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Research Article

Combining ability analysis for yield and its attributes in Blackgram (*Vigna mungo* (L.) Hepper)

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Abstract

Hybridization in Line x Tester mating design was conducted with 11 MYMV susceptible lines and three resistant testers in blackgram (*Vigna mungo* (L.) Hepper) to understand the nature of gene action, combining ability of the parents (*gca*) and to assess the potential for the exploitation of heterosis (*sca*) in hybrids. Data on nine quantitative characters *viz.,*days to 50 per cent flowering, plant height (cm), number of branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, hundred seed weight (g) and seed yield per plant (g) were collected on 33 hybrids and their 11 parents. Among the genotypes, PU 31, LBG 645, ADT 3, CO 6 and LBG 709 recorded relatively high *per se* performance and *gca* effects for majority of seed yield attributing traits. The hybrid, LBG 709 x PU 31 followed by CO 6 x PU 31 and LBG 645 x VBN (Bg) 6 exhibited significant high *per se* and *sca* for most of the traits *viz.*, number of branches per plant, number of clusters per plant, number of pods per plant, pod length and seed yield per plant .The crosses involving the parents, LBG 645 x PU 31 and ADT 3 x PU 31 recorded significant *gca* and non-significant *sca* effect for most of the characters inferring that these crosses would produce superior recombinants for seed yield.

Key words
Blackgram, combining ability, *per se* performance, *gca*, *sca,* non-additive gene action

Introduction:

Blackgram (*Vigna mungo* (L.) Hepper), an important pulse crop in India is ranked fourth in pulses production next to chickpea, pigeonpea, and mungbean. It is a cheap source of vegetarian dietary protein (18-26%), which also contains 67% of carbohydrates, 3-5% of fibre and 1.7% fat. India ranks first in blackgram yield with 19.46 lakh tonnes production from 31.48 lakh ha area but with a low productivity of 618 kg/ha (DES Statistics,GOI, 2012-13). Hence, there is a strong need to boost the productivity of this crop. It had been observed that all available parents with high order of *per se* alone may not be able to transmit their superior traits into their progenies unless the parents involved are good general combiners implying the need for selection of desired parents based on combining ability. Therefore, the present investigation was conducted to estimate the general and specific combining ability of parents and hybrids, respectively for yield and its components in blackgram through Line x Tester mating analysis.

Material and method

Fourteen varieties / culture(s) comprising of 11 MYMV susceptible lines *viz.*, ACM 05007, MDU 1, ADT 3, CO 5, CO 6, LBG 623, LBG 645, LBG 685, LBG 709, TMV 1 and VBN (Bg) 5 and three resistant testers *viz.*, PU 31, VBN (Bg) 4 and VBN (Bg) 6 were used as parents and crosses were effected in L x T fashion at Agricultural College and Research Institute, Madurai during October, 2013 and the resultant 33 F_1 hybrids were evaluated with VBN (Bg) 4 as standard check in RBD with two replications adopting a spacing of 30 cm x 10 cm during July, 2014 at NPRC, Vamban. Recommended agronomical practices were adopted to raise the crop. Biometrical observations were taken on 10 randomly selected plants in each replication for nine quantitative traits *viz.*, days to 50 per cent flowering, plant height (cm), number of branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, hundred seed weight (g) and seed yield per plant (g). Analysis of data for general and specific combining ability effects and variances was estimated by following the procedure of Line x Tester analysis given by Kempthorne (1957).

Result and discussion

The ANOVA revealed that mean squares due to genotypes, parents, crosses, lines, testers (except for plant height) and lines x testers (except plant height) were highly significant for all the traits (Table 1) under evaluation connoting the existence of wider genetic diversity among the lines, testers and hybrids. The ratio of GCA to SCA variance was less than unity for all the traits studied, indicating the preponderance of non-additive gene action governing the traits. Similar results were reported by Seenaiah *et al* (1993), Govindraj and Subramanian (2001) and Anbu Selvam and Elangaimannan (2010) , Isha Parveen *et al* (2012) and Vijay Kumar *et al* (2014).

The success of any breeding programme largely depends on the choice of parents used in the hybridization. Gilbert (1958) suggested that the parents with good *per se* performance would result in better hybrids. Gentoypes with high *per se* performance and high *gca* effects could be useful in evolving desirable segregants in the breeding programmes. The *gca* effect is due to additive gene action and is fixable (Sprague and Tatum, 1942). In the present investigation, the lines, LBG 645 (7.88) and LBG 709 (7.87) and all the testers *viz.,* PU 31 (8.09), VBN (Bg) 4 (9.18) and VBN (Bg) 6 (8.90) recorded significant high mean values for seed yield per plant (Table 2). The lines, ADT 3 (29.50) and CO 6 (30.50) and tester, PU 31 (30.50) were found to be early flowering. Most of the lines and testers were found to be of short plant stature. Among the parents, only VBN (Bg) 4 registered highly significant value (3.30) for number of branches per plant. Similarly the parents, CO 5 , VBN (Bg) 6 showed significantly high mean for number of clusters per plant (22.70, 21.40), pod length (5.21, 4.95) and LBG 645 (34.30) and VBN (Bg) 4 (36.50) for high number of pods per plant. The line LBG 709 (6.50) and tester VBN (Bg) 4 (6.50) showed highest number of seeds per plant. Among the lines MDU 1 (4.79) and tester VBN (Bg) 4 recorded maximum hundred seed weight. A perusal of the *per se* performance of hybrids for different traits showed that the hybrids, LBG 709 x PU 31 followed by CO 6 x PU 31 and LBG 645 x VBN (Bg) 6 were found to be superior for yield and its attributing traits (Table 3).

The *gca* effect is a good estimate of additive gene action (Sprague and Tatum, 1942). The general combining ability effects of parents for different traits are presented in Table 4. Among the genotypes studied, no entry had manifested good general combining ability for all the quantitative traits. However, good combiners identified for high seed yield per plant are LBG 645 (2.72) followed by LBG 709 (1.95) CO 6 (1.12) and tester, PU 31 (0.33). For early flowering, the lines ADT 3 (-1.70), CO 6 (-1.70) and tester PU 31 (-0.98) were identified to be good general combiners for early flowering. The line ADT 3 (-3.11) was also found to be best general combiner for short plant stature. The line LBG 709 (0.28) and tester PU 31(0.17) were good general combiners for number of branches per plant. For the trait, number of clusters per plant, the lines, LBG 709 (2.08) and tester PU 31 (0.81) were good general combiners. The line LBG 645 (4.73) and tester PU 31(1.42) were best general combiners for highest number of pods per plant. Among the lines LBG 709 and tester, PU 31 (0.05) were best combiners for maximum pod length. For the trait, number of seeds per plant , the line LBG 709 (0.36) and tester VBN (Bg) 4 were good general combiners. The lines Co 6 (0.38) and tester VBN (Bg) 6 (0.09) were good general combiners for hundred seed weight. Thus, it is observed from this study that the parents, CO 6 , LBG 709 PU 31 have recorded high *per se* and *gca* effects. Hence, involvement of these genotypes in the crossing programme would result in the identification of superior segregants with favourable genes for seed yield and its attributes.

The specific combining ability (*sca*) effects of the 33 F_1 crosses for nine quantitative traits were computed (Table. 5). s*ca* is the deviation from the performance predicted on the basis of general combining ability (Allard, 1956). High *sca* effect alone may not be the appropriate choice of the hybrid for heterosis exploitation because the hybrids with low mean value may also possess high *sca* effects, even if the *gca* effects of the parents were very low or even negative (Grakh and Chaudhary, 1985). From the present study, the hybrid, LBG 709 x PU 31 was identified as the best among all the crosses for most of the traits *viz.,* number of branches per plant, number of clusters per plant, number of pods per plant, pod length number and seed yield per plant. It is noteworthy to mention that the above cross possessed parents (LBG 709, PU 31) with high *gca* (1.95, 0.33) highest mean (13.98) and *sca* (2.95) for seed yield along with majority of desired yield components. Being a self-pollinated crop, it is not possible to exploit heterosis, however it may be utilized if any new method or male sterility is identified in blackgram in future.

The crosses involving the parents, LBG 645 x PU 31 and ADT 3 x PU 31 recorded non-significant *sca* effect for most of the characters including seed yield. The presence of highly significant *gca* and non-significant *sca* may be due to additive and additive x additive interaction. Hence, these two crosses may be utilized for recombination breeding for further exploitation as these hybrids would throw segregants for high seed yield. However the ratio of GCA/SCA variance indicated the preponderance of non-additive gene action and hence, selection could be postponed to later generations.

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Table 1. Analysis of variance for combining ability in blackgram for yield and its component traits

Source	df	Mean Squares								
		DFF	PLH	NBP	NCP	NPP	POL	NSP	HSW	SYP
Replication	1	0.89	0.05	0.03	0.04	0.01	0.01	0.09	0.03	0.01
Genotype	46	4.52 *	85.11 *	0.15*	18.42*	36.80*	0.08*	0.26*	0.38*	6.52*
Parents	13	6.21*	195.54*	0.13*	26.31*	20.57*	0.13*	0.23*	0.60*	4.44*
Crosses	32	3.94*	23.46*	0.16*	13.65*	36.63*	0.07*	0.23*	0.29*	5.47*
Parents Vs Crosses	1	1.28*	622.16*	0.07*	68.55*	253.66*	0.03*	1.72*	1.83*	67.31*
Lines	10	6.63*	21.81*	0.15*	22.92*	86.58*	0.12*	0.42*	0.74*	12.38*
Testers	2	21.02*	209.08*	0.50*	11.02*	47.72*	0.04*	0.22*	0.17*	2.67*
Lines x Testers	20	0.88*	5.73	0.13*	9.28*	10.54*	0.04*	0.13*	0.07*	2.29*
Error	46	0.12	3.23	0.01	0.40	2.60	0.01	0.02	0.04	0.23
GCA		0.08	0.45	0.01	0.11	0.67	0.06	0.02	0.01	0.08
SCA		0.10	0.71	0.06	4.39	3.66	0.20	0.06	0.03	0.99
GCA/SCA		0.80	0.63	0.16	0.03	0.18	0.30	0.33	0.33	0.08

* Significant at 5 % level

DFF - Days to 50 per cent flowering
PLH - Plant height
NBP - Number of branches per plant
NCP - Number of clusters per plant
NPP - Number of pods per plant
POL - Pod length
NSP - Number of seeds per pod
HSW - 100 seed weight
SYP - Seed yield per plant

Table 2. Mean performance of parents for yield and Yield attributing traits in blackgram

Parents	DFF	PLH (cm)	NBP	NCP	NPP	POL (cm)	NSP	HSW (g)	SYP (g)
Lines									
ACM 05007	32.50	49.10	2.60	13.10	30.00	4.55	6.00	4.64*	6.80
MDU 1	33.00	51.00	2.90	13.10	31.70	4.26	6.30	4.79*	6.89
ADT 3	32.00	34.30*	2.50	13.70	32.20	4.44	6.15	3.62	6.67
CO 5	35.00	56.10	2.90	22.70*	26.10	5.21*	5.95	3.51	4.53
CO 6	30.50*	35.80*	2.30	13.40	31.10	4.63	5.70	4.49	6.69
LBG 623	37.00	54.30	2.90	22.50*	25.85	5.10*	5.60	3.42	4.41
LBG 645	34.00	36.10*	2.53	17.10	34.30*	4.79	6.10	4.74*	7.88*
LBG 685	35.00	37.20*	2.55	18.10*	26.65	4.93*	5.65	3.79	4.81
LBG 709	33.50	36.20*	2.57	17.00	33.20	4.64	6.50*	4.76*	7.87*
TMV I	32.50	37.40*	2.48	13.90	30.30	4.73	6.35	4.38	6.81
VBN (Bg) 5	33.00	32.30*	2.50	14.30	31.30	4.71	6.15	4.32	7.04
Testers									
PU 31	30.50*	36.20*	2.50	19.70*	33.50*	4.53	5.85	4.56*	8.09*
VBN (Bg) 4	34.50	40.30	3.30*	20.10*	36.50*	4.73	6.50*	5.00*	9.18*
VBN (Bg) 6	33.00	19.10*	2.55	21.40*	34.00*	4.95*	5.70	4.98*	8.90*
Grand mean	33.11	40.90	2.65	17.15	31.19	4.73	6.04	4.48	6.90
SEd	1.06	0.62	0.13	0.39	1.07	0.04	0.17	0.01	0.17
CD (0.05)	2.28	1.34	0.29	0.85	2.31	0.09	0.38	0.12	0.37

* Significant at 5 % level

Table 3. Mean expression of different traits in blackgram hybrids

Hybrids	DFF	PLH (cm)	NBP	NCP	NPP	POL (cm)	NSP	HSW (g)	SYP (g)
ACM 05007 x PU 31	31.50	42.30	2.67	16.63*	39.55*	4.60	6.51	4.70	8.98
ACM 05007 x VBN (Bg) 4	34.00	39.10	2.64	16.20*	38.00	4.70	6.75*	4.60	8.64
ACM 05007 x VBN (Bg) 6	31.50	32.95	2.46	18.40*	40.10*	4.68	6.55	4.72	8.80
MDU 1 x PU 31	33.50	36.60	2.90*	16.85*	41.25*	4.56	6.35	4.71	9.24
MDU 1x VBN (Bg) 4	33.00	35.00	2.78*	16.60*	37.95	4.68	6.58	4.60	8.46
MDU 1 x VBN (Bg) 6	33.50	29.25	2.37	15.60	34.75	4.60	6.55	4.97*	8.47
ADT 3 x PU 31	30.50*	30.75*	2.63	14.70	36.40	4.64	6.38	3.60	8.45
ADT 3 x VBN (Bg) 4	32.00	36.23	2.67	15.93	34.88	4.70	6.70 *	3.84	9.82
ADT 3 x VBN (Bg) 6	31.50	31.50*	2.37	17.06*	31.43	4.60	6.56	3.87	8.19
CO 5 x PU 31	33.50	37.45	2.76*	17.84*	34.25	4.82*	6.21	4.70	8.39
CO 5 x VBN (Bg) 4	35.00	39.60	2.61	16.52*	32.45	4.66	6.60	4.36	8.33
CO 5 x VBN (Bg) 6	35.50	31.45	2.62	16.63*	29.10	4.61	5.68	4.89*	7.34
CO 6 x PU 31	29.50*	34.65	2.37	16.02*	39.27*	4.60	6.94*	5.00*	9.85
CO 6 x VBN (Bg) 4	32.50	31.92	2.46	12.60	37.48	4.59	6.45	5.11*	10.35
CO 6 x VBN (Bg) 6	32.00	29.38	2.33	13.10	35.10	4.62	6.68*	4.90*	9.39
LBG 623 x PU 31	32.50	34.95	2.63	15.75	30.85	4.74	6.38	4.30	7.52
LBG 623 x VBN (Bg) 4	34.50	36.95	2.63	19.15*	29.00	4.69	5.90	4.21	6.42
LBG 623 x VBN (Bg) 6	33.00	28.20	2.63	15.90	31.60	4.76	5.74	4.19	6.71
LBG 645 x PU 31	32.50	36.90	2.38	16.00*	40.95*	4.77	6.37	4.83*	11.24
LBG 645 x VBN (Bg) 4	34.50	37.60	2.37	12.90	40.25*	5.07*	6.73*	4.77*	11.05
LBG 645 x VBN (Bg) 6	33.50	32.59	2.36	16.90*	37.35	4.75	6.77*	5.21*	12.11*
LBG 685 x PU 31	31.50	32.90	3.36*	14.60	29.00	4.65	6.37	4.64	7.96
LBG 685 x VBN (Bg) 4	34.00	34.50	2.37	12.70	32.10	4.69	6.56	4.09	7.94
LBG 685 x VBN (Bg) 6	33.50	29.43	2.62	12.70	28.28	4.67	5.70	4.34	6.22
LBG 709 x PU 31	33.50	36.40	3.63*	24.00*	44.50*	5.31*	6.92*	4.76 *	13.98*
LBG 709 x VBN (Bg) 4	35.50	37.02	2.30	15.50	37.38	5.02*	6.67*	4.54	9.67
LBG 709 x VBN (Bg) 6	34.00	30.00	2.67	12.60	32.63	4.69	6.69*	4.63	8.43
TMV 1 x PU 31	32.50	34.53	2.63	13.55	28.85	4.57	6.39	4.19	6.26
TMV 1 x VBN (Bg) 4	34.50	33.63	2.33	13.03	30.13	4.36	6.18	4.40	7.40
TMV 1 x VBN (Bg) 6	32.50	29.15	2.63	14.05	31.40	4.73	5.94	4.91*	8.29
VBN (Bg) 5 x PU 31	31.50	33.70	2.45	11.10	33.40	4.80	6.04	4.23	8.02
VBN (Bg) 5 x VBN (Bg) 4	34.50	35.35	2.47	11.63	34.10	4.36	6.13	4.49	8.44
VBN (Bg) 5 x VBN (Bg) 6	33.00	31.60	2.38	11.60	34.20	4.39	6.30	4.25	8.28
Grand mean	33.03	35.72	2.59	15.28	34.78	4.69	6.40	4.62	8.75
SEd	0.82	2.10	0.07	0.70	1.79	0.06	0.10	0.07	1.51
CD (0.05)	1.68	4.29	0.16	1.43	3.66	0.13	0.21	0.14	3.08

* Significant at 5 % level

Table 4. General combining ability effects of parents for different traits in blackgram

Parents	DFF	PLH	NBP	NCP	NPP	POL	NSP	HSW	SYP
Lines									
ACM 05007	-0.70 *	4.07 *	0.00	1.79 *	4.43 *	-0.02	0.20 *	0.14*	0.06
MDU 1	0.30	-0.43	0.09 *	1.07 *	3.20 *	-0.07 *	0.09 *	0.23 *	-0.02
ADT 3	-1.70 *	-1.22	-0.03	0.61 *	-0.55	-0.04	0.14 *	-0.76 *	0.07
CO 5	1.64 *	2.12 *	0.07 *	1.71 *	-2.85 *	0.01	-0.24 *	0.12*	-0.73 *
CO 6	-1.70 *	-2.06 *	-0.20 *	-1.37 *	2.50 *	-0.09 *	0.29 *	0.47 *	1.12 *
LBG 623	0.30	-0.68	0.04	1.65 *	-4.30 *	0.05	-0.40 *	-0.30 *	-1.86 *
LBG 645	0.47	1.65	-0.22 *	-0.02	4.73 *	0.17 *	0.22 *	0.41 *	2.72 *
LBG 685	-0.03	-1.77 *	0.19 *	-1.95 *	-4.99 *	-0.01	-0.19 *	-0.17 *	-1.37 *
LBG 709	1.30 *	0.43	0.28 *	2.08 *	3.38 *	0.32 *	0.36 *	0.11*	1.95 *
TMV I	0.14	-1.61	-0.06	-1.74 *	-4.66 *	-0.13 *	-0.23 *	-0.03	-1.43 *
VBN (Bg) 5	-0.03	-0.56	-0.16 *	-3.84 *	-0.88	-0.17 *	-0.25 *	-0.21 *	-0.50 *
SE	0.33	-0.50	0.03	0.28	0.73	0.02	0.04	0.02	0.22
Testers									
PU 31	-0.98 *	1.51*	0.17 *	0.81 *	1.42 *	0.05 *	0.04	-0.02	0.33 *
VBN (Bg) 4	0.97 *	2.04*	-0.08 *	-0.49 *	0.10	-0.00	0.08 *	-0.08 *	0.03
VBN (Bg) 6	0.02	-3.55*	-0.10 *	-0.32 *	-1.52 *	-0.04 *	-0.11 *	0.09 *	-0.36 *
SE	0.17	0.44	0.01	0.15	0.38	0.01	0.02	0.01	0.11

* Significant at 5% level

Table 5. Specific combining ability effects of hybrids for different traits in blackgram

Hybrids	DFF	PLH	NBP	NCP	NPP	POL	NSP	HSW	SYP
ACM 05007 x PU 31	0.15	2.67	-0.09	-1.26*	-1.09	-0.11*	-0.13	0.05	-0.16
ACM 05007 x VBN (Bg) 4	0.70	-1.05	0.13 *	-0.39	-1.31	0.04	0.07	0.00	-0.20
ACM 05007 x VBN (Bg) 6	-0.85	-1.62	-0.04	1.65*	2.40	0.07	0.06	-0.05	0.36
MDU 1 x PU 31	1.15*	1.47	0.04	-0.31	1.84	-0.10 *	-0.18*	-0.03	0.18
MDU 1 x VBN (Bg) 4	-1.30 *	-0.65	0.18 *	0.74	-0.13	0.07	0.01	-0.09	-0.29
MDU 1 x VBN (Bg) 6	0.15	-0.82	-0.22 *	-0.43	-1.71	0.02	0.17 *	0.12 *	0.11
ADT 3 x PU 31	0.15	-3.59*	-0.10	-2.01 *	0.74	-0.05	-0.21*	-0.15 *	-0.70
ADT 3 x VBN (Bg) 4	-0.30	1.36	0.20 *	0.52	0.54	0.06	0.08	0.14 *	0.97 *
ADT 3 x VBN (Bg) 6	0.15	2.22	-0.09	1.49 *	-1.29	-0.01	0.13	0.01	-0.27
CO 5 x PU 31	-0.18	-0.23	-0.07	0.03	0.89	0.08	0.01	0.07	0.04
CO 5 x VBN (Bg) 4	-0.64	1.40	0.02	0.02	0.42	-0.03	0.36 *	-0.22 *	0.28
CO 5 x VBN (Bg) 6	0.82	-1.17	0.05	-0.05	-1.31	-0.05	-0.37 *	0.15 *	-0.32
CO 6 x PU 31	-0.85	1.16	-0.19 *	1.30 *	0.57	-0.05	0.21 *	0.01	-0.35
CO 6 x VBN (Bg) 4	0.20	-2.09	0.15 *	-0.82	0.09	-0.01	-0.31 *	0.18 *	0.46
CO 6 x VBN (Bg) 6	0.65	0.94	0.04	-0.48	-0.66	0.06	0.11	-0.19 *	-0.11
LBG 623 x PU 31	0.15	0.07	-0.18 *	-2.00 *	-1.06	-0.03	0.33 *	0.08	0.31
LBG 623 x VBN (Bg) 4	0.20	1.55	0.08	2.70 *	-1.58	-0.03	-0.18 *	0.05	-0.49
LBG 623 x VBN (Bg) 6	-0.35	-1.62	0.10	-0.71	2.64 *	0.07	-0.15 *	-0.14 *	0.18
LBG 645 x PU 31	-0.02	-0.31	-0.17 *	-0.08	0.01	-0.14 *	-0.29 *	-0.09	-0.56
LBG 645 x VBN (Bg) 4	0.03	-0.13	0.08	-1.88 *	0.64	0.21 *	0.03	-0.09	-0.45
LBG 645 x VBN (Bg) 6	-0.02	0.44	0.09	1.96 *	-0.65	-0.07	0.26 *	0.18 *	1.01 *
LBG 685 x PU 31	-0.52	-0.89	0.40 *	0.45	-2.21	-0.06	0.12	0.30 *	0.25
LBG 685 x VBN (Bg) 4	0.03	0.19	-0.34 *	-0.15	2.21	0.02	0.27 *	-0.19 *	0.54
LBG 685 x VBN (Bg) 6	0.48	0.70	-0.07	-0.31	0.00	0.04	-0.40 *	-0.12 *	-0.79
LBG 709 x PU 31	0.15	0.41	0.58 *	5.82 *	4.91 *	0.26 *	0.12	0.14 *	2.95 *
LBG 709 x VBN (Bg) 4	0.20	0.51	-0.49 *	-1.38 *	-0.89	0.01	-0.17 *	-0.03	-1.05 *
LBG 709 x VBN (Bg) 6	-0.35	-0.93	-0.10	-4.44 *	-4.02 *	-0.27 *	0.04	-0.11 *	-1.90 *
TMV 1 x PU 31	0.32	0.58	-0.07	-0.80	-2.70 *	-0.03	0.18 *	-0.29 *	-1.39 *
TMV 1 x VBN (Bg) 4	0.36	-0.84	-0.13 *	-0.03	-0.10	-0.19 *	-0.06	-0.02	0.05
TMV 1 x VBN (Bg) 6	-0.68	0.26	0.20 *	0.83	2.79 *	0.22 *	-0.12	0.31 *	1.34 *
VBN (Bg) 5 x PU 31	-0.52	-1.36	-0.16 *	-1.15 *	-1.92	0.23 *	-0.15 *	-0.08	-0.56
VBN (Bg) 5 x VBN (Bg) 4	0.53	-0.24	0.11 *	0.67	0.10	-0.15 *	-0.10	0.24 *	0.16
VBN (Bg) 5 x VBN (Bg) 6	-0.02	1.60	0.04	0.48	1.82	-0.08	0.26 *	-0.16 *	0.40
SE	0.58	1.47	0.05	0.49	1.27	0.04	0.07	0.05	0.39

* Significant at 5% level