CHAPTER-I

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Rice (*Oryza sativa* L.) is the predominant staple food in at least fifteen countries in Asia and the Pacific, ten countries in Latin America and the Caribbean, one country in North Africa and seven countries in Sub-Saharan Africa (FAO, 1999). The percent contribution of rice to total global cereal food grain production was 28.52 in the year 2002 with a production of 5.79 billion metric tones, an increase of 0.499 billion metric tones over ten years (1993 to 2002), FAO (2003). In India, food grain output has been stagnating for over a decade. Food grain yields are no longer going up. Per capita availability of cereals and pulses was 476.5 grams per day in 1979 in comparison to 444.5 grams per day in 2006 in our country. There is a growing gap between supply and demand. This has caused the recent price hike of food grains in India from February to April 2008 (Bhattacharya, 2008). Under these circumstances, there is a great need to develop the improved varieties of crops with higher productivity through genetic manipulations for increasing the total food grain production in India, thereby avoiding the impending food crisis. In Assam, rice is being grown in 25.36 lakh hectare area with a production of 38.54 lakh metric tones and productivity is 1.54 ton/ha during 2001-2002. (Deptt. of Agril, Govt. of Assam, 2003).

The Barak Valley Zone comes under one of the six agro-climatic zones of Assam and lies between 24°15′ and 25°9′ N latitude and between 92°16′ and 93°15′ E longitude. The zone is characterized by an undulating topography with wide plain area, low lying waterlogged area (*beels and haors*) and hillocks (*tillah*).
The climate of Barak Valley Zone is sub-tropical, warm and humid. The average annual rainfall is 3180mm with an average of 146 rainy days per annum. The mean minimum temperature ranges from 12.2° C in January to 25.4° C in August and the mean maximum temperature ranges from 24.3°C in January to 32°C in August. The mean bright sunshine hours are the lowest (3.8 hours) in July and the highest (8.4 hours) in December. The soil texture varies from sandy to clay loam with pH range of 4.6 to 5.7 (i.e. acidic).

Rice is the staple food of Barak Valley Zone and the main cereal crop covering an area of 2.2 lakh hectares. Traditional cultivars of this zone are losing patronage because of changes in the system of cultivation and popularization of the modern high yielding varieties. Despite low productivity, the farmers of this region still prefer to grow some bold grained traditional rice genotypes particularly in sali (kharif) season as because, some of their desired qualities, not available in modern high yielding varieties.

In post-independence era, rice breeders of India laid emphasis on increasing the yield of rice per unit area, many a time ignoring qualities in order to feed the incremental population. Most of the modern high yielding varieties are medium and fine-grained. However, the physically hard working group of population prefers bold grained rice having good taste and qualities.

Rice is a crop of subsistence agriculture in Barak Valley where traditional agriculture is commonly practised. Rice has established as a model plant to study grass genetics and genome organization due to diploid genome, relatively small genome size (450 Mb), well saturated genetic map and conserved synteny between grass species (Moore et al. 1998)
North East India including Assam is considered as one of the primary centers of origin of rice plant representing a rich source of genetic diversity and reservoir of valuable genes. The cultivation of rice under diverse agro-ecological conditions for continuous period under various biotic and abiotic stresses, specific adaptation through natural selection and farmer’s discretion, ethnic migration and immigration over years have resulted in the introduction of different types of rice cultivars into the region which lead to further diversification of the rice genetic stock to a great extent.

Nagarajan et al. (2008) reported that a number of agencies have initiated programs to conserve, document, characterize and publicize germplasm adapted to local environment. Their focus has been on conservation of crop diversity particularly of rice, ragi, jowar and grain legumes.

However, there is a lack of compilation depicting the key diagnostic characters of these varieties, which are very essential to carryout scientific seed production and certification. On the other hand, the World Trade Organization (WTO) had made its member countries to accord protection of plant varieties under Trade Related Intellectual Property Right (TRIPS) agreement. The Convention on Biological Diversity (CBD) provides sovereign rights to nations over their genetic resources. Countries can regulate access to their genetic resources and demand equitable sharing of benefits arising out of commercial exploitation of genetic resources. Enforcement of both these international agreements is possible only if the identity and ownership of the plant genotypes are established. Considering these, there is an urgent need for proper characterization of rice varieties based on effective morphological, biochemical or molecular marker system.
Hanamaratti et al. (2008) observed that traditional land races of rice are important reservoirs of valuable traits and need special attention for future conservation. They possess valuable traits viz. medicinal properties, nutrition, taste, aroma, tolerance to drought and submergence. Some land races, Dodiga and Navalisali, were found significantly superior for yield and productivity traits under varied moisture stress situations. These land races were identified as good donors for drought tolerance.

The scope of present investigation is to determine the donor from available bold grained local genotypes of rice with high protein content, good taste and qualities. It is therefore, required to examine the performance of local bold grained rice genotypes along with the widely cultivated HYV of rice like Ranjit and Monohar Sali under kharif season.

Study of morphological traits helps in the identification of genotypes as well as in formulating a crop ideotype for a particular region. Donald and Hamblin (1983) put forward the concept of convergent evolution of annual seed crops towards a communal ideotype. Ideotype breeding also offers scope for increasing the efficiency when a new crop is introduced in a new region (Siddiq et al. 1988). Both the qualitative and quantitative traits have been employed to characterize and identify plant varieties. Again, the description of varieties, along with the assessment of varietal identity and purity are essential for seed production and certification procedures. Farmers need assurance that they are being supplied with the best quality seed. The consumers often insist on purchasing produce of known identity and hence the quality. Morphological markers are convenient and economic for screening large germplasm collection, yet they have limited use because of their limited numbers. Only coding sequences of genome are expressed and the expression is still further under the influence of environment. Most of the
markers are not breeders neutral. These factors limit the usage of morphological markers.

The local cultivars, which have been cultivated since time immemorial, resulted in the formation of highly interacting gene blocks that exhibit better mean performance and adaptiveness.

At molecular level, the electrophoresis of seed or seedling extracts followed by appropriate protein or activity stains has been suggested as a possible method for distinguishing cultivars (Wilkinson and Beard, 1972). Isozyme is the alternate form of some enzyme that differs in electrophoretic mobility but has same enzyme activity. Isozyme reveals the allelic difference of common enzyme loci. Isozyme markers have been successfully used to classify rice cultivars into different taxonomic groups (Glaszmann, 1987).

These techniques are all based on the concepts that each cultivar is distinct and relatively homogeneous at the genetic level and subject to minimal environmental influence. Moreover, sensitivity, ease, economy, better resolution and a high degree of polymorphism make these markers suitable for effective germplasm management with respect to removing duplication from germplasm collection, estimating diversity and monitoring genetic erosion.

Despite the convenience of the morphological markers, the use of biochemical markers adds more information and can detect the minor differences between the varieties.

Morphological traits, SDS-PAGE, isozyme and biochemical traits have been used extensively for germplasm characterization and classification in rice and other crops (Chauhan and Nanda, 1984; Devi and Hazarika, 2000 and Patra, 2000). However, there are no such reports on use of these markers to characterize the local rice germplasm of Barak Valley.
Keeping in view the desires of physically hard working people for bold grained rice with higher nutritional qualities from the existing diversity of rice germplasm prevalent in this Barak Valley Zone, the present investigation has been formulated with the following objectives:

1. To study the morphological variation of bold grained land races of *Sali* rice.

2. To estimate the genetic parameters of yield and other yield contributing characters of bold grained land races.

3. To study the extent of genotypic and phenotypic correlation between yield and other components.

4. To investigate the pattern of variation of the genotype for yield and its component characters following classificatory analysis.

5. To study the nutritional qualities and cooking qualities of the land races and to identify the potential donor for improved quality traits on the basis of biochemical analysis.

6. To study the extent of heterosis for different characters.

7. To study the combining ability effects of parents and crosses for identification of potential donor.

The results of the present study are expected to provide information on the genetic diversity of bold grained rice genotypes for various characters, genetic correlation among characters for yield enhancement, clustering of genotypes and extent of heterosis. The study of combining ability effects would help to identify promising parents and specific crosses for rice genetic improvement through future breeding programme. Characterization and assessment of genetic diversity of existing germplasm is the fundamental step for genome improvement.