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Table 1: List of rice genotypes and their pedigree

S. No.	Genotypes	Pedigree
1.	Dhanya Lakshmi (BPT 1235)	Sabarmati/W 12703
2	Samba Mahsuri (BPT 5204)	GEB 24/TN1/Mahsuri
3	Erramallelu (WGL 20471)	BC 5/W 12708
4	GEB 24	Spontaneous mutant
5	Polasa Prabha (JGL 384)	BPT 5204/Kavya
6	Jagityala Sannalu (JGL 1798)	BPT 5204/Kavya
7	Kasturi	Basmati 470/CRR 88-17-1-5
8	Vijetha (MTU 1001)	Vajram / MTU 7014
9	Cotton Dora Sannalu(MTU 1010)	IR 64/Krishnaveni
10	Chaitanya (MTU 2067)	Sowbhagya / ARC 5984
11	MTU 2716	Vijaya / Mahsuri
12	Prabhat (MTU 3626)	IR 8 / MTU 3
13	Deepti (MTU 4870)	Sowbhagya / ARC 6650
14	Vasundhara	Phalguna / IET 6858
15	Pratibha (MTU 5293)	Sowbhagya / ARC 6650
16	Vajram (MTU 5249)	Sowbhagya / ARC 6650
17	Swarna (MTU 7029)	Vasishta / Mahsuri
18	Godavari (MTU 1032)	Krishnaveni / CR 316-639
19	Swarna Mukhi (NLR 145)	CICAG/IR 625-23-3-1/Tetep
20	PR 103	IR-8/IR 127-2-2
21	PR 106	IR 8 / PETA 5 / Bellapatna
22	Tarori Basmati	Pure line selection from local Basmati
23	Varalu (WGL 14377)	Erramallelu / CR 544-1-2
24	Kavya (WGL 48684)	WGL 27120 /// WGL 17672 / Mahsuri // Surekha
25	Triguna	Swarnadhan / RP 1579-38

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LIST OF ABBREVIATIONS AND SYMBOLS

%	Per cent
$\overline{X}$	Grand mean
ANOVA	Analysis of variance
b_i	Regression coefficient
CD	Critical difference
cm	Centimeters
CV	Coefficient of variation
DAS	Days after sowing
d.f.	Degrees of freedom
et. al.	Co-workers
E-I	Environment-I
E-II	Environment-II
E-III	Environment-III
E-IV	Environment-IV
g	Grams
GA	Genetic advance
GCV	Genotypic coefficient of variation
GAM	Genetic Advance as per cent over Mean
$H^2(b)$	Heritability in broad sense
Kg	Kilogram
mm	Millimeters
M^2	Square meter
PCV	Phenotypic coefficient of variation
RBD	Randomized Block Design
$\overline{S}^2d$	Deviation from regression
Viz.,	Namely

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Date : ***(B.S. Kumar Raja)***

ABSTRACT

Author	:	**B.S.KUMAR RAJA**
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The present investigation on “Stability analysis in rice genotypes” was carried out during 2003-04 at Agricultural Research Station, Maruteru to study the variability, heritability, genetic advance, character association and stability analysis, among 25 genotypes of rice in four environments (E-I = sowing on 10th July, 2003; E-II = sowing on 20th July, 2003; E-III = sowing on 10th December, 2003 and E-IV = sowing on 20th December, 2003).

The analysis of variance indicated significant differences among the genotypes for all the characters. Estimates of heritability and genetic advance revealed that, plant height at 65 DAS, plant height at harvest, test weight, biomass, L/B ratio (grain), L/B ratio (kernel) and protein content recorded high heritability coupled with high genetic advance. The trait milling per cent exhibited moderate heritability with low genetic advance and head rice recovery per cent exhibited high heritability with low genetic advance.

Correlation studies revealed that grain yield had significant positive association with biomass, days to 50 per cent flowering and harvest index. It suggests that selection for any of these characters will result in improvement of yield. The quality characters protein content and grain elongation ratio exhibited non-significant association with grain yield indicating independent nature of these characters.

The pooled analysis of variance for stability showed significant differences among the genotypes for all the characters. The genotype-environment interaction showed a high significance for all the characters except productive tillers/plant, grain elongation ratio and protein content. However, high significance of pooled deviation for all the characters except harvest index and L/B ratio (kernel) indicates the importance of non linear component in determining interaction of the genotypes with environments in the present study.

The genotypes MTU-7029 and MTU-2716 were found to be stable for grain yield. PR-106, NLR-145 and JGL-384 were found to be stable with reference to biomass. The genotypes BPT-1235, MTU-1010 and Kasturi were found to be suitable for favourable environments because of their below average stability for most of the characters. The variety JGL-384 was found to be suitable for poor environments with above average stability for characters *viz.,* grain yield, harvest index and L/B ratio (kernel).

CHAPTER - I

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important food crop occupying larger area under irrigated crops. It has brought vast change in the economy and life style of many homes in deltas and command areas through rice based food security and industrial growth. Most of the people in India meet their calorific and protein requirement (75%) through rice. Nearly 90 per cent of area cultivated under rice is in Asia only. In India, rice is cultivated in about 44.50 m ha with an annual production of 78.64 mt (Survey of Indian Agriculture, 2004).

Rice farming needs to be made remunerative for the farmers and at the same time the produce should remain competitively priced in global market. Quality improvement to meet the international standards is another requirement. Now, the globalization and food security buffers, triggered a competitive pricing policy and quality-consumer demand.

Yield is a polygenically controlled character, which is highly influenced by genotype and environment interactions. Developing a stable variety is of paramount importance to the plant breeder through selection of varieties that interact less with environment. This necessitates a deeper insight into nature of variability owing to genetic factors.

Evaluation of G x E interaction gives an idea of the buffering capacity of the rice genotypes under different environments (dates of sowing) thereby enabling plant breeder to recommend appropriate varieties to suit different sowing periods.

Keeping in view of the above background, the present investigations were conducted with 25 rice genotypes in four environments (dates of sowing), with the following objectives.

1. To study the extent of genetic variation among the cultivars of rice during both *kharif / rabi* situations.

2. To estimate the extent of inter- relationships among grain quality parameters in respect of *kharif* and *rabi* situations.

3. To study the stability of rice genotypes for yield and quality characters.

CHAPTER II

REVIEW OF LITERATURE

The present investigation was aimed at studying the stability of rice varieties for yield and quality characters. Pertinent literature in respect of variability, heritability, genetic advance, character association, genotype environment interaction and stability parameters with reference to rice are reviewed hereunder.

2.1 VARIABILITY

The magnitude of variability present in a crop species is of utmost importance as it provides the basis for effective selection and for all crop improvement programmes for evolving superior genotypes. This is the main concern of plant breeders.

Character	Variability	Reference
1. Plant height at 65 DAS	High	Lalitha and Sreedhar (1996)
		Ashwanipanwar *et. al.* (1997)
		Shivani and Sreeramareddi (1999)
		Awasthi and Pandey (2000)
	Moderate	Mruthunjaya and Mahadevappa (1995)
		Manonmani *et. al.* (1996)
		Bhavana (2003)
	Low	Narendra and Reddy (1997)

2. Plant height at harvest	High	Shivani and Sreeramareddi (1999)
		Awasthi and Pandey (2000)
	Moderate	Mruthunjaya and Mahadevappa (1995)
		Manonmani *et. al.* (1996)
	Low	Narendra and Reddy (1997)
		Nath and Talukdar (1997)
3. Days to 50% flowering	High	Satpute (1996)
		Awasthi and Pandey (2000)
	Moderate	Mruthunjaya and Mahadevappa (1995)
		Manonmani *et. al.* (1996)
		Saravanan and Senthil (1997)
	Low	Sawant and Patil (1995)
		Nath and Talukdar (1997)
		Kaw *et. al.* (1999)
4. No. of Productive tillers / plant	High	Sarma *et. al.* (1996) Ganesan *et. al.* (1997)
		Verma and Mani (1998)
		Shivani and Sreeramareddi (1999)
	Moderate	Mruthunjaya and Mahadevappa (1995)
		Narendra and Reddy (1997)
5. Test weight	High	Singh and Choudary (1996)
		Singh *et. al.* (1997)
		Vange *et. al.* (1999)
		Mishra (1999)
	Moderate	Nath and Talukdar (1997)
		Saravanan and Senthil (1997)
	Low	Verma and Mani (1997)
		Singh *et. al.* (1999)

6. Grain yield	High	Reddy and De (1996)
		Basavaraja *et. al.* (1997)
		Nath and Talukdar (1997)
		Verma and Mani (1998)
		Niranjan *et. al.* (1999)
		Vange *et. al.* (1999)
	Moderate	Bhavana (2003)
	Low	Supriya and Hazarika (1994)
7. Biomass	High	Ganesan *et. al.* (1995)
		Ganesan *et. al.* (1996)
		Selvarani and Rangasamy (1997)
		Nirajnan *et. al.* (1999)
	Moderate	Manuel and Prasad (1993)
8. Harvest index	High	Chauhan *et. al.* (1993)
		Manuel and Prasad (1993)
	Moderate	Ganesan *et. al.* (1996)
	Low	Selvarani and Rangasamy (1997)
9. L/B ratio (grain)	High	Marekar and Siddiqui (1996)
		Pathak and Sharma (1996)
		Sarwar *et. al.* (1999)
	Moderate	Rajamani (1993)
10. L/B ratio (kernel)	High	Vivekanandan and Giridharan (1998)
	Moderate	Lalitha and Sreedhar (1999)
11. Hulling %	Low	Chauhan and Nanda (1983)
		Pandey and Mani (1995)
		Nagajyothi (2001)
12. Milling %	Low	Chauhan and Nanda (1983)
		Pandey and Mani (1995)
		Nagajyothi (2001)

13. Head rice recovery	High	Pathak and Sharma (1996)
		Chauhan *et. al.*(1992)
	Low	Chauhan and Nanda (1983)
14. Grain elongation ratio	High	Muker *et. al.* (1998)
		Mishra and Verma (2002)
		Mishra *et. al.* (2003)
	Low	Sadukhan and Chattopadhyay (2000)
		Satyavathi *et. al.* (2001)
15. Protein content (%)	High	Srikrishnadevarayalu (1993)
		Kandali and Borah (1994)
		Tarasatyavathi (1994)
	Low	Deosarkar *et. al.* (1989)
		Lalitha (1995)
		Lalitha and Sreedhar (1999)

2.2 HERITABILITY AND GENETIC ADVANCE

Heritability and genetic advance are important in formulating selection index. Heritability in broad sense is the ratio of genotypic variance to phenotypic variance. Phenotype is the expression of a genotype in a given environment, some times when the environmental influence is less; the true heritability becomes much higher. So, it will not give a true picture of inherited variance. High heritability is not always an indication of high genetic gain. Hence there is need to estimate genetic advance, which is a relative measure and reliable indication of true genetic gain. High heritability estimates together with high genetic advance are more valid for selection than heritability estimates alone. High heritability coupled with high genetic gain could successfully be improved by direct selection.

Available literature on heritability and genetic advance is presented here.

Character	Heritability	Genetic advance as % of mean	Reference
1. Plant height at 65 DAS	High	High	Manonmani *et. al.* (1996)
			Saravanan and Senthil (1997)
			Niranjan *et. al.* (1999)
	High	Moderate	Nath and Talukdar (1997)
	High	Low	Narendra and Reddy (1997)
			Pattanayak and Gupta (1999)
2. Plant height at harvest	High	High	Manonmani *et. al.* (1996)
			Saravanan and Senthil (1997)
			Ashwanipanwar *et. al.* (1997)
			Bhavana (2003)
	High	Moderate	Nath and Talukdar (1997)
			Pattanayak and Gupta (1999)
3. Days to 50% flowering	High	High	Sawant and Patil (1995) Manonmani *et. al.* (1996)

	High	Low	Saravanan and Senthil (1997)
			Pattanayak and Gupta (1999)
			Gupta *et. al.* (1999)
			Bhavana (2003)
4. Productive tillers / plant	High	High	Ganesan *et. al.* (1996)
			Manonmani *et. al.* (1996)
			Singh and Choudary (1996)
			Narendra and Reddy (1997)
			Saravanan and Senthil (1997)
			Mishra (1999)
	High	Low	Ramarao (1996)
	Low	Low	Verma and Mani (1998)
			Niranjan *et. al.* (1999)
5. Test weight	High	High	Chauhan (1996)
			Ashwanipanwar *et. al.* (1997)
			Kumar *et. al.* (1998)
			Mishra (1999)
	High	Moderate	Ganesan *et. al.* (1995)
	High	Low	Roy *et. al.* (1995)
	Moderate	Low	Mruthunjaya and Mahadevappa (1995)
	Low	Low	Verma and Mani (1998)
6. Grain yield	High	High	Ganesan *et. al.* (1995)
			Chauhan (1996)
			Narendra and Reddy (1997)
			Kumar *et. al.* (1998)
			Pattanayak and Gupta (1999)
	High	Moderate	Manuel and Prasad (1993)
	Low	Low	Basavaraja *et. al.* (1997)

7. Biomass	High	High	Ganesan *et. al.* (1996)
			Pattanayak and Gupta (1999)
	High	Moderate	Niranjan *et. al.* (1999)
8. Harvest index	High	High	Chauhan *et. al.* (1993)
	Low	Low	Chaubey and Riccharia (1993)
	High	Low	Manuel and Prasad (1993)
9. L/B ratio (grain)	High	Low	Deosarkar *et. al.* (1989)
	High	High	Marekar and Siddiqui (1996)
			Vivekanandan and Giridharan (1998)
			Lalitha and Sreedhar (1999)
	High	Moderate	Nagajyothi (2001)
10. L/B ratio (kernel)	High	High	Nagajyothi (2001)
	High	Moderate	Lalitha (1995)
	Low	Low	Padmanjali (2002)
11.Hulling %	Low	Low	Chauhan and Nanda (1983)
			Nagajyothi (2001)
	High		Pathak and Sharma (1996)
12.Milling %	Low	Low	Chauhan and Nanda (1983)
	Moderate	Low	Nagajyothi (2001)
	High		Pathak and Sharma (1996)
13.Head rice recovery	High		Pathak and Sharma (1996)
	High	High	Mishra and Verma (2002)
	Moderate	Low	Chauhan and Nanda (1983)
14. Grain elongation ratio	High	High	Sadukhan and Chattopadhyay (2000)
			Satyavathi (2001)
			Mishra *et. al.* (2003)

15. Protein content	High	Low	Deosarkar *et. al.* (1989)
	Low	High	Hussain *et. al.* (1987)
	Low		Lalitha and Sreedhar (1999)
	High	High	Bhavana (2003)

2.3 CORRELATION SUTDIES

Study of character association has considerable use in plant breeding, while making selection for a character there may be simultaneous effect on the other characters also depending on the intensity of associations between two traits under consideration. If the correlation is strong between a set of desirable traits then if we make selection for one character, the other character will automatically be taken care (Falconer, 1964). If unfavourable association exists between desirable and undesirable traits selection may result in genetic slippage and limit genetic advance. Correlation studies indicate the magnitude of association between pairs of characters and are useful for selecting genotypes with desirable combinations of characters thereby aiding the plant breeder in crop improvement.

Knowledge of association between yield and yield component characters and among themselves is helpful in improvement of complex character yield for which direct selection is not effective. Several workers in the past have studied association between yield and yield component characters in rice and the literature presented here under.

Character	Correlation	Correlated character	Reference
1. Plant height at 65 DAS	Positive	Grain yield	Marekar and Siddiqui (1996)
			Gupta *et. al.* (1998)
			Jha *et. al.* (1998)
			Shanthi and Singh (2000)
	Negative	Grain yield	Nath and Talukdar (1997)
			Gupta *et. al.* (1998)
			Tarasatyavathi *et. al.* (2001)
	Positive	L/B ratio (grain)	Lalitha (1995)
2. Plant height at harvest	Positive	Grain yield	Marekar and Siddiqui (1996)
			Gupta *et. al.* (1998)
			Jha *et. al.* (1998)
			Shanthi and Singh (2000)
	Positive	L/B ratio (grain)	Lalitha (1995)
	Negative	Yield	Gupta *et. al.* (1998)
			Tarasatyavathi *et. al.* (2001)
	Negative	Harvest index	Chauhan *et. al.* (1993)
			Chaubey and Riccharia (1993)

3. Days to 50% flowering	Positive	Grain yield	Amrithadevarathinam (1990)
			Yadav (1992)
			Marekar and Siddiqui (1996)
			Satpute (1996)
			Rather and Raina (1997)
			Padmanjali (2002)
	Negative	Grain yield	Mehetre *et. al.* (1996)
4. Productive tillers / plant	Positive	Grain yield	Marekar and Siddiqui (1996)
			Saravanan *et. al.* (1996)
			Tarasatyavathi *et. al.* (2001)
			Annadurai (2001)
	Positive	Days to 50% flowering and grain yield	Amrithadevarathinam (1990)
	Negative	Plant height	Reddy *et. al.* (1997)
	Negative	Plant height and test weight	Kannabapu and Soundrapandian (1992)
5. Test weight	Positive	Grain yield	Marekar and Siddiqui (1996)
			Tarasatyavathi *et. al.* (2001)
	Negative	Grain yield	Shanti and Singh (2000)
	Negative	Productive tillers / plant	Reddy *et. al.* (1988)
	Positive	Harvest index	Shaktivel (2001)

6. Biomass	Positive	Grain yield	Ramalingam *et. al.* (1995)
			Madhuri (1996)
			Ganesan *et. al.* (1998)
			Selvarani and Rangasamy (1998)
7. Harvest index	Positive	Number of productive tillers	Ganesan *et. al.* (1997)
			Murthy *et. al.* (1992)
			Shaktivel (2001)
	Negative	Plant height	Mokate *et. al.* (1998)
	Positive	Milling per cent	Chauhan and Nanda (1982)
8. L/B ratio (grain)	Positive	Grain yield	Marekar and Siddiqui (1996)
			Tarasatyavathi *et. al.* (2001)
	Positive	L/B ratio of kernel	Nagajyothi (2001)
	Negative	Grain yield	Padmanjali (2002)
9. L/B ratio (kernel)	Negative	Grain yield	Nagajyothi (2001)
10.Hulling %	Positive	Milling per cent	Chauhan and Nanda (1982)
			Chauhan *et. al.* (1993)
	Positive	Milling per cent elongation ratio	Nayak *et. al.* (2003)
11.Milling %	Positive	Hulling per cent	Chauhan and Nanda (1982)
			Chauhan *et. al.* (1994)
	Negative	L/B ratio	Sarawagi *et. al.* (2000)
	Positive	Elongation ratio	Nayak *et. al.* (2003)

12. Head rice recovery	Negative	L/B ratio and Elongation ratio	Nayak *et. al.* (2003)
13. Protein content	Negative	Test weight	Hussain *et. al.* (1987)
14.Grain elongation ratio	Positive	Hulling	Nayak *et. al.* (2003)
15. Grain yield	Positive	Plant height, days to 50% flowering, test weight, L/B ratio	Amrithadevarathinam (1990)
		Days to 50% flowering, test weight, productive tillers / plant	Marekar and Siddiqui (1996)
		Biomass and harvest index	Shaktivel (2001)
	Negative	L/B ratio (grain), L/B ratio (kernel)	Nagajyothi (2001), Padmanjali (2002)

2.4 GENOTYPE x ENVIRONMENT INTERACTION AND STABILITY PARAMETERS

A stable variety is one which has high mean, unit regression and a minimum deviation from regression line. A breeder would usually desire to develop a variety that has high mean yield and meets the above requirements for stability. The genetic effects are not independent of the non-genetic environmental effects. This interplay of genetic and non-genetic effects is the genotype environment interaction (Eberhart and Russell, 1966).

When 5 common rice varieties were tested at 5 locations in Srilanka by Senanayake and Wijeratne (1990) to study the effect of rice genotype x environment interactions on quality characters, both variety and environment effects were found to be significant for grain elongation, amylose and brown rice protein and the variety x environment was significant. This indicated that the effects were non-additive. The L/B ratio did not show significant interaction with variety and environment.

Mishra and Agarwal (1992) studied stability of yield in 12 rice cultivars. They observed that the most stable cultivar had a high mean performance and regression coefficient (b_i) and deviation from regression ($\overline{S}^2d_i$) approaching zero. The negative b_i of cultivar JT80-8 (-0.172) indicated good response under poor conditions.

Geetha *et. al.* (1994) conducted stability analysis of five medium duration rice genotypes and one advanced line over four nitrogen levels and significant G X E interactions were observed for panicles / plant, filled grains / panicle, spikelet fertility, test weight, plant yield and harvest index.

Studies on genotype environment interaction for yield and related traits in twenty tall indica rice genotypes, had shown significant differences due to genotypes, environments and genotype x environment interaction for days to 50% flowering, plant height, grain weight and grain yield. The linear component of G X E interaction was important for grain weight and grain yield, whereas the non-linear component was significant for all the traits (Singh *et. al.,* 1995).

Mahapatra *et. al.* (1996) evaluated twelve early maturing rice varieties for their yield performance over 30 environments. Highly significant genotype environment interactions indicated differential responses of the genotypes to environmental changes. The stability analysis indicated the significance of the linear component of variation for grain yield.

Chikkalingaiah *et. al.* (1997) carried out an investigation to identify stable scented rice genotypes for varied agroclimatic zones of Karnataka. The study revealed significant GXE interactions for all characters except test weight.

Singh *et. al.* (1997) observed highly significant variance due to genotype x environment interactions for all the traits except days to 50% flowering. Portioning of G x E interactions showed that variance could be attributed to both G x E (linear) and pooled deviation (non-linear).

Singh *et. al.* (1997) observed highly significant G x E interaction for grain yield. IR-8, PR-106, and IR-64 had stable and moderately high grain yields.

The results of stability analysis in rice over different seasons for yield and its components indicated the presence of G x E interactions for all yield related characters studied. None of the genotypes was stable for all the characters (Shantakumar *et. al.*, 1997).

Hegde and Vidyachandra (1998) carried out yield stability analysis of rice hybrids. Highly significant G x E interactions were observed for yield and its components. None of the 5 hybrids and 4 controls evaluated showed stability for yield over the environments studied.

Basavaraja *et. al.* (1998) derived information on stability from data on yield and related traits in 16 rice genotypes grown under 5 low land environments. Significant G x E interactions was observed for all traits except grain length. The effect due to the environment (linear) was significant for all characters except grain length and L/B ratio.

Reddy *et. al.* (1998) investigated G x E interaction for grain yield in 24 lowland rice cultivars. Both linear and non-linear components of G x E interactions were significant.

Smitha and Mahapatra (1998) evaluated 16 early maturing rice varieties for stability of yield performance. The genotypes exhibited significant differences for grain yield. Both linear and non-linear components of variation were highly significant in stability analysis. Significant G x E (linear) indicated differential response of the genotypes to environmental changes.

The stability analysis of yield performance of 8 rice cultivars showed no significant interaction for cultivar x environment (linear) interaction. The deviation from regression was significant for all the cultivars (Honarnejad *et. al.*, 1999).

Kandhola and Panwar (1999) evaluated 52 indigenous and exotic genotypes of rice for their stability. The variation due to G x E interaction was significant for all the characters *viz.,* panicles / plant, grains / panicle, 1000 grain weight and grain yield / plant.

Both linear and non-linear components of G x E interaction were important for 1000 grain weight and grain yield / plant.

Honarnejad (2000) conducted stability analysis of 8 Iranian rice cultivars grown at 3 locations. Analysis of variance showed significant differences in yield performance and location x year interaction. Stability analysis revealed no significant cultivar x environment interaction.

Stability analysis of 6 rice genotypes, tested at 5 locations indicated significant genetic differences among rice genotypes while genotype x location interaction was non significant. The regression coefficient (b_i) and deviations from regression ($\overline{S}^2d$) were significant for all genotypes except Pak-4554 and Basmati-385 (Qayyum *et. al.*, 2000).

Swamy and Kumar (2003) conducted stability analysis for grain yield and its components in rice with 20 rice genotypes grown at 4 locations. Variance due to genotype, environment and genotype x environment interactions were significant for most of the characters studied.

CHAPTER III

MATERIALS AND METHODS

The present investigation on "**Stability Analysis in Rice Genotypes"** was carried out to study the stability of rice genotypes for yield and quality characters. The materials used and methods adopted in the present investigation are presented in detail hereunder.

3.1 MATERIALS

The experimental material comprised 25 genotypes / cultivars of rice (*Oryza sativa* L.). The information on the pedigree of these genotypes is presented in Table 1.

3.2 EXPERIMENTATION TECHNIQUE

The present investigation was carried out at Agricultural Research Station, Maruteru. The 25 rice genotypes were evaluated in the following four environments with three replications in each environment.

E_1 = Timely sown crop on 10-7-2003 *kharif*

E_2 = Late sown crop on 20-7-2003 *kharif*

E_3 = Timely sown crop on 10-12-2003 *rabi*

E_4 = Late sown crop on 20-12-2003 *rabi*

3.3 EXPERIMENTAL DESIGN

The nursery was sown in raised beds. One-month-old seedlings were transplanted in the main field in a randomized block design replicated thrice with a row length of 4.5 m by adopting a spacing of 20 x 15 cm in *kharif* and 15 x 15 cm in *rabi*. Uniform plots of 10 m^2 were adopted in all the four environments.

3.4 CULTURAL OPERATIONS

All recommended package of practices were adopted as per schedule throughout the crop growth period. Need based plant protection measures were taken up. Fertilizers were applied at the rate of 60 N, 40 P_2O_5, 30 K_2O kg/ha in *kharif* and 120 N, 60 P_2O_5 and 40 K_2O kg/ha in *rabi*.

3.5 RECORDING OF OBSERVATIONS

The observations were recorded for following quantitative and qualitative characters on 10 competitive random plants per replication per genotype. The mean data were considered for statistical analysis.

3.5.1 Plant Height at 65 DAS (cm)

Plant height in centimeters from the base to the tip of the leaf was measured at 65 days after sowing.

3.5.2 Plant Height at Harvest (cm)

Plant height in centimeters was measured from the base of the plant to the tip of the panicle at the time of harvest.

3.5.3 Days to 50% Flowering

The number of days taken from the day of sowing to opening of panicles in 50 per cent of the plants in a plot was taken as days to 50 per cent flowering.

3.5.4 Number of Productive Tillers/plant

The number of ear bearing tillers, which produced healthy panicles were counted on each plant at the time of harvest.

3.5.5 Test Weight (g)

One thousand well filled grains were weighed to the nearest milligram at 12 per cent moisture level.

3.5.6 Grain Yield (kg/plot)

Grain yield from net plot area was thoroughly sun dried to 17 per cent moisture content and weighed.

3.5.7 Biomass (kg)

Five plants randomly selected from each treatment per replication were uprooted, sun dried after removing roots and kept in hot air oven at 105-110°C for 5-10 min initially, 60°C for 72 h until constant weight obtained. Dried samples were weighed and expressed in kg per plot basis.

3.5.8 Harvest Index (%)

The harvest index per five hills per plot of each sample in each replication was calculated as per the following formula.

$$\text{Harvest Index} = \frac{\text{Grain yield}}{\text{Total biological yield (grain + straw)}} \times 100$$

3.5.9 L/B Ratio (Grain)

The length and breadth of ten grains selected at random from each sample was measured with dial thickness gauge and the ratio was estimated by using the following formula.

$$\text{L/B ratio (grain)} = \frac{\text{Mean length of the grain in mm}}{\text{Mean breadth of the grain in mm}}$$

3.5.10 L/B Ratio (Kernel)

The length and breadth of ten kernels selected at random from each sample was measured with dial thickness gauge and the ratio was calculated by using the following formula.

$$\text{L/B ratio (kernel)} = \frac{\text{Mean length of the kernel in mm}}{\text{Mean breadth of the kernel in mm}}$$

3.5.11 Hulling (%)

Two fifty grams of rough rice after thorough drying to a moisture level of 12-14 per cent were passed through paddy Sheller and the weight of the hulled rice was taken and the hulling percentage was calculated by using the following formula and presented in per cent.

$$\text{Hulling \%} = \frac{\text{Total weight of hulled rice (g)}}{\text{Total weight of rough rice (g)}} \times 100$$

3.5.12 Milling (%)

The hulled brown rice was subjected to milling for 90 sec *i.e.,* 5 per cent milling in Satake grain testing mill and the weight was recorded.

$$\text{Milling \%} = \frac{\text{Total weight of milled rice (g)}}{\text{Total weight of rough rice (g)}} \times 100$$

3.5.13 Head Rice Recovery (%)

The dehusked kernels were subjected to milling in a "Satake" polisher for a period of 45 sec. Then the polished kernels were passed repeatedly through a rice grader having 5 mm groves to separate the brokens from the head rice kernels having a length of 3/4th or more of the average length of unbroken grains were also included in the head rice.

$$\text{HRR \%} = \frac{\text{Weight of whole polished grain (g)}}{\text{Total weight of rough rice (g)}} \times 100$$

3.5.14 Grain Elongation Ratio

Five gram rice samples were soaked in 15 ml of water for 10 min., and cooked in water bath for 20 min after recording grain length on 10 grains. Cooked rice kernels were spread on blotting paper. The length of the kernels was measured on 10 cooked grains in millimeters and elongation ratio was calculated.

$$\text{Elongation ratio} = \frac{\text{Kernel length after cooking (mm)}}{\text{Kernel length before cooking (mm)}}$$

3.5.15 Protein Content (%)

The nitrogen content (%) in each sample was estimated by micro-kjeldahl method and the protein content (%) of the brown rice samples was computed as follows:

Protein content (%) = Nitrogen content (%) x 5.95 (factor).

3.6 STATISTICAL ANALYSIS

The details of statistical analysis are furnished below:

3.6.1 Analysis of Variance

The data for different characters were statistically analysed on the basis of the model suggested by Cochran and Cox (1950) for randomized block design.

$$Y_{ij} = \mu + b_i + t_j + e_{ij}$$

Where,

Y_{ij} = Performance of the j^{th} genotype in the I^{th} block.

μ = General mean

b_i = True effect of i_{th} block

t_j = True effect of j^{th} genotypes

e_{ij} = Random error associated with I^{th} block and j^{th} genotype.

The analysis of variance for each character was carried out as indicated below:

Source of variation	**d.f.**	**SS**	**MSS**	**F. ratio**
Replications	r-1	RSS	RMSS	RMSS/EMSS
Treatments	t-1	TrSS	TrMSS	TrMSS/EMSS
Error	(r-1)(t-1)	ESS	EMSS	
Total	(rt-1)	TSS		

Where,

r = Number of replications

t = Number of genotypes or treatments

df = Degrees of freedom

SS= Sum of squares

MSS = Mean sum of squares

RSS = Replication sum of squares

ESS = Error sum of squares

TSS = Total sum of squares

RMSS = Mean sum of squares due to replications

TrMSS = Mean sum of squares due to treatments.

EMSS = Mean sum of squares due to error.

The test of significance was carried out by "F" table values given by Fisher and Yates (1963).

3.6.2 Estimation of Genetic Parameters

Coefficient of Variation

Phenotypic and genotypic coefficients of variation (PCV and GCV) were computed according to Burton (1952).

$$GCV\ (\%) = \frac{\sigma^2 g}{\overline{X}} \times 100$$

$$PCV\ (\%) = \frac{\sigma^2 p}{\overline{X}} \times 100$$

Where, $\sigma^2 g$ = Genotypic variance = (TrMSS – EMSS) / r

$\sigma^2 e$ = Environment variance = EMSS / r

$\sigma^2 p$ = Phenotypic variance = $\sigma^2 g + \sigma^2 e$

$\overline{X}$ = General mean

Categorization of the range of variation was followed by Sivasubramanian and Menon (1973)

Less than 10%	= Low
10 – 20%	= Moderate
More than 20%	= High

3.6.3 Heritability in Broad Sense [h^2 (b)]

Heritability in broad sense was estimated as per Allard (1960).

$$h^2(b) = \frac{\sigma^2 g}{\sigma^2 p} \times 100$$

As suggested by Johnson *et. al.* (1955), h^2(b) estimates were categorised as :

Low	= 0-30%
Medium	= 31-60%
High	= 61% and above

3.6.4 Genetic Advance (GA)

This was estimated as per the formula proposed by Allard (1960).

$$GA = K \times \sigma p \times h^2(b)$$

where,

K = Selection differential at 5 per cent selection intensity which accounts to a constant value 2.06

h^2 (b) = Heritability in broad sense

σ_p = Phenotypic standard deviation

3.6.5 Genetic Advance as per cent of Mean (GAM)

$$GAM = \frac{GA}{\overline{X}} \times 100$$

The range of genetic advance as per cent of mean was classified as suggested by Johnson *et. al.* (1955).

Low	=	Less than 10%
Moderate	=	10-20%
High	=	More than 20%

3.7 METHODS TO MEASURE STABLE PERFORMANCE OF GENOTYPES

Analysis of variance of genotypic mean was computed for each agronomic variable in each environment. The data were as pooled over environments as the coefficients of variation values in each environment were generally low.

3.7.1 Bartlett's Test of Homogenity

As quoted by Panse and Sukhatme (1961).

$$\overline{S}^2 = 1/n \sum_{i}^{n} s^2 r$$

$$X^2 = Kcn \log S^{-2} - \sum_{i}^{n} \log s^2 r$$

$$C = 1 + n + 1/3nk$$

Where,

n = Number of environments

S^2r = Error mean squares of locations or environments.

K = Error degrees of freedom

$X^2 = (24\ df) = X^2/C$

If calculated X^2 is non-significant the experimental errors of traits may be regarded as homogenous.

3.7.2 Eberhart and Russell Model (1966)

Stability parameters were computed as given by Eberhart and Russell (1966).

$Y_{ij} = m + B_i I_j + \delta_{ij}$ (I= 1,2 ...t. and j = 1,2, ... S)

Where,

Y_{ij} = Mean of Ith variety in jth environment.

m = Mean of all the varieties over all the environments.

B_i = The regression coefficient of the Ith variety on the environmental index which measures the response of this variety to varying environments.

I_j = The environmental index which is defined as the deviation of the mean of all the varieties at a given location from the overall mean.

$$= \frac{\sum_i Y_{ij}}{t} - \frac{\sum_i \sum_j Y_{ij}}{ts}$$

With $\sum_j I_j = 0$

δ_{ij} = The deviation from regression of the jth variety at jth environment.

3.7.3 Analysis of Variance for Stability

The analysis of variance as proposed by Eberhart and Russell (1966) is given in Table 2.

Table 2 : Analysis of variance of stability model (as per Eberhart and Russell, 1966).

Source	df	Sum of squares	Mean squares
Total	(St-1)	$\Sigma I\ \Sigma j\ Y^2_{ji} - CF$	
Varieties	(t-1)	$1/e\ \Sigma_i Y^2_i - CF$	Ms_1
Environment + (varieties x environment)	t(S-1)	$\Sigma_i \Sigma_j\ Y^2_{ij} = \Sigma_i Y^2_j$ / e	
Environment (linear)	1	$1/g\ (Y_{ij} I_j)^2 / \Sigma_j I^2_j$	
Variety x Environment (linear)	(t-1)	$\Sigma_j[(\Sigma_j Y_{ij} I_j)^2 / \Sigma_j I_j^2]$	MS_2
Pooled deviation	t(S-2)	$\Sigma_i \Sigma_j S^2_{ij}$	MS_3
Deviation due to genotypes	(S-2)	$[\Sigma_j Y^2_{ij} - (Y_i^2)$ / e} $- [\Sigma_j Y_{ij} / \Sigma_j I^2_j = jS^2 ij$	
Pooled error	S(t-1) (r-1)		

S = No. of environments = 4

t = No. of varieties = 25

r = No. of replications = 3

$(\Sigma_j Y_{ij} I_j)^2 / \underset{j}{\Sigma} I^2_j$ = variance due to regression

S^2e = The estimate of pooled error.

3.7.4 Estimates of Stability Parameters

The regression coefficient (b_i) and mean square deviation from the linear regression ($\overline{S}^2{}_{di}$) were estimated as follows.

3.7.5 Computation of Regression Coefficient (b_i)

The regression coefficient which is the regression of the performance of each genotype under different environments on the environmental means over all the genotypes. This was estimated as follows.

$$b_i = \sum_j Y_{ij} I_j \,/\, \sum_j I_j^2$$

Where, $\sum_j Y_{ij} I_j$ = The sum of products of environmental index (I_j) with corresponding mean of that genotype at each environment (Y_{ij})

$\sum_j I_j^2$ = The sum of squares of the environmental index (I_j)

On the other hand $\Sigma_j\, Y_{ij}\, I_j$ for each genotype is the sum of products of environmental index (I_j) with the corresponding mean ($\overline{X}$) of that genotype in each environment.

$$[\overline{X}]\ [I_j] = [\sum_j Y_{ij}\, I_j] = [S]$$

$\overline{X}$ = Matrix of means

$[I_j]$ = vector for environmental index

[S] = Vector for sum of products i.e. $\sum_j Y_{ij} I_j$

3.7.6 Computation of Environmental Index (I_j)

$$I_j = \frac{\sum_j Y_{ij}}{t} - \frac{\sum_i \sum_j Y_{ij}}{ts}$$

$$= \frac{\text{Total of all the varieties at } j^{th} \text{ location}}{\text{Number of varieties}} - \frac{\text{Grand total}}{\text{Total No. of observations}}$$

3.7.7 Computation of mean square deviation ($\overline{S}^2 d_i$) from linear regression

$$\overline{S}^2 d_i = \frac{\sum_j \delta^2_{ij}}{(S-2)} - \frac{S^2_e}{r}$$

Where,

$$\sum_j \delta^2_{ij} = [\sum_j Y^2_{ij} - (Y^2_i / t)] - \frac{(\Sigma_j Y_{ij} I_j)^2}{\sum_j I_j^2}$$

Where, $[\sum_J Y_{ij}^2 - (Y^2_i / t)]$ = Variance due to dependent variable

$$\frac{(\sum_j Y_{ij} I_j)^2}{\sum_j I_j^2} = \text{Variance due to regression}$$

Because,

$$\frac{(\sum_j Y_{ij} I_j)^2}{\sum_j I_j^2} = \frac{(\sum_j Y_{ij} I_j)(\sum_j Y_{ij} I_j)}{\sum_j I_j^2} = b_i \sum_j Y_{ij} I_j$$

Mean square deviation =

$$\frac{\text{Deviation from regression}}{\text{Degrees of freedom of each environment}} - \frac{\text{Pooled error}}{\text{No. of replications}}$$

S^2e = The estimate of pooled error

G = Number of genotypes

S = Number of environments

r = Number of replications

3.7.8 Test of Significance

The following tests of significance were carried out.

1. To test the significance of the differences among the variety means *i.e.,*

   $H_O = \mu_1 = \mu_2 = \mu_3 \; ..... \; \mu_n$

$$F = \frac{\text{Mean squares due to varieties}}{\text{Mean squares due to pooled deviation}} = \frac{MS_1}{MS_3}$$

2. To test that the varieties do not differ for their regression on the environmental index *i.e.,*

   $Ho = b_1 = b_2 = \ldots\ldots b_n$,

$$F = \frac{\text{Mean squares due to GxE (Linear)}}{\text{Mean squares due to pooled deviation}} = \frac{MS_2}{MS_3}$$

3. Individual deviation from linear regression was tested as follows :

   $F = [(\Sigma_j \delta^2_{IJ}) / (S\text{-}2)] / \text{Pooled error}$

   $P = 0.05$ at $(g\text{-}2)$ df

4. To test the significance of b_i from zero "t" test is employed

   $t = b_i - 0 / SE\ b_i$

If b_i is significant, its significant deviation from unity is tested as:

$$t = 1\text{-}b_i / SEb_i$$

$P = < 0.05$ for $(g\text{-}2)$ df

$$S.E.b_i = \frac{(\sum_j \delta^2_{ij}/n\text{-}2)}{\sum_j I^2_j}$$

3.7.9 Stable Genotype

A genotype with unit regression coefficient (b=1) and the deviation not significantly differing from zero ($\overline{S}^2 d_i$=0) was taken to be stable genotype with unit response.

Mean of b = $\overline{b} = \sum_i b_i / v$

S.E.(b) = MS due to pooled deviation / ΣI_j^2

3.7.10 Population Mean

Population mean (μ) and standard error was calculated as :

$$\text{Population mean } (\mu) = \frac{\text{Grand total}}{\text{Number of observations}}$$

$$\text{Standard Error Mean} = \frac{\text{MS due to pooled deviation}}{\text{No. of environments - 1}}$$

3.8 CORRELATION STUDIES

Correlations were worked out by using formula suggested by Falconer (1964).

3.8.1 Phenotypic coefficients of correlation (rp)

$$r\,(x_i x_j)_p = \frac{Cov.(x_i x_j)_p}{v(x_i)_p \,.\, v(x_j)_p}$$

Where,

$r(x_i.x_j)_p$ = Phenotypic correlation between Ith and jth character

$Cov(x_i.x_j)_p$ = Phenotypic covariance between Ith and jth character

$v\,(x_i)_p$ = Phenotypic variance of ith character

$v\,(x_j)_p$ = Phenotypic variance of jth character.

Significance of correlation coefficients was tested by comparing phenotypic correlation coefficients with the table value (Fisher and Yates, 1963) at (n-2) degrees of freedom at 5% and 1% level where “n” denotes the number of paired observations used in the calculation.

Table 1: List of rice genotypes and their pedigree

S. No.	Genotypes	Pedigree
1.	BPT 1235 (Dhanya Lakshmi	Sabarmati/W 12703
2	BPT 5204 (Samba Mahsuri)	GEB 24/TN1/Mahsuri
3	WGL 20471 (Erramallelu)	BC 5/W 12708
4	GEB 24	Spontaneous mutant
5	JGL 384 (Polasa Prabha)	BPT 5204/Kavya
6	JGL 1798 (Jagityala Sannalu)	BPT 5204/Kavya
7	Kasturi	Basmati 470/CRR 88-17-1-5
8	MTU 1001 (Vijetha)	Vajram / MTU 7014
9	MTU 1010 (Cotton Dora Sannalu)	IR 64/Krishnaveni
10	MTU 2067 (Chaitanya)	Sowbhagya / ARC 5984
11	MTU 2716	Vijaya / Mahsuri
12	MTU 3626 (Prabhat)	IR 8 / MTU 3
13	MTU 4870 (Deepti)	Sowbhagya / ARC 6650
14	Vasundhara	Not available
15	MTU 5293 (Pratibha)	Sowbhagya / ARC 6650
16	MTU 5249 (Vajram)	Sowbhagya / ARC 6650
17	MTU 7029 (Swarna)	Vasishta / Mahsuri
18	MTU 1032 (Godavari)	Not available
19	NLR 145 (Swarna Mukhi)	CICAG/IR 625-23-3-1/Tetep
20	PR 103	Not available
21	PR 106	IR 8 / PETA 5 / Bellapatna
22	Tarori Basmati	Pure line selection from local Basmati
23	WGL 14377 (Varalu)	Erramallelu / CR 544-1-2
24	WGL 48684 (Kavya)	Not available
25	Triguna	Swarnadhan / RP 1579-38

CHAPTER - IV

RESULTS

The present investigation was made to evaluate 25 genotypes under four environments, to estimate stability of the genotypes for qualitative and quantitative characters *viz.,* plant height at 65 DAS, plant height at harvest, days to 50% flowering, productive tillers / plant, test weight, grain yield, biomass, L/B ratio (grain), L/B ratio (kernel), harvest index, hulling, milling, head rice recovery, grain elongation ratio and protein per cent. The results obtained are presented below under the following heads.

1. Analysis of variance.
2. Mean, genotypic and phenotypic coefficients of variation, heritability (broad sense), genetic advance and genetic advance as per cent of mean.
3. Character association of yield and components in each environment.
4. Stability parameters *viz.,* mean, regression coefficient and deviation from regression over four environments (Eberhart and Russell, 1966).

4.1 ANALYSIS OF VARIANCE

The analysis of variance revealed significant differences for all the characters among genotypes studied in all the environments. These results are presented in Table 3.

4.2 MEAN PERFORMANCE OF GENOTYPES, VARIABILITY, HERITABILITY, GENETIC ADVANCE AND GENETIC ADVANCE AS PER CENT OF MEAN

The mean values, genotypic and phenotypic coefficients of variation, heritability (broad sense), expected genetic advance and genetic advance as per cent of mean (GAM) of fifteen characters in 25 genotypes of rice for the four environments are presented in Tables 4 to 11 and fig. 1-8.

4.2.1 Environment – I

The results are presented in Tables 4 and 5 and fig. 1-2.

4.2.1.1 Plant height at 65 DAS (cm)

The trait ranges from 66.53 (MTU-7029) to 97.33 (Kasturi) with a mean of 79.74. The genotypic (10.22) and phenotypic (10.68) coefficients of variation for this trait were moderate. This character recorded 91.50 per cent of heritability with expected genetic advance 16.04 and genetic advance as per cent of mean 20.12 per cent (high).

4.2.1.2 Plant height at harvest (cm)

Plant height at harvest varied from 93.33 (MTU-7029) to 156.50 (GEB-24) with a mean of 117.43. The GCV (13.92) and PCV (14.31) for this trait were moderate. This trait has recorded 94.60 per cent heritability (high) with genetic advance 32.73 and 27.88 per cent genetic advance as per cent of mean (high).

4.2.1.3 Days to 50% flowering

The trait ranged from 76.00 (WGL-14377) to 123.66 (GEB-24) with a mean of 104.63. The genotypic (12.03) and phenotypic (12.36) coefficients of variation recorded were moderate. The heritability recorded was high (94.70%). The character had genetic advance 25.25 and genetic advance as per cent of mean 24.13 per cent (high).

4.2.1.4 Productive tillers / plant

Productive tillers per plant varied from 5.66 (JGL-384) to11.00 (MTU-5293) with a mean of 7.63. The GCV was moderate (14.20) and PCV was high (21.28). Mean heritability (44.50%) was noticed with 1.48 genetic advance. Genetic advance as per cent of mean (19.51%) was moderate.

4.2.1.5 Test weight (g)

The trait ranged from 14.28 (JGL-1798) to 29.40 (MTU-3626) with a mean of 20.46. The genotypic (17.80) and phenotypic (18.12) coefficients of variation for this trait were moderate. Heritability recorded was 96.50 per cent (high) with genetic advance 7.37. The genetic advance as per cent of mean (36.02%) was high.

4.2.1.6 Grain yield (kg/plot)

The trait ranged from 2.07 (Tarori Basmati) to 5.26 (MTU-1010) with a mean of 4.19. High GCV (23.27%) and PCV (23.42%) were recorded with high heritability (98.70%). Genetic advance recorded was 1.99 and genetic advance as per cent of mean was 47.62 per cent (high).

4.2.1.7 Biomass

The variation observed for this trait ranged from 5.07 (Erramallelu) to 12.28 (MTU-2716) with a mean of 9.36. The genotypic (21.99) and phenotypic (22.21) coefficients of variation were high. Heritability recorded was 98.10 per cent and genetic advance was 4.20. This trait had recorded high genetic advance as per cent of mean (44.87%).

4.2.1.8 Harvest index (%)

This trait exhibited variation, ranged from 34.33 (Tarori Basmati) to 49.81 (MTU-3626) with a mean of 44.75. Low GCV (8.65) and PCV (9.16) were recorded with high heritability (89.30%). This trait had recorded 7.54 genetic advance and 16.85 per cent (moderate) genetic advance as per cent of mean.

4.2.1.9 L/B ratio (grain)

The trait ranged from 2.85 (MTU-3626) to 4.87 (Tarori Basmati) with a mean of 3.63. The GCV (13.77) and PCV (14.13) were moderate. Heritability recorded was 94.90 per cent (high) with genetic advance 1.01. The genetic advance as per cent of mean 27.62 per cent (high).

4.2.1.10 L/B ratio (kernel)

Variation exhibited by this character ranged from 2.44 (MTU-4870) to 4.35 (Tarori Basmati) with a mean of 3.07. Genotypic and phenotypic coefficients of variation were 14.67 and 15.06 respectively, which were moderate in nature. This trait recorded (94.90%) heritability (high) with 0.90 genetic advance and 29.43 per cent genetic advance as per cent of mean (high).

4.2.1.11 Hulling (%)

The trait varies from 72.73 (MTU-4870) to 82.83 (MTU-5249) with a general mean of 78.34. GCV (2.62) and PCV (3.94) were low with moderate heritability (44.30%). Genetic advance was 2.82 with genetic advance as per cent of mean 3.59 per cent (low).

4.2.1.12 Milling (%)

This trait exhibited mean values ranged from 68.40 (BPT-1235) to 75.83 (WGL-14377) with a mean of 70.79. Low GCV (2.51) and PCV (3.66) were noticed. 47.00 per cent heritability (moderate) with 2.51 genetic advance and 3.54 per cent genetic advance as per cent of mean (low) were recorded.

4.2.1.13 Head rice recovery (%)

The mean values ranged from 52.50 (MTU-3626) to 62.50 (NLR-145) with a mean of 56.95. GCV and PCV observed were 4.35 (low) and 5.43 (low) respectively. 64.30 per cent heritability (high) with 4.09 genetic advance and 7.18 per cent genetic advance as per cent of mean (high) were also recorded.

4.2.1.14 Grain elongation ratio

Mean values for this trait ranged from 1.55 (Kasturi) to 1.92 (MTU-2716) with a general mean of 1.76. Low values of GCV (5.72) and PCV (6.42) were recorded. Heritability recorded was 79.50 per cent with genetic advance 0.19 and genetic advance as per cent of mean 10.51 per cent (moderate).

4.2.1.15 Protein content (%)

Protein per cent ranged from 6.62 (JGL-834) to 8.66 (PR-103) with a mean of 7.92. The genotypic (6.30) and phenotypic coefficients of variation (6.96) were low with high heritability (82.00%). Genetic advance observed was 0.93. Moderate advance as per cent of mean (11.75%) was noticed for this trait.

4.2.2 Environment – II

The results are presented in Tables 6 and 7 and fig. 3-4.

4.2.2.1 Plant height at 65 DAS (cm)

Plant height at 65 DAS varied from 63.50 (Vasundhara) to 109.49 (GEB-24) with a mean of 83.39. GCV (12.79) and PCV (13.18) were moderate with high heritability (94.20%). Genetic advance recorded was 21.33. Genetic advance as per cent of mean (25.58%) recorded was high.

4.2.2.2 Plant height at harvest (cm)

This trait varied from 96.40 (PR-103) to 147.33 (GEB-24) with a mean of 111.93. Moderate GCV (12.59) and moderate PCV (12.82) were observed with high heritability (96.40%). Genetic advance recorded was 28.49. Genetic advance as per cent o mean (25.46%) recorded was high.

4.2.2.3 Days to 50% flowering

This trait varied from 66.67 (WGL-14377) to 115.00 (GEB-24) with a mean of 94.21. Genotypic and phenotypic coefficients of variation were 12.09 and 12.53 respectively were moderate. The heritability recorded was 93.20 per cent (high) with 22.67 genetic advance and 24.06 per cent genetic advance as per cent of mean (high).

4.2.2.4 Productive tillers / plant

The mean values of this trait ranged from 5.66 (JGL-384) to 10.33 (MTU-5293) with a mean of 6.99. Genotypic (14.19) and phenotypic coefficients of variation (18.13) were moderate with high heritability (61.30%). Genetic advance was 1.60 and genetic advance as per cent of mean 22.88 per cent (high).

4.2.2.5 Test weight (g)

Test weight varied from 13.21 (JGL-1798) to 26.95 (MTU-3626) with a mean of 19.73. Moderate GCV (17.47) and PCV (17.86) with high heritability (95.70%) were recorded. Genetic advance was 6.95 and genetic advance as per cent of mean 35.22 per cent (high).

4.2.2.6 Grain yield (kg/plot)

The character varied from 1.87 (Erramallelu) to 5.03 (MTU-7029) with a mean of 3.96. GCV (24.54) and PCV (24.71) recorded high with high heritability (98.60%). Genetic advance was 1.99 and genetic advance as per cent of mean 50.20 per cent (high).

4.2.2.7 Biomass (kg)

Biomass varied from 4.62 (Erramallelu) to 11.81 (MTU-5293) with a mean of 8.89. Genotypic and phenotypic coefficients of variation were 23.16 (high) and 23.36 (high) respectively. High heritability (98.40%) was observed with 4.21 genetic advance and 47.32 per cent (high) genetic advance as per cent of mea.

4.2.2.8 Harvest index (%)

Harvest index ranged from 33.65 (Tarori Basmati) to 49.85 (MTU-3626) with a mean of 44.46. GCV (9.18) and PCV (9.62) were low with high heritability (91.00%). Genetic advance and genetic advance as per cent of mean were 8.02 and 18.04 (moderate) respectively.

4.2.2.9 L/B ratio (grain)

This trait ranged from 2.91 (MTU-7029) to 4.67 (Tarori Basmati) with mean 3.60. Moderate GCV (11.84) and PCV (12.27) with high heritability (93.10%) were recorded. Genetic advance recorded was 0.85 with high genetic advance as per cent of mean (23.54%).

4.2.2.10 L/B ratio (kernel)

This trait varied from 2.65 (MTU-3626) to 4.27 (Tarori Basmati) with a mean of 3.11. Moderate GCV (13.46) and PCV (13.87) with high heritability (94.20%) were recorded for this trait. Genetic advance (0.84) and high genetic advance as per cent of mean (26.92%) were noticed.

4.2.2.11 Hulling (%)

Hulling per cent varied from 73.90 (MTU-2067) to 81.54 (JGL-1798) with a mean of 77.88. Low GCV (1.71) and PCV (3.60) were noticed with (low) heritability (22.50%). Genetic advance (1.29) and low genetic advance as per cent of mean (1.67%) were recorded.

4.2.2.12 Milling (%)

Milling per cent ranged from 65.14 (Kasturi) to 77.60 (JGL-1798) with a mean of 71.03. 3.58 GCV (low) and 4.93 PCV (low) with 52.8 per cent (moderate) heritability were recorded. 3.80 genetic advance with low genetic advance as per cent of mean (5.35%) were noticed.

4.2.2.13 Head rice recovery (%)

This trait varies from 52.60 (Tarori Basmati) to 65.50 (WGL-48684) with a mean of 57.21. Low genotypic (4.97) and phenotypic coefficients of variation (5.80) were recorded. 73.33 per cent heritability (high) with 5.01 genetic advance and 8.76 per cent genetic advance as per cent of mean (low) were noticed.

4.2.2.14 Grain elongation ratio

Grain elongation ratio varies from 1.56 (BPT-1235) to 1.91 (BPT-5204) with a mean of 1.75. GCV and PCV were 5.47 (low) and 6.41 (low) respectively. 72.70 per cent of heritability (high) with 0.17 genetic advance and 9.6 per cent (low) genetic advance as per cent of mean were recorded.

4.2.2.15 Protein content (%)

Protein per cent varies from 6.66 (JGL-384) to 8.65 (MTU-2716) with a mean of 7.92. Low GCV (6.2) and PCV (6.81) were recorded with high heritability (82.80%). Genetic advance was 0.92 and genetic advance as per cent of mean was 11.62 per cent (moderate).

4.2.3 Environment - III

The results are presented in Tables 8 and 9 and fig 5-6.

4.2.3.1 Plant height at 65 DAS (cm)

Plant height at 65 DAS varies from 63.50 (MTU 7029) to 104.46 (GEB-24) with a mean of 77.9. This trait recorded moderate GCV (10.76), low PCV (11.34), high heritability (90.0%), genetic advance as (16.38) and high genetic advance as per cent of mean (21.02%).

4.2.3.2 Plant height at harvest (cm)

This trait ranges from 92.23 (WGL 14377) to 156.83 (GEB 24) with a mean of 112.07 moderate genotypic (12.27) and phenotypic (12.55) coefficients of variation with high heritability (95.5%) were recorded. This trait noticed 27.68 genetic advance with 24.7 per cent (high) genetic advance as per cent of mean.

4.2.3.3 Days to 50% flowering

Days to 50 per cent flowering varies from 82.00 (WGL-14377) to 113.33 (GEB 24) with a mean of 101.92. Low GCV (8.62) and PCV (8.99) with high heritability (91.7%) were recorded. Genetic advance of 17.32 with moderate genetic advance as per cent of mean (16.99%) were noticed.

4.2.3.4 Productive tillers/plant

Productive tillers per plant ranges from 5.66 (MTU-7029) to 9.67 (MTU-5293) with a mean of 6.76. Moderate genotypic (13.06) and phenotypic coefficients of variation (18.19) with moderate heritability (51.5%) were recorded. Genetic advance of 1.31 with moderate genetic advance as per cent of mean (19.31%) were recorded.

4.2.3.5 Test weight (g)

The mean values of this trait ranges from 14.46 (BPT-5204) to 24.83 (MTU-3626) with a general mean of 20.07. Moderate GCV (14.52) and PCV (15.0) with high heritability (93.7%) were recorded. 5.81 genetic advance and 28.96 per cent (high) genetic advance as per cent of mean were noticed.

4.2.3.6 Grain yield (kg/plot)

Grain yield ranges from 3.06 (MTU-5293) to 6.88 (MTU-3626) with a mean of 4.74. Moderate GCV (18.54), PCV (18.81) with high heritability (97.2%) were noticed. This character had also recorded 1.78 genetic advance and 37.64 per cent genetic advance as per cent of mean (high).

4.2.3.7 Biomass (kg)

Biomass ranges from 6.72 (MTU-5293) to 13.58 (MTU-3626) with a mean of 9.82. Moderate GCV (17.06) and PCV (17.29) were noticed. This trait had a high heritability (97.4%) with genetic advance (3.41) and genetic advance as per cent of mean (34.67%).

4.2.3.8 Harvest index (%)

Harvest index varies from 42.71 (BPT-5204) to 50.69 (MTU-3626) with a mean of 48.18. Low GCV (3.68) and low PCV (4.50) with high heritability (66.8%) were recorded. 2.99 genetic advance with 6.19 per cent (low) genetic advance as per cent of mean were noticed.

4.2.3.9 L/B Ratio (grain)

This trait ranges from 3.12 (MTU-7029) to 4.83 (Tarori basmati) with a mean of 3.63. Moderate GCV (11.56) and PCV (12.1) with high heritability (91.3%) were noticed. 0.82 genetic advance with 22.77 per cent (high) genetic advance as per cent of mean were recorded.

4.2.3.10 L/B Ratio (kernel)

This trait ranges from 2.42 (MTU-7029) to 4.32 (Tarori basmati) with a mean of 3.09. Moderate GCV (13.92) and PCV (14.32) with high heritability (94.5%) were recorded. Genetic advance of 0.86 with a genetic advance as per cent of mean 27.87 per cent (high) were noticed.

4.2.3.11 Hulling (%)

Hulling per cent varies from 75.66 (MTU-2067) to 82.70 (Vasundhara) with a mean of 78.25. Low GCV (1.39) and PCV (3.28) with low heritability (18.0%) were recorded. This trait had 0.95 genetic advance and 1.22 per cent (low) genetic advance as per cent of mean.

4.2.3.12 Milling (%)

Milling per cent varies from 69.13 (GEB 24) to 77.43 (Vasundhara) with a mean of 72.13. Low GCV (2.81) and PCV (4.13) with moderate heritability (46.3%) were observed for this trait. It had genetic advance of 2.84 and genetic advance as per cent of mean 3.94 per cent (low).

4.2.3.13 Head rice recovery (%)

This trait ranges from 52.50 (MTU-3626) to 62.20 (MTU-2067) with a mean of 57.16. It had low GCV (5.06) and low PCV (5.88) with high heritability (74.1%). Genetic advance of 5.13 and genetic advance as per cent of mean 8.98 per cent were recorded.

4.2.3.14 Grain elongation ratio

It ranges from 1.55 (Kasturi) to 1.88 (BPT-5204) with a mean of 1.74. It had recorded low GCV (5.95) and low PCV (6.68) with high heritability (79.6%) 0.19 genetic advance with 10.95 genetic advance as per cent of mean (moderate) were noticed for this trait.

4.2.3.15 Protein content (%)

Protein content ranges from 6.44 (JGL-384) to 8.65 (PR-103) with a mean of 7.89. It had record low GCV (6.45) and low PCV (7.07) with high heritability (83.2%). It had noticed 0.96 genetic advance and 12.12 per cent genetic advance as per cent of mean (moderate).

4.2.4 Environment – IV

The results are presented in Tables 10 and 11 and fig.7-8.

4.2.4.1 Plant height at 65 DAS (cm)

The trait varies from 60.37 (MTU-7029) to 97.56 (GEB-24) with a mean of 73.93. This character had moderate GCV (10.55), moderate PCV (11.02) with high heritability (91.5%) 15.37 genetic advance and 20.79 per cent genetic advance as per cent of mean (high) were recorded.

4.2.4.2 Plant height at harvest (cm)

The trait ranges from 88.33 (WGL-14377) to 147.00 (GEB-24) with a mean of 107.45. GCV (12.10) and PCV (12.48) recorded were moderate with high heritability (94.1%). 25.99 genetic advance and 24.19 per cent of genetic advance as per cent of mean (high) were noticed.

4.2.4.3 Days to 50% flowering

Days to 50% flowering ranges from 76.00 (WGL-14377) to 113.00 (MTU-5293) with a mean of 99.13. Low GCV (9.93), moderate (10.38) PCV and high heritability (91.50%) were recorded. 19.39 genetic advance with 19.56 per cent genetic advance as per cent of mean were recorded.

4.2.4.4 Productive tillers/plant

Productive tillers per plant ranges from 5.33 (PR 106) to 9.33 (MTU 5293) with a mean 6.64. Moderate GCV (14.72) and moderate PCV (19.14) with moderate heritability (59.1%) were recorded. Genetic advance noticed was 1.55. Genetic advance as per cent of mean was (23.31 per cent) high.

4.2.4.5 Test weight (g)

Test weight ranges from 14.17 (BPT-5204) to 25.42 (MTU-3626) with a mean value of 19.93. GCV (14.87) and PCV (15.26) were moderate. High heritability (94.9%) with genetic advance (5.94) and high genetic advance as per cent of mean (29.83) were recorded.

4.2.4.6 Grain yield (kg/plot)

The trait varies from 2.84 (MTU-5293) to 6.56 (MTU-3626) with a mean of 4.50. GCV and PCV were 19.42 and 19.63 respectively, which are moderate. 97.9 per cent heritability (high), 1.78 genetic advance and 39.59 per cent (high) genetic advance as per cent of mean, were recorded.

4.2.4.7 Biomass (kg)

Biomass ranges from 6.31 (MTU-5293) to 13.18 (MTU-3626) with a mean of 9.38. It had moderate GCV (17.82) and PCV (18.08) with high heritability (97.1%). 3.39 genetic advance and 36.17 per cent genetic advance as per cent of mean (high) were recorded.

4.2.4.8 Harvest Index (%)

Harvest index ranges from 42.65 (BPT-5204) to 50.53 (MTU-1010) with a mean of 47.93. GCV (3.56) and PCV (4.76) recorded were low. Moderate heritability (56.1%) with 2.64 genetic advance and 5.50 per cent genetic advance as per cent of mean were recorded.

4.2.4.9 L/B ratio (grain)

This character ranges from 2.98 (MTU-3626) to 4.88 (Tarori Basmati) with a mean of 3.57. 12.27 GCV and 12.66 PCV were recorded which are moderate. High heritability 93.8 per cent with 0.87 genetic advance and 24.48 genetic advance as per cent of mean (high) were noticed.

4.2.4.10 L/B ratio (kernel)

The trait varies from 2.57 (MTU-7029) to 4.33 (Tarori Basmati) with a mean of 3.08. It has moderate GCV (14.36) and moderate PCV (14.71). This character recorded high heritability 95.4 per cent with 0.89 genetic advance and 28.89 per cent genetic advance as per cent of mean (high).

4.2.4.11 Hulling (%)

Hulling per cent ranges from 72.57 (MTU-4870) to 81.20 (WGL-14377) with a mean of 77.70. GCV was low (1.99) with low PCV (3.39). Heritability noticed moderate (34.6%) with genetic advance (1.87) and low genetic advance as per cent of mean (2.41%).

4.2.4.12 Milling (%)

Milling ranges from 67.50 (JGL-1798) to 76.23 (MTU-7029) with a mean of 72.17. Low GCV and PCV recorded were 2.82 and 4.28 with 43.2 per cent heritability. Genetic advance

2.75 and 3.81 per cent genetic advance as per cent of mean (low) were noticed.

4.2.4.13 Head rice recovery (%)

It varies from 52.10 (Vasundhara) to 62.60 (WGL-14377) with a mean of 56.68. GCV (4.88) and PCV (5.66) were low with high heritability (74.2%). Genetic advance noticed was 4.91 and low genetic advance as per cent of mean noticed was 8.65 per cent (low).

4.2.4.14 Grain elongation ratio

Grain elongation ratio ranges from 1.56 (BPT-1235) to 1.88 (MTU- 2716) with a mean of 1.74. GCV and PCV noticed were 5.86 (low) and 6.48 (low) respectively. High heritability (81.9%) with 0.19 genetic advance and 10.93 per cent (moderate) genetic advance as per cent of mean were recorded.

4.2.4.15 Protein content (%)

Protein content varies from 6.46 (JGL-384) to 8.68 (MTU-2716) with a mean of 7.90. The genotypic and phenotypic coefficients of variation recorded were 6.37 (low) and 6.98 (low) respectively. High heritability (83.1 per cent) with 0.94 genetic advance and moderate genetic advance as per cent of mean (11.95 per cent) were noticed.

4.3 CHARACTER ASSOCIATION

The phenotypic correlation coefficients among quantitative and qualitative characters are presented environment wise in Tables 12-15. The results were presented character wise, here under.

4.3.1 Environment I

The results are presented in Table12

4.3.1.1 Plant height at 65 DAS (cm)

This trait recorded a positive and significant correlation with plant height at harvest (0.461**), L/B ratio (grain) (0.271*) and L/B ratio (kernel) (0.259*).

It recorded negative and significant correlation with days to 50% flowering (-0.396**), biomass (-0.362**) and yield (-0.453**).

4.3.1.2 Plant height at harvest (cm)

Plant height had negative and significant association with grain yield (-0.368**) and biomass (-0.311**).

This trait recorded positive and significant correlation with plant height at 65 DAS (0.461**), L/B ratio (grain) (0.398**) and L/B ratio (kernel) (0.232*).

4.3.1.3 Days to 50% flowering

This character recorded positive and significant correlation with biomass (0.524**) and grain yield (0.442**).

It recorded negative and significant association with L/B ratio (grain) (-0.312**), L/B ratio of (kernel) (-0.496**), hulling (-0.288*) and milling (0.245*).

4.3.1.4 Productive tillers/ plant

This character recorded positive and significant correlation with biomass (0.243*) and non-significant correlation with yield (0.222).

A negative association with hulling (-0.042), milling (-0.204), head rice recovery (-0.173) and grain elongation ratio (-0.045).

4.3.1.5 Test weight (g)

It exhibited negative and significant relation with hulling (-0.248*) and head rice recovery (-0.282*) and non-significant positive association with other characters.

4.3.1.6 Biomass (kg)

This character was found to have positive and significant correlation with grain yield (0.919**), protein (0.296**) and a negative and significant correlation with L/B ratio(grain)(-0.562**), L/B ratio (kernel) (-0.59**) and milling (-0.279*).

4.3.1.7 Harvest Index (%)

It correlated positive and significantly with grain yield (0.408**).

It exhibited negative and significant relation with L/B ratio (grain) (-0.466**) and L/ B ratio (kernel) (-0.396**).

4.3.1.8 L/B ratio (grain)

This trait recorded a positive and significant correlation with L/B ratio (kernel) (0.826**).

It recorded negative and significant correlation with grain elongation ratio (-0.238*) and grain yield (-0.66**).

4.3.1.9 L/B ratio (kernel)

It exhibited positive significant association with L/B ratio (grain) (0.826**).

It correlated negatively and significantly with grain yield (-0.670**), days to 50% flowering (-0.496**), biomass (-0.590**) and harvest index (-0.396**).

4.3.1.10 Hulling (%)

It associated positively and significantly with milling (0.464**), significant negative association with days to 50% flowering (-0.288*) and test weight (-0.248*) and negatively and non-significantly with grain yield (-0.155). The remaining characters showed positive and non-significant associations with hulling.

4.3.1.11 Milling (%)

It had negative and significant association with days to 50% flowering (-0.245*), biomass (-0.279*) and grain yield (-0.274*). It had positive significant association with hulling per cent (0.464**).

4.3.1.12 Head rice recovery (%)

It had negative and significant association with test weight (-0.282*) and positive non- significant association with grain yield (0.02)

4.3.1.13 Grain elongation ratio

It had negative and significant association with L/B ratio of grain (-0.238*) and positive non-significant association with grain yield (0.136) and protein (0.189).

4.3.1.14 Protein Content (%)

It exhibited positive and significant association with biomass (0.296**) and showed positive non-significant association with grain yield (0.189).

4.3.1.15 Grain yield (kg/plot)

This trait recorded a positive and significant correlation with days to 50% flowering (0.442**), biomass (0.919**) and harvest index (0.408**).

It recorded negative and significant correlation with plant height at 65 DAS (-0.453**), plant height at harvest (-0.368**), L/B ratio (grain) (-0.66**), L/B ratio (kernel) (-0.670**) and milling (-0.274*).

4.3.2 Environment II

The results are presented in Table 13.

4.3.2.1 Plant height at 65 DAS (cm)

This trait recorded a positive and significant correlation with plant height at harvest (0.611**).

It recorded negative and significant correlation with biomass (-0.253*) and harvest index yield (-0.356**).

4.3.2.2 Plant height at harvest (cm)

This trait recorded positive and significant correlation with L/B ratio (grain) (0.272*).

Plant height had negative and significant association with grain yield (-0.315**), milling (-0.233*) and harvest index (-0.404**).

4.3.2.3 Days to 50% flowering

This character recorded positive and significant correlation with biomass (0.322**) and grain yield (0.302**).

It recorded negative and significant association with L/B ratio (grain) (-0.434**), L/B ratio (kernel) (-0.324**) and milling (-0.258*).

4.3.2.4 Productive tillers/plant

This character recorded positive and non-significant correlation with test weight (0.060), biomass (0.068), L/B ratio (grain) (0.176), L/B ratio (kernel) (0.146), hulling (0.004), Protein (0.039) and grain yield (0.03).

It recorded a negative association with harvest index (-0.114), milling (-0.046), head rice recovery (-0.073) and grain elongation ratio (-0.026).

4.3.2.5 Test weight (g)

It exhibited positive and significant association with protein (0.250*), positive and non-significant association with grain yield (0.115).

It exhibited negative and significant relation with head rice recovery (-0.376**).

4.3.2.6 Biomass (kg)

This character was found to show positive and significant correlation with days to 50% flowering (0.322**), grain yield (0.923**) and protein content (0.300**).

It exhibited negative and significant association with L/B ratio (grain) (-0.500**) and L/B ratio (kernel) (-0.670**), plant height at 65 DAS (-0.253*).

4.3.2.7 Harvest Index (%)

It correlated positive and significantly with milling (0.245*), head rice recovery (0.241*) and grain yield (0.451**).

It exhibited negative and significant relation with L/B ratio (grain) (-0.420**) and L/B ratio (kernel) (-0.419**), plant height at harvest (-0.404**) and plant height at 65 DAS (-0.343**).

4.3.2.8 L/B ratio (grain)

This trait recorded a positive and significant correlation with L/B ratio (Kernel) (0.873**) and plant height at harvest (0.272*).

It recorded a negative and significant correlation with head rice recovery (-0.245*) and grain yield (-0.586**), harvest index (-0.420**), biomass (-0.500**) and days to 50% flowering (-0.434**).

4.3.2.9 L/B ratio (kernel)

It exhibited positive and significant correlation with L/B ratio (grain) (0.873**).

It correlated negatively and significantly with grain yield (-0.732**), harvest index (-0.419**), biomass (-0.620**) and days to 50% flowering (-0.324**).

4.3.2.10 Hulling (%)

It associated positively and significantly with milling (0.525**), and grain elongation ratio (0.291*).

It exhibited positive and non-significant association with head rice recovery (0.105), protein content (0.054) and grain yield (0.054).

4.3.2.11 Milling (%)

It had positive and significant correlation with hulling (0.525**) and harvest index (0.245*).

It exhibited negative and significant relation with protein content (-0.230*), plant height at harvest (-0.233*) and days to 50% flowering (-0.258*) and non-significant with grain yield (-0.085).

4.3.2.12 Head rice recovery (%)

It had positive and significant association with harvest index (0.241*).

It exhibited negative and significant correlation with test weight (-0.376**), L/B ratio of (grain) (-0.245*) and negative non-significant association with grain yield (-0.049).

4.3.2.13 Grain elongation ratio

It had positive and significant association with hulling (0.291*) and non-significant positive association with protein (0.161) and grain yield (0.136).

4.3.2.14 Protein Content (%)

It exhibited positive and significant association with test weight (0.250*) and biomass (0.300**) and positive and non-significant association with grain yield (0.202). It exhibited negative significant association with milling per cent (-0.230*).

4.3.2.15 Grain yield (kg/plot)

This trait recorded a positive and significant correlation with days to 50% flowering (0.302**), biomass (0.923**) and harvest index (0.451**).

It recorded negative and significant correlation with plant height at 65 DAS (-0.356**), plant height at harvest (-0.315**), L/B ratio (grain) (-0.586**) and L/B ratio (kernel) (-0.732**).

4.3.3 Environment III

The results are presented in Table 14.

4.3.3.1 Plant Height at 65 DAS (cm)

This trait recorded a positive and significant correlation with plant height at harvest (0.666**).

It recorded negative and significant correlation with test weight (-0.243*) and negative and non-significant correlation with grain yield (-0.202).

4.3.3.2 Plant height at harvest (cm)

Plant height had negative and significant correlation with head rice recovery (-0.246*).

It recorded negative and non-significant correlation with grain yield (-0.113).

4.3.3.3 Days to 50% flowering

This character recorded positive and significant correlation with biomass (0.286*), head rice recovery (0.366**) and grain yield (0.230*).

It recorded negative and significant correlation with test weight (-0.249*), L/B ratio (grain) (-0.520**), L/B ratio (kernel) (-0.515**), hulling (-0.252*) and milling (-0.354**).

4.3.3.4 Productive tillers/plant

It recorded negative association with biomass (-0.176), harvest index (-0.054), hulling (-0.112) and milling (-0.136). This character recorded positive association with test weight (0.030), L/B ratio (kernel) (0.124), head rice recovery (0.015), grain elongation ratio (0.055), protein content (0.031) and grain yield (0.154).

4.3.3.5 Test weight (g)

It exhibited positive and significant correlation with harvest index (0.474**) and protein content (0.315**) and non-significant correlation with grain yield (0.195).

It recorded significant negative association with plant height at 65 DAS (-0.243*) and days to 50% flowering (-0.249*).

4.3.3.6 Biomass (kg)

This trait was found to have positive and significant correlation with grain yield (0.964**) and days to 50% flowering (0.286*).

It exhibited negative and significant correlation with L/B ratio (grain) (-0.519**) and L/B ratio (kernel) (-0.546**).

4.3.3.7 Harvest Index (%)

It correlated positively and significantly with grain yield (0.345**) and test weight (0.474**).

It exhibited negative and significant association with head rice recovery (-0.240*) and grain elongation ratio (-0.229*).

4.3.3.7 L/B ratio (grain)

This trait recorded a positive and significant correlation with L/B ratio (kernel) (0.883**).

It recorded a negative and significant correlation with grain yield (-0.472**), days to 50 per cent flowering (-0.520**) and biomass (-0.519**).

4.3.3.9 L/B ratio (kernel)

It exhibited positive and significant association with L/B ratio (grain) (0.883**).

It correlated negatively and significantly with grain yield (-0.509**), days to 50 per cent flowering (-0.515**) and biomass (-0.546**).

4.3.3.10 Hulling (%)

It associated positively and significantly with milling (0.330**) and grain elongation ratio (0.253*), while, it recorded negative significant with days to 50 per cent flowering (-0.252*).

It exhibited a negative non-significant association with grain yield (-0.026) and head rice recovery (-0.191).

4.3.3.11 Milling (%)

It had positive and significant association with hulling (0.330**), while, negative significant with days to 50 per cent flowering (-0.354**).

It recorded negative non-significant association with head rice recovery (-0.043), grain elongation ratio (-0.086), protein content (-0.175) and grain yield (-0.087).

4.3.3.12 Head rice recovery (%)

It recorded positive and significant correlation with protein content (0.261*) and days to 50 per cent flowering (0.366**). This character exhibited negative and significant correlation with plant height at harvest (-0.246*), harvest index (-0.240*) and grain elongation ratio (-0.346**) and negative non-significant association with grain yield (-0.133).

4.3.3.13 Grain elongation ratio

It exhibited positive and significant correlation with hulling (0.253*) and non-significant positive association with grain yield (0.006).

It had negative and significant association with harvest index (-0.229*) and head rice recovery (-0.346**).

4.3.3.14 Protein content (%)

This trait showed positive and significant correlation with head rice recovery (0.261*), test weight (0.315**) and non-significant positive association with grain yield (0.018).

4.3.3.15 Grain yield (kg/plot)

Grain yield recorded positive and significant correlation with days to 50% flowering (0.230*), biomass (0.964**) and harvest index (0.345**).

It recorded negative and significant correlation with L/B ratio (grain) (-0.472**) and L/B ratio (kernel) (-0.509**).

4.3.4 Environment IV

The results are presented in Table 15.

4.3.4.1 Plant height at 65 DAS (cm)

This character recorded positive and significant correlation with plant height at harvest (0.631**).

It recorded negative and non-significant correlation with grain yield (-0.173).

4.3.4.2 Plant Height at Harvest (cm)

This trait recorded positive and significant correlation with grain elongation ratio (0.250*).

It recorded negative and significant correlation with milling (-0.331**) and non-significant correlation with grain yield (-0.117).

4.3.4.3 Days to 50% flowering

Days to 50 per cent flowering had positive and significant association with biomass (0.268*) and grain yield (0.230*).

It recorded negative and significant correlation with L/B ratio (grain) (-0.556**), L/B ratio (kernel) (-0.583**), hulling (-0.295*) and milling (-0.258*).

4.3.4.4 Productive tillers/plant

This character recorded positive and non-significant association with L/B ratio (grain) (0.059), L/B ratio (kernel) (0.025), head rice recovery (0.180) protein content (0.102) and grain yield (0.076).

It recorded negative and significant association with hulling (-0.283*) and milling (-0.308**).

4.3.4.5 Test weight (g)

It exhibited positive and significant correlation with harvest index (0.325**) and protein per cent (0.289*), while it showed non-significant association with grain yield (0.052).

It recorded negative and significant correlation with head rice recovery (-0.315**).

4.3.4.6 Biomass (kg)

This character was found to have positive and significant correlation with grain yield (0.964**) and days to 50 per cent flowering (0.268*).

It recorded negative and significant correlation with L/B ratio (grain) (-0.551**) and L/B ratio (kernel) (-0.531**).

4.3.4.7 Harvest index (%)

It correlated positively and significantly with grain yield (0.376**) and test weight (0.325**).

It exhibited negative and significant correlation with head rice recovery (-0.302**).

4.3.4.8 L/B ratio (grain)

This trait recorded a positive and significant correlation with L/B ratio (kernel) (0.891**).

It exhibited negative and significant correlation with grain yield (-0.529**), biomass (-0.551**) and days to 50 per cent flowering (-0.556**).

4.3.4.9 L/B ratio (kernel)

This trait recorded a positive and significant correlation with L/B ratio (grain) (0.891**).

It exhibited negative and significant correlation with grain yield (-0.499**), biomass (-0.531**) and days to 50 per cent flowering (-0.583**).

4.3.4.10 Hulling (%)

It associated positively and significantly with milling (0.351**) and showed non-significant positive association with grain yield (0.012).

It recorded negative significant association with days to 50 per cent flowering (-0.295*) and productive tillers per plant (-0.283*).

It showed negative and non-significant association with head rice recovery (-0.009) and protein content (-0.049).

4.3.4.11 Milling (%)

It correlated positively and significantly with hulling (0.351**).

This character associated negatively and non-significantly with grain yield (-0.123) and significantly with productive tillers per plant (-0.308**) and plant height at harvest (-0.331**).

4.3.4.12 Head rice recovery (%)

This character showed negative and significant association with grain elongation ratio (-0.276*), test weight (-0.315**) and harvest index (-0.302**).

It correlated negatively and non-significantly with grain yield (-0.042).

4.3.4.13 Grain elongation ratio

It exhibited positive and significant association with plant height at harvest (0.250*) and non-significant positive association with grain yield (0.053).

It correlated negatively and significantly with head rice recovery (-0.276*).

4.3.4.14 Protein content (%)

It exhibited positive and non-significant association with grain yield (0.022), while it recorded positive significant association with test weight (0.289*).

It showed negative and non-significant association with plant height at 65 DAS (-0.139), plant height at harvest (-0.043), L/B ratio (grain) (-0.214), L/B ratio (kernel) (-0.212), hulling (-0.049), milling (-0.154) and head rice recovery (-0.066).

4.3.4.15 Grain yield (kg/plot)

This trait recorded a positive and significant correlation with days to 50% flowering (0.230*), biomass (0.964**) and harvest index (0.376**).

It recorded negative and significant correlation with L/B ratio (grain) (-0.529**) and L/B ratio (kernel) (-0.499**).

4.4 STABILITY ANALYSIS

The Bartlett's χ^2 values for different characters are presented in Table 16. The χ^2 values were non-significant and also the coefficient of variations are low for all the characters except productive tillers per plant indicating homogeneity of error variances over environments and allowing pooling of data over environment for further analysis.

Eberhart and Russell (1966) stability Model

The analysis of variance for stability for characters as suggested by Eberhart and Russell is given in Table 18. The genotypes showed significant differences for all the characters. Environment and genotype-environment interaction components showed high significance for all the characters except productive tillers/plant, grain elongation ratio, and protein content, indicating wide differences between environments and differential behaviour of genotypes in different environments. The high significance of environment (linear) component for all the characters conforms to the earlier observation of widely differing environments in the analysis of variance and also to the widely ranging environmental indices for different characters (Table 17).

The genotype-environment (linear) component showed significance for all the characters except hulling per cent when tested against pooled error. However, the genotype environment (linear) interaction was significant for plant height at harvest, grain yield, biomass, harvest index and L/B ratio of kernel when tested against pooled deviation and pooled error. The high significance of pooled deviation for all the characters except harvest index and L/B ratio kernel indicates the importance of non-linear component in determining interaction of the genotypes with environments in the present study (Table 18). Stability parameters for different characters under investigation are presented in Table 19.

4.4.1 Plant height at 65 DAS (cm)

The mean for this trait varied from 65.48 (MTU 7029) to 98.5 (GEB -24). The genotypes Kasturi (1.739 $\pm$ 0.130, 94.61 cm), BPT-1235 (1.558 $\pm$ 0.170, 72.13 cm), MTU-7029 (1.194 $\pm$ 0.130, 65.48 cm), MTU-1010 (1.852 $\pm$ 0.340, 74.73 cm), MTU-3626 (1.356 $\pm$ 0.110, 75.60 cm) and WGL-48684 (1.395 $\pm$ 0.370, 88.62) exhibited below average stability with regression coefficient greater than unity and non-significant deviations from regression. PR-106 (0.566 $\pm$ 0.200, 71.94 cm) and MTU-5249

(0.523 ± 0.240, 74.73 cm) recorded above average stability with regression coefficient less than unity and non-significant deviations from regression. The remaining genotypes had significant deviations from linearity.

4.4.2 Plant height at harvest (cm)

The mean character for this trait varied from 93.8 (WGL-14377) to 151.9 (GEB-24). The genotypes PR-106 (2.161 ± 0.390, 115.70 cm) and WGL-48684 (1.420 ± 0.170, 138.50 cm) exhibited below average stability with regression coefficient greater than unity and non significant deviation from regression. The genotypes MTU-3626 (0.591 ± 0.290, 96.10 cm) recorded above average stability with regression coefficient less than unity and non-significant deviations from regression. The remaining genotypes showed significant deviation from regression.

4.4.3 Days to 50% flowering

The mean value for this trait varied from 75.2 (WGL-14377) to 115.5 (GEB-24). The genotype WGL-48684 (0.480 ± 0.33, 87.30) recorded above average stability with regression coefficient less than unity and non-significant deviation from regression. The remaining genotypes showed significant deviations from regression.

4.4.4 Test weight (g)

The mean value for this trait varied from 14.21 (BPT-5204) to 26.65 (MTU-3626). The genotypes PR-103 (4.231 ± 0.870, 22.13 g), BPT-1235 (3.587 ± 1.32, 24.06g) and NLR-145 (2.272 ± 1.12, 21.08g) recorded below average stability with regression coefficient greater than unity and non-significant deviations from regression. Vasundhara (-6.049 ± 1.26, 20.39) and MTU-5293 (-0.292 ± 0.440, 18.44g) recorded above average stability with regression coefficient less than unity and non significant deviations from regression. Whereas, the remaining genotypes showed significant deviations from regression.

4.4.5 Grain yield (kg/plot)

The mean value for this trait ranged from 2.68 (Tarori basmati) to 5.93 (MTU-3626). The genotypes MTU-7029 (0.990 ± 0.010, 5.39 kg) and MTU-2716 (1.058 ± 0.040, 5.04 kg) recorded desirable mean around unity regression and deviation from regression approaching zero. BPT-1235 (0.701 ± 0.110, 3.36 kg), MTU-2067 (0.768 ± 0.070, 4.75 kg), MTU-5249 (0.261 ± 0.220, 4.64kg), JGL-384 (0.893 ± 0.06, 4.38 kg) and MTU-1032 (0.628 ± 0.150, 4.95 kg) recorded above average stability with regression coefficient less than unity and non-significant deviations from regression. The genotypes Kasturi (1.360 ± 0.110, 4.14 kg), MTU-1010 (1.448 ± 0.140, 5.54 kg), GEB-24 (1.663 ± 0.210, 3.98 kg), MTU-1001 (1.391 ± 0.130, 5.42 kg) and JGL-1798 (1.411 ±

0.140, 4.96 kg) recorded below average stability with regression coefficient greater than unity and non-significant deviations from regression. The remaining genotypes showed significant deviations from regression.

4.4.6 Harvest index (%)

The mean value for this character ranged from 40.69 (Tarori basmati) to 50.03 (MTU-3626). All the genotypes showed non-significant deviations from regression. The genotypes Kasturi (1.993 ± 0.08, 45.93%), Erramallelu (2.389 ± 0.130, 44.70%), PR-103 (2.313 ± 0.070, 43.77%), Triguna (2.199 ± 0.070, 45.18%), MTU- 5293 (1.745 ± 0.03, 42.30%), GEB-24 (2.205 ± 0.070, 44.72%), Tarori basmati (3.876 ± 0.090, 40.89%), MTU-5249 (1.918 ± 0.060, 45.50%), MTU-2716 (2.776 ± 0.150, 44.27%), WGL-14377 (1.088 ± 0.030, 46.88%) and MTU-1032 (1.071 ± 0.010, 47.10%) showed below average stability. The liner regression values are significant for all the genotypes except MTU-1010, WGL-14377. The genotypes Vasundhara (0.711 ± 0.030, 48.11%), BPT-1235 (0.817 ± 0.020, 47.78%) and MTU-7029 (0.905 ± 0.030, 48.35%), BPT-5204 (0.821 ± 0.050, 44.10%), MTU-1010 (0.855 ± 0.040, 49.06%), MTU-4870 (-1.130 ± 0.060, 47.64%), MTU-1001 (0.824 ± 0.040, 47.74%), MTU-3626 (0.127 ± 0.130, 50.03%), NLR-145 (-0.430 ± 0.040, 47.90%), JGL-1798 (-0.216 ± 0.040, 48.90%), JGL-384 (0.416 ± 0.060, 45.09%), WGL-48684 and (-1.105 ± 0.11, 47.28%) showed above average stability with high mean regression coefficient less than unity and non significant deviations from regression.

4.4.7 Biomass (kg)

The mean value for this trait ranged from 6.47 (Tarori basmati) to 11.84 (MTU-3626). The genotypes PR-106 (1.001 ± 0.100, 7.45 kg) NLR-145 (1.001 ± 0.08, 9.59 kg), JGL-384 and (1.02 ± 0.018, 9.70kg) recorded desirable mean with unit regression and deviations from regression approaching zero. BPT-5204 (1.495 ± 0.270, 9.92 kg), MTU-1010 (1.595 ± 0.390, 11.28 kg), GEB-24 (1.184 ± 0.150, 8.88 kg) and MTU-1001 (1.574 ± 0.390, 11.35 kg) recorded below average stability with regression coefficient greater than unity and non significant deviations from regression. The genotypes BPT-1235 (0.835 ± 0.130, 7.03 kg) and MTU-7029 (0.874 ± 0.070, 11.15 kg) recorded above average stability with regression coefficient less than unity and non-significant deviations from regression. The remaining genotypes showed significant deviations from regression.

4.4.8 L/B ratio (grain)

The mean value for this trait ranged from 3.05 (MTU-3626) to 4.81 (Tarori basmati). The varieties PR-106 (4.034 ± 0.590, 4.32), MTU-5293 (-0.999 ± 2.36, 3.53), Triguna (-0.186 ± 1.62, 2.83), GEB-24 (-0.228 ± 2.750, 3.32), Tarori Basmati (0.399 ± 3.25, 4.81) and MTU-2067 (-1.359 ± 3.09, 3.31) recorded below average stability with regression coefficient greater than unity and non significant deviations from regression.

4.4.9 L/B ratio (kernel)

The mean value for this trait ranged from 2.52 (MTU-7029) to 4.32 (Tarori basmati). The varieties Kasturi (4.614 ± 2.47, 3.29), Erramallelu (4.132 ± 2.900, 3.82), Vasundhara (2.498 ± 0.820, 3.12), Triguna (3.551 ± 1.026, 3.18), MTU-5293 (2.281 ± 1.260, 3.18), GEB-24 (5.728 ± 4.220, 2.61), MTU-2067 (7.286 ± 4.100, 2.73), MTU-4870 (5.619 ± 3.24, 2.59), MTU-1001 (5.497 ± 0.650, 2.63), MTU-5249 (3.694 ± 0.410, 2.590), WGL-48684 (2.166 ± 1.120, 3.00) and MTU-3626 (-0.542 ± 1.630, 2.64) recorded below average stability with regression coefficient greater than unity and non-significant deviations from regression. The genotypes MTU-1010 (-4.886 ± 0.500, 3.22), Tarori basmati (-1.929 ± 0.000, 4.31), NLR-145 (-1.447 ± 1.610, 3.18), JGL-1798 (-1.436 ± 1.000, 3.15), JGL-384 (-3.177 ± 1.040, 3.12), MTU-7029 (-2.486 ± 3.340, 3.52) and MTU-2716 (-3.221 ± 4.120, 2.75) recorded high mean, with linear regression less than unity and non-significant deviations from regression. The genotype MTU-1032 only showed significant deviation from regression.

4.4.10 Hulling (%)

The mean value for this trait ranged from 75.03 to 81.53 (Vasundhara). The genotypes Erramallelu (3.314 ± 2.270, 79.54%), MTU-1010 (3.615 ± 1.420, 79.67%), MTU-2716 (3.002 ±

0.600, 78.16%), MTU-2067 (-0.008 ± 2.040, 75.03%) and MTU-1001 (-1.413 ± 3.280, 78.08%) recorded below average stability with regression coefficient greater than unity and non- significant deviations from regression. The varieties PR-106 (-0.775 ± 1.730, 76.38%), BPT 1235 (-2.247 ± 2.170, 76.67%), Triguna (-0.815 ± 3.100, 77.48%), MTU-5293 (1.100 ± 1.070, 77.56%) and BPT-5204 (1.787 ± 1.000, 79.45%) recorded above average stability with regression coefficient less than unity and non significant deviations from regression. The genotypes MTU-4870, MTU-5249, JGL-1798 recorded significant deviation from regression.

4.4.11 Milling (%)

The mean value for this trait ranged from 68.81 (Kasturi) to 76.90 (WGL-14377). BPT-1235 (2.347 ± 0.710, 70.35%), Triguna (2.652 ± 0.920, 71.36%), BPT-5204 (3.059 ± 0.850, 71.51%), MTU-2067 (3.056 ± 1.170, 70.51%) and JGL-384 (2.982 ± 0.870, 71.26%) recorded below average stability with regression coefficient greater than unity and non-significant deviations from regression. The genotypes MTU-1001 (-0.207 ± 1.250, 71.68%), PR-103 (0.188 ± 0.430, 70.31%), MTU-1010 (-0.234 ± 0.880, 70.62%), GEB-24 (-0.623 ± 0.400, 69.51%) and MTU-5249 (-1.461 ± 1.430, 72.48%) recorded above average stability with regression coefficient less than unity and non-significant deviations from regression. The remaining varieties showed significant deviation from regression.

4.4.12 Head rice recovery (%)

The mean value for this trait ranged from 53.03 (Tarori basmati) to 61.53 (NLR-145). The genotypes BPT-1235 (3.274 ± 1.630, 54.16%), GEB-24 (7.114 ± 2.510, 56.05%), MTU-5249 (4.825 ± 1.540, 56.90%) and NLR-145 (3.604 ± 2.590, 61.53%) recorded below average stability with a regression coefficient greater than unity and non-significant deviation from regression. The genotypes JGL-384 (-7.519 ± 3.12, 57.29%) and WGL-14377 (-5.526 ± 3.540, 60.30%) recorded above average stability with regression coefficient less than unity and non-significant deviation from regression. The remaining genotypes showed significant deviation from regression.

Table 4: Mean performance of 25 genotypes of rice in Environment – I

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/ plot)	Biomass (kg)	Harvest index
Kasturi	97.33	136.56	99.00	9.33	18.52	3.85	9.13	43.15
Erramallelu	73.46	115.93	101.00	6.00	19.43	2.06	5.07	40.76
Vasundhara	68.43	115.90	104.00	7.66	17.50	4.55	9.68	47.06
PR-103	80.33	104.83	93.33	7.66	26.08	3.33	8.29	40.12
PR-106	73.90	128.70	111.00	8.66	22.81	3.42	7.42	46.58
BPT-1235	74.50	111.93	88.00	7.00	25.20	3.32	7.13	46.56
MTU-7029	66.53	93.33	114.00	7.00	19.84	5.24	11.18	46.87
Triguna	77.20	131.53	112.99	6.00	17.38	5.05	12.15	41.61
MTU-5293	79.73	100.83	117.33	11.00	18.43	4.83	12.26	39.43
BPT-5204	76.43	109.93	115.99	7.66	14.40	4.43	9.73	45.52
MTU-1010	78.13	122.26	86.00	8.33	25.01	5.26	11.04	47.59
GEB-24	82.50	156.50	123.66	6.00	19.57	3.62	8.78	41.26
Tarori Basmati	94.90	146.60	93.00	8.33	21.72	2.07	6.05	34.33
MTU-2067	73.80	113.79	115.00	7.66	20.15	4.67	9.56	48.83
MTU-4870	75.26	117.93	117.00	7.66	20.68	4.85	9.80	49.48
MTU-1001	82.66	126.00	111.33	8.67	24.29	5.16	11.11	46.39
MTU-3626	76.13	97.90	96.00	8.00	29.40	5.25	10.54	49.81
MTU-5249	73.70	95.93	116.99	7.66	20.67	4.73	11.16	42.36
MTU-2716	79.43	113.36	115.00	7.00	20.30	4.85	12.28	39.53
NLR-145	84.63	115.43	104.00	7.33	22.37	4.64	9.53	48.69
JGL-1798	72.29	105.80	91.00	10.00	14.28	4.67	9.63	48.49
JGL-384	88.44	115.66	101.67	5.66	14.98	4.26	9.57	44.53
WGL-48684	93.03	145.89	91.66	6.66	18.55	2.88	5.85	49.21
WGL-14377	94.43	96.60	76.00	6.00	18.48	2.86	6.38	45.19
MTU-1032	76.50	116.50	121.00	7.66	21.50	4.93	10.85	45.42
Mean	79.74	117.43	104.63	7.62	20.46	4.19	9.36	44.75
CD 5%	4.08	6.43	4.86	1.98	1.14	0.18	0.47	2.20
CV%	3.12	3.34	2.83	15.86	3.39	2.64	3.08	2.99

Contd..1

Genotypes	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	4.47	3.18	78.67	69.33	58.40	1.55	8.11
Erramallelu	4.72	3.81	81.17	74.67	57.77	1.64	7.22
Vasundhara	3.66	3.08	80.87	71.17	55.77	1.81	8.15
PR-103	3.74	3.25	79.26	69.70	60.37	1.75	8.66
PR-106	4.36	3.72	75.54	69.50	58.67	1.69	7.48
BPT-1235	3.85	3.48	75.53	68.40	54.80	1.58	8.32
MTU-7029	3.20	2.59	78.39	70.27	58.43	1.81	8.48
Triguna	3.84	3.10	75.86	70.30	58.60	1.68	7.98
MTU-5293	3.53	2.83	77.93	69.83	56.33	1.77	8.26
BPT-5204	3.64	3.19	80.37	69.60	58.46	1.92	8.04
MTU-1010	3.85	3.30	80.33	70.98	55.60	1.88	8.21
GEB-24	3.38	2.47	75.77	69.53	56.50	1.88	7.82
Tarori Basmati	4.87	4.35	79.56	70.37	50.47	1.86	7.93
MTU-2067	3.27	2.59	74.80	68.53	54.50	1.63	8.04
MTU-4870	3.35	2.44	72.73	68.43	52.60	1.81	8.12
MTU-1001	3.27	2.55	78.83	70.33	55.57	1.82	8.56
MTU-3626	2.85	2.66	76.13	70.53	52.50	1.79	6.91
MTU-5249	3.10	2.54	82.83	74.77	56.53	1.64	7.60
MTU-2716	3.19	2.88	79.33	71.36	56.67	1.92	8.63
NLR-145	3.35	3.17	78.90	70.63	62.50	1.77	7.82
JGL-1798	3.66	3.16	80.50	70.03	60.57	1.74	7.33
JGL-384	3.68	3.19	79.36	69.57	58.73	1.75	6.62
WGL-48684	3.34	2.95	80.60	75.23	56.83	1.87	7.59
WGL-14377	3.55	3.19	79.53	75.83	59.27	1.71	7.82
MTU-1032	3.21	3.01	75.60	70.57	57.33	1.66	8.28
Mean	3.63	3.07	78.34	70.79	56.95	1.76	7.92
CD 5%	0.19	0.17	3.78	3.09	3.03	0.08	0.38
CV%	3.19	3.41	2.94	2.66	3.24	2.90	2.96

Table 6: Mean performance of 25 genotypes of rice in Environment - II

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index
Kasturi	102.43	132.73	93.00	8.33	18.05	3.66	8.68	42.05
Erramallelu	82.73	111.10	95.00	6.66	17.94	1.87	4.62	40.42
Vasundhara	63.50	113.00	95.00	6.67	21.76	4.31	9.22	46.71
PR-103	76.83	96.40	87.00	7.00	22.71	3.06	7.76	39.43
PR-106	74.24	112.83	100.00	8.33	21.56	3.14	6.87	45.64
BPT-1235	79.44	102.50	84.00	6.33	22.28	3.07	6.64	46.20
MTU-7029	71.54	97.67	103.33	6.00	17.94	5.03	10.76	46.70
Triguna	79.24	129.83	100.00	5.67	16.16	4.80	11.66	41.14
MTU-5293	82.50	106.87	78.67	10.33	18.61	4.62	11.81	39.15
BPT-5204	72.80	97.34	107.00	6.34	13.80	4.21	9.23	45.54
MTU-1010	83.50	113.00	78.67	7.33	23.07	5.01	10.52	47.57
GEB-24	109.50	147.33	115.00	6.33	17.90	3.38	8.33	40.57
Tarori Basmati	99.73	136.33	83.34	7.67	22.61	1.90	5.64	33.65
MTU-2067	78.40	104.33	102.00	7.33	19.92	4.44	9.08	48.83
MTU-4870	73.43	104.67	106.00	7.33	20.20	4.66	9.38	49.72
MTU-1001	98.57	107.33	97.00	7.33	26.60	4.90	10.59	46.24
MTU-3626	82.40	97.00	86.00	6.99	26.95	5.02	10.06	49.85
MTU-5249	78.40	106.53	105.00	6.67	20.34	4.48	10.68	42.01
MTU-2716	83.40	116.17	103.00	6.33	19.85	4.64	11.77	39.38
NLR-145	85.50	104.50	96.00	6.33	20.78	4.40	9.06	48.62
JGL-1798	75.90	102.67	86.00	9.00	13.21	4.44	9.12	48.66
JGL-384	87.97	104.67	90.00	5.66	14.53	4.03	9.11	44.25
WGL-48684	93.43	136.83	86.00	6.33	17.87	2.64	5.32	49.21
WGL-14377	91.73	98.17	66.67	6.00	16.94	2.65	5.90	44.81
MTU-1032	77.53	118.33	111.67	6.33	21.54	4.69	10.39	45.09
Mean	83.39	111.93	94.21	6.99	19.73	3.96	8.89	44.46
CD 5%	4.32	4.48	5.04	1.29	1.19	0.19	0.43	2.10
CV%	3.16	2.44	3.26	11.28	3.68	2.93	2.99	2.88

Cont... 6

Genotypes	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	3.76	3.38	74.73	65.14	56.07	1.58	8.08
Erramallelu	4.30	3.95	77.80	73.97	55.70	1.62	7.21
Vasundhara	3.66	3.17	81.50	72.83	54.70	1.83	8.15
PR-103	3.45	3.31	76.83	70.80	58.50	1.74	8.63
PR-106	4.22	3.76	75.93	67.97	55.23	1.69	7.48
BPT-1235	3.86	3.38	78.26	69.47	54.83	1.56	8.31
MTU-7029	2.91	2.50	76.93	67.70	55.80	1.79	8.44
Triguna	3.90	3.25	77.10	68.93	55.70	1.63	7.95
MTU-5293	3.63	2.90	76.76	68.33	57.70	1.81	8.24
BPT-5204	3.59	3.21	78.73	69.60	62.83	1.91	8.06
MTU-1010	4.13	3.12	78.47	70.50	53.73	1.88	8.17
GEB-24	3.37	2.68	75.63	70.37	58.10	1.83	7.83
Tarori Basmati	4.67	4.27	78.23	70.23	52.60	1.84	7.92
MTU-2067	3.20	2.85	73.90	68.60	55.66	1.62	8.05
MTU-4870	2.98	2.69	78.97	73.60	54.47	1.77	8.12
MTU-1001	3.25	2.75	80.90	73.00	57.20	1.81	8.57
MTU-3626	3.17	2.65	76.90	74.47	56.40	1.76	6.94
MTU-5249	3.14	2.68	78.10	71.80	58.50	1.64	7.63
MTU-2716	3.30	2.71	77.70	69.80	56.10	1.90	8.65
NLR-145	3.58	3.14	78.17	70.64	61.46	1.75	7.82
JGL-1798	3.75	3.12	81.54	77.60	61.97	1.73	7.32
JGL-384	3.76	3.07	76.10	69.20	56.37	1.73	6.66
WGL-48684	3.40	3.04	78.26	72.93	65.50	1.87	7.60
WGL-14377	3.75	3.18	81.00	77.03	58.53	1.72	7.84
MTU-1032	3.20	2.88	78.50	71.16	56.50	1.66	8.33
Mean	3.60	3.11	77.88	71.03	57.21	1.75	7.92
CD 5%	0.19	0.17	4.05	3.94	2.81	0.09	0.36
CV%	3.22	3.33	3.17	3.39	2.99	3.35	2.82

Table 8: Mean performance of 25 genotypes of rice in Environment - III

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index
Kasturi	92.37	126.06	106.00	8.33	20.45	4.68	9.46	49.43
Erramallelu	78.37	115.70	97.00	6.00	18.69	3.93	7.93	49.53
Vasundhara	81.50	113.00	93.00	6.33	20.78	4.15	8.40	49.37
PR-103	68.30	104.57	101.67	6.66	24.47	4.78	10.00	47.82
PR-106	70.20	113.67	105.00	7.66	22.78	3.94	7.99	49.31
BPT-1235	69.50	105.44	93.00	6.33	24.62	3.66	7.42	49.30
MTU-7029	63.50	103.86	108.00	5.66	17.80	5.78	11.58	49.94
Triguna	76.20	116.53	105.67	5.67	17.62	5.02	10.24	49.03
MTU-5293	74.77	96.44	111.67	9.67	18.15	3.06	6.72	45.55
BPT-5204	79.07	107.40	108.00	6.33	14.46	4.54	10.63	42.71
MTU-1010	70.47	112.53	96.33	7.00	23.98	6.07	12.01	50.56
GEB-24	104.46	156.83	113.33	6.33	18.31	4.58	9.43	48.59
Tarori Basmati	84.53	128.37	82.03	7.66	20.93	3.50	7.35	47.67
MTU-2067	71.53	107.40	106.34	6.33	19.28	5.06	10.98	46.14
MTU-4870	79.20	109.43	107.00	6.67	19.40	4.15	9.06	45.75
MTU-1001	82.87	110.83	101.33	6.99	23.08	5.93	12.06	49.16
MTU-3626	74.53	97.83	101.00	6.67	24.83	6.88	13.58	50.69
MTU-5249	73.63	101.30	106.00	6.66	22.12	4.78	9.78	48.88
MTU-2716	71.37	116.17	103.00	6.33	20.77	5.45	11.10	49.06
NLR-145	76.03	105.50	109.00	6.33	20.48	4.78	10.13	47.19
JGL-1798	79.40	104.90	101.00	9.00	15.36	5.48	11.09	49.41
JGL-384	76.37	104.03	110.00	5.67	14.56	4.75	10.32	46.05
WGL-48684	87.04	139.20	86.67	6.34	18.72	4.37	9.59	45.55
WGL-14377	84.73	92.23	82.00	5.67	19.34	3.94	8.07	48.81
MTU-1032	77.60	112.33	114.00	6.66	20.85	5.24	10.68	49.08
Mean	77.90	112.07	101.92	6.76	20.07	4.74	9.82	48.18
CD 5%	4.58	4.89	4.33	1.40	1.24	0.24	0.45	2.05
CV%	3.59	2.66	2.59	12.67	3.77	3.17	2.81	2.60

Contd ... 8

Genotypes	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	3.70	3.28	76.83	70.23	60.10	1.55	8.11
Erramallelu	4.55	3.75	79.83	76.57	55.80	1.58	7.22
Vasundhara	3.61	3.15	82.70	77.43	53.26	1.83	8.13
PR-103	3.46	3.29	79.23	70.44	59.20	1.74	8.65
PR-106	4.29	3.68	77.13	69.30	55.80	1.83	7.44
BPT-1235	3.64	3.51	76.37	70.87	54.26	1.57	8.19
MTU-7029	3.12	2.42	79.20	71.40	58.57	1.82	8.38
Triguna	3.79	3.22	79.07	73.63	60.07	1.61	7.90
MTU-5293	3.55	2.82	77.90	70.33	60.90	1.79	8.15
BPT-5204	3.64	3.23	79.54	72.36	58.60	1.88	8.09
MTU-1010	3.86	3.24	81.10	71.00	54.90	1.87	8.14
GEB-24	3.21	2.74	78.93	69.13	56.13	1.86	7.82
Tarori Basmati	4.83	4.32	77.13	70.40	52.90	1.86	7.94
MTU-2067	3.35	2.86	75.66	73.83	62.20	1.63	8.09
MTU-4870	3.17	2.58	76.93	70.49	59.10	1.80	8.22
MTU-1001	3.34	2.65	77.53	72.53	57.03	1.63	8.59
MTU-3626	3.21	2.60	77.73	74.63	52.50	1.82	7.10
MTU-5249	3.23	2.59	76.37	70.50	57.03	1.65	7.64
MTU-2716	3.45	2.75	78.46	70.43	52.53	1.78	8.60
NLR-145	3.59	3.19	76.07	70.20	62.37	1.64	7.82
JGL-1798	3.62	3.16	78.43	74.97	55.60	1.71	7.22
JGL-384	3.65	3.09	78.67	72.14	54.77	1.74	6.44
WGL-48684	3.42	3.00	77.74	72.63	54.67	1.86	7.44
WGL-14377	4.06	3.23	81.07	76.80	60.83	1.72	7.83
MTU-1032	3.32	2.78	76.67	70.33	59.83	1.64	8.24
Mean	3.63	3.09	78.25	72.13	57.16	1.74	7.89
CD 5%	0.21	0.17	2.78	3.58	2.80	0.08	0.37
CV%	3.63	3.35	2.97	3.02	2.99	3.01	2.90

Table 10: Mean performance of 25 genotypes of rice in Environment - IV

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index
Kasturi	86.33	124.17	103.00	8.00	18.75	4.38	8.93	49.10
Erramallelu	75.40	108.37	86.00	5.67	20.60	3.69	7.57	48.10
Vasundhara	65.53	104.33	90.00	5.67	21.53	3.90	7.92	49.30
PR-103	66.60	95.93	105.00	5.99	24.47	4.57	9.57	47.73
PR-106	69.40	107.50	104.00	5.33	21.40	3.71	7.56	49.15
BPT-1235	65.10	102.07	93.00	6.33	24.17	3.42	6.97	49.08
MTU-7029	60.37	95.34	106.00	5.66	16.67	5.54	11.11	49.89
Triguna	68.17	114.37	97.00	6.66	15.74	4.81	9.82	48.94
MTU-5293	70.57	93.30	113.00	9.33	18.60	2.84	6.31	45.09
BPT-5204	73.17	102.26	103.00	5.66	14.17	4.30	10.09	42.65
MTU-1010	66.80	110.04	91.00	7.00	21.70	5.85	11.58	50.53
GEB-24	97.56	147.00	110.00	6.00	19.47	4.36	8.99	48.49
Tarori Basmati	81.53	124.07	78.00	8.00	21.02	3.23	6.85	47.11
MTU-2067	68.10	103.14	106.00	6.66	20.31	4.83	10.51	45.91
MTU-4870	72.53	104.77	110.00	7.00	20.53	3.93	8.61	45.61
MTU-1001	78.43	103.06	97.00	7.67	21.20	5.73	11.65	49.18
MTU-3626	69.37	91.77	104.00	6.00	25.42	6.56	13.18	49.79
MTU-5249	73.20	102.70	103.33	6.66	19.52	4.57	9.37	48.76
MTU-2716	74.70	117.10	106.99	6.00	21.41	5.22	10.63	49.11
NLR-145	76.37	102.67	105.00	6.67	20.72	4.55	9.65	47.11
JGL-1798	75.67	104.13	95.00	9.33	14.53	5.26	10.67	49.24
JGL-384	72.77	102.80	105.00	5.67	14.35	4.48	9.82	45.55
WGL-48684	81.00	131.77	85.00	6.00	19.22	4.14	9.16	45.18
WGL-14377	83.06	88.33	76.00	5.66	20.45	3.72	7.63	48.72
MTU-1032	76.50	105.40	106.00	6.33	22.22	4.96	10.12	48.82
Mean	73.93	107.45	99.13	6.64	19.93	4.50	9.38	47.93
CD 5%	3.88	5.33	4.93	1.33	1.12	0.20	0.47	2.48
CV%	3.20	3.03	3.05	12.24	3.45	2.83	3.06	3.15

Contd.... 10

Genotypes	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	3.73	3.34	77.70	70.23	58.53	1.58	8.12
Erramallelu	4.56	3.79	79.30	75.90	54.50	1.57	7.23
Vasundhara	3.50	3.10	81.07	72.00	52.10	1.82	8.12
PR-103	3.43	3.18	78.87	70.33	56.73	1.73	8.65
PR-106	4.07	3.68	76.93	72.67	52.80	1.81	7.78
BPT-1235	3.83	3.61	76.53	72.67	52.77	1.56	8.18
MTU-7029	3.11	2.57	79.20	76.23	56.47	1.82	8.37
Triguna	3.81	3.18	77.90	72.60	57.83	1.68	7.86
MTU-5293	3.44	2.80	77.67	70.17	58.07	1.81	8.17
BPT-5204	3.68	3.20	79.20	74.49	56.60	1.85	8.11
MTU-1010	3.61	3.24	78.80	69.43	52.57	1.87	8.13
GEB-24	3.32	2.55	75.73	69.04	53.47	1.87	7.82
Tarori Basmati	4.88	4.33	77.33	72.73	56.17	1.85	7.95
MTU-2067	3.43	2.63	75.77	71.10	61.83	1.61	8.12
MTU-4870	3.20	2.65	72.57	69.50	56.80	1.78	8.21
MTU-1001	3.48	2.59	78.17	70.87	56.43	1.64	8.56
MTU-3626	2.98	2.67	79.13	72.20	53.97	1.79	7.11
MTU-5249	3.04	2.58	77.63	72.86	55.53	1.66	7.67
MTU-2716	3.12	2.66	77.17	72.00	54.50	1.88	8.68
NLR-145	3.55	3.23	76.43	74.44	59.80	1.62	7.82
JGL-1798	3.52	3.19	73.50	67.50	58.40	1.73	7.23
JGL-384	3.74	3.14	79.30	74.17	59.30	1.74	6.46
WGL-48684	3.27	3.02	78.10	70.63	58.40	1.87	7.44
WGL-14377	3.76	3.19	81.20	75.84	62.60	1.72	7.83
MTU-1032	3.21	2.86	77.33	72.53	60.77	1.67	8.22
Mean	3.57	3.08	77.70	72.17	56.68	1.74	7.90
CD 5%	0.18	0.16	3.49	3.82	2.67	0.07	0.37
CV%	3.14	3.17	2.74	3.23	2.88	2.76	2.87

Table 20: Classification of genotypes for different characters based on stability parameters.

Characters	Genotypes stable over all environments (b=1)	Genotypes suitable for favourable environments (b>1)	Genotypes suitable for poor environment (b<1)
1. Plant height at 65 DAS	--	Kasturi, BPT-1235, MTU-7029, MTU-1010, MTU-3626 and WGL-48684	PR-106 and MTU-5249
2. Plant height at harvest	--	PR-106 and WGL-48684	MTU-3626
3. Days to 50% flowering	--	--	WGL-48684
4. Test weight	--	PR-103, BPT-1235 and NLR-145	Vasundhara and MTU-5293
5. Grain yield	MTU-7029 and MTU-2716	Kasturi, MTU-1010, GEB-24, MTU-1001 and JGL-1798	BPT-1235, MTU-2067, MTU-5249, JGL-384 and MTU-1032
6. Harvest index	--	Kasturi, Erramallelu, PR-103, Triguna, MTU-5293, GEB-24, Tarori Basmati, MTU-5249, MTU-2716, WGL-14377 and MTU-1032.	Vasundhara, BPT.1235, MTU-7029, BPT-5204, MTU-1010, MTU-4870, MTU-1001, MTU-3626, NLR-145, JGL-1798, JGL-384 and WGL-48684
7. Biomass	PR-106, NLR-145 and JGL-384	BPT-5204, MTU-1010, GEB-24 and MTU-1001	BPT-1235 and MTU-7029
8.L/B ratio grain	--	PR-106, Triguna, MTU-5293, GEB-24, Tarori Basmati and MTU-2067	--
9.L/B ratio kernel	--	Kasturi, Erramallelu, Vasundhara, Triguna, MTU-5293, GEB-24, MTU-2067, MTU-4870, MTU-1001, MTU-3626, MTU-5249 and WGL-48684	MTU-7029, MTU-1010, Tarori Basmati, MTU-2716, NLR-145, JGL-1798 and JGL-384
10. Hulling (%)	--	Erramallelu, MTU-1010, MTU-2067, MTU-1001 and MTU-2716	PR-106, BPT-1235, Triguna, MTU-5293 and BPT-5204
11. Milling (%)	--	BPT-1235, Triguna, BPT-5204, MTU-2067 and JGL-384	PR-103, MTU-1010, GEB-24, MTU-1001 and MTU-5249
12. Head rice recovery	--	BPT-1235, GEB-24, MTU-5249 and NLR-145	WGL-14377.

Table 4: Mean performance of 25 genotypes of rice in Environment - I

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/ plot)	Biomass (kg)	Harvest index	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	97.33	136.56	99.00	9.33	18.52	3.85	9.13	43.15	4.47	3.18	78.67	69.33	58.40	1.55	8.11
Erramallelu	73.46	115.93	101.00	6.00	19.43	2.06	5.07	40.76	4.72	3.81	81.17	74.67	57.77	1.64	7.22
Vasundhara	68.43	15.90	104.00	7.66	17.50	4.55	9.68	47.06	3.66	3.08	80.87	71.17	55.77	1.81	8.15
PR-103	80.33	104.83	93.33	7.66	26.08	3.33	8.29	40.12	3.74	3.25	79.26	69.70	60.37	1.75	8.66
PR-106	73.90	128.70	111.00	8.66	22.81	3.42	7.42	46.58	4.36	3.72	75.54	69.50	58.67	1.69	7.48
BPT-1235	74.50	111.93	88.00	7.00	25.20	3.32	7.13	46.56	3.85	3.48	75.53	68.40	54.80	1.58	8.32
MTU-7029	66.53	93.33	114.00	7.00	19.84	5.24	11.18	46.87	3.20	2.59	78.39	70.27	58.43	1.81	8.48
Triguna	77.20	131.53	112.99	6.00	17.38	5.05	12.15	41.61	3.84	3.10	75.86	70.30	58.60	1.68	7.98
MTU-5293	79.73	100.83	117.33	11.00	18.43	4.83	12.26	39.43	3.53	2.83	77.93	69.83	56.33	1.77	8.26
MTU-5204	76.43	109.93	115.99	7.66	14.40	4.43	9.73	45.52	3.64	3.19	80.37	69.60	58.46	1.92	8.04
MTU-1010	78.13	122.26	86.00	8.33	25.01	5.26	11.04	47.59	3.85	3.30	80.33	70.98	55.60	1.88	8.21
GEB-24	82.50	156.50	123.66	6.00	19.57	3.62	8.78	41.26	3.38	2.47	75.77	69.53	56.50	1.88	7.82
Tarori Basmati	94.90	146.60	93.00	8.33	21.72	2.07	6.05	34.33	4.87	4.35	79.56	70.37	50.47	1.86	7.93
MTU-2067	73.80	113.79	115.00	7.66	20.15	4.67	9.56	48.83	3.27	2.59	74.80	68.53	54.50	1.63	8.04
MTU-4870	75.26	117.93	117.00	7.66	20.68	4.85	9.80	49.48	3.35	2.44	72.73	68.43	52.60	1.81	8.12
MTU-1001	82.66	126.00	111.33	8.67	24.29	5.16	11.11	46.39	3.27	2.55	78.83	70.33	55.57	1.82	8.56
MTU-3626	76.13	9.90	96.00	8.00	26.40	5.25	10.54	49.81	2.85	2.66	76.13	70.53	52.50	1.79	6.91
MTU-5249	73.70	95.93	116.99	7.66	20.67	4.73	11.16	42.36	3.10	2.54	82.83	74.77	56.53	1.64	7.60
MTU-2716	79.43	113.36	115.00	7.00	20.30	4.85	12.28	39.53	3.19	2.88	79.33	71.36	56.67	1.92	8.63
NLR-145	84.63	115.43	104.00	7.33	22.37	4.64	9.53	48.69	3.35	3.17	78.90	70.63	62.50	1.77	7.82
JGL-1798	72.29	105.80	91.00	10.00	14.28	4.67	9.63	48.49	3.66	3.16	80.50	70.03	60.57	1.74	7.33
JGL-384	88.443	96.60	76.00	6.00	18.48	2.86	6.38	45.19	3.55	3.19	79.53	75.83	59.27	1.71	7.82
WGL-48684	83.03	145.89	91.66	6.66	18.55	2.88	5.85	49.21	3.34	2.95	80.60	75.23	56.83	1.87	7.59
WGL-14377	94.43	96.60	76.00	6.00	18.48	2.86	6.38	45.19	3.55	3.19	79.53	75.83	59.27	1.71	7.82
MTU-1032	76.50	116.50	121.00	7.66	21.50	4.93	10.85	45.42	3.21	3.01	75.60	70.57	57.33	1.66	8.28
Mean	79.74	117.43	104.63	7.62	20.46	4.19	9.36	44.75	3.63	3.07	78.34	70.79	56.95	1.76	7.92
CD 5%	4.08	6.43	4.86	1.98	1.14	0.18	0.47	2.20	0.19	0.17	3.78	3.09	3.03	0.08	0.38
CV%	3.12	3.34	2.83	15.86	3.39	2.64	3.08	2.99	3.19	3.41	2.94	2.66	3.24	2.90	2.96

Table 7: Mean performance of 25 genotypes of rice in Environment - II

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	102.43	132.73	93.00	8.33	18.05	3.66	8.68	42.05	3.76	3.38	74.73	65.14	56.07	1.58	8.08
Erramallelu	82.73	111.10	95.00	6.66	17.94	1.87	4.62	40.42	4.30	3.95	77.80	73.97	55.70	1.62	7.21
Vasundhara	63.50	13.00	95.00	6.67	21.76	4.31	9.22	46.71	3.66	3.17	81.50	72.83	54.70	1.83	8.15
PR-103	76.83	96.40	87.00	7.00	22.71	3.06	7.76	39.43	3.45	3.31	76.83	70.80	58.50	1.74	8.63
PR-106	74.24	112.83	100.00	8.33	21.56	3.14	6.87	45.64	4.22	3.76	75.93	67.97	55.23	1.69	7.48
BPT-1235	79.44	102.50	84.00	6.33	22.28	3.07	6.64	46.20	3.86	3.38	78.26	69.47	54.83	1.56	8.31
MTU-7029	71.54	97.67	103.33	6.00	17.94	5.03	10.76	46.70	2.91	2.50	76.93	67.70	55.80	1.79	8.44
Triguna	79.24	129.83	100.00	5.67	16.16	4.80	11.66	41.14	3.90	3.25	77.10	68.93	55.70	1.63	7.95
MTU-5293	82.50	106.87	78.67	10.33	18.61	4.62	11.81	39.15	3.63	2.90	76.76	68.33	57.70	1.81	8.24
MTU-5204	72.80	97.34	107.00	6.34	13.80	4.21	9.23	45.54	3.59	3.21	78.73	69.60	62.83	1.91	8.06
MTU-1010	83.50	113.00	78.67	7.33	23.07	5.01	10.52	47.57	4.13	3.12	78.47	70.50	53.73	1.88	8.17
GEB-24	109.50	147.33	115.00	6.33	17.90	3.38	8.33	40.57	3.37	2.68	75.63	70.37	58.10	1.83	7.83
Tarori Basmati	99.73	136.33	83.34	7.67	22.61	1.90	5.64	33.65	4.67	4.27	78.23	70.23	52.60	1.84	7.92
MTU-2067	78.40	104.33	102.00	7.33	19.92	4.44	9.08	48.83	3.20	2.85	73.90	68.60	55.66	1.62	8.05
MTU-4870	73.43	104.67	106.00	7.33	20.20	4.66	9.38	49.72	2.98	2.69	78.97	73.60	54.47	1.77	8.12
MTU-1001	98.57	107.33	97.00	7.33	26.60	4.90	10.59	46.24	3.25	2.75	80.90	73.00	57.20	1.81	8.57
MTU-3626	82.40	97.00	86.00	6.99	26.95	5.02	10.06	49.85	3.17	2.65	76.90	74.47	56.40	1.76	6.94
MTU-5249	78.40	106.53	105.00	6.67	20.34	4.48	10.68	42.01	3.14	2.68	78.10	71.80	58.50	1.64	7.63
MTU-2716	83.40	116.17	103.00	6.33	19.85	4.64	11.77	39.38	3.30	2.71	77.70	69.80	56.10	1.90	8.65
NLR-145	85.50	104.50	96.00	6.33	20.78	4.40	9.06	48.62	3.58	3.14	78.17	70.64	61.46	1.75	7.82
JGL-1798	75.90	102.67	86.00	9.00	13.21	4.44	9.12	48.66	3.75	3.12	81.54	77.60	61.97	1.73	7.32
JGL-384	87.97	104.67	90.00	5.66	14.53	4.03	9.11	44.25	3.76	3.07	76.10	69.20	56.37	1.73	6.66
WGL-48684	93.43	136.83	86.00	6.33	17.87	2.64	5.32	49.21	3.40	3.04	78.26	72.93	65.50	1.87	7.60
WGL-14377	91.73	97.17	66.67	6.00	16.94	2.65	5.90	44.81	3.75	3.18	81.00	77.03	58.53	1.72	7.84
MTU-1032	77.53	118.33	111.67	6.33	21.54	4.69	10.39	45.09	3.20	2.88	78.50	71.16	56.50	1.66	8.33
Mean	83.39	111.93	94.21	6.99	19.73	3.96	8.89	44.46	3.60	3.11	77.88	71.03	57.21	1.75	7.92
CD 5%	4.32	4.48	5.04	1.29	1.19	0.19	0.43	2.10	0.19	0.17	4.05	3.94	2.81	0.09	0.36
CV%	3.16	2.44	3.26	11.28	3.68	2.93	2.99	2.88	3.22	3.33	3.17	3.39	2.99	3.35	2.82

Table 8: Mean performance of 25 genotypes of rice in Environment - III

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	92.37	126.06	106.00	8.33	20.45	4.68	9.46	49.43	3.70	3.28	76.83	70.23	60.10	1.55	8.11
Erramallelu	78.37	115.70	97.00	6.00	18.69	3.93	7.93	49.53	4.55	3.75	79.83	76.57	55.80	1.58	7.22
Vasundhara	81.50	113.00	93.00	6.33	20.78	4.15	8.40	49.37	3.61	3.15	82.70	77.43	53.26	1.83	8.13
PR-103	68.30	104.57	101.67	6.66	24.47	4.78	10.00	47.82	3.46	3.29	79.23	70.44	59.20	1.74	8.65
PR-106	70.20	113.67	105.00	7.66	22.78	3.94	7.99	49.31	4.29	3.68	77.13	69.30	55.80	1.83	7.44
BPT-1235	69.50	105.44	93.00	6.33	24.62	3.66	7.42	49.30	3.64	3.51	76.37	70.87	54.26	1.57	8.19
MTU-7029	63.50	103.86	108.00	5.67	17.80	5.78	11.58	49.94	3.12	2.42	79.20	71.40	58.57	1.82	8.38
Triguna	76.20	116.53	105.67	5.67	17.62	5.02	10.24	49.03	3.79	3.22	79.07	73.63	60.07	1.61	7.90
MTU-5293	74.77	96.44	111.67	9.67	18.15	3.06	16.72	45.55	3.55	2.82	77.90	70.33	60.90	1.79	8.15
MTU-5204	79.07	107.40	108.00	6.33	14.46	4.54	10.63	42.71	3.64	3.23	79.54	72.36	58.60	1.88	8.09
MTU-1010	70.47	112.53	96.33	7.00	23.98	6.07	12.01	50.56	3.86	3.24	81.10	71.00	54.90	1.87	8.14
GEB-24	104.46	156.83	113.33	6.33	18.31	4.58	9.43	48.59	3.21	2.74	78.93	69.13	56.13	1.86	7.82
Tarori Basmati	84.53	128.37	82.00	7.66	20.93	3.50	7.35	47.67	4.83	4.32	77.13	70.40	52.90	1.86	7.94
MTU-2067	71.53	107.40	106.34	6.33	19.28	5.06	10.98	46.14	3.35	2.86	75.66	73.83	62.20	1.63	8.09
MTU-4870	79.20	109.43	107.00	6.67	19.40	44.15	9.06	45.75	3.17	2.58	76.93	70.49	59.10	1.80	8.22
MTU-1001	82.87	110.83	101.33	6.99	23.08	5.93	12.06	49.16	3.34	2.65	77.53	72.53	57.03	1.63	8.59
MTU-3626	74.53	97.83	101.00	6.67	24.83	6.88	13.58	50.69	3.21	2.60	77.73	74.63	52.50	1.82	7.10
MTU-5249	73.63	101.30	106.00	6.66	22.12	4.78	9.78	48.88	3.23	2.59	76.37	70.50	57.03	1.65	7.64
MTU-2716	71.37	116.17	103.00	6.33	20.77	5.45	11.10	49.06	3.45	2.75	78.46	70.43	52.53	1.78	8.66
NLR-145	76.03	105.50	109.00	6.33	20.48	4.78	10.13	47.19	3.59	3.19	76.07	70.20	62.37	1.64	7.82
JGL-1798	79.40	104.90	101.00	9.00	15.36	5.48	11.09	49.41	3.62	3.16	78.43	74.97	55.60	1.71	7.22
JGL-384	76.37	104.03	110.00	5.67	14.56	4.75	10.32	46.05	3.65	3.09	78.67	72.14	54.77	1..74	6.44
WGL-48684	87.04	139.20	86.67	6.34	18.72	4.37	9.59	45.55	3.42	3.00	77.74	72.63	54.67	1.86	7.44
WGL-14377	84.73	92.23	82.00	5.67	19.34	3.94	8.07	48.81	4.06	3.23	81.07	76.80	60.83	1.72	7.83
MTU-1032	77.60	112.33	114.00	6.66	20.85	5.24	10.68	49.08	3.32	2.78	76.67	70.33	59.83	1.64	8.24
Mean	77.90	112.07	101.92	6.76	20.07	4.74	9.82	48.18	3.63	3.09	78.25	72.13	57.16	1.74	7.89
CD 5%	4.58	4.89	4.33	1.40	1.24	0.24	0.45	2.05	0.21	0.17	2078	3.58	2.80	0.08	0.37
CV%	3.59	2.66	2.59	12.67	3.77	3.17	2.81	2.60	3.63	3.09	2.97	3.02	2.99	3.01	2.90

Table 11: Mean performance of 25 genotypes of rice in Environment - IV

Genotypes	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Productive tillers per plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index	L/B ratio grain	L/B ratio kernel	Hulling (%)	Milling (%)	Head rice recovery	Grain elongation ratio	Protein content (%)
Kasturi	86.33	124.17	103.00	8.00	18.75	4.38	8.93	49.10	3.73	3.34	77.70	70.23	58.53	1.58	8.12
Erramallelu	75.40	108.37	86.00	5.67	20.60	3.69	7.57	48.10	4.56	3.79	79.30	75.90	54.50	1.57	7.23
Vasundhara	65.53	104.33	90.00	5.67	21.53	3.90	7.92	49.30	3.50	3.10	81.07	72.00	52.10	1.82	8.12
PR-103	66.60	95.93	105.00	5.99	24.47	4.57	9.57	47.73	3.43	3.18	78.87	70.33	56.73	1.73	8.65
PR-106	69.40	107.50	104.00	5.33	21.40	3.71	7.56	49.15	4.07	3.68	76.93	72.67	52.80	1.81	7.78
BPT-1235	65.10	102.07	93.00	6.33	24.17	3.42	6.97	49.08	3.83	3.61	76.53	72.67	52.77	1.56	8.18
MTU-7029	60.37	95.34	106.00	5.66	16.67	5.54	11.11	49.89	3.11	2.57	79.20	76.23	56.47	1.82	8.37
Triguna	68.17	114.37	97.00	6.66	15.74	4.81	9.82	48.94	3.81	3.18	77.90	72.60	57.83	1.68	7.86
MTU-5293	70.57	93.30	11.300	9.33	18.60	2.84	6.31	45.09	3.44	2.80	77.67	70.17	58.07	1.81	8.17
MTU-5204	73.17	93.30	113.00	9.33	18.60	2.84	6.312	45.09	3.44	2.80	77.67	70.17	58.07	1.81	8.17
MTU-1010	66.80	110.04	91.00	7.00	21.70	5.85	11.58	50.54	3.61	3.24	78.80	69.43	52.57	1.87	8.13
GEB-24	97.56	147.00	110.00	6.00	19.47	4.36	8.99	48.49	3.32	2.55	75.73	69.04	53.47	1.87	7.82
Tarori Basmati	81.53	124.07	78.00	8.00	21.02	3.23	6.85	47.11	4.88	4.33	77.33	72.73	56.17	1.85	7.95
MTU-2067	68.10	103.14	106.00	6.66	20.31	4.83	10.51	45.91	3.473	2.63	75.77	71.10	61.83	1.61	8.12
MTU-4870	72.53	104.77	110.00	7.00	20.53	3.93	8.61	45.61	3.20	2.65	72.57	69.50	56.80	1.78	8.21
MTU-1001	78.43	103.06	97.00	7.67	21.20	5.73	11.65	49.18	3.48	2.59	78.17	70.87	56.43	1.64	8.56
MTU-3626	69.37	91.77	104.00	6.00	25.42	6.56	13.18	49.79	2.98	2.67	79.13	72.20	53.97	1.79	7.11
MTU-5249	73.20	102.70	103.33	6.66	19.52	4.57	9.37	48.76	3.04	2.58	77.63	72.86	55.53	1.66	7.67
MTU-2716	74.70	117.10	106.99	6.00	21.41	5.22	10.63	49.11	3.12	2.66	77.17	72.00	54.50	1.88	8.68
NLR-145	76.37	102.67	105.00	6.67	20.72	4.55	9.65	47.11	3.55	3.23	76.43	74.44	59.80	1.62	7.82
JGL-1798	75.67	104.13	95.00	9.33	14.53	5.26	10.67	49.24	3.52	3.19	73.50	67.50	58.40	1.73	7.23
JGL-384	72.77	102.80	105.00	5.67	14.35	4.48	9.82	45.55	3.74	3.14	79.30	74.17	59.30	1.74	6.48
WGL-48684	81.00	131.77	85.00	6.00	19.22	4.14	9.16	45.18	3.27	3.02	78.10	70.63	58.40	1.87	7.44
WGL-14377	83.06	88.33	76.00	5.66	20.45	3.72	7.63	48.72	3.76	3.19	81.20	77.94	62.60	1.72	7.83
MTU-1032	76.50	105.40	106.00	6.33	22.22	4.96	10.12	48.82	3.21	2.86	77.33	72.53	60.77	1.67	8.22
Mean	73.93	107.45	99.13	6.64	19.93	4.50	9.38	47.93	3.57	3.08	77.70	72.17	56.68	1.74	7.90
CD 5%	3.88	5.33	4.93	1.33	1.12	0.20	0.47	2.48	0.18	0.16	3.49	3.82	2.67	0.07	0.37
CV%	3.20	3.03	3.05	12.24	3.45	2.83	3.06	3.15	3.14	3.17	2.74	3.23	2.88	2.76	2.87

Table 16 : Coefficients of variation and Bartlett's χ^2 values for different characters

	Character	Coefficients of variation				Bartlett's χ^2 values
		E1	E2	E3	E4	
1	Plant height at 65DAS (cm)	3.12	3.16	3.59	3.2	1.45
2	Plant height at harvest (cm)	3.34	2.44	2.66	3.02	7.05
3	Days to 50% flowering	2.83	3.26	2.59	3.03	1.21
4	Productive tillers/ plant	15.86	11.28	12.67	12.24	12.41 *
5	Test weight (g)	3.39	3.68	3.7	3.45	0.56
6	Grain yield (kg/plot)	2.64	2.93	3.17	2.83	5.45
7	Biomass (kg)	3.08	2.99	2.81	3.06	0.41
8	Harvest index (%)	2.99	2.88	2.6	3.15	2.08
9	L/B ratio grain	3.64	3.22	3.56	3.14	1.09
10	L/B ratio kernel	3.07	3.33	3.36	3.17	0.3
11	Hulling (%)	2.94	3.17	2.97	2.74	1.03
12	Milling (%)	2.66	3.39	3.03	3.23	3.18
13	Head rice recovery (%)	3.24	2.99	2.99	2.88	0.7
14	Grain elongation ratio	2.9	3.35	3.01	2.76	2.04
15	Protein content (%)	2.96	2.82	2.9	2.87	0.11

Table 17: Environment index values for different environments for 15 characters

	Character	Environment index			
		E1	E2	E3	E4
1	Plant height at 65DAS (cm)	1.007	4.645	-0.839	-4.813
2	Plant height at harvest (cm)	5.209	-0.296	-0.147	-4.766
3	Days to 50% flowering	4.663	-5.763	1.943	-0.843
4	Productive tillers/ plant	0.624	-0.017	-0.244	-0.363
5	Test weight (g)	0.428	-0.301	-0.026	-0.101
6	Grain yield (kg/plot)	-0.154	-0.389	0.391	0.152
7	Biomass (kg)	0.006	-0.476	0.466	0.004
8	Harvest index (%)	-1.577	-1.871	1.853	1.595
9	L/B ratio grain	0.031	-0.011	0.017	-0.037
10	L/B ratio kernel	-0.021	0.017	0.01	-0.006
11	Hulling (%)	0.294	-0.164	0.21	-0.34
12	Milling (%)	-0.738	-0.503	0.6	0.641
13	Head rice recovery (%)	-0.048	0.207	0.163	-0.322
14	Grain elongation ratio	0.012	0.001	-0.009	-0.004
15	Protein content (%)	0.01	0.01	-0.01	-0.01

Table 16 : Coefficients of variation and Bartlett's χ^2 values for different characters

	Character	Coefficients of variation				Bartlett's χ^2 values
		E1	E2	E3	E4	
1	Plant height at 65DAS (cm)	3.12	3.16	3.59	3.2	1.45
2	Plant height at harvest (cm)	3.34	2.44	2.66	3.02	7.05
3	Days to 50% flowering	2.83	3.26	2.59	3.03	1.21
4	Productive tillers/ plant	15.86	11.28	12.67	12.24	12.41 *
5	Test weight (g)	3.39	3.68	3.7	3.45	0.56
6	Grain yield (kg/plot)	2.64	2.93	3.17	2.83	5.45
7	Biomass (kg)	3.08	2.99	2.81	3.06	0.41
8	Harvest index (%)	2.99	2.88	2.6	3.15	2.08
9	L/B ratio (grain)	3.64	3.22	3.56	3.14	1.09
10	L/B ratio (kernel)	3.07	3.33	3.36	3.17	0.3
11	Hulling (%)	2.94	3.17	2.97	2.74	1.03
12	Milling (%)	2.66	3.39	3.03	3.23	3.18
13	Head rice recovery (%)	3.24	2.99	2.99	2.88	0.7
14	Grain elongation ratio	2.9	3.35	3.01	2.76	2.04
15	Protein content (%)	2.96	2.82	2.9	2.87	0.11

Table 17: Environment index values for different environments for 15 characters

	Character	Environment index E1	E2	E3	E4
1	Plant height at 65DAS (cm)	1.007	4.645	-0.839	-4.813
2	Plant height at harvest (cm)	5.209	-0.296	-0.147	-4.766
3	Days to 50% flowering	4.663	-5.763	1.943	-0.843
4	Productive tillers/ plant	0.624	-0.017	-0.244	-0.363
5	Test weight (g)	0.428	-0.301	-0.026	-0.101
6	Grain yield (kg/plot)	-0.154	-0.389	0.391	0.152
7	Biomass (kg)	0.006	-0.476	0.466	0.004
8	Harvest index (%)	-1.577	-1.871	1.853	1.595
9	L/B ratio (grain)	0.031	-0.011	0.017	-0.037
10	L/B ratio (kernel)	-0.021	0.017	0.01	-0.006
11	Hulling (%)	0.294	-0.164	0.21	-0.34
12	Milling (%)	-0.738	-0.503	0.6	0.641
13	Head rice recovery (%)	-0.048	0.207	0.163	-0.322
14	Grain elongation ratio	0.012	0.001	-0.009	-0.004
15	Protein content (%)	0.01	0.01	-0.01	-0.01

Table 18 : Analysis of variance for stability performance

Source	df	Plant Height 65DAS (cm)	Plant Height at harvest (cm)	Days to 50% flowering	Product-ive Tillers/ plant	Test weight (g)	Grain yield (kg/plot)	Biomass (kg)	Harvest index (%)	L/B ratio grain	L/B ratio Kernel	Hulling (%)	Milling (%)	Head rice recovery (%)	Grain elongation ratio	Protein content (%)
Genotypes	24	255.82^{++} **	780.89^{++} **	382.57^{++} **	4.490^{++}	39.38^{++} **	2.83^{++} **	10.78^{++} **	20.18^{++} **	0.76^{++} **	0.756^{++} **	9.23^{++} **	12.74^{++} **	19.49^{++} **	0.04^{++}	1.065^{++}
Environments	3	387.12^{++}	416.37^{++}	495.38^{++}	4.84	2.45^{++}	2.92^{++}	3.65^{++}	99.76^{++}	0.023^{++}	0.006^{++}	2.27^{++}	13.06^{++}	1.46^{++}	0.002	0.003
Genotype X environment	72	21.40^{++}	18.97^{++}	30.43^{++}	0.19	1.24^{++}	0.207^{++}	1.16^{++}	6.65^{++}	0.019^{++}	0.005^{++}	2.49^{++}	3.87^{++}	4.90^{++}	0.001	0.002
Environment (linear)	1	1161.36^{++} **	1249.12^{++} **	1486.15^{++} **		7.33^{++} *	8.77^{++} **	10.96^{++} **	299.28^{++} **	0.07^{++}	0.02 **	6.81^{++}	39.19^{++} **	4.40^{++}		
Genotype X enviroment (linear)	24	22.78^{++}	27.91^{++} *	20.61^{++}		1.29^{++}	0.53^{++} **	1.77^{++} *	19.83^{++} **	0.01^{++}	0.01^{++} **	1.49	3.79^{++}	2.99^{++}		
Pooled deviation	50	19.88^{++}	13.92^{++}	33.90^{++}		1.17^{++}	0.05^{++}	0.82^{++}	0.06	0.02^{++}	0.003	2.87^{++}	3.76^{++}	5.62^{++}		
pooled error	192	2.21	3.52	2.85	0.29	0.17	0.005	0.03	0.61	0.005	0.003	1.78	1.63	0.99	0.001	0.017

* Significant at 0.05 level of probability (When tested against pooled deviation)
** Significant at 0.01 level of probability (When tested against pooled deviation)

\+ Significant at 0.05 level of probability (When tested against pooled error)
++ Significant at 0.01 level of probability (When tested against pooled error)

Table 19 : Stability parameters for different characters

	Plant height at 65 DAS (cm)				Plant height at harvest (cm)		
Genotype	$\overline{X}$	b_i	$\overline{S}^2 d_i$	Genotype	$\overline{X}$	b_i	$\overline{S}^2 d_i$
1 Kasturi	94.61	1.739* ± 0.13	-1.403	1 Kasturi	129.90	1.237 ± 0.49	8.3*
2 Erramallelu	77.49	0.638 ± 0.57	12.736**	2 Erramallelu	112.80	0.751 ± 0.36	2.8
3 Vasundhara	69.74	-0.429 ± 1.42	91.83**	3 Vasundhara	111.60	1.129 ± 0.34	2.3
4 PR 103	73.01	1.290 ± 0.76	24.886**	4 PR 103	100.40	0.900 ± 0.57	12.8*
5 PR 106	71.94	0.566 ± 0.20	-0.419	5 PR 106	115.70	2.161 ± 0.39	4.2
6 BPT 1235	72.13	1.558 ± 0.17	-0.912	6 BPT 1235	105.50	1.016 ± 0.33	1.8
7 MTU 7029	65.48	1.194 ± 0.13	-1.400	7 MTU 7029	97.60	-0.248 ± 0.77	26.2**
8 Triguna	75.20	1.158 ± 0.30	2.037	8 Triguna	123.10	1.692 ± 0.96	42.9**
9 MTU 5293	76.89	1.316 ± 0.20	-0.421	9 MTU 5293	99.40	0.696 ± 0.89	36.3**
10 BPT 5204	75.36	-0.072 ± 0.53	10.785**	10 BPT 5204	104.20	0.813 ± 0.78	26.9**
11 MTU 1010	74.73	1.852 ± 0.34	3.137	11 MTU 1010	114.50	1.250 ± 0.29	0.6
12 GEB 24	98.50	0.742 ± 2.04	191.7**	12 GEB 24	151.90	0.960 ± 0.67	18.7**
13 Tarori Basmati	90.17	2.055 ± 0.51	9.76**	13 Tarori Basmati	133.80	2.264 ± 0.62	15.7**
14 MTU 2067	72.95	1.092 ± 0.08	-1.911	14 MTU 2067	107.20	1.092 ± 0.3	0.9
15 MTU 4870	75.10	0.029 ± 0.53	10.861**	15 MTU 4870	109.20	1.360 ± 0.49	8.6*
16 MTU 1001	85.63	2.025 ± 0.70	20.338**	16 MTU 1001	111.80	2.343 ± 0.5	8.8*
17 MTU 3626	75.60	1.356 ± 0.11	-1.700	17 MTU 3626	96.10	0.591 ± 0.29	0.700
18 MTU 5249	74.73	0.523 ± 0.24	0.464	18 MTU 5249	101.60	-0.724 ± 0.56	12.3*
19 MTU 2716	77.22	1.033 ± 0.61	14.844**	19 MTU 2716	115.70	-0.381* ± 0.08	-3.2
20 NLR 145	80.63	1.098 ± 0.50	9.28**	20 NLR 145	107.00	1.312 ± 0.35	2.7
21 JGL 1798	75.81	-0.117 ± 0.52	10.104**	21 JGL 1798	104.40	0.180 ± 0.19	-1.7
22 JGL 384	81.38	1.794 ± 0.68	19.225**	22 JGL 384	106.80	1.327 ± 0.43	5.9
23 WGL 48684	88.62	1.395 ± 0.37	4.175	23 WGL 48684	138.50	1.420 ± 0.17	-2
24 WGL 14377	88.49	1.082 ± 0.61	15.236**	24 WGL 14377	93.80	0.792 ± 0.53	10.5*
25 MTU 1032	77.03	0.083 ± 0.09	-1.812	25 MTU 1032	113.20	1.068 ± 0.65	17.7**
	G.M 78.74	S.e(m) 2.574 S.e(b_i) 0.654			G.M 112.2	S.e(m) 2.2 S.e(b_i) 0.5	

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability.

contd..

Table 19 contd…

Test weight (g)

	Genotype	$\overline{X}$	b_i			$\overline{S}^2 d_i$
1	Kasturi	18.94	0.601	±	2.32	1.411**
2	Erramallelu	19.16	1.098	±	2.45	1.586**
3	Vasundhara	20.39	-6.049*	±	1.26	0.293
4	PR 103	24.43	4.231	±	0.87	0.054
5	PR 106	22.13	1.96	±	1.03	0.14
6	BPT 1235	24.06	3.587	±	1.32	0.342
7	MTU 7029	18.06	3.214	±	1.92	0.91**
8	Triguna	16.72	2.049	±	1.5	0.485*
9	MTU 5293	18.44	-0.292	±	0.44	-0.111
10	BPT 5204	14.20	0.766	±	0.41	-0.119
11	MTU 1010	23.44	3.406	±	2.07	1.086**
12	GEB 24	18.81	1.772	±	1.42	0.417*
13	Tarori Basmati	21.57	-0.749	±	1.68	0.657**
14	MTU 2067	19.91	0.123	±	1.02	0.134
15	MTU 4870	20.20	0.476	±	1.25	0.288
16	MTU 1001	23.79	-1.376	±	5.03	7.248**
17	MTU 3626	26.65	3.939	±	3.69	3.811**
18	MTU 5249	20.66	0.971	±	2.36	1.458**
19	MTU 2716	20.58	0.083	±	1.51	0.496*
20	NLR 145	21.08	2.272	±	1.12	0.2
21	JGL 1798	14.34	1.163	±	1.83	0.807**
22	JGL 384	14.60	0.714	±	0.33	-0.137
23	WGL 48684	18.58	0.491	±	1.22	0.262
24	WGL 14377	18.80	0.952	±	3.28	2.97**
25	MTU 1032	21.52	-0.388	±	1.24	0.277

G.M 20.05 S.e(m) 0.624
S.e(b_i) 1.996

Days to 50% flowering

	Genotype	$\overline{X}$	b_i			$\overline{S}^2 d_i$
1	Kasturi	100.20	0.754	±	0.72	27.5**
2	Erramallelu	94.70	0.664	±	0.89	44.3**
3	Vasundhara	95.50	0.712	±	0.81	36.4**
4	PR 103	96.70	0.721	±	1.19	81.0**
5	PR 106	105.00	0.97	±	0.23	0
6	BPT 1235	89.50	0.48	±	0.6	18.6**
7	MTU 7029	107.80	0.952	±	0.26	0.900
8	Triguna	103.90	1.247	±	0.69	25.1**
9	MTU 5293	105.20	3.625	±	1.21	83.4**
10	BPT 5204	108.50	0.795	±	0.66	22.7**
11	MTU 1010	88.00	0.978	±	0.97	53.3**
12	GEB 24	115.50	0.696	±	0.78	33.5**
13	Tarori Basmati	84.10	0.79	±	0.84	39.1**
14	MTU 2067	107.30	1.105	±	0.38	5.7
15	MTU 4870	110.00	0.839	±	0.52	13.1**
16	MTU 1001	101.70	1.266	±	0.59	17.9**
17	MTU 3626	96.80	1.019	±	1.03	59.5**
18	MTU 5249	107.80	0.997	±	0.69	25.2**
19	MTU 2716	107.00	0.885	±	0.65	21.7**
20	NLR 145	103.50	0.925	±	0.57	16.1**
21	JGL 1798	93.30	0.755	±	0.85	40.4**
22	JGL 384	101.70	1.356	±	0.95	50.7**
23	WGL 48684	87.30	0.480	±	0.33	3.3
24	WGL 14377	75.20	1.101	±	0.64	21.1**
25	MTU 1032	113.20	0.889	±	0.76	31.3**

G.M 100.0 S.e(m) 3.4
S.e(b_i) 0.8

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability.

contd…

Table 19 contd…

Harvest index (%)

	Genotype	$\bar{X}$	b_i			$\bar{S}^2 d_i$
1	Kasturi	45.93	1.933*	±	0.08	-0.541
2	Erramallelu	44.70	2.389*	±	0.13	-0.413
3	Vasundhara	48.11	0.711*	±	0.03	-0.602
4	PR 103	43.77	2.313*	±	0.07	-0.547
5	PR 106	47.67	0.912	±	0.1	-0.494
6	BPT 1235	47.78	0.817*	±	0.02	-0.607
7	MTU 7029	48.35	0.905	±	0.03	-0.601
8	Triguna	45.18	2.199*	±	0.07	-0.548
9	MTU 5293	42.30	1.745*	±	0.03	-0.598
10	BPT 5204	44.10	0.821*	±	0.05	-0.579
11	MTU 1010	49.06	0.855	±	0.04	-0.588
12	GEB 24	44.72	2.205*	±	0.07	-0.557
13	Tarori Basmati	40.69	3.876*	±	0.09	-0.513
14	MTU 2067	47.42	-0.807*	±	0.07	-0.547
15	MTU 4870	47.64	-1.132*	±	0.06	-0.560
16	MTU 1001	47.74	0.824*	±	0.04	-0.596
17	MTU 3626	50.03	0.127*	±	0.13	-0.418
18	MTU 5249	45.50	1.918*	±	0.06	-0.566
19	MTU 2716	44.27	2.776*	±	0.15	-0.357
20	NLR 145	47.90	-0.432*	±	0.04	-0.590
21	JGL 1798	48.94	0.216*	±	0.04	-0.594
22	JGL 384	45.09	0.416*	±	0.06	-0.564
23	WGL 48684	47.28	-1.105*	±	0.11	-0.475
24	WGL 14377	46.88	1.088	±	0.03	-0.602
25	MTU 1032	47.10	1.071*	±	0.01	-0.611

G.M 46.33 S.e(m) 0.145

S.e(b_i) 0.072

Grain yield (kg/plot)

	Genotype	$\bar{X}$	b_i			$\bar{S}^2 d_i$
1	Kasturi	4.14	1.360	±	0.11	0.001
2	Erramallelu	2.88	3.000	±	0.64	0.136**
3	Vasundhara	4.23	-0.461	±	0.46	0.069**
4	PR 103	3.93	2.452	±	0.45	0.064**
5	PR 106	3.56	1.004	±	0.07	-0.003
6	BPT 1235	3.36	0.701	±	0.11	-0.001
7	MTU 7029	5.39	0.990	±	0.01	0.000
8	Triguna	4.92	0.131	±	0.27	0.019*
9	MTU 5293	3.84	-2.607	±	1.09	0.406**
10	BPT 5204	4.37	0.316	±	0.2	0.008
11	MTU 1010	5.54	1.448	±	0.14	0.001
12	GEB 24	3.98	1.663	±	0.21	0.010
13	Tarori Basmati	2.67	2.285	±	0.42	0.054**
14	MTU 2067	4.75	0.768	±	0.07	-0.003
15	MTU 4870	4.39	-0.978	±	0.57	0.108**
16	MTU 1001	5.42	1.391	±	0.13	0.001
17	MTU 3626	5.92	2.646	±	0.46	0.067**
18	MTU 5249	4.64	0.261	±	0.22	0.010
19	MTU 2716	5.04	1.058	±	0.04	0.000
20	NLR 145	4.59	0.380	±	0.19	0.007
21	JGL 1798	4.96	1.411	±	0.14	0.002
22	JGL 384	4.38	0.893	±	0.06	-0.004
23	WGL 48684	3.50	2.469	±	0.45	0.065**
24	WGL 14377	3.29	1.809	±	0.27	0.020**
25	MTU 1032	4.95	0.628	±	0.15	0.002

G.M 4.349 S.e(m) 0.124

S.e(b_i) 0.364

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability.

Contd..

Table 19 contd…

Biomass (kg)

Genotype	$\bar{X}$	b_i			$\bar{S}^2 d_i$
1 Kasturi	9.05	0.825	±	0.18	-0.012
2 Erramallelu	6.32	3.566	±	1.94	1.615**
3 Vasundhara	8.80	-0.895	±	1.33	0.743**
4 PR 103	8.90	2.408	±	0.95	0.370**
5 PR 106	7.45	1.001	±	0.1	0
6 BPT 1235	7.03	0.835	±	0.13	-0.018
7 MTU 7029	11.15	0.874	±	0.07	-0.023
8 Triguna	10.96	-1.544	±	1.75	1.315**
9 MTU 5293	9.27	-5.493	±	4.46	8.682**
10 BPT 5204	9.92	1.495	±	0.27	0.005
11 MTU 1010	11.28	1.595	±	0.39	0.041
12 GEB 24	8.88	1.184	±	0.15	-0.015
13 Tarori Basmati	6.47	1.833	±	0.6	0.129**
14 MTU 2067	10.03	2.043	±	0.7	0.190**
15 MTU 4870	9.21	-0.355	±	0.9	0.326**
16 MTU 1001	11.35	1.574	±	0.39	0.04
17 MTU 3626	11.84	3.789	±	1.97	1.668**
18 MTU 5249	10.24	-0.976	±	1.35	0.770**
19 MTU 2716	11.44	-0.733	±	1.25	0.654**
20 NLR 145	9.59	1.001	±	0.08	0
21 JGL 1798	10.12	2.117	±	0.78	0.237**
22 JGL 384	9.70	1.02	±	0.18	0
23 WGL 48684	7.48	4.590	±	2.46	2.629**
24 WGL 14377	6.98	2.328	±	0.96	0.380**
25 MTU 1032	10.52	0.301	±	0.52	0.092*

G.M 9.364 S.e(m) 0.521

S.e(b_i) 1.365

L/B ratio (grain)

Genotype	$\bar{X}$	b_i			$\bar{S}^2 d_i$
1 Kasturi	3.91	7.955	±	9.61	0.115**
2 Erramallelu	4.53	2.777	±	5.1	0.029**
3 Vasundhara	3.60	1.944	±	1.78	-0.001
4 PR 103	3.52	3.630	±	3.48	0.011*
5 PR 106	4.23	4.034*	±	0.59	-0.004
6 BPT 1235	3.79	-1.204	±	3.33	0.009*
7 MTU 7029	3.08	1.813	±	3.74	0.013*
8 Triguna	2.83	-0.186	±	1.62	-0.001
9 MTU 5293	3.53	0.999	±	2.36	0
10 BPT 5204	3.63	-0.27	±	1.29	-0.002
11 MTU 1010	3.83	2.198	±	6.86	0.056**
12 GEB 24	3.32	-0.228	±	2.75	0.005
13 Tarori Basmati	4.81	0.399	±	3.25	0.009
14 MTU 2067	3.31	-1.359	±	3.09	0.007
15 MTU 4870	3.17	2.335	±	4.52	0.021**
16 MTU 1001	3.33	-2.308	±	2.63	0.004
17 MTU 3626	3.05	-0.637	±	5.62	0.036**
18 MTU 5249	3.13	1.48	±	2.11	0.001
19 MTU 2716	3.26	2.257	±	4.32	0.019**
20 NLR 145	3.51	-2.071	±	3.15	0.008
21 JGL 1798	3.64	1.32	±	2.92	0.006
22 JGL 384	3.70	-1.326	±	0.98	-0.003
23 WGL 48684	3.65	1.01	±	1.93	0
24 WGL 14377	3.78	-0.395	±	6.99	0.058**
25 MTU 1032	3.23	0.711	±	1.69	0.001

G.M 3.608 S.e(m) 0.083

S.e(b_i) 2.757

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability.

Table 19 contd…

Genotype	L/B ratio (kernel) $\bar{X}$	b_i			$\bar{S}^2 d_i$	Genotype	Hulling (%) $\bar{X}$	b_i			$\bar{S}^2 d_i$
1 Kasturi	3.29	4.614	±	2.47	-0.0002	1 Kasturi	76.98	2.147	±	3.62	1.858
2 Erramallelu	3.82	4.132	±	2.9	0.0012	2 Erramallelu	79.52	3.314	±	2.27	-0.327
3 Vasundhara	3.12	2.498	±	0.82	-0.0034	3 Vasundhara	81.53	0.77	±	1.84	-0.804
4 PR 103	3.25	2.423	±	2.24	-0.0008	4 PR 103	78.54	1.922	±	2.35	-0.222
5 PR 106	3.71	1.003	±	1.55	-0.0024	5 PR 106	76.38	-0.755	±	1.73	-0.919
6 BPT 1235	3.49	-3.924	±	3.56	0.0038	6 BPT 1235	76.67	-2.247	±	2.17	-0.446
7 MTU 7029	2.52	-2.486	±	3.34	0.003	7 MTU 7029	78.43	0.49	±	2.48	-0.048
8 Triguna	3.18	3.551	±	1.26	-0.0029	8 Triguna	77.48	-0.815	±	3.1	0.897
9 MTU 5293	2.84	2.281	±	1.26	-0.0028	9 MTU 5293	77.56	1.1	±	1.07	-1.42
10 BPT 5204	3.21	0.545	±	0.76	-0.0034	10 BPT 5204	79.45	1.787	±	1	-1.459
11 MTU 1010	3.22	-4.886*	±	0.5	-0.0036	11 MTU 1010	79.67	3.615	±	1.43	-1.17
12 GEB 24	2.61	5.728	±	4.22	0.007	12 GEB 24	76.51	2.547	±	3.32	1.276
13 Tarori Basmati	4.31	-1.929*	±	0	-0.0038	13 Tarori Basmati	78.06	1.701	±	2.3	-0.291
14 MTU 2067	2.73	7.286	±	4.1	0.0063	14 MTU 2067	75.03	-0.008	±	2.04	-0.6
15 MTU 4870	2.59	5.619	±	3.24	0.0025	15 MTU 4870	75.30	-0.309	±	7.42	13.329**
16 MTU 1001	2.63	5.497*	±	0.65	-0.0036	16 MTU 1001	78.85	-1.413	±	3.28	1.201
17 MTU 3626	2.64	-0.542	±	1.63	-0.002	17 MTU 3626	77.47	-2.972	±	2.15	-0.469
18 MTU 5249	2.59	3.694*	±	0.41	-0.004	18 MTU 5249	78.73	4.336	±	5.87	7.704**
19 MTU 2716	2.75	-3.221	±	4.12	0.006	19 MTU 2716	78.16	3.002	±	0.6	-1.634
20 NLR 145	3.18	-1.447	±	1.61	-0.0023	20 NLR 145	77.39	1.331	±	3.04	0.794
21 JGL 1798	3.15	-1.436	±	1	-0.0032	21 JGL 1798	78.49	6.496	±	6.98	11.597**
22 JGL 384	3.12	-3.177*	±	1.04	-0.0031	22 JGL 384	78.35	1.488	±	3.45	1.512
23 WGL 48684	3.00	2.166	±	1.12	-0.0031	23 WGL 48684	78.67	2.303	±	2.58	0.081
24 WGL 14377	3.19	-0.52	±	1.15	-0.003	24 WGL 14377	80.70	-1.781	±	1.33	-1.249
25 MTU 1032	2.88	-2.84	±	4.4	0.0078*	25 MTU 1032	77.02	-3.079	±	1.84	-0.812

L/B ratio (kernel): G.M 3.085 S.e(m) 0.033 $S.e(b_i)$ 2.178

Hulling (%): G.M 78.042 S.e(m) 0.977 $S.e(b_i)$ 3.237

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability.

Contd..

Table 19 contd…

	Milling (%)				Head rice recovery (%)			
Genotype	$\overline{X}$	b_i	$\overline{S}^2 d_i$	Genotype	$\overline{X}$	b_i	$\overline{S}^2 d_i$
1 Kasturi	68.80	1.914 ± 1.99	4.652*	1 Kasturi	58.27	-1.419 ± 4.76	2.997*
2 Erramallelu	75.27	1.454 ± 0.51	-1.173	2 Erramallelu	55.94	1.725 ± 3.77	1.518
3 Vasundhara	73.35	2.205 ± 2.25	6.370**	3 Vasundhara	53.95	3.142 ± 4.14	2.041*
4 PR 103	70.31	0.188 ± 0.43	-1.296	4 PR 103	58.70	3.378 ± 3.75	1.496
5 PR 106	69.85	1.711 ± 1.53	2.075	5 PR 106	55.62	4.044 ± 6.44	6.303**
6 BPT 1235	70.35	2.347 ± 0.71	-0.792	6 BPT 1235	54.16	3.274 ± 1.63	-0.505
7 MTU 7029	71.40	3.696 ± 2.32	6.870**	7 MTU 7029	57.31	0.626 ± 4.06	1.915
8 Triguna	71.36	2.652 ± 0.92	-0.245	8 Triguna	58.05	-0.655 ± 5.30	3.961**
9 MTU 5293	69.66	0.807 ± 0.69	-0.847	9 MTU 5293	58.25	2.681 ± 5.28	3.915**
10 BPT 5204	71.51	3.059 ± 0.85	-0.449	10 BPT 5204	59.12	8.700 ± 4.63	2.788*
11 MTU 1010	70.62	-0.234 ± 0.88	-0.372	11 MTU 1010	54.19	2.707 ± 3.40	1.056
12 GEB 24	69.51	-0.623 ± 0.4	-1.338	12 GEB 24	56.05	7.114 ± 2.51	0.131
13 Tarori Basmati	70.93	1.026 ± 0.93	-0.02	13 Tarori Basmati	53.03	-5.679 ± 5.59	4.507**
14 MTU 2067	70.51	3.056 ± 1.17	0.571	14 MTU 2067	58.54	-4.925 ± 11.27	21.295**
15 MTU 4870	70.50	-0.429 ± 2.16	5.712*	15 MTU 4870	55.74	0.544 ± 8.25	10.961**
16 MTU 1001	71.68	0.207 ± 1.25	0.856	16 MTU 1001	56.55	1.711 ± 1.79	-0.408
17 MTU 3626	72.95	0.991 ± 1.79	3.414*	17 MTU 3626	53.84	1.924 ± 5.21	3.793**
18 MTU 5249	72.48	-1.461 ± 1.43	1.632	18 MTU 5249	56.90	4.625 ± 1.54	-0.556
19 MTU 2716	70.90	0.407 ± 0.91	-0.289	19 MTU 2716	54.97	-0.441 ± 5.29	3.936**
20 NLR 145	71.47	1.388 ± 1.67	2.809	20 NLR 145	61.53	3.604 ± 2.59	0.203
21 JGL 1798	72.52	-1.570 ± 4.35	28.096**	21 JGL 1798	59.13	1.022 ± 8.08	10.492**
22 JGL 384	71.26	2.982 ± 0.87	-0.385	22 JGL 384	57.29	-7.519 ± 3.12	0.742
23 WGL 48684	72.85	-2.139 ± 1.05	0.155	23 WGL 48684	58.84	5.362 ± 13.18	29.511**
24 WGL 14377	76.90	0.848 ± 0.6	-1.029	24 WGL 14377	60.30	-5.526 ± 3.54	1.23
25 MTU 1032	71.14	0.524 ± 0.89	-0.339	25 MTU 1032	58.60	-4.957 ± 4.75	2.988*
	G.M 71.528	S.e(m) 1.119			G.M 56.99	S.e(m) 1.369	
		S.e(b_i) 1.549				S.e(b_i) 5.661	

* Significant at 0.05 level of probability ** Significant at 0.01 level of probability.

Table 15 : Phenotypic correlation coefficients among 15 characters in environment IV

S.No	Character	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Product-ive tillers /plant	Test weight (g)	Biomass (Kg)	Harvest Index (%)	L/B ratio Grain	L/B ratio Kernel	Hulling (%)	Milling (%)	Head rice recovery (%)	Grain elongation ratio	Protein content (%)	Grain yield (Kg/Plot)
1	Plant height (65 DAS)	1.000	0.631**	-0.129	0.114	-0.096	-0.165	-0.081	0.13	0.02	-0.158	-0.119	0.211	0.034	-0.139	-0.173
2	Plant height at harvest			-0.054	-0.014	-0.108	-0.118	-0.031	0.161	0.115	-0.186	-0.331**	-0.187	0.250*	-0.043	-0.117
3	Days to 50% flowering				0.038	-0.092	0.268*	-0.163	-0.556**	-0.583**	-0.295*	-0.258*	0.012	0.028	0.165	0.230*
4	Productive tillers/plant					-0.216	-0.06	-0.095	0.059	0.025	-0.283*	-0.308**	0.18	-0.025	0.102	0.076
5	Test weight (g)						-0.029	0.325**	-0.071	0.043	0.064	-0.058	-0.315**	-0.112	0.289*	0.052
6	Biomass (kg)							0.199	-0.551**	-0.531**	0.025	-0.122	0.046	0.068	0.003	0.964**
7	Harvest Index (%)								-0.063	-0.004	0.117	0.054	-0.302**	-0.109	0.056	0.376**
8	L/B ratio Grain									0.891**	0.12	0.209	-0.075	-0.147	-0.214	-0.529**
9	L/B ratio Kernel										0.097	0.159	-0.133	-0.116	-0.212	-0.499**
10	Hulling (%)											0.351**	-0.009	0.076	-0.049	0.012
11	Milling (%)												0.079	-0.154	-0.154	-0.123
12	Head rice recovery (%)													-0.276*	-0.066	-0.042
13	Grain elongation ratio														0.027	0.053
14	Protein content (%)															0.022
15	Grain yield (kg/plot)															1.000

* Significant at 0.05 level of probability

** Significant at 0.01 level of probability

Table 14 : Phenotypic correlation coefficients among 15 characters in environment III

S.No	Character	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Product-ive tillers /plant	Test weight (g)	Biomass (Kg)	Harvest Index (%)	L/B ratio (Grain)	L/B ratio (Kernel)	Hulling (%)	Milling (%)	Head rice recovery (%)	Grain elongation ratio	Protein content (%)	Grain yield (Kg/Plot)
1	Plant height (65 DAS)	1.000	0.666**	-0.098	0.103	-0.243*	-0.193	-0.115	0.059	0.065	0.054	0.038	-0.034	0.067	-0.123	-0.202
2	Plant height at harvest			-0.037	-0.023	-0.094	-0.114	-0.025	0.079	0.16	-0.015	-0.2	-0.246*	0.211	0.01	-0.113
3	Days to 50% flowering				0.067	-0.249*	0.286*	-0.168	-0.520**	-0.515**	-0.252*	-0.354**	0.366**	-0.107	0.026	0.230*
4	Productive tillers/plant					0.03	-0.176	-0.054	0.099	0.124	-0.112	-0.136	0.015	0.055	0.031	0.154
5	Test weight (g)						0.069	0.474**	-0.014	0.057	-0.106	-0.176	-0.209	-0.11	0.315**	0.195
6	Biomass (kg)							0.185	-0.519**	-0.546**	-0.014	0.067	-0.061	0.048	0.016	0.964**
7	Harvest Index (%)								0.096	0.002	0.18	0.042	-0.240*	-0.229*	0.017	0.345**
8	L/B ratio (Grain)									0.883**	0.129	0.133	-0.192	-0.004	-0.221	-0.472**
9	L/B ratio (Kernel)										0.115	0.053	-0.196	-0.047	-0.172	-0.509**
10	Hulling (%)											0.330**	-0.191	0.253*	0.078	-0.026
11	Milling (%)												-0.043	-0.086	-0.175	0.087
12	Head rice recovery (%)													-0.346**	0.261*	-0.133
13	Grain elongation ratio														0.015	0.006
14	Protein content (%)															0.018
15	Grain yield (kg/plot)															1.000

* Significant at 0.05 level of probability

** Significant at 0.01 level of probability

Table 13 : Phenotypic correlation coefficients among 15 characters in environment II

S.No	Character	Plant height at 65 DAS	Plant height at harvest	Days to 50% flowering	Product-ive tillers /plant	Test weight (g)	Biomass (Kg)	Harvest Index (%)	L/B ratio (Grain)	L/B ratio (Kernel)	Hulling (%)	Milling (%)	Head rice recovery (%)	Grain elongation ratio	Protein content (%)	Grain yield (Kg/Plot)
1	Plant height (65 DAS)	1.000	0.611**	-0.138	-0.009	0.053	-0.253*	-0.343**	0.173	0.1	-0.149	-0.06	0.067	0.076	-0.066	-0.356**
2	Plant height at harvest			0.202	-0.031	-0.072	-0.179	-0.404**	0.272*	0.225	-0.192	-0.233*	-0.044	0.06	0.002	-0.315**
3	Days to 50% flowering				-0.192	-0.082	0.322**	0.026	-0.434**	-0.324**	-0.158	-0.258*	-0.024	-0.009	0.14	0.302**
4	Productive tillers/plant					0.06	0.068	-0.114	0.176	0.146	0.004	-0.046	-0.073	-0.026	0.039	0.03
5	Test weight (g)						0.066	0.06	-0.098	-0.043	0.055	0.039	-0.376**	0.04	0.250*	0.115
6	Biomass (kg)							0.089	-0.500**	-0.670**	-0.039	-0.216	-0.103	0.156	0.300**	0.923**
7	Harvest Index (%)								-0.420**	-0.419**	0.151	0.245*	0.241*	-0.012	-0.151	0.451**
8	L/B ratio Grain									0.873**	0.026	-0.047	-0.245*	-0.07	-0.221	-0.586**
9	L/B ratio Kernel										0.04	-0.056	-0.183	-0.181	-0.176	-0.732**
10	Hulling (%)											0.525**	0.105	0.291*	0.054	0.054
11	Milling (%)												0.187	0.161	-0.230*	-0.085
12	Head rice recovery (%)													0.211	-0.117	-0.049
13	Grain elongation ratio														0.161	0.136
14	Protein content (%)															0.202
15	Grain yield (kg/plot)															1.000

* Significant at 0.05 level of probability
** Significant at 0.01 level of probability

Table 5 : Genetic parameters of 15 characters for 25 genotypes of rice in environment I

	Character	GCV	PCV	h^2(b)	GA	GAM
1	Plant height at 65 DAS (cm)	10.22	10.68	91.5	16.04	20.12
2	Plant height at harvest (cm)	13.92	14.31	94.6	32.73	27.88
3	Days to 50% flowering	12.03	12.36	94.7	25.25	24.13
4	Productive tillers/ plant	14.20	21.28	44.5	1.48	19.51
5	Test weight (g)	17.80	18.12	96.5	7.37	36.02
6	Grain yield (kg/ plot)	23.27	23.42	98.7	1.99	47.62
7	Biomass (kg)	21.99	22.21	98.1	4.20	44.87
8	Harvest index (%)	8.65	9.16	89.3	7.54	16.85
9	L/B ratio (grain)	13.77	14.13	94.9	1.01	27.62
10	L/B ratio (kernel)	14.67	15.06	94.9	0.90	29.43
11	Hulling (%)	2.62	3.94	44.3	2.82	3.59
12	Milling (%)	2.51	3.66	47.0	2.51	3.54
13	Head rice recovery (%)	4.35	5.43	64.3	4.09	7.18
14	Grain elongation ratio	5.72	6.42	79.5	0.19	10.51
15	Protein content (%)	6.30	6.96	82.0	0.93	11.75

Table 7: Genetic parameters of 15 characters for 25 genotypes of rice in environment II

	Character	GCV	PCV	$h^2(b)$	GA	GAM
1	Plant height at 65 DAS (cm)	12.79	13.18	94.2	21.33	25.58
2	Plant height at harvest (cm)	12.59	12.82	96.4	28.49	25.46
3	Days to 50% flowering	12.09	12.53	93.2	22.67	24.06
4	Productive tillers/ plant	14.19	18.13	61.3	1.60	22.88
5	Test weight (g)	17.47	17.86	95.7	6.95	35.22
6	Grain yield (kg/ plot)	24.54	24.71	98.6	1.99	50.20
7	Biomass (kg)	23.16	23.36	98.4	4.21	47.32
8	Harvest index (%)	9.18	9.62	91.0	8.02	18.04
9	L/B ratio (grain)	11.84	12.27	93.1	0.85	23.54
10	L/B ratio (kernel)	13.46	13.87	94.2	0.84	26.92
11	Hulling (%)	1.71	3.60	22.5	1.29	1.67
12	Milling (%)	3.58	4.93	52.8	3.80	5.35
13	Head rice recovery (%)	4.97	5.80	73.3	5.01	8.76
14	Grain elongation ratio	5.47	6.41	72.7	0.17	9.60
15	Protein content (%)	6.20	6.81	82.8	0.92	11.62

Table 9 : Genetic parameters of 15 characters for 25 genotypes of rice in environment III

	Character	GCV	PCV	$h^2(b)$	GA	GAM
1	Plant height at 65 DAS (cm)	10.76	11.34	90.0	16.38	21.02
2	Plant height at harvest (cm)	12.27	12.55	95.5	27.68	24.70
3	Days to 50% flowering	8.62	8.99	91.7	17.32	16.99
4	Productive tillers/ plant	13.06	18.19	51.5	1.31	19.31
5	Test weight (g)	14.52	15.00	93.7	5.81	28.96
6	Grain yield (kg/ plot)	18.54	18.81	97.2	1.78	37.64
7	Biomass (kg)	17.06	17.29	97.4	3.41	34.67
8	Harvest index (%)	3.68	4.50	66.8	2.99	6.19
9	L/B ratio (grain)	11.56	12.10	91.3	0.82	22.77
10	L/B ratio (kernel)	13.92	14.32	94.5	0.86	27.87
11	Hulling (%)	1.39	3.28	18.0	0.95	1.22
12	Milling (%)	2.81	4.13	46.3	2.84	3.94
13	Head rice recovery (%)	5.06	5.88	74.1	5.13	8.98
14	Grain elongation ratio	5.95	6.68	79.6	0.19	10.95
15	Protein content (%)	6.45	7.07	83.2	0.96	12.12

Table 11 : Genetic parameters of 15 characters for 25 genotypes of rice in environment IV

	Character	GCV	PCV	$h^2(b)$	GA	GAM
1	Plant height at 65 DAS (cm)	10.55	11.02	91.5	15.37	20.79
2	Plant height at harvest (cm)	12.10	12.48	94.1	25.99	24.19
3	Days to 50% flowering	9.93	10.38	91.5	19.39	19.56
4	Productive tillers/ plant	14.72	19.14	59.1	1.55	23.31
5	Test weight (g)	14.87	15.26	94.9	5.94	29.83
6	Grain yield (kg/ plot)	19.42	19.63	97.9	1.78	39.59
7	Biomass (kg)	17.82	18.08	97.1	3.39	36.17
8	Harvest index (%)	3.56	4.76	56.1	2.64	5.50
9	L/B ratio (grain)	12.27	12.66	93.8	0.87	24.48
10	L/B ratio (kernel)	14.36	14.71	95.4	0.89	28.89
11	Hulling (%)	1.99	3.39	34.6	1.87	2.41
12	Milling (%)	2.82	4.28	43.2	2.75	3.81
13	Head rice recovery (%)	4.88	5.66	74.2	4.91	8.65
14	Grain elongation ratio	5.86	6.48	81.9	0.19	10.93
15	Protein content (%)	6.37	6.98	83.1	0.94	11.95

CHAPTER V

DISCUSSION

Success of any breeding programme largely depends upon the knowledge of genetic variability present in a given crop species for the character under improvement. The genotypic coefficient of variation measures the range of variability available in a crop species and also enables us to compare the amount of variability present among different characters. The phenotypic expression of a character is the result of interaction between the genotype and environment. Hence, the total variance needs to be partitioned into heritable and non-heritable components so as to assess the true breeding nature of a particular trait (Falconer, 1964).

Investigation on **Stability analysis in rice genotypes** was carried out and the results pertaining to variability, heritability, genetic advance, genetic advance as per cent of mean, character association and stability analysis are discussed hereunder.

5.1 ANALYSIS OF VARIANCE

The analysis of variance revealed significant differences for all the characters among genotypes studied in all the environments (Table 3).

5.2 VARIABILITY, HERITABILITY, GENETIC ADVANCE AND GENETIC ADVANCE AS PER CENT OF MEAN

In the present study, the estimates of phenotypic coefficients of variation for all the characters were higher than the estimates of genotypic coefficients of variation, which may be due to higher influence of the environment. The results obtained are discussed character wise (Table 5, 7, 9 and 11).

5.2.1 Plant height at 65 DAS (cm)

The genotypic and phenotypic coefficients of variation were moderate in all the environments. This indicates that phenotypic variability is the measure of genotypic variability. These results are in confirmity with Manonmani *et. al.* (1996) and Bhavana (2003). High heritability coupled with high genetic advance as per cent of mean was recorded for all the environments. It indicates that this trait was controlled by additive gene action, thus offers the possibility of improvement of this trait through selection. These results were in concurrent with the findings of Saravanan and Senthil (1997) and Niranjan *et. al.* (1999).

5.2.2 Plant height at harvest (cm)

This trait recorded moderate genotypic and phenotypic coefficients of variation in all the environments. Narrow differences between GCV and PCV were observed. High heritability with high genetic advance as per cent of mean was recorded n all the environments. These results indicate that this trait was influenced by additive gene action and therefore amenable for improvement through selection.

These results are in accordance with the findings of Manonmani *et. al.* (1996) and Bhavana (2003).

5.2.3 Days to 50% flowering

Moderate GCV and PCV with high heritability and high genetic advance as per cent of mean were noticed in Environment I and II. It indicates that this character is reliable for direct selection.

Low GCV and PCV with high heritability and moderate genetic advance as per cent of mean were noticed in Environment III. It indicates less variation among genotypes studied. Low GCV and moderate PCV were noticed with high heritability and moderate GAM in Environment IV. It indicates predominance of both additive and non-additive gene actions. Therefore desired results may not be obtained by simple selection. Similar results were reported by Manonmani *et. al.* (1996), Saravanan and Senthil (1997) and Bhavana (2003).

5.2.4 Productive tillers / plant

This trait recorded moderate GCV and PCV in Environments II, III and IV. Moderate GCV with High PCV was noticed in Environment I. High heritability with high genetic advance as per cent of mean (GAM) was noticed in Environment II. Moderate heritability with moderate GAM was noticed in Environment I and III. Moderate heritability with high GAM was noticed in Environment IV.

Moderate values of GCV and PCV were reported by Mruthunjaya and Mahadevappa (1995) and Narendra and Reddy (1997). High heritability with high GAM was earlier reported by Manonmani *et. al.* (1996) and Mishra (1999).

5.2.5 Test weight (g)

Genotypic and phenotypic coefficients of variation were recorded high in all environments under study. Similar reports of high GCV and PCV were reported by Vange *et. al.* (1999) and Mishra (1999). High heritability with high genetic advance as per cent of mean was noticed in all environments. Similar results were reported by Chauhan (1996), Aswanipanwar *et. al.* (1997), Kumar *et. al.* (1998) and Mishra (1999). These results indicates that greater variability was observed for this trait. Results also indicates the predominance of additive gene action, hence the trait can be improved by simple selection.

5.2.6 Grain yield (kg/plot)

High GCV and PCV were observed for this trait in Environment I and II. Moderate GCV and PCV were recorded in

Environment III and IV. High GCV and PCV were in accordance with Reddy and De (1996), Basavaraja *et. al.* (1997) and Niranajan *et. al.* (1999). Moderate GCV and PCV were earlier reported by Bhavana (2003). High heritability with high genetic advance as per cent of mean was noticed in all environments. It indicates predominance of additive gene action and hence, response to selection could be anticipated in improving this trait. These results were in agreement with Ganesan *et. al.* (1995), Narendra and Reddy (1997) and Pattanayak and Gupta (1999).

5.2.7 Biomass (kg*)*

High genotypic and phenotypic coefficients of variation for this trait were noticed in Environment I and II. This trait registered moderate GCV and PCV in Environment III and IV. Similar reports of high GCV and PCV were reported by Niranjan *et. al.* (1999) and moderate GCV and PCV were reported by Manuel and prasad (1993).

High heritability coupled with high genetic advance as per cent of mean was reported in four environments. Similar results were reported by Ganesan *et. al.* (1996) and Pattanayak and Gupta (1999).

5.2.8 Harvest index (%)

Low GCV and PCV were observed for this trait in all environments indicating less variation among genotypes studied for this trait. Similar results were reported by Selvarani and Rangasamy (1997). High heritability with moderate GAM was recorded in Environment I and Environment II. These results were in confirmity with Manuel and Prasad (1993). High heritability with low GAM was recorded in Environment III. Moderate heritability with low GAM was recorded in Environment IV. Similar results were reported by Manuel and Prasad (1993).

5.2.9 L/B ratio (grain)

Moderate GCV and PCV were observed for this trait in all the environments. It indicates lower variability in the material for this trait. Similar results were reported by Rajamani (1993).

High heritability coupled with high genetic advance as per cent of mean was noticed. Similar results were reported by Marekar and Siddiqui (1996), Vivekanandan and Giridharan (1998) and Lalitha and Sreedhar (1999).

5.2.10 L/B ratio (kernel)

Genotypic and phenotypic coefficients of variation for this trait were moderate in all environments. These results indicates less range of variability. Similar results were reported by Lalitha and Sreedhar (1999).

High heritability coupled with high GAM was recorded for this character indicating the predominance of additive gene action. Hence, it offers best possibility of improvement of this trait through simple selection. These results are in confirmity with Nagajyothi (2001).

5.2.11 Hulling (%)

Low GCV and PCV were observed for this trait indicates less range of variation for this trait in all environments. Similar results were reported by Chauhan and Nanda (1983), Chauhan *et. al.* (1995), Pandey and Mani (1995) and Nagajyothi (2001). Moderate heritability with low GAM was recorded in Environments I and IV. Low heritability with low genetic advance as per cent of mean was recorded in Environments II and III. It indicates the preponderance of non-additive gene action. Hence, it is difficult to improve this trait through simple selection. Similar results were reported by Chauhan and Nanda (1983) and Nagajyothi (2001).

5.2.12 Milling (%)

Genotypic and phenotypic coefficients of variation were low in all environments for this trait. It indicates less variability in the material. Similar reports were given by Chauhan and Nanda (1983), Pandey and Mani (1995) and Nagajyothi (2001).

Moderate heritability with low genetic advance as per cent of mean was recorded in all the four environments. This result indicates predominance of non-additive gene action. Therefore, further improvement of these traits would be easier through heterosis breeding rather than simple selection. Similar reports were obtained by Chauhan and Nanda (1983) and Nagajyothi (2001).

5.2.13 Head rice recovery (%)

The genotypic and phenotypic coefficients of variation were low in all environments. Similar results were reported by Chauhan and Nanda (1983).

High heritability with low genetic advance as per cent of mean was noticed in all environments. It indicates predominance of non-additive gene action. It further indicates that this trait may not be amenable to simple selection. Similar results were reported by Pathak and Sharma (1996).

5.2.14 Grain elongation ratio

Low genotypic and phenotypic coefficients of variation were noticed in all environments. While, high GCV and PCV were reported by Sadukhan and Chattopadhyay (2000) and Satyavathi *et. al.* (2001).

High heritability with moderate genetic advance as per cent of mean was noticed in Environment I, III and IV. It indicates operation of both additive and non-additive gene actions. Therefore, desired results may not be obtained by direct selection. High heritability with low GAM was noticed in Environment II. Similar results of high heritability were reported by Sadukan and Chattopadhyay (2000) and Satyavathi *et. al.* (2001).

5.2.15 Protein content (%)

Genotypic and phenotypic coefficients of variation recorded were low in all environments for this trait. It indicates less range of variation for the character in all environments. These results were in concurrence with Deosarkar *et. al.* (1989), Lalitha (1995) and Lalitha and Sreedhar (1999).

High heritability with moderate genetic advance as per cent of mean was recorded, in all the four environments for this trait. It indicates operation of both additive and non additive genes and offers the best possibility of improvement of this trait through mass selection, progeny selection, family selection or any other suitable modified selection procedure aiming to exploit the additive gene effects.

5.3 CORRELATIONS

Correlation studies are of primary importance to know the suitability of various characters for selection, because selection of a particular trait may induce desirable or undesirable changes in the associated characters. Generally direct selection for yield was not aimed, as it is a complex quantitative character and highly influenced by environment. Therefore, correlation between yield and yield components are of considerable importance in selection programme (Lalitha, 1995).

In the present investigation the results obtained form the correlation studies were discussed hereunder character wise and environment wise.

5.3.1 Plant height at 65 DAS (cm)

This trait showed positive correlation with plant height at harvest in all the environments with L/B ratio (grain) and L/B ratio (kernel) in E-1. These results were in conformity with Lalitha (1995).

It recorded negative correlation with grain yield in E-I and E-II. Nath and Talukdar (1997), Gupta *et. al.* (1998) and Tarasatyavathi *et. al.* (2001) reported negative correlation of plant height with grain yield.

5.3.2 Plant height at harvest (cm)

This trait showed positive correlation with L/B ratio (grain) in E-I and E-II and with grain elongation ratio in E-IV. The positive association of this trait with L/B ratio (grain) was reported by Lalitha (1995).

It recorded negative correlation with grain yield in E-I and E-II with biomass in E-I with harvest index and milling in E-II and E-IV.

Gupta *et. al.* (1998) and Tarasatyavathi *et. al.* (2001) reported negative correlation of plant height with grain yield. Negative correlation of plant height with harvest index were reported by Chauhan (1993) and Chauhan and Riccharia (1993).

5.3.3 Days to 50 per cent flowering

Days to 50 per cent flowering recorded significant positive correlation with grain yield, biomass and significant negative correlation with L/B ratio (grain), L/B ratio (kernel), hulling, milling in all the environments. Positive significant correlation between days to 50 per cent flowering and grain yield reported by Amrithadevarathinam (1990), Yadav (1992), Marekar and Siddiqui (1996) Satpute (1996) Rather and Raina (1997) and Padmanjali (2002).

5.3.4 Productive tillers / plant

This trait exhibited positive and significant correlation with biomass in E-I and negative correlation with hulling and milling in E-IV. It exhibited positive non-significant correlation with grain yield in all the environments indicating the independent inheritance of these characters. While positive significant correlation of productive tillers were reported by Marekar and Siddiqui (1996), Saravanan *et. al.* (1996) and Tarasatyavathi *et. al.* (2001).

5.3.5 Test weight (g)

Test weight showed positive non-significant correlation with grain yield indicating that they are independently inherited characters. This trait exhibited positive correlation with harvest index in E-III and E-IV with protein content in E-II and E-III while it recorded negative correlation with head rice recovery in E-I, E-II, E-III and with hulling in E-I. A significant positive correlation of test weight with harvest index reported by Shaktivel (2001).

5.3.6 Biomass (kg)

This trait exhibited positive correlation with grain yield in all the environments and with protein content in E-I and E-II. It also showed significant negative correlation with L/B ratio of grain and kernel in all the environments and with milling in E-I. These results are in conformity with Ramalingam *et. al.* (1995), Madhuri (1996), Ganesan *et. al.* (1998) and Shaktivel (2001).

5.3.7 Harvest index (%)

This trait recorded significant positive correlation with grain yield in all the environments. It also showed significant negative correlation with L/B ratio of grain and kernel in E-I and E-II with head rice recovery in E-III and E-IV. These results are in conformity with Murthy *et. al.* (1992) and Shaktivel (2001).

5.3.8 L/B ratio (grain)

L/B ratio (grain) exhibited significant positive correlation with L/B ratio (kernel) in all the environments. This was in agreement with the findings of Nagajyothi (2001).

This trait discerned significant negative correlation with gain elongation ratio in E-I and grain yield in all the environments. This was in agreement with the findings of Padmanjali (2002).

5.3.9 L/B ratio (kernel)

L/B ratio (kernel) exhibited significant negative correlation with grain yield in all the environments and with head rice recovery in E-II. Similar results were reported by Nagajyothi (2001).

5.3.10 Hulling (%)

Hulling was found to have non-significant association with grain yield indicating that they are independently inherited characters. This trait exhibited significant positive correlation with milling in all environments and with grain elongation ratio in E-I and E-II. This was in agreement with the findings of Chauhan *et. al.* (1993) and Nayak *et. al.* (2003).

5.3.11 Milling (%)

Milling recorded negative significant correlation with grain yield in E-I with protein content in E-II and non-significant association with grain yield in E-II, E-III and E-IV. Milling exhibited significant positive correlation with hulling in all the environments. This was in agreement with the reports of Nayak *et. al.* (2003).

5.3.12 Head rice recovery (%)

This trait recorded significant negative correlation with test weight in E-I and E-II and with grain elongation ratio in E-III and E-IV while it recorded significant positive correlation with harvest index in E-II and protein content in E-IV. These results are in accordance with Nayak *et. al.* (2003).

5.3.13 Grain elongation ratio

Grain elongation ratio recorded a positive and significant association with hulling in E-II and E-IV while it recorded negative and significant association with head rice recovery in E-III and E-IV. These results were in conformity with Nayak *et. al.* (2003).

5.3.14 Protein content (%)

Protein content recorded positive and non-significant association with grain yield in all the environments indicating the independent inheritance of these traits. This trait recorded positive significant correlation with test weight in E-II and E-III with biomass in E-I and E-II and with head rice recovery in E-III. However, Hussain *et. al.* (1987) recorded significant negative correlation of this trait with test weight.

5.3.15 Grain yield (kg/plot)

Grain yield showed positive correlation with days to 50 per cent flowering. Biomass and harvest index in all the environments. The above characters were highly associated among themselves and also with grain yield. Hence by exercising simple selection for any one, it could be possible to obtain improvement in desirable yield components simultaneously. Similar results were obtained by Marekar and Siddiqui (1996), Shaktivel (2001) and Padmanjali (2002).

This trait exhibited negative correlation of grain yield with L/B ratio (grain) and L/B ratio (kernel) in all environments and with plant height in E-I and E-II. These are in agreement with the findings of Nagajyothi (2001) and Padmanjali (2002).

5.4 STABILITY ANALYSIS

In the present study, stability model suggested by Eberhart and Russell (1966) was followed. According to them, a stable genotype is the one with high mean with unit regression coefficient (b=1) and non-significant derivation from linear regression ($\overline{S}^2$ d=0).

In the present investigation, an attempt was made to characterize the stability performance of 25 selected genotypes of rice grown over four different environments (dates of sowing and season).

While, pooling the data over four environments, Bartlett's test was performed to study the homogeneity of error variances. The Bartlett's x^2 values (Table 16) showed non significance for all the characters except for productive tillers/plant. So the experimental errors of traits over environments were homogenous for all the traits except productive tillers per plant allowing pooling of data over environments. The genotypes showed significant differences for all the characters. Environment and genotype x environment interaction component showed high significance for all the characters except for productive tillers/plant, grain elongation ratio and protein content, indicating wide differences between environments and differential behaviour of genotypes in different environments. The high significance of environment (linear) component for all the characters confirms the earlier observation of widely differing environments in the analysis of variance and also to the widely ranging environmental indices for different characters.

The genotype x environment (linear) component showed significance for all the characters except hulling when tested against pooled error. However, the genotype x environment (linear) interaction was significant for plant height at harvest, grain yield, biomass, harvest index, L/B ratio kernel when tested against pooled deviation and pooled error. The high significance of pooled deviation for all the characters except for harvest index and L/B ratio kernel indicates the importance of non-linear component in determining interaction of the genotypes with environments in the present study.

Significant genotype x environment interactions have been reported by Senanayake and Wijeratne (1990) for grain elongation, amylose and brown rice protein, Geetha *et. al.* (1994) for panicles per plant, test weight and grain yield. Singh *et. al.* (1995) for days to 50 per cent flowering, plant height, grain yield. Similar reports were given by Mahapatra *et. al.* (1996), Singh *et. al.* (1997), Chikkalingaiah *et. al.* (1997), Basavaraja *et. al.* (1998), Hegde and Vidyachandra (1998), Reddy *et. al.* (1998), Smitha Mishra and Mahapatra (1998), Hegde and Vidyachandra (1998), Honarnejad *et. al.* (1999), Honarnejad (2000), Qayum *et. al.* (2000), Kandhola and Panwar (1999), Swamy and Kumar (2003).

The results of the present study are discussed for 12 characters based on stability parameters for the 25 genotypes of rice hereunder.

5.4.1 Plant height at 65 DAS

The genotypes Kasturi, BPT-1235, MTU-7029, MTU-1010, MTU-3626 and WGL-48684 were found to be suitable for favourable environments with predictable performance because of their more than unity regression and non-significant deviations from regression. The genotypes PR-106 and MTU-5249 were found to be suitable for poor environments because of their above average stability with less than unity regression coefficient and non-significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from linearity.

5.4.2 Plant height at harvest (cm)

The genotypes PR-106 and WGL-48684 were found to be suitable for favourable environments because of their more than unity regression and non-significant deviations from regression. The genotypes MTU-3626 were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from linearity.

5.4.3 Days to 50% Flowering

The genotype WGL-48684 was found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from linearity.

5.4.4 Test weight (g)

Genotypes *viz.,* PR-103, BPT-1235 and NLR-145 were found to be suitable for favourable environments with predictable performance since they recorded more than unity regression and non-significant deviations from regression. Vasundhara and MTU-5293, were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from linearity.

5.4.5 Grain yield (kg/plot)

The genotypes MTU-7029 and MTU-2716 were identified as stable genotypes as they recorded high mean, regression coefficient around unity and deviations from regression approximately zero. The genotypes BPT-1235, MTU-2067, MTU-

5249, JGL-384 and MTU-1032 were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviations from regression. Kasturi, MTU-1010, GEB-24, MTU-1001 and JGL-1798 were found to be suitable for favourable environments with predictable performance because of their greater than unity regression and non-significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from regression.

5.4.6 Harvest index (%)

The performance of all the genotypes was predictable as they recorded non-significant deviations from regression. The genotypes Kasturi, Erramallelu, PR-103, Triguna, MTU-5293, GEB-24, Tarori basmati, MTU-5249, MTU-2716, WGL-14377 and MTU-1032 were found to be suitable for favourable environments with predictable performance because of their greater than unity regression and non significant deviations from regression. The genotypes Vasundhara, BPT-1235, MTU-7029, MTU-1010, BPT-5204, MTU-4870, MTU-1001, MTU-3626, NLR-145, JGL-1798, JGL-384 and WGL-48684 were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviations from regression.

5.4.7 Biomass (kg)

PR-106, NLR-145 and JGL-384 were found to be stable since they recorded high mean unit regression coefficient and deviation from regression nearly zero. The genotypes BPT-5204, MTU-1010, GEB-24 and MTU-1001 were found to be suitable for favourable environments with predictable performance because of their more than unity regression and non-significant deviations from regression. The genotypes BPT-1235 and MTU-7029 were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from regression.

5.4.8 L/B ratio (grain)

The genotypes PR-106, JGL-1798, Triguna, MTU-5293, GEB-24, Tarori basmati and MTU-2067 were found to be suitable for favourable environments with predictable performance because for their more than unity regression and non-significant deviations from regression.

5.4.9 L/B ratio (kernel)

The genotype PR-106 was identified as stable genotype as it recorded high mean, regression coefficient around unity and deviation from regression approaching zero. The varieties

Kasturi, Erramallelu, Vasundahra, PR-103, Triguna, MTU-5293, GEB-24, MTU-2067, MTU-4870, MTU-1001, MTU-5249, WGL-48684 and MTU-3626 were found to be suitable for favourable environments with predictable performance because of their greater than unity regression and non-significant deviations from regression. The genotypes MTU-2716, MTU-1010, Tarori basmati, NLR-145, JGL-1798, JGL-384 and MTU-7029 were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviations from regression.

5.4.10 Hulling (%)

The genotypes Erramallelu, MTU-1010, MTU-2716, MTU-2067 and MTU-1001 were found to be suitable for favourable environments because of their more than unity regression and non-significant deviations from regression. The varieties PR-106, BPT-1235, Triguna, MTU-5293 and BPT-5204 were found to be suitable for poor environments since they showed above average stability with $b_i < 1$ and non-significant deviation from regression. The performance of the genotypes MTU-4870, MTU-5249 and JGL-1798 were unpredictable as they recorded significant deviations from regression.

5.4.11 Milling (%)

The genotypes BPT-1235, Triguna, BPT-5204, MTU-2067 and JGL-384 were found to be suitable for favourable environments with predictable performance because of their more than unity regression and non-significant deviation from regression. The genotypes MTU-1001, PR-103, MTU-1010, GEB-24, MTU-1001 and MTU-5249 were found to be suitable for poor environments because of their above average stability with regression coefficient less than unity and non-significant deviation from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from regression.

5.4.12 Head rice recovery (%)

GEB-24, BPT-1235, MTU-5249 and NLR-145 were found to be suitable for favourable environments with predictable performance because of their more than unity regression and non-significant deviations from regression. The genotypes JGL-384 and WGL-14377 were found to be suitable for poor environments because for their above average stability with regression coefficient less than unity and non-significant deviations from regression. The performance of the remaining genotypes was unpredictable as they recorded significant deviations from linearity.

5.5 CLASSIFICATION OF GENOTYPES FOR DIFFERENT CHARACTERS BASED ON STABILITY PARAMETERS

Based on the mean performance and taking stability parameters into consideration, the genotypes were grouped in to three categories *viz.,* 1. Genotypes stable over all environments 2. Genotypes suitable for favourable environments and 3. Genotypes suitable for poor environments for different characters (Table 20).The genotypes identified for cultivation during the different seasons are presented in Table 21.

CONCLUSIONS

- The estimates of mean variability, heritability and genetic advance as per cent of mean were high to moderate for plant height at 65 DAS, plant height at harvest, test weight, biomass, L/B ratio (grain) and L/B ratio (kernel), hence simple selection is useful for improving these traits in rice.
- Hulling per cent, milling per cent, head rice recovery per cent, grain elongation ratio and protein content are the least variable characters hence, there exists little effect of environment over these traits.
- Biomass, harvest index and days to 50 per cent flowering had significant positive correlation with grain yield hence, selection for any one of the above characters will be effective in yield improvement.

- The genotypes MTU-7029 and MTU-2716 were found to be stable over environments for grain yield and PR-106, NLR-145 and JGL-384 were found to be stable over environments for biomass, hence these genotypes might be considered desirable for utilization in future breeding programme of rice.

- The study revealed that genotypes Kasturi, BPT-1235 and MTU-1010 were found to be suitable for favourable environments for most of the characters.

- The variety JGL-384 showed above average stability for characters *viz.,* grain yield, harvest index and L/B ratio kernel. Therefore, can also be recommended for poor environments.

Table 20 : Classification of genotypes for different characters based on stability parameters

	Characters	Genotypes stable over all environments (b = 1)	Genotypes suitable for favourable environments (b > 1)	Genotypes suitable for poor environment (b < 1)
1	Plant height at 65 DAS	- -	Kasturi, Dhanyalakshmi, Swarna, Cotton dora Sannalu, Prabhat, Kavya	PR-106, Vajram
2	Plant height at harvest	- -	Kavya, PR-106	Prabhat
3	Days to 50% flowering	- -	- -	Kavya
4	Test weight	- -	Dhanya Lakshmi, Swarnamukhi, PR-103	Vasundhara, Prathibha
5	Grain yield	Swarna, MTU 2716	Kasturi, Cotton dora Sannalu, Vijetha, GEB-24, Jagityala Sannalu	Dhanyalakshmi, Chaitanya, Vajram, Polasa prabha, Godavari
6	Harvest index	- -	Kavya, Godavari	Vasundhara, Cotton dora Sannalu, Deepthi, Vijetha, Prabhat, Swarnamukhi, Kavya, Jagityala Sannalu
7	Biomass	Swarnamukhi, Polasa Prabha, PR-106	Samba Mahsuri, Cotton dora Sannalu, Vijetha, GEB-24	Dhanyalakshmi, Swarna
8	L/B ratio (grain)	- -	Triguna, Pratibha, Tarori basmati, Chaitanya, PR 106, GEB-24.	- -
9	L/B ratio (kernel)	- -	Kasturi, Erramallelu, Vasundhara, Kavya	Cotton dora sannalu, Tarori basmati, Polasa prabha, Jagityala Sannalu, Swarna mukhi
10	Hulling (%)	- -	Erramallelu, Cotton dora Sannalu, Chaitanya, Vijetha, MTU 2716	Dhanyalakshmi, Triguna, Pratibha, Samba Mahsuri, PR 106.
11	Milling (%)	- -	Dhanyalakshmi, Triguna, Samba mahsuri, Chaitanya, Polasa prabha	Cotton dora Sannalu, Vijetha, Vajram, PR-103, GEB-24
12	Head rice recovery	- -	Dhanyalakshmi, Vajram, Swarnamukhi, GEB-24.	Varalu

Table 21: Stable and adaptable genotypes with high mean performance (over general mean) identified for grain yield per plot in different seasons.

Season	Genotypes identified
Kharif and rabi	MTU 7029 and MTU 2716
Kharif	NLR 145, BPT 5204, MTU 5249, JGL 384 and MTU 1032, MTU 2067
Rabi	MTU 1010, MTU 1001, JGL 1798

CHAPTER - VI

SUMMARY

The present investigation "Stability analysis in rice genotypes" involving 25 genotypes of rice grown under four environments (E-I = sowing on 10th July, 2003; E-II = sowing on 20th July, 2003; E-III = sowing on 10th December, 2003 and E-IV = sowing on 20th December, 2003) was conducted at Agricultural Research Station, Maruteru during 2003-04.

The results of analysis of variance revealed significant differences among the genotypes for all the characters studied.

High estimates of heritability coupled with high genetic advance were recorded for plant height at 65 DAS, plant height at harvest, test weight, biomass, L/B ratio (grain), L/B ratio (kernel) and protein content. The results indicated that these characters were under the control of additive gene action. The trait milling per cent exhibited moderate heritability with low genetic advance. Head rice recovery per cent exhibited high heritability with low genetic advance, which suggests that they are controlled by non additive gene action.

Correlation studies revealed that grain yield had significant positive correlation with days to 50% flowering, biomass, harvest index, hence, by exercising selection for these characters, it may be possible to isolate high yielding genotypes.

The quality characters grain elongation ratio, protein content exhibited non significant association with grain yield indicating independent inheritance of these characters.

The pooled analysis of variance for stability showed significant differences among the genotypes for all the characters. The genotype-environment interaction component showed high significance for all the characters except productive tillers/plant. Grain elongation ratio and protein content indicating wide differences between environments and differential behaviour of genotypes in different environments. The high significance of environment (linear) component confirms widely differing environments. The high significance of pooled deviation for all the characters except harvest index and L/B ratio (kernel) indicates the importance of non linear component in determining interaction of the genotypes with environments in the present study.

The genotypes MTU-7029 and MTU-2716 were found to be stable for grain yield. PR-106, NLR-145 and JGL-384 were found to be stable with reference to biomass. Kasturi, BPT-1235 and MTU-1010 were found to be suitable for favourable environments. The variety JGL-384 was found to be suitable for poor environments with above average stability for characters *viz.,* grain yield, harvest index and L/B ratio (kernel).

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