Most of the desirable grain yield attributes are found to be controlled by both additive and non-additive gene actions as indicated by the significant values. However, plant, height, panicle length, number of grains 100 grain weight and harvest index are predominantly governed by additive factors while tiller number, grain yield and straw yield are influenced mostly by non-additive factors. All the grain quality factors viz., length, width, and length-width ratio of grain are controlled by additive gene action predominantly. In such a situation, where there is predominance of non-additive components or influence of both addtive and non-additive components, simple pedigree selection method may not be adequate since it will not yield a desirable level of improvement. Probably this may be the reason for the slow progress in combining high yield and fine quality of grains.

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STUDIES ON COMBINING ABILITY FOR GRAIN PROTEIN AND LYSINE CONTENTS IN DURUM WHEAT*

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Combining ability study was carried out for protein and lysine contents in a diallel set of five durum wheat (*Triticum durum* Desf.) strains. General as well a specific combining ability variances were highly significant for both the traits. However, the magnitude of GCA variances was higher than that of SCA varinces fo both the characters reflecting the predominance of additive gene effects in the genetic control of these quality traits. The *per se* performance of the parents was associated with their GCA effects. The varieties, Raj 911 followed by MACS 9 were the good combiners for both protein and lysine contents. The cross Raj 911 X RCBD 8 could be exploited further for obtaining nutritionally high protein hybrids in durum wheat.

Little information is available on plant breeding approaches to evaluate nutritional quality of durum wheat (*Triticum durum* Desf.) With this, in view, combining ability for grain protein and lysine, an essential amino-acid, in a diallel cross of five varieties was undertaken.

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MATERIALS AND METHODS

Five genetically diverse strains of durum wheat viz. Raj 911, MACS 45, RCBD 78 (JS"S" / LD357E-TC'XG11 "S"Eg"S"), RCBD81 (Gediz = LD 357-TC'-AL"S") and MACS 9 were crossed in diallel fashion (excluding reciprocals) Ten hybrids alongwith their five parents were grown during *rabi*, 1978-79 in randomised block design with three replications at Rajasthan College of Agriculture, Udaipur. Parents and F_1s were planted in single row plots. Each row was four meter length with the sparing of 25 cm between rows and 10 cm between plants. Non-experimental rows were planted around the experiment to remove border effects. Fertilizers were applied at the rate of 100N+60 P+40K kg/ha under irrigated conditions.

Seeds of five competitive plants were bulked in each plot separately and used for chemical analysis. Protein content of grains was estimated by the standard micro-Kjeldahl method and expressed in percentage. Lysine content was determined as per the method given by Villegas and Merstz (1971) and expressed in gm amino acid/100 gm protein. The data were finally subjected to combining ability analysis using Method II and Model I of Griffing (1956).

RESULTS AND DISCUSSION

The results of combining ability Table 1 revealed that variances due to general and specific combining ability were highly significant for both the traits depicting importance of additive as well as non additive gene effects.

Table 1. Analysis of variance fo: combining ability for protein and lysine contents in durum wheat

Source	df	Protein	Lpnine
GCA	4	4.957**	0.078**
SCA	10	0.974**	0.011**
Error		0.312	0 002
GCA/SCA		5.089	7.090

** Significant at 1% level.

However, GCA/SCA ratio obviously indicated preponderance of additive variance for both the characters. Ram and Srivatsav (1975) and Mihaljev and Kovacev-Djolai (1978) also reported significant additive gene effects for protein content in bread wheat. Maloo and Kaul (1980) found the predominance of non-additive gene effects for protein content while additive gene effects for lysine content in durum wheat.

Table 2. Mean values and general combining ability effects of parents for protein and lysine contents in du.um wheat.

Parents	Protein		Lysine	
	Mean Value (per cent)	GCA effects	Mean value (gm. amino acid/100 gm protein)	GCA effects
Raj 911	15.91	1.06**	3.09	0.14
MACS 45	13.20	-0.26	2.80	0.01
RCBD 76	12.28	-0.74**	2.66	-0.08**
RCBD 81	11.22	-0.75**	2.62	-0.12**
MACS 9	15.19	0 71**	2.99	0.06**
S. E.± (gi)		0.17		0.01

** Significant at 1% level.

Mean values of parents and GCA effects are presented in Table 2. The parents Raj 911 followed by MACS 9 were best general combiners for both the characters and appeared to be promising for the nutritionl improvement of durums. The *per se* values of both the traits and GCA effects observed in this study, suggested that the average performance, preferably on the basis of multilocational trial could be used for obtaining some idea about the GCA effects of the varieties. This will save the screening of large array of cultivars.

Table 3: Specific combining ability effects of the crosses for protein and lysine contents in durnm wheat

Crosses	Protein	Lysine
Raj 911 x MACS 45	-0.65	-0.04
Raj 911 x RCBD 76	-1.22**	-0.03
Raj 911 x RCBD 81	2.03**	0.20**
Raj 911 x MACS 9	0.32	0.05
MACS 45 x RCBD 76	1.01*	0.17**
MACS 45 x RCBD 81	0.44	0.12**
MACS 45 x MACS 9	-0.22	0.00
RCBD 76 x RCBD 81	0.22	-0.12**
RCBD 76 x MACS 9	0.53	0.12**
RCBD 81 x MACS 9	-0.11	-0.12**
S. E. ± (sij)	0.47	0.03

*, ** Significant at 5% and 1% levels, respectively.

Estimates of SCA effects (Table 3) showed that two cross combinations for protein and four for lysine contant had significant positive SCA effects. The highest positive SCA for both the characters was shown by Raj 911 X RCBD 81, involving high and poor combinrng parents. Therefore, disirable transgressive segregates may be expected which can be utilized in the selection of superior pure-line varieties. For remaining crosses, significant SCA effects were associated with low x low gene effects reflecting a non-additive type of gene action. Hence, these cross combination are unpredictable.

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