Table 3. Correlation coefficients for various physiological and yield determining characters in pigeonpea cv ICPL 288 subjected to water and light stresses and PGR treatment

Character	Control (Non-stress)	Water stress	Light stress
Total dry matter production m^{-2}	0.8444**	0.8042**	0.6714*
No. of flowers formed pl^{-1}	0.1828	0.1901	0.2849
No. of flowers shed pl^{-1}	-0.7624*	-0.8146**	-0.8041**
% of flower shedding	-0.6933*	-0.6815*	-0.6876*
No. of pods m^{-2}	0.8712**	0.8349**	0.8766**
Number of seeds pod^{-1}	0.6866*	0.6953*	0.6782*
100-seed weight	0.6853*	0.6955*	0.6581

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

partitioning to reproductive parts is decreased resulting low seed weight. In addition, the number of flowers formed had no significant correlation, however the number of flowers shed was found to have strong negative relationship with water and light stress conditions and negative correlation with seed yield under nonstressed conditions. From the foregoing discussion it is suggested that increased seed yield interms of increased pod number and weight and decreased seed yield due to increased pod number and weight and decreased seed yield due to increased shedding of flowers especially under stress conditions. Hence the foliar application of NAA (20 ppm) which can enhance the number of pods with concomitant decrease of flower shedding is the most effective in enhancing the yield of pigeonpea.

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COMBINING ABILITY FOR GRAIN TRAITS IN RICE

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ABSTRACT

Combining ability studies in rice for grain traits revealed additive gene action for 100 grain weight, grain length, breadth and thickness. Based on the *per se* performance and *gca* effects, ADT 39 and Improved White Ponni were the best parents for improvement of grain traits besides grain yield. ADT 39/Pusa Basmati 1 and Improved White Ponni/Pusa Basmati 1 are suitable for recombination breeding, while IR 50/Pusa Basmati 1 may be exploited for heterosis breeding.

KEY WORDS : Rice, grain quality, combining ability

For a systematic breeding programme, it is essential to identify the parents and crosses for further genetic improvement. Combining ability of the parents gives useful genetic information regarding the selection of parents in terms of the performance of their hybrids. Eventhough many studies have been made on the combining abi for yield and component traits in rice, informa on the combining ability for grain traits is limit Hence, an attempt was made to study combining ability of grain characters through l x Tester analysis.

Table 1. Analysis of variance for combining ability

Source of variance	df	Mean square					
		100 grain weight	Grain length	Grain breadth	Grain thickness	Hulling percentage	Grain yield
Replication	2	0.003	0.001	0.001	0.31	8.28	
Line (L)	4	0.24**	1.54**	0.225**	0.031**	[illegible]	221.82**
Tester (T)	2	0.27**	0.32**	0.025**	0.018**	0.80	218.65**
L x T	8	0.004	0.06**	0.005**	0.002	2.59**	80.46**
Error	44	0.003	0.001	0.001	0.001	0.39	6.13
σ^2 GCA		0.021	0.073	0.010	0.002	0.046	11.65
σ^2 SCA		0.001	0.018	0.002	0.0003	0.732	24.78
σ^2 GCA/ σ^2 SCA		21.00	4.056	5.00	6.667	0.063	0.47

* Significant at 1% level.

MATERIALS AND METHODS

Five high yielding cosmopolitan rice varieties *viz.*, TKM 9, ADT 37, ADT 39, IR 50 and Improved White Ponni (Lines) were crossed with three improved Basmati varieties *viz.*, ADT 41, Pusa Basmati 1 and Kasturi (Testers). The resultant 15 hybrids along with 8 parents were raised during late *Thaladi* season (Oct 91 - Feb 92) at Tamil Nadu Rice Research Institute, Aduthurai in randomised in two rows of 3 m length adopting a spacing of 30 x 20 cm. Observations were recorded on ten randomly selected plants per replication both in parents and in hybrids for 100 grain weight, grain length, breadth, thickness, hulling percentage and grain yield. Analysis for combining ability was done as per Kempthorne (1957).

RESULTS AND DISCUSSION

The variances due to lines and testers were significant for all the characters except for hulling percentage in testers. The interaction effects between lines and testers were significant for grain length, grain breadth, hulling percentage and grain yield. The variances due to GCA were of greater in magnitude than SCA for 100 grain weight, grain length, grain breadth and grain thickness indicating additive gene action for these characters (Table 1). Additive gene effect for grain length and grain width was reported by Murai and Kinoshita (1986) and Kato (1989). Preponderance of non-additive gene action for 100 grain weight was reported by Lokaprakash *et al.* (1991).

High mean value was the main criterion among the breeders for a long time. Gilbert (1958) suggested that parents with good *per se* performance would result in better genotypes. Further, the parents having high *gca* effects could be useful since the *gca* effect is due to additive gene action and is fixable. Hence, the parents were evaluated based on *per se* performance and *gca* effects (Table 2).

Table 2. Mean performance and general combining ability effects for grain traits

Parent	100 grain weight (g)		Grain length (mm)		Grain breadth (mm)		Grain thickness (mm)		Hulling %		Grain yield (g)	
	mean	*gca*	mean	gca	mean	gca	mean	gca	mean	gca	mean	gca
Line												
TKM9	2.40	0.25*	5.57	-0.04*	2.60	0.12*	1.83	0.07*	76.7*	-0.54*	23.9	-5.61*
ADT37	1.89*	0.01	4.57	-0.52*	2.50	0.21*	1.77	0.06*	77.4*	-0.13	26.3	-2.23*
ADT39	1.67*	-0.09*	5.39	-0.05*	2.07	-0.05*	1.52*	-0.05*	78.7*	1.03*	37.5*	4.69*
IR50	2.12	0.03	5.80	0.64*	1.90*	-0.16*	1.63	-0.03*	76.6*	-0.30	29.1	-2.62*
I.W.Ponni @	1.57*	-0.19*	5.27	-0.04*	1.87*	-0.11*	1.49*	-0.05*	73.4	-0.06	32.4*	5.77*
SE		0.02		0.01		0.01		0.01		0.21		0.83
Tester												
ADT41	2.45	0.13*	7.50*	0.16*	1.80*	-0.003	1.66	0.02*	71.1	-0.14	25.7	4.39*
P.B.1	1.88*	-0.14*	6.50*	-0.13*	1.70*	-0.04*	1.60	-0.04*	73.4	-0.12	25.4	-2.51*
Kasturi	2.00	0.02	7.20*	-0.04*	1.60*	0.04*	1.58*	-0.02*	71.6	0.27	14.9	-1.88*
SE	0.04	0.01	0.07	0.01	0.03	0.01	0.02	0.01	0.5	0.16	2.0	0.64

* Significant at 1% level ; @ Improved White Ponni ; PB1 Pusa Basmati 1

Among the lines studied, ADT 39 and Improved White Ponni recorded significantly desirable performance for 100 grain weight, grain thickness and grain yield. Further ADT 39 possessed high mean value for hulling percentage while Improved White Ponni for kernel breadth. Among the testers, Pusa Basmati 1 and Kasturi had desirable mean performance for grain length and grain breadth. Further Pusa Basmati 1 possessed desirable mean value for 100 grain weight while kasturi for grain thickness. The *gca* effects of the lines ADT 39 and Improved White Ponni were in high order for the traits 100 grain weight, grain breadth, grain thickness and grain yield. Further ADT 39 had high *gca* effect for hulling percentage. Among the testers Pusa Basmati 1 alone had desirable *gca* effects for grain length, breadth and thickness.

Considering the *per se* performance and *gca* effects, ADT 39 and Improved White Ponni were the best parents for four traits. Similarlty, Pusa Basmati 1 was the next best for 100 grain weight and grain breadth. Therefore, crosses involving ADT 39, Improved White Ponni and Pusa Basmati 1 would result in identification of superior segregants with favourable genes for the grain traits besides grain yield.

Hybrids for recombination breeding

The criterion for the selection of hybrids f recombination breeding is that the parents shou have significant *gca* effects and the hybrids wi non-significant *sca* effects. Based on this, t hybrids were evaluated (Table 3). The parents AD 39, Improved White Ponni and Pusa Basmati possessed favourable and significant *gca* effects f 100 grain weight, grain breadth and thickness an the resultant hybrids involving these parents ha non-significant *sca* effects.

Exploitation of hybrids for heterosis breedin is best judged by mean performance, *sca* effec and magnitude of heterosis. Evaluation of hybri on the above basis revealed no similarity in t identification of best hybrids (Table 4). High *s* effects may not be the appropriate choice f heterosis exploitation because hybrid with lo mean value may also possess high *sca* effects, if t *gca* effects of the parents were very low or even negative. Further more, heterosis value alone may also mislead the identity of superior hybrid because heterosis of the hybrids tend to be high when the parental means are low and *vice versa*. The mean performance being the actual realised value, but the *sca* effects and heterosis being estimates, the former should be given preference. Based on the

Table 3. Promising hybrids for recombinatiohs breeding

Character	Parent	*gca* effect	Cross	*sca* effect	Selected hybrid
100 grain	ADT 39	-0.09*	ADT 39/P B 1	-0.04	ADT 39/P B 1
weight	I W Ponni	-0.19*	I W Ponni/P B 1	0.02	I W Ponni/ P B 1
	P B 1	-0.14*			
Grain length	IR 50	0.64*	IR 50/ADT 41	0.04	IR 50/ADT 41
	ADT 41	0.16*			
Grain breadth	ADT 39	-0.05*	ADT 39/P B 1	-0.02	ADT 39/P B 1
	IR 50	-0.16*	IR 50/P B 1	0.01	IR 50/P B 1
	IW Ponni	-0.11*	I W Ponni/P B 1	-0.002	I W Ponni/P B 1
	P B 1	-0.04*			
Grain thick-	ADT 39	-0.05*	ADT 39/ P B 1	-0.002	ADT 39/P B 1
ness	IR 50	-0.03*	ADT 39/Kasturi	0.004	ADT 39/Kasturi
	I W Ponni	-0.05*	IR 50/P B 1	-0.02	IR 50/P B 1
	P B 1	-0.04*	IR 50/Kasturi	0.02	IR 50/Kasturi
	Kasturi	-0.02*	I W Ponni / P B 1	0.01	I W Ponni/P B 1
			I W Ponni/Kasturi	-0.04*	-
Hulling	ADT 39	1.03*	-	-	-
Grain yield	ADT 39	4.69*	ADT 39/ADT 41	-1.94	ADT 39/ADT 41
	I W Ponni	5.67*	I W Ponni/ADT 41	-3.28*	
	ADT 41	4.39*			

* Significant at 5% level ; I W Ponni : Improved White Ponni ; P B 1 : Pusa Basmati 1

able 4. Hybrids identified based on mean performance, *sca* effects and heterosis

Mean performance	*sca* effects	heterosis
ADT 39/ADT 41 (3)	TKM 9/Pusa Basmati 1 (4)	TKM 9/ADT 41 (4)
ADT 39/Pusa Basmati 1 (3)	ADT 37/Kasturi (3)	TKM 9/Pusa Basmati 1 (5)
R 50/Pusa Basmati 1 (4)		ADT 39/Pusa Basmati 1 (3)
W Ponni/ADT 41 (3)		IR 50/ADT 41 (3)
W Ponni/Pusa Basmati 1 (4)		IR 50/Pusa Basmati 1 (3)
W Ponni/Kasturi (3)		IR 50/Kasturi (3)
		I W Ponni/Pusa Basmati 1 (3)

igures in paranthesis indicate suitability of hybrids for number of characters ; I W Ponni : Improved White Ponni

bove, IR 50/Pusa Basmati 1 and Improved White onni/Pusa Basmati 1 are the two hybrids identified r heterosis breeding which combine grain traits d grain yield.

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WATER RETENTION CHARACTERISTICS OF SOME IMPORTANT SOIL GROUPS OF KAMARAJAR DISTRICT, TAMIL NADU

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ABSTRACT

Water retention characteristics of soils representing soil subgroups Typic Chromusterts, Typic Ustropept, Udic Haplustalf, Typic Haplustalf, Vertic Haplustalf and Typic Ustorthent in Kamarajar district of Tamil Nadu were evaluated and the influence of clay, total porosity, exchangeable sodium percentage, CEC, organic carbon, electrical conductivity and aggregate stability were studied. The results indicated that clay content in the soil is the major contributing factor to variations in water retention characteristics, to the extent of 83 to 91 per cent.

KEY WORDS : Water retention characteristics, soil subgroups

The amount of water retained in the soil is a function of matrix suction. Pore size distribution dominates water retention in low tension ranges of 0. to 1 bar, but the pore-space system itself is dependent on soil structure and bulk density. Clay plays a major role in influencing water retention (Lal, 1979) and the water retained at any tension from 0.33 to 15 bar depends on the type of clay. The present study was undertaken during 1991 to evaluate the pattern of water retention in relation to total porosity, exchangeable sodium percentage (ESP), cation exchange capacity (CEC), organic carbon (OC), electrical conductivity (EC) and aggregate stability (AS) in soil, and to examine the extent of quantifiable relationship between the above parameters and the water retension at field capacity (33 kpa) and wilting coefficient (1500 kPa).

MATERIALS AND METHODS

Twenty one profiles representing the soil subgroups (1) Typic Chromustert, (Tcsv), Typic Ustropept (Tutp), 3) Udic Haplustalf (Unsf), 4) Typic Haplustalf (Thef), 5) Vertic Haplustalf (Vhsf) and 6) Typic Ustorthent (Tuot) in Kamarajar district of Tamil Nadu were exposed. A total of 42 bulk soil samples from the first 2 natural horizons