Table 3. Morphological and grain quality characteristics of Cowpea culture DPI 1243

Characters	Description
Plant height (CM)	60
Duration (days)	85 – 90
Days to 50% flowering	52
No.of branches/plant	3.4
No.of clusters/plant	5.4
No.of pods/cluster	2.0
Pod length (cm)	15
No.of seeds/pod	16
100 -Seed weight (g)	9.9
Grain colour	Brick red
Protein (%)	24.6

superiority over the ruling strains. As a rainfed crop, it gave on an average a grain yield of 760 kg/ha, the increase in yield being 15.7 per cent over Co 3 and 14.1 per cent over C 152.

The morphological and grain quality of the culture DPI 1243 are presented in Table 3. The culture maturing in 85-90 days is highly tolerant to drought and moderately resistant to *Cercospora*, rust and mosaic under field conditions. Its grains with attractive colour are accepted by consumers and traders. Besides high grain yield, the culture also retains greenness till harvest with minimum shedding of leaves enhancing fodder value (493 Kg/ha/day). Its suitability for bund cropping in rice fields is an added advantage of this culture. The presence of inverted 'V' shaped white spot on leaflets helps to distinguish this culture from other cultivars.

Based on the above desirable features, the culture DPI 1243 was released by TNAU as Paiyur 1 during 1984 for general cultivation in dry tracts of Tamil Nadu.

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COMBINING ABILITY OF SOME QUANTITATIVE TRAITS IN TRITICALE

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ABSTRACT

A line x tester (6 x 3) analysis involving morphologically diverse females of triticale showed JNK6T-233 and JNIT-73 as best general combiners for the characters studied. Specific combining ability analysis represented the combinations of best x good (grain number/ear), good x average (ear number, grain weight/ear and grain yield), poor x average (days to maturity) and poor x poor (ear length) general combiners. The epistatic type of gene action appeared to be involved in the most of the cases.

KEY WORDS : Triticale, Combining ability

Combining ability analysis provided useful information on the nature of inheritance of quantitative characters and also helps in identifying the superior parents and the cross combinations likely to yield better progenies. The combining ability approach for line x tester analysis is used for classification of parental genotypes in terms of their hybrid performance and preferred where maternal effect, epistasis and non independent gene action are suspected. The present investigations were conducted in 6 x 3 line x tester set to study the general and specific combining ability and gene actions of desirable quantitative traits of triticale *Triticosecale* Wittmack)

MATERIALS AND METHODS

Six morphologically diverse females *viz.* UPT-78269, T.L. 419, JNIT-78, JNK6T-230 and JNK6T-233, three broad genetic base testers JNIT-67, JNK6T-231 and JNK6T-229 and their 18 hybrids were planted in a randomized block design with three replications at the J.N. Agriculture University, College of Agriculture farm, Indore, during winter 1981-82. Three meter long rows were spaced 23 cm apart, with a 10 cm distance between plants within a row. Observations were recorded on five randomly selected plants for plant height, peduncle length, number of ears/plant, ear length, number of spikelets/ear, number of grains/ear, grain weight/ear, grain yield/plant and 1,000 grain weight whereas days to maturity was determined on plot basis. Combining ability analysis was done using the procedure of Kempthorne (1957).

RESULTS AND DISCUSSION

There were significant differences among parents for all the characters under study except grain yield (Table 1). Since the parents were selected from the improved populations available for the breeding programme, the lack of genetic variability for grain yield in these parents was expected as also reported by Vela (1974).

The female parents showed significant variations for all the characters except number of ears per plant and grain yield. The mean squares for males were significant for days to maturity and plant height. Variations among crosses were significant for all characters, indicating genetic variability in parents. The differences between parents and crosses were significant for all characters except days to maturity. This indicated the presence of heterosis for all characters except days to maturity. The female x male interaction was significant for days to maturity, number of ears per plant, ear length, number of grains per ear, grain weight per ear and grain yield, which indicated significance of nonadditive genetic variance. The variance due to general combining ability was larger than that due to specific combining ability for plant height, peduncle length, ear length, number of spikelets per ear and 1000 grain

Table 1. Analysis of variance for yield and other characters of Triticale genotypes

Source of variation	d.f.	Days to maturity	Plant height	Peduncle length	No. of ears / plant	Ear length	No. of spikelets / ear	No. of grains / ear	1000 grain weight	Grain weight / ear	Grain yield / plant
Replic-ations	2	4.23	200.14**	32.46**	10.01**	0.61	1.89	405.47**	24.26**	0.35**	75.69**
Parents	8	22.50**	866.81**	16.70**	3.36**	9.67**	42.00**	150.39**	43.73**	0.73**	5.28
Hybrids	17	22.27**	499.64**	15.04*	1.93**	7.97**	28.07**	146.12**	40.13**	0.53**	20.51**
ParentsVs Hybrids	1	3.23	336.30**	160.60**	10.11**	7.30**	11.15**	288.00**	415.36**	3.54**	278.22**
Males	2	29.46*	84.55**	1.97	3.66	1.98	5.75	70.83	13.18	0.04	3.94
Females	5	49.75**	1651.24**	45.53**	9.98	25.20**	88.76**	285.46	119.58**	1.41**	22.98
Female x Male	10	7.08**	6.86	2.42	2.07**	0.56**	2.20	91.50*	5.79	0.18*	22.59**
Error	52	1.47	14.06	4.11	0.56	0.25	1.25	35.91	5.35	0.07	3.82
σ^2 GCA		0.23	14.77	0.38	-0.004	0.22	0.78	1.64	1.03	0.01	0.14
σ^2 SCA		1.87	-2.40	-0.57	0.50	0.10	0.32	18.53	0.15	0.04	6.26
σ^2 GCA / σ^2 SCA		0.12	-	-	-0.01	2.16	2.48	0.09	7.10	0.26	0.02

*, ** Significant at 5 and 1 percent levels respectively

weight which indicated that additive genetic variance was consistently predominant for these traits. For the remaining characters, nonadditive genetic variance was important, because variation due to the specific combining ability was predominant for these characters (Table 2).

Among females, JNK6T-233 was the best general combiner for most of the characters *viz.* days to maturity, peduncle length, number of spikelets per ear, 1000 grain weight, grain weight per ear and grain yield per plant. The other superior general combiner was JNIT-73 for number of ears per plant, ear length and number of grains per ear, whereas UPT-78269 was found to be poor general combiner for most of the characters including grain yield. The male parents failed to show significant combining ability effects for almost all the characters including grain yield (Table 2).

The F_1 crosses had significant *sca* effects for most of the characters as days to maturity, number of ears per plant, ear length, number of grains per ear, grain weight per ear and grain yield per plant (Table 3). The cross combinations that showed significant *sca* effects wer different for different characters except fe combinations such as JNIT-73 x JNIT-6 which was best for days to maturity an number of grains per ear, JNIT-73 JNK6T-231 which was good for number c ears per plant, ear length and grain yield pe plant and JNIT-78 x JNIT-67 which wa desirable for grain yield, besides number c ears per plant, number of grains per ear an grain weight per ear. The best cross a regards high *sca* effects represented th combinations of best x good (grain numbe per ear), good x average (ear number, grai weight per ear and grain yield), poor x average (days to maturity) and poor x poo (ear length) general combiners. The hig *sca* effects in such crosses appeared to b due to complementary gene interaction. I none of the cases best general combiner resulted in highest *sca* effects which shov that high *gca* effects of parents nev guarantees high *sca* effects in the crosse

The results of the study have som bearing on the breeding methodology to b followed in triticale. Triticale to a grea extent behaves as self pollinated crop. Fo

Table 2. General combining ability effects for grain yield and other characters.

Parents	Days to maturity	Plant height	Peduncle length	No. of ears / plant	Ear length	No. of spikelets / ear	No. of grains / ear	1000 grain weight	Grain weight / ear	Grain yield / plant
Females										
UPT-78269	-0.31	-17.79**	-3.21**	0.31	-1.38**	-2.56**	-3.82**	-5.14**	-0.53**	-1.94
TL-419	-0.20	-8.44**	-0.23**	0.07	-1.09**	-1.89**	-6.97**	0.18	-0.30**	-1.50
JNIT-73	4.58**	6.41**	0.12	0.44	2.73**	3.84**	5.25**	-2.07	0.14	1.11
JNIT-78	-0.87*	-3.77**	0.91	-0.37	-1.13**	-2.29**	5.21**	0.10	0.26**	0.77
JNK6T-230	-0.98**	1.90**	-1.17	-0.16	-0.51**	-1.28**	-4.35*	1.04	-0.13	-0.58
JNK6T-233	-2.20**	21.70**	3.57**	-0.29	1.38**	4.19**	4.67*	5.89**	0.56**	2.15
Males										
JNIT-67	0.08	-1.94*	0.05	-0.52**	-0.38**	-0.45	1.76	-0.85	0.03	-0.54
JNK6T-231	-1.31**	2.34**	0.30	0.24	0.13	-0.19	-2.15	0.86	-0.05	0.33
JNK6T-229	1.24**	-0.40	-0.35	0.28	0.35**	0.64*	0.39	-0.01	0.03	0.21
S.E. Females (±)	0.40	1.25	0.68	0.25	0.16	0.37	2.00	0.77	0.09	0.65
S.E. Males (±)	0.29	0.88	0.48	0.18	0.17	0.26	1.41	0.55	0.06	0.46

*, ** Significant at 5 and 1 percent levels respectively

Table 3. Specific combining ability effects of the crosses for grain yield and other characters.

Parents	Days to maturity	Plant height	Peduncle length	No. of ears / plant	Ear length	No. of spikelets / ear	No. of grains / ear	1000 grain weight	Grain weight / ear	Grain yield / plant
UPT-78269 x JNIT-67	1.15	-0.44	0.21	-0.66	0.001	-0.22	-0.99	-0.64	-0.17	-1.07
TL-419 x JNIT-67	0.04	0.80	0.90	0.19	0.11	0.45	-1.30	0.11	-0.02	-0.05
JNIT-73 x JNIT-67	-3.08**	0.29	-1.05	-0.92*	-0.84*	-1.55*	10.05**	1.29	-0.35*	-4.20**
JNIT-78 x JNIT-67	2.04**	1.07	-0.34	0.98*	0.42	1.00	8.52*	-0.29	0.34*	3.05**
JNK6T-230 x JNIT-67	-0.19	-0.13	-1.03	0.61	0.87**	0.09	3.35	-0.95	0.08	2.03
JNK6T-233 x JNIT-67	0.04	-1.60	-1.30	-0.19	0.11	0.23	0.46	0.47	0.11	0.24
UPT-78269 x JNK6T-231	-0.13	1.35	-0.57	0.05	0.09	0.59	0.53	-0.69	0.02	-0.47
TL-419 x JNK6T-231	0.09	0.73	-0.61	-0.11	-0.13	0.05	0.15	1.40	0.07	-0.06
JNIT-73 x JNKT-231	1.31	-0.05	0.50	1.51**	0.71*	1.12	6.39	-0.62	0.62	4.95**
JNIT-78 x JNK6T-231	-0.91	-2.34	0.38	-0.94**	-0.48	0.76	-6.76*	-0.80	-0.34*	-3.43**
JNK6T-230 x JNK6T-231	-0.46	0.79	0.65	-0.49	0.02	-0.57	0.13	1.94	0.15	-0.36
JNK6T-233 x JNK6T-231	0.09	-0.47	-0.35	-0.02	-0.20	-0.14	-0.43	-1.17	0.16	-0.63
UPT-78269 x JNK6T-229	1.54**	-0.91	0.35	0.26	-0.09	-0.37	0.46	1.33	0.14	1.54
TL-419 x JNK6T-229	2.43**	-1.53	-0.99	-0.68	0.02	-0.50	1.15	-1.52	0.05	0.11
JNIT-73 x JNK6T-229	4.31**	-0.68	0.55	-0.94*	0.13	-0.43	3.66	-0.77	0.09	-0.74
JNIT-78 x JNK6T-229	1.43*	1.27	-0.04	-0.39	0.06	-0.25	-1.76	1.08	-0.01	0.38
JNK6T-230 x JNK6T-229	3.30**	-0.66	0.38	-0.47	-0.22	0.48	-3.47	0.99	-0.23	-1.67
JNK6T-233 x JNK6T-229	2.43**	2.07	0.96	-0.14	0.09	0.21	-0.03	0.77	0.05	0.40
S.E. (±)	0.69	2.17	1.17	0.43	0.29	0.64	3.46	1.34	0.15	1.23

*, ** Significant at 5 and 1 percent levels respectively

the improvement of characters which exhibited predominant additive genetic variance, simple selection procedure would be effective. Reddy (1976) and Chowdhury and Singh (1978) also reported predominant additive gene action for most of the characters in Triticale. Certain characters including grain yield showed predominant additive gene action for most of the characters in Triticale certain characters including grain yield showed pre and over dominance of non additive genetic variance which could be exploited through a hybrid breeding programme. Chowdhury and Singh (1978) also reported the importance of nonadditive gene action for ear number and grain yield in Triticale.

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