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HETEROSIS AND INBREEDING DEPRESSION IN BLACKGRAM*

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ABSTRACT

Heterosis (over better parent) and inbreeding depression were estimated among 50 hybrids generated from 15 parents in blackgram for nine biometriacal traits. Maximum heterobeltiosis was observed for branches per plant followed by pods per plant, seed yield per plant followed by pods per plant. The crossesvig., Vamban 1 x VB 3. Vamban 1 x VB 20 and Pant U 30 x TAU 5 showed high heterosis over better parent for pods per plant and seed yield per plant. In general, hybrids showing high heterosis also showed high inbreeding depression for most of the characters suggesting the importance of non-additive gene action.

KEY WORDS : Blackgram. Heterosis. Inbreeding depression

Investigation on the magnitude of heterosis helps to identify the promising hybrid combinations for exploitation. In addition to enhance the yield potential of hybrids, it is necessary to reshuffle the genes by crossing and to study the heterotic effects in F_1 and its maintenance in F_2 and subsequent generations. Hybrid vigour is based primarily on allelic non-additive action. Dominant genes are equally effective to both the categories of vigour by acting either non-additively or additively (Fasoulas, 1981).

Through the development of hybrids does not seem to be economically feasible in blackgram at present. it is possible to develop purelines from the hybrids. The present investigation was to study the heterosis and inbreeding depression in blackgram (*Vigna mungo* (L.) Hepper).

MATERIALS AND METHODS

The materials comprised of 50 hybrids obtained from 15 parents crossed in line x tester fashion using 10 lines and five testers. The 15 parents and their 50 F_1 hybrids and F_2 were grown in randomised block design with 3 replication during kharif 1996 at the Agricultural Research Station, Pattukkottai. The parents and F_1 were sown in single row and F_2 was sown in six rows of four metre length by adopting a spacing of 30 x 10 cm. Observations on nine biometrical characters were recorded on five random plants in parents and F_1 and 20 plants in F_2 in each replication. Heterosis values were estimated for all the characters as per cent of increase or decrease over better parental value (heterobeltiosis). The deviation of F_2 from F_1 (inbreeding depression) was calculated for all the cross combinations for different characters under study.

RESULTS AND DISCUSSION

The range of mean, heterosis and inbreeding depression are presented in Table 1. and the extent of inbreeding depression for best five hybrids selected on the basis of beterobeltiosis is presented in Table 2. The highest positive heterobeltiosis was recorded by Vamban 1 x VB 20 (58.30) followed by PDU 104 x TAU 5 (49.66). pant U 30 x TAU 5 (42.81) and Vamban 1 x VB 3, Vamban 1 x VB 20 and Pant U 30 x TAU 5 showed high heterosis for pods per plants. The heterosis observed for seed yield per plant was mainly attributed through pods per plant. The exploitation of heterosis to develop hybrid is not possible for the present in crop like blackgram, but it is possible to develop high yielding pure lines from those F_1 hybrids which had Shown hybrid vigour over better parent. All those crosses showing no heterosis over better parent got rejected in early segregating generation as suggested by Singh (1971).

Relationship between heterotic response and inbreeding depression i.e. crosses showing high heterosis also showed high inbreeding depression, suggesting the importance of non-additive gene

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Table 1. Range of mean (F_1 & F_2) heterobeltiosis (dii) and inbreeding depression (ID) for different characters

Characters	Range				No.of crosses showing significant dii		No.of F_2 showing significant ID	
	F_1	F_2	dii	ID	Negative side	Positive s2ide	Negative side	Positive side
Days to maturity	64.67 - 77.33	64.67 - 75.33	-8.06 - 17.89	-11.24 - 8.50	17	18	8	11
Plant height	29.63 - 54.07	29.77 - 51.13	-41.29 - 41.37	-39.15 30.63	15	19	11	15
Branches/ plant	1.73 - 4.83	2.03 - 4.80	-44.09 - 74.70	-8.11 - 38.69	6	4	13	16
Clusters/ plant	9.70 - 24.57	10.20 - 21.17	-44.68 - 50.00	-46.44 - 32.67	22	17	8	8
pods/ plant	18.23 - 47.23	20.33 - 49.40	-47.39 - 67.37	-102.74 - 38.00	19	14	5	5
pod length	4.10 - 5.20	3.39 - 4.95	-15.17 - 17.97	-17.07 - 22.63	17	9	8	17
seeds/pod	5.47 - 7.23	5.23 - 7.03	-17.07 - 7.61	-18.83 - 19.17	29	10	20	13
100 seed weight	3.45 - 4.57	3.20 - 4.20	-5.22 - 15.09	-10.53 - 14.24	5	23	3	20
Seed yield/ plant	4.07 - 14.57	5.13 - 12.87	-50.76 - 58.30	-148.93 - 38.71	21	13	10	14

action (Tewari and Pandey, 1987). Similar situations were noticed in the present study for most of the hybrids for branches per plant, clusters per plant, pod lenght, seeds per pod, 100 seed weight and seed yield per plant. This is in accordance with the observation made by Rao (1991) and Shanmugasundaram and Sree Rangaswamy (1995) in blackgram, by sharma and Yadav (1993)in greengram and by Tewari and Pandey (1987) in Chickpea. However, the cross combinations PDU 10 x VB 20 for branches per plant and Vamban 1 x VB 3 for per pods per plant exhibited inbreeding vigour (inbreeding depression in negative direction) coupled with high heterosis which could be attributed due to epistatic gene action (Singh *et al.*, 1976 Dasmukh and bhapker, 1982, Tewari and Pandey, 1987 and Shnmugasundaram and Sree Ranaswamy, 1995). In some crosses viz., PDU 104 x TAU 5 for branches per plant, ADT 5 x VB 3 and Vamban 1 x VB 3 for clusters per plant, ADT 3 x TAU 5, ADT 5 x VB 3, Vamban 1 x VB 20 amd Pant U 30 x TAU 5 for pdos per plant. Vamban 1 Z VB 3 for pod length, Vamban 1 Z WBG 57 for seeds per pod and PDU 104 x TAU 5 for 100 seed weight, there was significant heterosis with no marked inbreding depression in F_2. This suggested that there might be a high proportionof fixable genes in these crosses and inheritance due to stable polygenic system (Fasoulas, 1981, Sharma and Chaugan, 1983 and Naidu and Sathyanarayana, 1993). Therefore the above cross combinations may further be exploited through pedigree method of selection to obtain desirable segregants.

Instances were also found in which significant negative heterosis coupled with inbreeding vigour as observed in the case of T9 x VB 3 and TMV 1 x VB 3 for days to maturity and Co 5 x TAU 12, Co 5 x WBG 57, TMV 1 x 3 and TMV 1 x VB 20 for plant height suggesting the occurance of transgressive handled through pedigree breeding for isolation of desirable elite recombinants in later generation (Naidu and Sathyanarayana, 1993).

Fir developing superior and elite recombinats, intermating among the desirable segreganmts followed by predigree method of breeding is suggested in order to harness all the types of gene actions exhibited in the biological materials handled

Table 2. Extent of inbreeding depression for best five hybrids selected on the basis of heterobeltiosis

Hybrids	Heterobeltiosis	Inbreeding depression
Days to maturity		
Co 5 x WBG 57	-6.64**	-1.42
ADT 3 x TAU 5	-5.77**	-0.52
ADT 3 x VB 3	-8.06**	-0.50
T9 x VB 3	-7.11**	-11.24**
TMV1 x VB 3	-6.16**	-8.59**
Plant height		
Co 5 x TAU 12	-19.20**	-10.38**
Co 5 x WBG 57	-41.29**	-10.89**
T9 x VB 3	-24.54**	-6.53
TMV 1 x WBG 57	-27.01**	-39.15**
TMV 1 x VB 20	-25.37**	-14.75**
Branches/plant		
Co 5 x TAU 5	26.83**	13.54**
T9 x VB 20	52.69**	38.69**
PDU 10 x WBG 57	74.70**	33.13**
PDU 10 x VB 20	24.73**	-24.03**
DU 104 x TAU 5	36.59**	5.36
Clusters/plant		
ADT 4 x VB 3	50.00**	29.25**
ADT 5 x VB 3	33.54**	4.07
Vamban 1 x VB 3	33.26**	5.76
T9 x TAU 5	39.85**	21.04**
PDU 10 x VB 3	42.90**	19.87**
Pods/plant		
ADT 3 x TAU 5	28.06**	5.62
ADT 5 xVB 3	51.12**	4.02
Vamban 1 x VB 3	67.37**	-14.44**
Vamban 1 x VB 20	41.47**	8.37
Pant U 30 x TAU 5	34.31**	9.38
Pod length		
ADT 5 x WBG 57	14.06**	9.03**
ADT 5 x VB 20	17.45**	13.12**
Vamban 1 x VB 3	16.67**	5.07
Pant U 30 x VB 3	17.42**	20.70**
PUD 10 x VB 3	13.08**	10.20**

Table 2. Contd.,

Hybrids	Heterobeltiosis	Inbreeding depression
Seeds/pod		
ADT 3 x WBG 57	5.10**	6.40**
ADT 5 x WBG 57	7.61**	9.05**
ADT 5 X VB 20	7.11**	7.97**
Vamban 1 x WBG 57	6.29**	3.55
Pant U 30 x WBG 57	6.70**	5.36**
100 seed weight		
ADT 4 x TAU 12	13.76**	4.84*
ADT 5 x TAU 12	14.68**	8.15**
Pant U 30 x VB 3	15.09**	7.37**
PDU 104 x TAU 5	12.96**	-2.52
PDU 104 x VB 3	14.56**	10.94**
Seed yield/plant		
Vamban 1 x VB 3	39.93**	16.74**
Vamban 1 x VB 20	58.30**	18.18**
Pant U 30 x TAU 5	42.81**	22.52**
PDU 104 x TAU 5	49.66**	38.71**
TMV 1 x TAU 5	32.19**	21.76**

* Significant at 5% level **Significant at 1% level

in the present study.

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SEEDING METHODS AND NITROGEN MANAGEMENT PRACTICES FOR IRRIGATED LOWLAND RICE IN CAUVERY DELTA ZONE OF TAMIL NADU

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Investigation was carried out at Tamil Nadu Rice Research Institute, Aduthurai from June 1995 to February 1997 to evaluate the efficient N management practices for direct seeded rice raised under irrigated lowland condition. The experiments were carried out both in *Kuruvai* and *thaladi* seasons of 1995-'96 and 1996-'97. The experiment I consisted of three methods of sowing *viz.*, transplanting, sowing sprouted seeds in lines manually and using seed drum as main plot treatments and eight N management practices in the sub plots. The experiment II consisted of the same main plot treatments with modified N management practices based on the results of the first experiment. Eventhough the seeding methods had no significant differences among them, the drum seeding recorded numerically higher grain yield and net return than manual sowing and transplanting leading to reduction in crop duration by one week. Application of neem cake blended urea and placement of urea solution at 100 percent recommended N level favourably influenced the growth and yield components. These treatments recorded significantly higher grain and straw yields than conventional split application. Application of 75 per cent recommended N as placement of urea solution and as gypsum and neem cake blended urea gave comparable effect with improved split application of 100 per cent recommended N and integrated application of green manure and urea each supplying 50 percent recommended N in respect of grain yields of rice. These treatments also showed increased net return and return per rupee invested compared to conventional split application of prilled urea.

KEY WORDS : Seeding methods, Drum seeder, Liquid urea applicator, Gypsum, Neem cake, Green manure.

In Tamil Nadu rice is cultivated over an area of 2.7 million ha with a production of 7.16 million tonnes. During 2000 AD the estimated production will be 8.9 million tonnes with 4.5 percent growth rate (Pillai, 1996). Cauvery delta zone is the potential area of traditional rice cultivation in Tamil Nadu due to the canal irrigation system of Cauvery river. This zone accounts for about 22.3 percent of the rice area and 25.3 per cent of rice production of the state. Hence it is named as "The Rice Bowl of Tamil Nadu".

In this zone, rice is cultivated in three distinct seasons viz., *Kuruvai* followed by thaladi (in double crop wetlands) and samba (in single crop wetlands). *Kuruvai* rice solely depends on the Cauvery river water from Mettur dam, whereas *thaladi* and *samba* rice utilises heavy monsoon