

and late sowings, when compared to normal date of sowing. During the third year NI 8796 and NI 8841, gave more grain yield over other varieties under normal sowing, whereas under late sown conditions the variety HI 977 significantly produced more grain yield over other varieties tested. The superiority of the above mentioned varieties under dates of sowing may be due to the production of higher ear number and number of grains/earhead. In addition, the better performance of certain varieties under early and late conditions may be due to better adaptability to higher mean temperatures during different growth periods.

It is concluded that the optimum time of sowing of wheat in Tamil Nadu is between November 5th and 11th and the varieties suitable

for different dates of sowings are (i) early - APAU 1577 and HD 4502; (ii) Normal - DWR 39, APAU 1577, NI 8796 and NI 8841; (iii) Late - DWR 39, NI 8818 and HI 977.

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LINE X TESTER ANALYSIS FOR SEEDLING CHARACTERS IN COTTON (*Gossypium hirsutum* L.)

P.NAGARAJAN, M.KADAMBAVANASUNDARAM and S.R.SREE RANGASAMY

School of Genetics, Tamil Nadu Agricultural University, Coimbatore.

ABSTRACT

A line x tester analysis involving 7 lines and 4 testers of upland cotton was carried out to estimate combining ability for seed in the germination, root length, shoot length and vigour index during winter 1989. The parent TCH 65/8 (Sparsely fuzzed) was found to be a good combiner for all the characters studied. Both additive and non-additive genetic effects were operative in the inheritance of these traits.

The studies on combining ability help the breeders in devising efficient methodology for effecting genetic improvement in any crop. The present investigation was carried out to gather information on the combining ability and genetic constitution of four seedling characters through a line x tester analysis involving seven lines and four testers of *G. hirsutum* cotton.

MATERIALS AND METHODS

Seven lines, TCH 63/1, TCH 63/4, TCH 104/1, TCH 65/8, TCH 96/6, TCH 70/7 and TCH 89/7 differing in fuzziness (Hutchinson and Ramiah, 1938) were used as ovule parents. They were crossed with testers, MCU 5, MCU 7, MCU 9 and LRA 5166 as pollinators in a line X testers fashion (Kempthorne 1957). Representative seed samples were drawn from five plants each of the parents and the crossed seeds of all the 28, line x tester

combinations. Germination test was conducted as per the procedures of ISTA (Anon., 1985), with ten seeds from each sample of the parents and crossed seeds. The germination and other seedling studies were repeated three times from separate sample. For seedling study, five seedlings from each sample were taken from the germination tests. The length from the collar region to the tip of the seedling in centimetres as shoot length and the length from the collar region to the tip of the root in centimetres as root length were measured in each seedling. And for the calculation of vigour index, the following formula was used (Abdul Baki and Anderson, 1972).

$V_1 = \text{germination \%} \times \text{Total mean length of seedling.}$

RESULTS AND DISCUSSION

The analysis of variance of combining ability revealed that variance due to sca as well as gca were highly significant for all the seedling

Table 1. General combining ability effects of parents for different seedling characters.

Parents	Characters			
	Germination %	Root length	Shoot length	Vigour index
Lines				
TCH 63/1	0.73	-0.84*	0.09	107.20*
TCH 63.4	-2.59*	-0.90*	-0.56*	-181.88*
TCH 104/1	0.02	0.27	-0.11	-10.05
TCH 65.8	2.38*	7.14*	0.63*	101.89*
TCH 96/6	-0.50	0.46*	-0.16	10.44
TCH 70/7	0.64	1.37*	-0.01	188.92*
TCH 89/7	-0.68	-0.36	0.12	216.53*
Testers				
MCU 5	2.00*	-0.44*	0.14	-23.41
MCU 7	-1.22*	0.63*	-0.16	69.47*
MCU 9	0.23	-0.96*	-0.27*	-83.95*
LRA 5166	-1.00*	0.77*	0.28*	37.90
SE (Lines)	0.20	0.15	0.12	22.51
SE (Testers)	0.21	0.11	0.09	17.01

characters suggesting that additive as well as non-additive gene actions were important in determining these characters. The estimates of general combining ability effects of parents (lines x testers) and sca effects of their 28 hybrids are presented in Tables 1 and 2 respectively.

For germination, significant and positive gca effects were recorded by the line TCH 65/8 and among testers by MCU.5. Seven out of 28 crosses recorded significant and positive sca effects for germination. The hybrid MCU 9 x TCH 63/1 recorded the maximum positively significant sca effects of 6.59, which involves parents with low gca, indicating additive x additive gene interaction. The parents MCU 5 and TCH 65/8 with positively significant gca effects produced a hybrid with negatively significant sca effects. This might be due to non-additive gene effects.

TCH 65/8, TCH 96/6 and TCH 70/7 among lines and MCU 7, LRA 5166 among testers recorded positively significant gca effects for root length. Four out of 28 crosses recorded significant and positive sca effects. The cross MCU 5 x TCH 65/8 which showed a positive sca effects. The cross MCU 5 x TCH 65/8 which showed a positive and

Table 2. Specific combining ability effects of hybrids for seedling characters.

Crosses	Germination %	Root length	Shoot length	Vigour index
MCU 5 x TCH 63/1	-8.16*	-0.60	-1.14*	196.21*
MCU 5 x TCH 63/4	2.49*	-0.70	-1.58*	-196.35*
MCU 5 x TCH 104/1	-1.56	0.16	-0.34	123.16
MCU 5 x TCH 65/8	-1.86*	0.18	1.13*	-129.72*
MCU 5 x TCH 96/6	0.64	0.53	0.68*	351.87*
MCU 5 x TCH 70/7	4.84*	-0.60	0.60	-327.21*
MCU 5 x TCH 89/7	3.62*	2.39*	0.64	17.97
MCU 7 x TCH 63/1	1.28	0.04	-0.94*	66.27
MCU 7 x TCH 63/4	0.20	-0.14	-0.48	-212.76*
MCU 7 x TCH 104/1	-1.59	0.63	0.73*	196.42*
MCU 7 x TCH 65/8	0.98	1.59*	1.93*	258.47*
MCU 7 x TCH 96/6	-0.01	-0.20	0.11	-42.48
MCU 7 x TCH 70/7	0.30	-0.34	-0.27	-166.75*
MCU 7 x TCH 89/7	-1.15	-1.58	-0.09	-99.18
MCU 9 x TCH 63/1	6.59*	2.10*	1.21	-171.81*
MCU 9 x TCH 63/4	-4.48*	-0.51	-0.23	-17.76
MCU 9 x TCH 104/1	0.12	0.25	0.15	-191.16*
MCU 9 x TCH 65/8	-2.27*	-1.35*	-2.15	-62.87
MCU 9 x TCH 96/6	1.25	-0.68	0.46	-310.19*
MCU 9 x TCH 70/7	-2.17*	0.35	-0.82*	565.07*
MCU 9 x TCH 89/7	0.96	-0.15	1.39*	153.21*
LRA 5166 x TCH 63/1	0.30	-0.54	0.86*	-90.66
LRA 5166 x TCH 63/4	1.80	1.35*	2.28*	391.35*
LRA 5166 x TCH 104/1	3.03*	-1.05*	-0.54	-128.41*
LRA 5166 x TCH 65/8	3.15*	-0.05	-0.91*	-65.87
LRA 5166 x TCH 96/6	-1.88*	0.35	-1.26*	0.80
LRA 5166 x TCH 70/7	-2.97*	-0.59	0.46	-71.11
LRA 5166 x TCH 89/7	-3.42	-0.65	-0.93*	-36.07
SE	0.57	0.29	0.23	45.01

* Significant at P = 0.05

significant sca effects, in which, both the parents have recorded the positive and significant gca effects: and in the cross LRA 5166 x TCH 63/4 recorded the positive sca effects, in which, at least one of the parents is a good combiner, indicating

additive gene action. The hybrid MCU 5 x TCH 63/1 recorded negatively significant sca effects, in which both the parents involved are poor combiners, indicating non-additiveness for this character.

For shoot length, TCH 65/8 among lines and among testers LRA 5166 recorded significant and positive gca effects. Seven out of 28 crosses recorded significant and positive sca effects, in which atleast one of the parents was a good combiner indicating additive gene action. The maximum sca effects of 2.28 was recorded by the cross LRA 5166 x TCH 63/4 in which one of the parents is a good combiner. In other crosses recording positive sca effects involved parents which are poor combiners indicating non-additive gene action.

For vigour index TCH 63/7, TCH 65/8, TCH 70/7 and TCH 89/7 among lines and among testers MCU 7 recorded positively significant gca effects. Seven crosses recorded positively significant sca effects in which the parents involved are high x high, poor x high combiners and the maximum sca effect of 565.07 was recorded by the cross MCU 9 x TCH 70/7 in which atleast one of the parents is a good combiner. Hence additive and non-additive gene action is prevalent as for as vigour index is combined.

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PHYSICO-CHEMICAL AND COOKING QUALITY OF SOME RELEASED AND PROMISING UPLAND RICE VARIETIES

S.S.THORAT, A.R.SAIKH, and B.D.JADHAV

Department of Food Science and Technology, College of Agricultural University, Parbhani.

ABSTRACT

It was observed that there were significant differences for most of the physical parameters of paddy and rice. The appearance of all the varieties was translucent except kalinga-2 and shape of all the varieties was medium to slender. The proximate composition indicated that the protein and crude fat content of brown rice was in the range of 8.29 to 9.86 and 2 to 3.92 per cent respectively for all the rice cultivars. The water uptake of variety Ambemohar L. was higher and significant over all the varieties and the per cent volume increase was the highest for kalinga-2 followed by RHR- 1, Prabhavati and MAU-Sci-9. The swelling number for all the varieties was in the range of 2.44 to 3.29.

India is one of the leading rice (*oryza sativa* L.) producing countries in the world with total production of 10.19 MMT (Anonymous, 1988). The market price and the consumers acceptability of the newly released rice varieties are largely dependent on the quality of the grains. Many reports are available on the chemical composition

Based on gca effects (Table-1), the sparsely fuzzed line TCH 65/8 was found to be the good combiner for all the characters studied. But none of the testers was a good combiner. In fact, the high combiners for root length were high combiner for vigour index while high combiner for vigour index were high combiners for root length. This is possibly due to positive association between root length and vigour index. The intermating population involving all possible crosses among these genotypes and simultaneously subjected to biparental mating in early generations will offer maximum promise in breeding varieties with better seedlings characters and high vigour index. Further, only a few crosses had high sca effects for seedling characters. Thus there is little scope for exploitation of heterosis for any of these parameters.

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and cooking quality of several Indian rice varieties (Singh *et al.*, 1977). In the present study efforts were made to study some of the physico-chemical and cooking qualities of some released and promising rice varieties suitable for upland irrigated conditions on black soils.