**Study of genetic erosion, variation and correlation among morpho-physiological traits of ahu rice of Assam**

**ABSTRACT:**

Survival of the invaluable landraces in the farmer’s fields along with the accompanying traditional practices and knowledge is considered very important for food security in the long term. But, the landraces are getting lost from the farmers’ fields which has not got due attention from the scientific community. The study was performed using 12 ahu rice cultivars to assess and analyze genetic erosion, variation and determine nature and extent of association among traits in upland ahu rice of two villages ( Jorhat and Golaghat district ) primarily inhabited by *Mising* (plain tribal) farmers. The study revealed loss of several rice landraces from the farmers’ fields highlighting the threat of genetic erosion. The analysis of variance revealed the existence of significant variation among the genotypes for all the traits except radicle length, leaf area index, photosynthesis and conductance. Among the genotypes, a newly introduced variety Kolong recorded high yield as well as highest filled grains per panicle and spikelets per panicle. Among the genetic parameters high estimates of GCV and PCV and GA were recorded for the trait chlorophyll stability index and high estimates of heritability was recorded for days to 50% flowering**.** Grain yield showed significantly positive correlation with number of tillers per m2, number of panicles per m2, spikelets per panicle, filled grains per panicle and spikelet fertility at both genotypic and phenotypic level

**Key words:** Genotypic coefficient of variation, phenotypic coefficient of variation, genetic analysis, genetic parameters.

# INTRODUCTION:

Rice (*Oryza sativa* L.) stands as the most important food crop globally and is a primary dietary staple for over half of the world's population (Way and Heong, 1994; Khush, 2005). As a species of paramount agronomic and socio-economic importance, rice occupies a central position in ensuring global food and nutritional security. India, being the second-largest producer of rice after China, contributes significantly to both domestic consumption and global trade (FAO, 2021). Among the rice-growing regions of India, the North Eastern Region (NER), particularly the state of Assam, holds a distinct position due to its unique agro-climatic conditions and rich genetic diversity of rice landraces.

In Assam, rice is not only the dominant staple but also the principal agricultural crop, accounting for approximately 60% of the gross cropped area and over 90% of the net cropped area. It contributes more than 96% of the total food grain production in the state (Assam Agricultural Statistics, 2022). The region is recognized as a secondary center of origin and diversity for *Oryza sativa* (Sharma et al., 2000; Vaughan et al., 2008), with considerable in situ conservation of traditional cultivars, especially among indigenous and tribal farming communities. Assam Agricultural University (AAU), Jorhat, alone maintains a repository of over 4000 rice landraces collected from across the state, demonstrating the magnitude of diversity still retained in farmers’ fields (Baruah et al., 2018).

Despite this rich heritage, a significant number of traditional rice varieties—particularly upland ahu rice—are under threat of extinction. These landraces, cultivated predominantly in marginal, rainfed, and risk-prone areas by tribal communities such as the Mising, are reservoirs of valuable genetic traits including resilience to biotic and abiotic stress. Their survival is intricately linked with traditional ecological knowledge (TEK), cultural practices, and socio-economic identity (Deb, 2009; Padulosi et al., 2013). However, factors such as agricultural modernization, land use changes, developmental pressures, market-driven varietal replacement, and natural disasters (e.g., floods and soil erosion) are accelerating the erosion of these genetic resources (Pathak and Borgohain, 2009; Maikhuri et al., 2003).

Genetic erosion—the loss of genetic diversity within a species—poses a direct threat to long-term food and livelihood security. Although the need to quantify and mitigate genetic erosion has been recognized globally (FAO, 2010), very limited empirical data exists on its extent, particularly in indigenous cropping systems. There is a pressing need for baseline studies that document on-farm variation and assess the bio-cultural dynamics contributing to the conservation or erosion of traditional rice varieties (Hammer et al., 1996; Jarvis et al., 2008).

Direct-seeded upland ahu rice varieties remain largely unimproved and represent a relatively untouched genetic reservoir. Their conservation assumes added significance in areas where tribal farmers continue to cultivate them using time-honored agronomic practices. However, anecdotal and preliminary field observations indicate a steady decline in the cultivation of certain landraces, suggesting ongoing genetic erosion that has largely escaped scientific scrutiny (Borgohain and Hazarika, 2014). Therefore, systematic assessment of this erosion, coupled with the analysis of phenotypic variation and trait association, is imperative for framing targeted conservation strategies.

In light of these concerns, the present study has been undertaken with the objective of assessing genetic erosion, analyzing morphological variation, and determining the nature and extent of trait associations among upland ahu rice landraces cultivated by the Mising tribal community in selected villages of Jorhat and Golaghat districts in Assam. This research aims to provide a critical benchmark for understanding on-farm rice genetic diversity and to inform policy and conservation planning at regional and national levels.

# MATERIALS AND METHODS

Two villages, inhabited, primarily by the *Mising* (plain tribal) farmers one in Jorhat district and the other in Golaghat district were taken for the present study. The field trail with the *ahu* rice varieties collected from these two villages were conducted at the Instructional cum Research (ICR) Farm of the College of Agriculture and laboratory studies were conducted in the laboratories of Plant Breeding and Genetics. Present investigation comprised of 12 rice varieties grown direct seeded in *ahu* season under upland situation by the *mising* farmers of two villages *viz.,* Hatisal, Jorhat and Danichapori, Golaghat. The rice genotypes used in this study are namely Ikorguni, Bihari, Erepi, Borkola, Kopowguni, Ikhojoi, Kola Bengan, Amrow, Luit, Disang, Kolong and Rongkhang.

# METHOD:

The ahu varieties were sown direct seeded under upland condition in a Randomized Block Design with three replications using plot size of 3.1 m2 (2.2 m × 1.4 m). Different morpho- physiological parameters like Coleoptile, Plumule and Radicle length, Days to 50 % flowering, Plant height, Number of tillers/m², Number of panicles/ m², Leaf length, breadth and area, Leaf area index, Chlorophyll content, Chlorophyll stability index (CSI), Stomatal conductance, Panicle length, Spikelets and filled grains per panicle and spikelet fertility, 1000-grain weight, Grain yield, Grain length (L), breadth (B) and L/B ratio, Kernel length (L), breadth (B) and L/B ratio were recorded following established procedures and the data thus obtained were used for computation of the mean value.

# STATISTICAL PROCEDURE:

Mean values for all the observations recorded on each entry at all the replications were subjected to the following statistical and biometrical analysis.

**Analysis of Variance:** The mean data of each character in each replication was subjected to analysis of variance following Randomized Block Design. Genotypic variances were tested against error variances by applying F-test for significance. In order to test the differences of mean of the genotypes, critical difference (CD) were calculated as follows:

# C.D. =

2 ×𝐸𝑚𝑠

√

𝑟

× t Where, r = number of replications

# Genetic parameters

Genetic parameters were calculated for various characters separately for each environment as follows:

1. **Genotypic variance ( σ²g ):** Genotypic variance was computed as follows:

σ²g = MSg− MSe

𝑟

Where,

MSg = Mean square due to genotype, MSe = Mean square due to error, R= Number of replications

1. **Phenotypic variance (σ²p):** Phenotypic variance was computed for each character using the formula,

σ²p = σ²g + σ²e Where, σ²e = MSe

1. **Genotypic coefficient of variation (GCV):** Genotypic coefficient of variation was computed using the formula:

GCV = σ²g × 100 %

𝑋̅

1. **Phenotypic coefficient of variation (PCV):** Phenotypic coefficient of variation was computed using the formula:

PCV = σ²p × 100 %

𝑋̅

1. **Heritability in broad sense ( hb² ):** It was computed by the formula:

hb² = σ²g × 100 %

σ²p

# Correlation coefficient (r)

The correlation coefficients among various parameters at genotypic and phenotypic levels were calculated using the following formula

**Genotypic correlation coefficient** (rgxy ) σgxy

√σ²gx × σ²gy

Where,

σgxy = Genotypic covariance between X and Y, σ²gx = Genotypic variance of X, σ²gy = Genotypic variance of Y,

**Phenotypic correlation coefficient (rpxy )** = **𝜎pxy/(√σ²px×σ²py)**

Where,

σpxy = Phenotypic covariance between X and Y, σ²px = Phenotypic variance of X σ²py = Phenotypic variance of Y

The genotypic and phenotypic correlation coefficients were tested for

significance by using ‘t’ tests as follows: t = 𝑟

√1−𝑟2

√𝑛 − 2 at (n-2) df

# EXPERIMENTAL FINDINGS:

**Participatory assessment of rice diversity**

It was evident from the study that the farmers in the past used to grow the landraces like Ikorguni, Kopowguni, Borkola, Erepi, Ikhojoi, Kola Bengan, Boga Amro, Kola Amro, Betguti, Kutkong, Messap (scented), Rongadoria and Gerem ahu .Of which the last four Kutkong, Messap, Rongadoria and Gerem ahu had been abandoned by the community.But in the recent period, they started growing another set of varieties like Ikorguni, Kopowguni, Borkola, Erepi, Ikhojoi, Kola Bengan, Amrow, Bihari, Luit, Disang, Kolong and Rongkhang The last four happened to be very recent addition

# Analysis of variance

The analysis of variance revealed the presence of significant variation among the genotypes for all the characters except radicle length, leaf area index, photosynthesis and stomatal conductance.

# Table 1: Analysis of variance of various morpho-physiological traits

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sources of | Degree | Mean square | | | | | | |
| variation | of freedom | Coleoptile length | Plumule length | Radicle length | Days to 50%  flowerin g | Plant height | Number of tillers/m2 | Number of panicles/m  2 |
| Replicatio  n | 2 | 0.35\*\* | 0.75 | 0.75 | 0.33 | 29.9\*\* | 806.25 | 602.78 |
| Genotypes | 11 | 0.09\* | 3.09\*\* | 3.90 | 129.8\*\* | 294.8\*\* | 6943.9\*\* | 7530.1\*\* |
| Error | 22 | 0.04 | 0.86 | 2.54 | 1.09 | 4.35 | 468.37 | 275.51 |

**Table2: Analysis of variance of various morpho-physiological traits**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sources of variation | Degree of freedom | Mean square | | | | | | |
| Leaf length | Leaf breadth | Leaf area | Leaf area index | Chlorophyll content | Chloro- phyll stability index | Conductanc e |
| Replication | 2 | 10.15\*\* | 0.001 | 6.34 | 0.06 | 0.24 | 0.03 | 0.230\*\* |
| Genotypes | 11 | 47.32\*\* | 0.033\* | 61.03\*\* | 0.11 | 6.39\*\* | 7.87\*\* | 0.009 |
| Error | 22 | 1.42 | 0.014 | 5.69 | 0.18 | 0.19 | 0.34 | 0.005 |

# Table.3: Analysis of variance of various morpho-physiological traits

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sources of variation | Degree of freedom | Mean square | | | | | |
| Panicle length | Spikelet/ panicle | Filled  grains/ panicle | Spikelet  fertility (%) | 1000-grain weight | Grain yield/m2 |
| Replicatio  n | 2 | 0.26 | 26.33 | 31.44 | 6.78 | 0.94 | 454.53 |
| Genotypes | 11 | 18.03\*\* | 891.15\*\* | 610.88\*\* | 57.99\*\* | 28.63\*\* | 5716.62\*\* |
| Error | 22 | 0.32 | 12.30 | 12.47 | 4.57 | 0.68 | 322.30 |

**Table.4: Analysis of variance of various morpho-physiological traits**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Sources of variation | Degree of freedom | Mean square | | | | | |
| Grain length | Grain breadth | Grain L/B ratio | Kernel length | Kernel breadth | Kernel  L/B ratio |
| Replicatio  n | 2 | 0.01 | 0.06\* | 0.03 | 0.01 | 0.13\*\* | 0.04 |
| Genotypes | 11 | 1.47\*\* | 0.17\*\* | 0.18\*\* | 1.48\*\* | 0.17\*\* | 0.22\*\* |
| Error | 22 | 0.03 | 0.01 | 0.01 | 0.06 | 0.01 | 0.02 |

\* Significant at 5 percent level of significance

\*\* Significant at 1 percent level of significance

# Mean performance

The mean and range of various traits studied and the mean performances of all the genotypes for different traits with coefficient of variation and critical difference at 5 per cent level of significance

# List 1 : Mean performance of the varieties in respect of various traits

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variety | Coleoptile length  (cm) | Plumule length  (cm) | Radicle length  (cm) | Days to 50%  flowering | Plant height  (cm) | Number of tillers/m2 | Number of panicles/m2 |
| Ikorguni | 1.9 | 6.6 | 6.6 | 64 | 88.6 | 248 | 222 |
| Bihari | 1.8 | 6.9 | 7.8 | 78 | 93.8 | 372 | 342 |
| Erepi | 1.9 | 6.5 | 8.0 | 65 | 86.4 | 230 | 180 |
| Borkola | 1.9 | 6.5 | 7.5 | 66 | 88.5 | 257 | 222 |
| Kopowguni | 1.7 | 5.7 | 4.7 | 65 | 91.8 | 200 | 160 |
| Ikhojoi | 2.1 | 8.4 | 8.6 | 62 | 81.5 | 258 | 197 |
| Kola Bengen | 1.9 | 8.0 | 6.9 | 66 | 92.0 | 217 | 168 |
| Amrow | 1.7 | 4.9 | 5.2 | 75 | 96.5 | 222 | 168 |
| Luit | 1.6 | 8.2 | 6.8 | 78 | 75.5 | 223 | 192 |
| Disang | 1.7 | 7.6 | 7.5 | 80 | 65.9 | 187 | 152 |
| Kolong | 1.4 | 6.8 | 6.2 | 72 | 69.8 | 278 | 207 |
| Rongkhang | 1.8 | 6.8 | 7.8 | 64 | 92.2 | 268 | 188 |
| C.D. 5% | 0.32 | 1.57 | NS | 1.77 | 3.53 | 36.65 | 28.11 |
| C.V. | 10.75 | 13.43 | 22.90 | 1.50 | 2.45 | 8.77 | 8.31 |

**Table 5: Mean performance of the varieties in respect of various traits**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variety | Leaf length  (cm) | Leaf breadth  (cm) | Leaf area (cm2) | Leaf area index | Chlorophyll content  (mg g-1) | Chlorophyll stability index  (%) | Conductance (m mol m-2S-  1) |
| Ikorguni | 17.70 | 1.10 | 14.4 | 1.2 | 5.6 | 3.3 | 0.27 |
| Vihari | 29.30 | 1.2 | 25.8 | 1.5 | 5.6 | 2.7 | 0.17 |
| Erepi | 19.97 | 0.97 | 14.4 | 1.6 | 6.5 | 3.1 | 0.14 |
| Borkola | 18.63 | 1.10 | 15.4 | 1.4 | 10.4 | 7.6 | 0.22 |
| Kopowguni | 21.93 | 0.97 | 15.8 | 1.2 | 6.4 | 2.2 | 0.21 |
| Ikhojoi | 18.17 | 0.87 | 11.8 | 1.5 | 7.2 | 3.1 | 0.15 |
| Kola  Bengen | 20.83 | 1.07 | 16.8 | 1.1 | 6.3 | 2.4 | 0.17 |
| Amrow | 30.00 | 1.13 | 26.0 | 1.6 | 8.1 | 3.9 | 0.31 |
| Luit | 22.63 | 0.87 | 14.7 | 1.5 | 6.2 | 1.5 | 0.16 |
| Disang | 19.90 | 0.97 | 14.7 | 1.5 | 7.2 | 3.9 | 0.14 |
| Kolong | 21.63 | 0.90 | 14.5 | 1.2 | 8.7 | 5.1 | 0.12 |
| Rongkhang | 23.33 | 1.07 | 18.8 | 1.2 | 5.4 | 2.5 | 0.18 |
| C.D. 5% | 2.02 | 0.20 | 4.04 | NS | 0.74 | 0.98 | NS |
| C.V. | 5.41 | 11.47 | 14.09 | 30.65 | 6.24 | 16.88 | 36.37 |

# Table 6: Mean performance of the varieties in respect of various traits

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variety | Panicle  length (cm) | Spikelets/ panicle | Filled  grains/ panicle | Spikelet  fertility (%) | 1000-grain weight  (g) | Grain  yield/m2 (g) |
| Ikorguni | 18.5 | 63 | 52 | 82 | 25.8 | 118 |
| Vihari | 22.9 | 102 | 83 | 81 | 23.9 | 216 |
| Erepi | 14.3 | 75 | 54 | 71 | 20.4 | 129 |
| Borkola | 16.6 | 79 | 61 | 77 | 21.4 | 138 |
| Kopowguni | 18.6 | 85 | 66 | 78 | 22.5 | 151 |
| Ikhojoi | 16.3 | 92 | 76 | 83 | 21.3 | 180 |
| Kola Bengen | 18.7 | 64 | 46 | 73 | 27.1 | 107 |
| Amrow | 21.1 | 75 | 54 | 72 | 22.2 | 129 |
| Luit | 18.7 | 66 | 47 | 72 | 20.9 | 109 |
| Disang | 19.0 | 60 | 43 | 72 | 19.1 | 104 |
| Kolong | 18.6 | 118 | 86 | 73 | 25.9 | 240 |
| Rongkhang | 14.6 | 81 | 64 | 79 | 16.3 | 142 |
| C.D. 5% | 0.95 | 5.94 | 5.98 | 3.62 | 1.39 | 30.40 |
| C.V. | 3.10 | 4.38 | 5.79 | 2.81 | 3.70 | 12.23 |

**Table 7: Mean performance of the varieties in respect of various traits**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variety | Grain length (mm) | Grain breadth (mm) | Grain shape L/B ratio | Kernel length (mm) | Kernel breadth (mm) | Kernel shape (L/B ratio) |
| Ikorguni | 7.9 | 3.7 | 2.1 | 5.9 | 3.3 | 1.8 |
| Vihari | 8.8 | 3.4 | 2.6 | 6.8 | 2.9 | 2.4 |
| Erepi | 7.7 | 3.5 | 2.2 | 5.5 | 3.1 | 1.8 |
| Borkola | 7.4 | 3.6 | 2.0 | 5.6 | 3.2 | 1.7 |
| Kopowguni | 7.9 | 3.6 | 2.2 | 6.0 | 3.1 | 1.9 |
| Ikhojoi | 8.0 | 3.6 | 2.2 | 6.0 | 3.1 | 1.9 |
| Kola Bengen | 7.9 | 3.7 | 2.1 | 5.9 | 3.2 | 1.8 |
| Amrow | 7.6 | 3.6 | 2.1 | 5.4 | 3.2 | 1.7 |
| Luit | 8.9 | 3.3 | 2.7 | 6.5 | 2.9 | 2.2 |
| Disang | 8.5 | 3.2 | 2.7 | 6.6 | 2.8 | 2.3 |
| Kolong | 8.8 | 3.5 | 2.5 | 7.0 | 2.9 | 2.4 |
| Rongkhang | 6.4 | 2.9 | 2.2 | 4.4 | 2.5 | 1.8 |
| C.D. 5% | 0.29 | 0.18 | 0.18 | 0.42 | 0.19 | 0.24 |
| C.V. | 2.18 | 3.13 | 4.71 | 4.17 | 3.68 | 7.12 |

**Coleoptile length:** The mean value of coleoptile length measured after 7 days of germination was 1.78 cm for the genotypes**.** Ikhojoi had the longest coleoptile (2.1cm) and shortest coleoptile length (1.4 cm) was observed in Kolong

**Plumule length:** The mean value of plumule length measured after 7 days of germination was

6.91 cm for the genotypes. The plumule length among the 20 varieties ranges from 4.9 cm to

8.4 cm considering that variety Ikhojoi had the longest plumule (8.4cm) and Amrow has the shortest plumule length (4.9 cm)

**Radicle length:** The radicle length among these genotypes ranged from 4.7 cm to 8.6 cm. Among these varieties, Ikhojoi had the longest radical length (8.6cm) and the shortest was observed in Kopowguni (4.7 cm).

**Days to 50% flowering:** The mean value of days to 50% flowering was 69 days. The variety Disang took the longest duration of 80 days to flower and Ikhojoi was the earliest (62 days) among all the varieties and differed significantly with the others in duration taken for flowering. **Plant height:** The tallest variety was Amrow (96.5 cm) followed by Bihari (93.8cm) and they were at par with each other. On the other hand, the shortest variety was Disang (65.9 cm) and was significantly shorter than all other varieties.

**Number of tillers per m2:** Bihari recorded the highest number of tillers per m2 (372) and Disang recorded the lowest (187)

**Number of panicles per m2:** Like that in case of the number of tillers per m2, Bihari and Disang recorded the highest and lowest number of panicles per m2 (342 and 152, respectively).

**Leaf length:** The mean value of leaf length was recoreded to be 22 cm ranging from 17.70 cm to 30 cm. Among the varieties, Amrow had the longest leaf of 30 cm which was statistically *at par* with the variety Bihari. The shortest leaf length was observed in Ikorguni (17.7 cm) which was statistically *at par* with Borkola and Ikhojoi.

**Leaf breadth:** The overall mean value of leaf breadth was 1.01 cm. The leaf breadth among the genotypes ranged from 0.87 cm to 1.2 cm. Among the varieties, Bihari had the widest leaf (1.2 cm) and the narrowest was observed in Ikhojoi and Luit (0.87 cm) which was statistically *at par* with Kopowguni, Kolong, Disang and Erepi.

**Leaf area:** The leaf area per plant for the genotypes varied from 11.8 cm2 to 26 cm2 and the grand mean was 16.92 cm2*.* Among the varieties, Amrow had the largest leaf (26 cm) while the smallest was observed in Ikhojoi (11.8 cm)

**Leaf area index:** The overall mean the genotypes for leaf area index was 1.37. The leaf area index ranged from 1.1 for Kolabengan to 1.6 for Amrow.

**Chlorophyll content:** The grand mean of all the genotypes for chlorophyll content was 6.96 mg g-1 and it varied from 5.4 mg g-1 for Rongkhang to 10.4 mg g-1 for Borkola.

**Chlorophyll stability index**: The grand mean of chlorophyll stability index was 3.44 per cent and it varied from 1.5 per cent for Luit to 7.6 per cent for Borkola. The varieties Kolabengan, Kopowguni were *at par* with the lowest ranking variety Luit.

**Stomatal conductance:** The overall mean of all the genotype was 0.19 m mol m-2 s-1. The mean value for the character varied from 0.12 m mol m-2 s-1 for Kolong to 0.31 m mol m-2 s-1 for Amrow.

**Panicle length:** The overall mean for the genotypes was 18.16 cm. The variety Bihari had the longest panicle length (22.9 cm) followed by Amrow and they were at par with each other. The shortest panicle (14.3 cm) was observed in the variety Erepi

**Spikelets per panicle:** The variety Kolong had the highest number of spikelets (118). The lowest number of spikelets was observed in Disang. The overall mean for all the genotypes was 61 spikelets.

**Filled grains per panicle:** The variety Kolong had the highest number of filled grains (86) followed by Bihari and they were at par with each other. The lowest number of filled grains was observed in Disang that was *at par* with Kolabengan and Luit. The overall mean for all the genotypes was 61 filled grains.

**Spikelet fertility:** The mean spikelet fertility of the genotypes was 75.94 per cent and it varied from 71 per cent for Erepi to 83 per cent for Ikhojoi. The genotypes Kolabengan, Amrow, Luit, Disang, Kolong were *at par* with Erepi in respect of, the spikelet fertility.

**1000 grain weight:** Kolabengan had the heaviest grains with its 1000 grain weight being as high as 27.1 gram while the lightest grains were borne by the variety Rongkhang being as low as 16.3 gram

**Grain yield:** The overall mean for all the genotypes was 146.85 gram per m2. Kolong showed the highest performance (240 g/m2) which was statistically *at par* with Bihari. On the other hand, the lowest yield was recorded by the variety Disang (104 g/m2) which was statistically *at par* with Luit, Amrow, Kolabengan, Erepi and Ikorguni.

**Grain length & breadth:** The length of the grains in the test varieties varied from 6.4 mm to

8.9 mm. Among all the genotypes, Luit had the longest grain of 8.9 mm and Rongkhang had the shortest grain size of 6.4 mm. The breadth of the grains in the test varieties varied from 2.9 mm to 3.7 mm. Among the genotypes, Ikorguni and Kolabengan had the widest grain of 3.7 mm. On the other hand, Rongkhang had the narrowest grain size of 2.9 mm that differed significantly from all the other varieties. The grand mean of all the genotype was 3.47 mm.

**Grain shape:** The ratio of the grain length to breadth (L/B ratio) varied from 2.0 to 2.7. The varieties Luit and Disang recorded similar L/B ratio of 2.7 and were statistically *at par* with Bihari. The variety Borkola recorded the lowest L/B ratio of 2.0 and was *at par* with Ikorguni, Kolabengan and Amrow.

**Kernel length & breadth :** The length of the milled kernel in the test varieties varied from 4.4 mm to 7.0 mm. Among all the genotypes, Kolong had the longest kernel of 7.0 mm and Rongkhang had the shortest kernel size of 4.4 mm.

The breadth of the grains in the test varieties varied from 2.5 mm to 3.3 mm. Among all the genotypes, Ikorguni had the widest grain of 3.3 mm. On the other hand, Rongkhang had the narrowest grain size of 2.5 mm that differed significantly from all the other varieties. The grand mean of all the genotype was 3.02 mm.

# Genetic parameters

The GCV and PCV estimates were low to moderate. The highest estimates of GCV and PCV were recorded for chlorophyll stability index (46.13% and 49.12%) while the lowest estimates were recorded for spikelet fertility (5.56% and 6.23%). Moderate estimates were recorded for plant height, number of tillers per m2, leaf length, panicle length, 1000 grain weight, chlorophyll content, kernel length and kernel shape while low estimates were recorded for all other remaining traits.

Heritability in broad sense ranged from 14 % for leaf area index to as high as 98 % for days to 50% flowering. Heritability estimates were relatively high for plant height, leaf length, number of panicles per m2, number of tillers per m2, panicle length, filled grains per panicle, spikelets per panicle, 1000 grain weight, grain yield, chlorophyll content, chlorophyll stability index, grain length and breadth, grain shape and kernel length and breadth respectively. The traits like leaf area, spikelet fertility and kernel shape had moderate estimates of heritability while the other remaining traits exhibited low heritability estimates. Genetic advance as percentage of mean (GA) ranged from as low as just 8.04 % for leaf area index to as high as

89.24 % for chlorophyll stability index followed by grain yield (54.78%). The others had rather low GA.

# List 2 : Genetic parameters of various traits

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Character** | **σ²g** | **σ²p** | **GCV (%)** | **PCV (%)** | **h2**  **bs**  **(%)** | **GA as % of mean** |
| Coleoptile length | 0.02 | 0.06 | 8.00 | 13.40 | 36 | 9.84 |
| Plumule length | 0.74 | 1.60 | 12.48 | 18.33 | 46 | 17.50 |
| Radicle length | 0.45 | 3.00 | 9.66 | 24.85 | 15 | 7.74 |
| Days to 50% flowering | 42.91 | 44.00 | 9.39 | 9.51 | 98 | 19.11 |
| Plant height | 96.82 | 101.17 | 11.55 | 11.80 | 96 | 23.27 |
| Number of tillers/m2 | 2158.52 | 2626.89 | 18.84 | 20.78 | 82 | 35.17 |
| Number of panicles/m2 | 2418.18 | 2693.69 | 24.62 | 25.99 | 90 | 48.06 |
| Leaf length | 15.30 | 16.72 | 17.78 | 18.59 | 92 | 35.04 |
| Leaf breadth | 0.007 | 0.02 | 7.95 | 13.96 | 32 | 9.32 |
| Leaf area | 18.44 | 24.13 | 25.38 | 29.03 | 76 | 45.71 |
| Leaf area index | 0.02 | 0.16 | 10.59 | 28.77 | 14 | 8.04 |
| Chlorophyll content | 2.07 | 2.26 | 20.65 | 21.57 | 92 | 40.72 |
| Chlorophyll stability index | 2.51 | 2.85 | 46.13 | 49.12 | 88 | 89.24 |
| Conductance | 0.003 | 0.007 | 21.29 | 42.14 | 26 | 22.15 |
| Panicle length | 5.90 | 6.22 | 13.38 | 13.73 | 95 | 26.85 |
| Spikelets/panicle | 292.95 | 305.25 | 21.40 | 21.84 | 96 | 43.18 |
| Filled grains/panicle | 199.47 | 211.94 | 23.16 | 23.88 | 94 | 46.29 |
| Spikelet fertility | 17.81 | 22.37 | 5.56 | 6.23 | 80 | 10.21 |
| 1000-grain weight | 9.32 | 10.00 | 13.73 | 14.22 | 93 | 27.30 |
| Grain yield/m2 | 1798.11 | 2120.40 | 28.88 | 31.36 | 85 | 54.78 |
| Grain length | 0.48 | 0.51 | 8.67 | 8.94 | 94 | 17.33 |
| Grain breadth | 0.05 | 0.06 | 6.63 | 7.33 | 82 | 12.35 |
| Grain shape (L/B ratio) | 0.05 | 0.07 | 10.10 | 11.14 | 82 | 18.85 |
| Kernel length (mm) | 0.47 | 0.53 | 11.53 | 12.26 | 88 | 22.33 |
| Kernel breadth(mm) | 0.05 | 0.06 | 7.57 | 8.42 | 81 | 14.02 |
| Kernel shape (L/B ratio) | 0.07 | 0.09 | 13.08 | 14.90 | 77 | 23.67 |

**Association**

Coleoptile length showed significantly positive correlation with plant height, spikelet fertility at both genotypic and phenotypic levels and significantly positive genotypic correlation with grain breadth and kernel breadth and significantly negative genotypic correlation with days to 50% flowering, leaf length, panicle length, grain length and shape and kernel length and shape. Plumule length was found to have significantly positive genotypic and phenotypic correlation with grain and kernel length and shape and negative correlation with plant height, leaf length and leaf area. Days to 50% flowering was found to have significantly positive genotypic and phenotypic correlation with leaf length, leaf area, panicle length, grain length and shape, kernel length and shape and negative phenotypic and genotypic correlation with spikelet fertility and plant height. Plant height showed significantly positive correlation with leaf length, breadth and area at both genotypic and phenotypic levels. It recorded negative correlation with grain length and shape and kernel length and shape at both phenotypic and genotypic levels. Number of tillers per m2 was found to have significantly positive phenotypic and genotypic correlation with number of panicles per m2, leaf length, leaf area, filled grains per panicle, spikelets per panicle, spikelet fertility and grain yield. Similarly, number of panicles per m2 had significantly positive phenotypic and genotypic correlation with leaf length, leaf area, filled grains per panicle, spikelets per panicle, spikelet fertility, grain yield and panicle length. Leaf length was found to have significant positive phenotypic and genotypic correlation with leaf breadth, leaf area, panicle length. Leaf breadth had significantly negative genotypic relation with grain length and shape and kernel length and shape. Leaf area

had significantly positive phenotypic and genotypic correlation with panicle length.

Spikelets per panicle showed significantly positive phenotypic and genotypic correlation with grain yield and kernel shape. Spikelet fertility had significant positive phenotypic correlation with grain yield as well. 1000 grain weight showed significantly positive correlation with grain length and breadth, kernel length and breadth at phenotypic and genotypic level.

Grain yield recorded highly significant correlation with number of tillers and panicles per square meter and number of spikelets and filled grains per panicle both at genotypic and phenotypic levels. Again, at phenotypic level, grain yield had significant positive correlation spikelet fertility percentage, kernel length and shape. However, grain yield showed correlation with none of the leaf related traits. Among leaf characters, there were close correlation among themselves. Similarly, chlorophyll content was found to have significant positive genotypic and phenotypic correlation with chlorophyll stability index.

Grain length showed significant positive correlation with grain shape and kernel length and shape both at genotypic and phenotypic levels. Similarly, grain breadth had highly significant positive correlation with kernel breadth and negative correlation with both grain and kernel shape at genotypic and phenotypic levels.

# List 3 : Estimates of genotypic correlation coefficient (rg) (upper diagonal) and phenotypic correlation coefficient (rp) (lower diagonal) among different traits

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Character | Col eop tile len gth | Plu mu le len gth | Da ys to 50  %  flo wer ing | Pla nt hei ght | Nu mb er of till ers  /m  2 | Nu mb er of pa nic les  /m  2 | Le af len gth | Le af bre adt h | Le af are a | Chl orop hyll cont ent | Chl orop hyll stab ility inde x | Pa nic le len gth | Spi kel ets  /pa nic le | Fil led gra ins  /pa nic le | Spi kel et fer tili ty | 10  00-  gra in we igh t | Gr ain yie ld/ m2 | Gr ain len gth | Gr ain bre adt h | Gr ain sha pe | Ke rne l len gth | Ke rne l bre adt h | Ke rne l sha pe |
| Coleoptile |  | 0.0 | - | 0.5 | 0.0 | 0.0 | - | 0.1 | - | - | - | - | - | - | 0.6 | - | - | - | 0.3 | - | - | 0.5 | - |
| length | 5 | 0.8 | 8\* | 9 | 9 | 0.4 | 8 | 0.2 | 0.10 | 0.01 | 0. | 0.3 | 0.1 | 9\* | 0.1 | 0.3 | 0.5 | 5\* | 0.8 | 0.6 | 3\* | 0.8 |
|  |  | 0\*\* | \* |  |  | 1\* |  | 1 |  |  | 45 | 2 | 1 | \* | 7 | 2 | 7\* |  | 0\* | 5\* | \* | 9\* |
|  |  |  |  |  |  |  |  |  |  |  | \*\* |  |  |  |  |  | \* |  | \* | \* |  | \* |
| Plumule | 0.3 |  | 0.0 | - | 0.0 | 0.0 | - | - | - | - | - | - | - | - | 0.0 | - | - | 0.3 | - | 0.4 | 0.3 | - | 0.4 |
| length | 3 | 3 | 0. | 5 | 7 | 0. | 0. | 0. | 0.27 | 0.35 | 0.2 | 0.1 | 0.1 | 9 | 0.0 | 0.0 | 6\* | 0.2 | 6\* | 5\* | 0.1 | 0\* |
|  |  |  | 60 |  |  | 54 | 84 | 66 |  | \* | 1 | 4 | 0 |  | 1 | 8 |  | 4 | \* |  | 5 |  |
|  |  |  | \*\* |  |  | \*\* | \*\* | \*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Days to | - | 0.0 |  | - | 0.1 | 0.2 | 0.5 | 0.0 | 0.4 | 0.00 | - | 0.6 | - | - | - | - | 0.0 | 0.6 | - | 0.8 | 0.6 | - | 0.7 |
| 50% | 0.4 | 5 | 0.4 | 0 | 2 | 7\* | 1 | 6\* |  | 0.09 | 9\* | 0.0 | 0.1 | 0.4 | 0.0 | 3 | 4\* | 0.3 | 5\* | 0\* | 0.3 | 5\* |
| flowering | 5 |  | 0\* |  |  | \* |  | \* |  |  | \* | 1 | 1 | 7\* | 3 |  | \* | 4 | \* | \* | 2 | \* |
|  | \*\* |  |  |  |  |  |  |  |  |  |  |  |  | \* |  |  |  |  |  |  |  |  |
| Plant | 0.3 | - | - |  | 0.2 | 0.2 | 0.4 | 0.9 | 0.6 | - | - | 0.1 | - | 0.0 | 0.3 | 0.1 | - | - | 0.2 | - | - | 0.2 | - |
| height | 5 \* | 0.3 | 0.3 | 6 | 5 | 3\* | 3\* | 1\* | 0.22 | 0.14 | 0 | 0.0 | 4 | 5\* | 1 | 0.0 | 0. | 8 | 0.6 | 0.6 | 7 | 0.7 |
|  |  | 7 \* | 9 \* |  |  | \* | \* | \* |  |  |  | 6 |  |  |  | 9 | 55 |  | 7\* | 0\* |  | 0\* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \*\* |  | \* | \* |  | \* |
| Number | - | - | 0.1 | 0.2 |  | 0.9 | 0.4 | 0.5 | 0.4 | - | 0.10 | 0.3 | 0.6 | 0.7 | 0.5 | 0.1 | 0.7 | 0.1 | - | 0.2 | 0.2 | - | 0.3 |
| of | 0.0 | 0.0 | 0 | 4 | 4 | 1\* | 2 | 8 | 0.10 |  | 2 | 7 | 5 | 2 | 6 | 3 | 8 | 0.1 | 4 | 0 | 0.2 | 4 |
| tillers/m2 | 4 | 3 |  |  | \*\* |  | \*\* | \*\* |  |  |  | \*\* | \*\* | \*\* |  | \*\* |  | 4 |  |  | 5 |  |
| Number | 0.0 | - | 0.2 | 0.2 | 0.9 |  | 0.3 | 0.6 | 0.4 | - | 0.09 | 0.4 | 0.4 | 0.5 | 0.5 | 0.2 | 0.5 | 0.3 | - | 0.3 | 0.3 | - | 0.3 |
| of | 0 | 0.0 | 0 | 4 | 4 | 8\* | 0\* | 8\* | 0.12 |  | 6 | 8\* | 8\* | 2\* | 5 | 7\* | 3 | 0.0 | 0 | 3 | 0.0 | 7\* |
| panicles/ |  | 3 |  |  | \*\* |  | \* | \* |  |  | \*\* | \* | \* | \* |  | \* |  | 2 |  |  | 8 |  |
| m2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Leaf | - | - | 0.5 | 0.3 | 0.3 | 0.3 |  | 0.5 | 0.9 | - | - | 0.6 | 0.2 | 0.2 | - | - | 0.2 | 0.1 | - | 0.2 | 0.0 | - | 0.2 |
| length | 0.2 | 0.3 | 4 | 9 \* | 5 \* | 3 \* | 5 | 6 | 0.16 | 0.24 | 7 | 8 | 4 | 0.1 | 0.0 | 7 | 1 | 0.1 | 6 | 2 | 0.2 | 1 |
|  | 6 | 5 \* | \*\* |  |  |  | \*\* | \*\* |  |  | \*\* |  |  | 7 | 2 |  |  | 9 |  |  | 8 |  |
| Leaf | 0.1 | - | 0.0 | 0.5 | 0.2 | 0.2 | 0.3 |  | 0.7 | - | 0.25 | 0.5 | - | - | 0.3 | 0.2 | - | - | 0.1 | - | - | 0.2 | - |
| breadth | 8 | 0.2 | 6 | 5 | 4 | 9 | 9 \* | 7 | 0.08 |  | 1 | 0.1 | 0.0 | 2 | 2 | 0.1 | 0. | 7 | 0.4 | 0.4 | 4 | 0.5 |
|  |  | 5 |  | \*\* |  |  |  | \*\* |  |  | \*\* | 5 | 6 |  |  | 2 | 44 |  | 7 | 4 |  | 4 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \*\* |  | \*\* | \*\* |  | \*\* |
| Leaf area | - | - | 0.4 | 0.5 | 0.3 | 0.3 | 0.9 | 0.7 |  | - | - | 0.6 | 0.1 | 0.1 | - | 0.0 | 0.1 | - | - | 0.0 | - | - | 0.0 |
|  | 0.1 | 0.3 | 2 \* | 4 | 7 \* | 7 \* | 0 | 4 | 0.14 | 0.11 | 9 | 7 | 7 | 0.0 | 4 | 7 | 0.0 | 0.0 | 6 | 0.1 | 0.1 | 0 |
|  | 0 | 8 \* |  | \*\* |  |  | \*\* | \*\* |  |  | \*\* |  |  | 2 |  |  | 5 | 9 |  | 1 | 5 |  |
| Chloroph | - | - | 0.0 | - | - | - | - | - | - |  | 0.90 | - | 0.2 | 0.1 | - | 0.0 | 0.1 | - | 0.3 | - | 0.1 | 0.3 | - |
| yll content | 0.1 | 0.1 | 1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 | 0.1 | \*\* | 0.0 | 2 | 3 | 0.2 | 4 | 5 | 0.0 | 6\* | 0.2 | 2 | 8\* | 0.1 |
|  | 0 | 6 |  | 3 | 1 | 3 | 4 | 3 | 1 |  | 5 |  |  | 5 |  |  | 2 |  | 1 |  |  | 0 |
| Chloroph | - | - | - | - | 0.0 | 0.0 | - | 0.1 | - | 0.89 |  | - | 0.1 | 0.1 | - | 0.0 | 0.1 | - | 0.2 | - | 0.0 | 0.3 | - |
| yll | 0.0 | 0.2 | 0.0 | 0.1 | 6 | 6 | 0.1 | 7 | 0.0 | \*\* | 0.0 | 9 | 5 | 0.0 | 5 | 7 | 0.1 | 6 | 0.2 | 2 | 1 | 0.1 |
| stability | 5 | 2 | 7 | 4 |  |  | 9 |  | 5 |  | 9 |  |  | 4 |  |  | 6 |  | 8 |  |  | 6 |
| index |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Panicle | - | - | 0.6 | 0.0 | 0.2 | 0.4 | 0.6 | 0.2 | 0.5 | - | - |  | 0.1 | 0.1 | 0.0 | 0.5 | 0.2 | 0.6 | 0.2 | 0.4 | 0.6 | 0.1 | 0.5 |
| length | 0.2 | 0.1 | 7 | 9 | 6 | 2 \* | 0 | 6 | 6 | 0.05 | 0.11 | 5 | 5 | 1 | 1\* | 4 | 3\* | 3 | 5\* | 2\* | 4 | 3\* |
|  | 8 | 4 | \*\* |  |  |  | \*\* |  | \*\* |  |  |  |  |  | \* |  | \* |  | \* | \* |  | \* |
| Spikelets/ | - | - | - | - | 0.6 | 0.4 | 0.2 | - | 0.1 | 0.25 | 0.23 | 0.1 |  | 0.9 | 0.2 | 0.1 | 1.0 | 0.2 | 0.0 | 0.2 | 0.3 | - | 0.4 |
| panicle | 0.2 | 0.1 | 0.0 | 0.0 | 6 | 9 | 6 | 0.1 | 3 |  |  | 4 | 7 | 5 | 8 | 0\* | 4 | 1 | 1 | 2 | 0.2 | 2\* |
|  | 2 | 4 | 1 | 5 | \*\* | \*\* |  | 1 |  |  |  |  | \*\* |  |  | \* |  |  |  |  | 2 |  |
| Filled | - | - | - | 0.0 | 0.7 | 0.5 | 0.2 | - | 0.1 | 0.16 | 0.18 | 0.1 | 0.9 |  | 0.4 | 0.1 | 0.9 | 0.1 | 0.0 | 0.1 | 0.2 | - | 0.3 |
| grains/pan | 0.0 | 0.0 | 0.1 | 5 | 5 | 9 | 3 | 0.0 | 4 |  |  | 3 | 7 | 7 | 5 | 8 | 8 | 0 | 5 | 6 | 0.2 | 6\* |
| icle | 8 | 9 | 0 |  | \*\* | \*\* |  | 5 |  |  |  |  | \*\* | \*\* |  | \*\* |  |  |  |  | 1 |  |
| Spikelet | 0.4 | 0.1 | - | 0.3 | 0.5 | 0.5 | - | 0.1 | 0.0 | - | - | - | 0.2 | 0.4 |  | 0.0 | 0.3 | - | 0.0 | - | - | 0.0 | - |
| fertility | 4 | 1 | 0.3 | 1 | 2 | 1 | 0.1 | 4 | 0 | 0.29 | 0.07 | 0.0 | 4 | 7 | 1 | 0 | 0.1 | 1 | 0.2 | 0.1 | 1 | 0.1 |
|  | \*\* |  | 9 \* |  | \*\* | \*\* | 1 |  |  |  |  | 3 |  | \*\* |  |  | 7 |  | 1 | 4 |  | 3 |
| 1000- | - | 0.0 | - | 0.1 | 0.1 | 0.2 | - | 0.1 | 0.0 | 0.06 | 0.05 | 0.4 | 0.1 | 0.1 | 0.0 |  | 0.2 | 0.5 | 0.8 | - | 0.5 | 0.6 | 0.1 |
| grain | 0.1 | 1 | 0.0 | 1 | 8 | 6 | 0.0 | 1 | 4 |  |  | 9 | 9 | 7 | 5 | 5 | 0 | 3 | 0.0 | 4 | 7 | 3 |
| weight | 0 |  | 3 |  |  |  | 1 |  |  |  |  | \*\* |  |  |  |  | \*\* | \*\* | 8 | \*\* | \*\* |  |
| Grain | - | - | 0.0 | - | 0.7 | 0.5 | 0.2 | - | 0.1 | 0.20 | 0.21 | 0.2 | 0.9 | 0.9 | 0.3 | 0.2 |  | 0.3 | 0.0 | 0.3 | 0.4 | - | 0.5 |
| yield | 0.1 | 0.0 | 4 | 0.0 | 3 | 9 | 4 | 0.0 | 4 |  |  | 1 | 6 | 6 | 6 \* | 6 | 5\* | 1 | 0 | 3\* | 0.2 | 2\* |
|  | 8 | 8 |  | 7 | \*\* | \*\* |  | 6 |  |  |  |  | \*\* | \*\* |  |  |  |  |  | \* | 0 | \* |
| Grain | - | 0.3 | 0.6 | - | 0.1 | 0.2 | 0.0 | - | - | - | - | 0.6 | 0.2 | 0.1 | - | 0.4 | 0.2 |  | 0.1 | 0.7 | 0.9 | 0.1 | 0.8 |
| length | 0.3 | 3 | 1 | 0.5 | 4 | 8 | 9 | 0.3 | 0.0 | 0.02 | 0.16 | 0 | 1 | 5 | 0.1 | 5 | 7 | 8 | 8\* | 9\* | 3 | 6\* |
|  | 4 \* |  | \*\* | 2 |  |  |  | 0 | 7 |  |  | \*\* |  |  | 7 | \*\* |  |  | \* | \* |  | \* |
|  |  |  |  | \*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Grain | 0.1 | - | - | 0.2 | - | - | - | 0.0 | - | 0.33 | 0.27 | 0.2 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.1 |  | - | 0.2 | 1.0 | - |
| breadth | 4 | 0.1 | 0.3 | 8 | 0.0 | 0.0 | 0.1 | 9 | 0.0 |  |  | 0 | 0 | 1 | 5 | 0 | 4 | 4 | 0.4 | 3 | 4 | 0.3 |
|  |  | 7 | 1 |  | 9 | 1 | 7 |  | 8 |  |  |  |  |  |  | \*\* |  |  | 7 |  | \*\* | 5\* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \*\* |  |  |  |
| Grain | - | 0.3 | 0.7 | - | 0.1 | 0.2 | 0.2 | - | 0.0 | - | - | 0.3 | 0.1 | 0.1 | - | - | 0.1 | 0.7 | - |  | 0.7 | - | 1.0 |
| shape | 0.4 | 4 \* | 5 | 0.6 | 6 | 3 | 3 | 0.3 | 3 | 0.19 | 0.27 | 9 \* | 8 | 2 | 0.2 | 0.0 | 9 | 4 | 0.5 | 4 | 0. | 0 |
| (L/B | 2 \* |  | \*\* | 3 |  |  |  | 0 |  |  |  |  |  |  | 3 | 7 |  | \*\* | 4 | \*\* | 56 | \*\* |
| ratio) |  |  |  | \*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \*\* |  | \*\* |  |
| Kernel | - | 0.2 | 0.5 | - | 0.1 | 0.2 | 0.0 | - | - | 0.08 | - | 0.5 | 0.2 | 0.2 | - | 0.5 | 0.3 | 0.9 | 0.1 | 0.6 |  | 0.1 | 0.8 |
| length | 0.3 | 6 | 4 | 0.5 | 4 | 8 | 3 | 0.2 | 0.0 |  | 0.01 | 8 | 8 | 3 | 0.1 | 0 | 4 \* | 4 | 6 | 9 | 4 | 6\* |
|  | 0 |  | \*\* | 6\* |  |  |  | 2 | 8 |  |  | \*\* |  |  | 3 | \*\* |  | \*\* |  | \*\* |  | \* |
|  |  |  |  | \* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Kernel | 0.2 | - | - | 0.2 | - | - | - | 0.0 | - | 0.30 | 0.25 | 0.1 | - | - | 0.0 | 0.6 | - | 0.1 | 0.8 | - | 0.1 |  | - |
| breadth | 1 | 0.1 | 0.2 | 3 | 0.1 | 0.0 | 0.2 | 5 | 0.1 |  |  | 7 | 0.1 | 0.1 | 1 | 2 | 0.1 | 0 | 3 | 0.4 | 1 | 0.4 |
|  |  | 8 | 8 |  | 8 | 5 | 2 |  | 2 |  |  |  | 8 | 7 |  | \*\* | 6 |  | \*\* | 6 |  | 0\* |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \*\* |  |  |
| Kernel | - | 0.3 | 0.6 | - | 0.2 | 0.2 | 0.1 | - | 0.0 | - | - | 0.4 | 0.3 | 0.3 | - | 0.1 | 0.3 | 0.7 | - | 0.8 | 0.8 | - |  |
| shape (L/B  ratio) | 0.3  4 \* | 5 \* | 4  \*\* | 0.6  1 | 3 | 8 | 6 | 0.2  1 | 1 | 0.08 | 0.15 | 2  \*\* | 5 \* | 0 | 0.1  0 | 0 | 9 \* | 8  \*\* | 0.3  2 | 7  \*\* | 2  \*\* | 0.4  7 |
|  |  |  |  | \*\* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | \*\* |

\*, \*\* Significant at P = 0.05 and 0.01 levels, respectively

# RESULTS AND DISCUSSION:

**Genetic erosion and variation:**

The present study very clearly revealed the loss of rice landraces from the farmers’ fields proving the apprehension of genetic erosion correct. The analysis of variance revealed existence of significant variation among the varieties for most of the characters except few. In the study, almost all the farmers’ varieties were very early maturing with relatively good early vigour and similar plant stature indicating to the farmers’ deliberate choice of varieties with specific combination of characters to suit the direct seeded upland rice ecosystem.

# Genetic analysis

The analysis of variance revealed the existence of significant variation among the varieties for most of the characters except few. Presence of genetic variation is the prerequisite for the success of selection and any breeding programme.

The GCV provides information for comparison of the genetic variability. The estimates of GCV and PCV were relatively low for all the characters. Highest GCV & PCV were observed for chlorophyll stability index followed by grain yield. Moderate estimates were recorded for plant height, number of tillers per m2, leaf length, panicle length, 1000 grain weight, chlorophyll content, kernel length and kernel shape while low estimates were recorded for all other remaining traits. The heritability estimates were relatively high for days to 50% flowering, plant height, number of spikelets per panicle, number of filled grains per panicle and 1000 grain weight suggesting that selection for such traits would lead to desired grain.

High heritability estimates along with high genetic advance were more useful in predicting the resultant effect for selecting the best individuals (Johnson *et al.,* 1955). In the study, besides chlorophyll stability index, grain yield recorded high heritability with relatively high genetic advance indicating that selection might be effective for bringing about improvement in grain yield

# Association studies

Information on correlation helps the breeder to choose appropriate breeding strategies, particularly, selection criteria for improvement of the traits of concern. In the present study, genotypic and phenotypic correlation coefficients among all the characters in all possible combinations were worked out.

Grain yield recorded highly significant correlation with number of tillers and panicles per square meter and number of spikelets and filled grains per panicle both at genotypic and phenotypic levels. Earlier, Chitra *et al.* (2005) also observed strong positive association between number of tillers per m2 and grain yield. Positive significant correlation of spikelet fertility with grain yield was observed by Ramakrishnan *et al*. (2006).

Negative genotypic and phenotypic correlation was observed between days to 50% flowering and spikelet fertility. Earlier, Das and Borthakur (1973) also observed similar association between days to flowering and spikelet fertility. 1000 grain weight showed significantly positive correlation with grain length at both genotypic and phenotypic level and supporting results were obtained by S.K. Singh *et al.* (2004).

1000 grain weight showed significantly positive correlation with grain length and breadth, kernel length and breadth at both phenotypic and genotypic level. Similar results were also reported by De and Rao (1988). Kernel length showed significant and positive genotypic correlation with kernel shape which was found to be similar with the results of Nayak *et al.* (2003).

# CONCLUSION:

The study revealed loss of several rice landraces from the farmers’ fields highlighting the threat of genetic erosion. The analysis of variance revealed the existence of significant variation among the genotypes for all the traits except radicle length, leaf area index, photosynthesis and stomatal conductance. Among the genotypes, a newly introduced variety Kolong recorded high yield as well as highest filled grains per panicle and highest spikelets per panicle. Kolong showed the longest and slender most kernels while Amrow had the shortest kernels, which was statistically *at par* with Rongkhang. Among the genetic parameters high estimates of GCV and PCV and GA were recorded for the trait chlorophyll stability index and high estimates of heritability was recorded for days to 50% flowering**.** Grain yield showed significantly positive correlation with number of tillers per m2, number of panicles per m2, spikelets per panicle,

filled grains per panicle and spikelet fertility at both genotypic and phenotypic level and these characters also showed positive association among themselves.

# FUTURE PROSPECTS:

The present study was very preliminary in nature where only two villages were taken for the case study. This study is considered to be just beginning of a larger project for systematic assessment of the issue of genetic erosion and also for evaluation of the rice genetic resources of Assam. For better understanding the issue of genetic erosion and bio-cultural dynamics future study with wider area encompassing many more ethno-cultural groups is needed.

**DISCLAIMER (ARTIFICIAL INTELLIGENCE)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**CONFLICT OF INTERESTS:**

Authors have declared that no conflicts of interests exist. All authors read and approved the final manuscript.

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