) 4 X Mash 1008	0.16*	0.03	0.34**	0.27**	0.32**	0.66**		
	VBN 8 X Mash 114	0.20**	0.32**	0.30**	0.24**	0.36**	0.38**		
	VBN 8 X Mash 1008	-0.02	0.13**	0.24**	0.11*	0.24**	0.30**		
	VBN 8 X VBG 11053	0.15**	0.17**	0.15**	0.03	0.19**	0.16**		
100 - seed weight (g) (HSW)	VBN(Bg) 4 X Mash 114	-0.11*	0.04	0.13*	0.09	0.14**	0.11*	0.04	
	VBN(Bg) 4 X Mash 1008	-0.01	0.06	0.22**	0.20**	0.22**	0.35**	0.46**	
	VBN 8 X Mash 114	-0.11*	0.04	0.13*	0.09	0.14**	0.11**	0.04	
	VBN 8 X Mash 1008	-0.16**	0.10*	0.08	0.08	0.08	0.06	0.18**	
	VBN 8 X VBG 11053	-0.03	0.15**	0.05	0.10*	0.09*	0.01	0.13**	
Seed yield per plant (g)	VBN(Bg) 4 X Mash 114	0.09	0.46**	0.69**	0.32**	0.75**	0.15**	0.30**	0.40**
	VBN(Bg) 4 X Mash 1008	0.19**	0.41**	0.72**	0.27**	0.75**	0.25**	0.27**	0.25**
	VBN 8 X Mash 114	0.09	0.46**	0.69**	0.32**	0.75**	0.15**	0.30**	0.40**
	VBN 8 X Mash 1008	0.23**	0.52**	0.72**	0.29**	0.83**	0.10*	0.25**	0.25**
	VBN 8 X VBG 11053	0.19**	0.50**	0.70**	0.27**	0.80**	0.06	0.24**	0.28**

*,** Significant at 5 % and 1 % level of probability, respectively.



Table 2. Direct and indirect effect of yield components on yield per plant in F₂ generation for various crosses

Character	cross	PH	NPB	NCPP	NPPC	NPPP	PL	NSPP	HSW	Simple correlation coefficient with seed yield per plant(g)
Plant height (cm) (PH)	VBN(Bg) 4 X Mash 114	-0.100	-0.009	0.049	-0.009	0.185	-0.004	0.013	-0.031	0.094
	VBN(Bg) 4 X Mash 1008	-0.015	0.007	0.075	-0.011	0.135	-0.004	0.001	-0.001	0.188**
	VBN 8 X Mash 114	-0.100	-0.009	0.049	-0.009	0.185	-0.004	0.013	-0.031	0.094
	VBN 8 X Mash 1008	0.003	0.009	0.002	0.002	0.243	0.003	0.000	-0.029	0.232**
	VBN 8 X VBG 11053	-0.071	0.008	0.035	0.002	0.211	-0.004	0.012	-0.006	0.188**
Number of branches per plant (NPB)	VBN(Bg) 4 X Mash 114	-0.037	-0.025	0.095	-0.024	0.417	-0.003	0.022	0.011	0.456**
	VBN(Bg) 4 X Mash 1008	-0.003	0.036	0.125	-0.013	0.265	-0.003	0.000	0.005	0.413**
	VBN 8 X Mash 114	-0.037	-0.025	0.095	-0.024	0.417	-0.003	0.022	0.011	0.456**
	VBN 8 X Mash 1008	0.000	0.069	0.004	0.003	0.419	0.001	0.002	0.018	0.516**
	VBN 8 X VBG 11053	-0.018	0.033	0.06	0.006	0.386	-0.004	0.014	0.029	0.505**
Number of cluster per plant (NCPP)	VBN(Bg) 4 X Mash 114	-0.032	-0.016	0.153	-0.017	0.546	-0.004	0.020	0.039	0.688**
	VBN(Bg) 4 X Mash 1008	-0.004	0.016	0.275	-0.024	0.444	-0.005	0.003	0.02	0.724**
	VBN 8 X Mash 114	-0.032	-0.016	0.153	-0.017	0.546	-0.004	0.020	0.039	0.688**
	VBN 8 X Mash 1008	0.001	0.038	0.007	0.003	0.651	0.004	0.004	0.015	0.722**
	VBN 8 X VBG 11053	-0.023	0.018	0.108	0.003	0.577	-0.004	0.012	0.009	0.700**
Number of pods per cluster (NPPC)	VBN(Bg) 4 X Mash 114	-0.012	-0.008	0.034	-0.078	0.338	0.000	0.016	0.026	0.317**
	VBN(Bg) 4 X Mash 1008	-0.003	0.007	0.104	-0.063	0.211	-0.005	0.002	0.018	0.273**
	VBN 8 X Mash 114	-0.012	-0.008	0.034	-0.078	0.338	0.000	0.016	0.026	0.317**
	VBN 8 X Mash 1008	0.001	0.024	0.002	0.010	0.22	0.015	0.002	0.014	0.286**
	VBN 8 X VBG 11053	-0.008	0.01	0.014	0.020	0.211	-0.001	0.003	0.02	0.268**
Number of pods per plant (NPPP)	VBN(Bg) 4 X Mash 114	-0.029	-0.016	0.13	-0.041	0.643	-0.004	0.024	0.04	0.746**
	VBN(Bg) 4 X Mash 1008	-0.004	0.019	0.247	-0.027	0.494	-0.005	0.002	0.02	0.746**
	VBN 8 X Mash 114	-0.029	-0.016	0.13	-0.041	0.643	-0.004	0.024	0.04	0.746**
	VBN 8 X Mash 1008	0.001	0.038	0.006	0.003	0.759	0.002	0.004	0.014	0.826**
	VBN 8 X VBG 11053	-0.022	0.019	0.093	0.006	0.672	-0.003	0.015	0.018	0.797**



Pod length (cm) (PL)	VBN(Bg) 4 X Mash 114	-0.016	-0.004	0.027	0.001	0.103	-0.023	0.026	0.032	0.146**
	VBN(Bg) 4 X Mash 1008	-0.004	0.006	0.091	-0.018	0.156	-0.016	0.005	0.032	0.252**
	VBN 8 X Mash 114	-0.016	-0.004	0.027	0.001	0.103	-0.023	0.026	0.032	0.146**
	VBN 8 X Mash 1008	0.000	0.002	0.001	0.004	0.041	0.038	0.005	0.010	0.100*
	VBN 8 X VBG 11053	-0.008	0.004	0.013	0.001	0.068	-0.033	0.013	0.002	0.059
Number of seeds per pod (NSPP)	VBN(Bg) 4 X Mash 114	-0.020	-0.008	0.046	-0.019	0.232	-0.009	0.067	0.010	0.300**
	VBN(Bg) 4 X Mash 1008	-0.002	0.001	0.093	-0.017	0.157	-0.011	0.008	0.042	0.272**
	VBN 8 X Mash 114	-0.020	-0.008	0.046	-0.019	0.232	-0.009	0.067	0.010	0.300**
	VBN 8 X Mash 1008	0.000	0.009	0.002	0.001	0.181	0.011	0.015	0.033	0.252**
	VBN 8 X VBG 11053	-0.011	0.006	0.016	0.001	0.126	-0.005	0.082	0.026	0.240**
100 - seed weight(g) (HSW)	VBN(Bg) 4 X Mash 114	0.011	-0.001	0.021	-0.007	0.088	-0.003	0.002	0.291	0.402**
	VBN(Bg) 4 X Mash 1008	0.000	0.002	0.06	-0.013	0.108	-0.006	0.004	0.091	0.246**
	VBN 8 X Mash 114	0.011	-0.001	0.021	-0.007	0.088	-0.003	0.002	0.291	0.402**
	VBN 8 X Mash 1008	0.000	0.007	0.001	0.001	0.058	0.002	0.003	0.179	0.250**
	VBN 8 X VBG 11053	0.002	0.005	0.005	0.002	0.063	0.000	0.011	0.191	0.279**

* Bold figures denote direct effects .

S.No	Crosses	Residual effect
1	VBN(Bg) 4 X Mash 114	0.5721
2	VBN(Bg) 4 X Mash 1008	0.6460
3	VBN 8 X Mash 114	0.5721
4	VBN 8 X Mash 1008	0.5261
5	VBN 8 X VBG 11053	0.5566

*,** Significant at 5 % and 1 % level of probability, respectively.