REVIEW OF LITERATURE
From the earliest days of domestication of plants for human use about 12000 years ago, agricultural biodiversity has played a pivotal role in sustaining and strengthening food, nutrition, health and livelihood security all over the world. To exploit the full biological potential of indigenous rice germplasm and to protect the local knowledge base and genetic base of the crop, it is essential to evaluate traditional agricultural practices, farmers' perceptions, religious, cultural, social and ceremonial importance of the indigenous crop, germplasm collection, conservation, characterization, evaluation of its yield performance.

3.1 Indigenous Knowledge and Agricultural Practices

Indigenous Knowledge (IK) is a valuable and sophisticated system of knowledge developed by adivasi and rural communities over a period of time (Sahai, 2003). IK has been developed pertaining to all the important fields related to human life, ranging from human and animal health, home building food and agriculture, textiles, handicrafts, natural resources management etc. This vast repertoire of knowledge, which is still being developed, is transmitted from one generation to the next in oral form.

Indigenous technological knowledge (ITK) can also be defined as basis for knowledge, believes and customs which are internally consistent and logical to those holding them, but at odds with the objectively deduced findings of formal science. So, it is important for scientists to build upon the components of ITK, which are not consistent with scientific knowledge seeking to change overtime any potentially counter productive practices associated with local belief system. Traditional agriculture is not a universal package of practices, which can be, implemented anywhere and any time. It is generated by the local people with their own experiences and experimentation to meet their need and which is sustainable. Traditional knowledge has a minimum risk factor, environmentally healthy, readily available, easily understandable and labour intensive (Farrington and Martin, 1988).

M.S.S.R.F. report (1994) highlighted those women who have been the seed selectors and conservers and have practiced what we now call the mass pedigree system of selection by which they have been able to advance sometimes by one percent per year the yield potential of the crops. So we owe to the farm tribal women and men of last ten thousand years the enormous amount of variability are observed within a species.
Women are most often the primary trustees and users of cultivated crops and landraces, forest genetic diversity and medicinal plants. They have valuable knowledge of genetic diversity. Thus, women are an important source of information on the use and characteristics of local crop varieties and the feasibility and social acceptability of conservation system. Through repeated mass selection, women farmers have over generations improved crop production and developed landraces highly adapted to their communities, particular to local conditions and socio-cultural requirements (Rani, 1994).

The loss of seeds from the household also meant the loss of power for women in the agrarian culture. The women conserve, preserve and germinate seeds. This involves highly intricate knowledge, which is transmitted from mothers to daughters, from sisters to sisters, from mother-in-law to daughter-in-law or from one village sister to another. Unless one is familiar with the delicate wisdom of seed conservation and propagation, it is hard even to guess why some seeds should be dried under bright sun and others under shade. Among the germination techniques, some seeds are left overnight in the atmospheric moisture. Once such knowledge sharing started among peasant women, they decide to recollect their science in a more systematic manner (Mazhar, 1996).

Kandulna (1998) studied the local farming systems in Ranchi, Jharkhand. Padaria and Singh (1990) also conducted similar studies in village Nagari in Kanke block of district Ranchi, Jharkhand, and documented some indigenous practices like plot-to-plot bunding, terracing of slopply lands, land preparation, etc.

Chakravarty (1982), studied indigenous farm practices prevailing in paddy belt of Tamil Nadu and identified 20 indigenous farm practices. Use of indigenous wooden plough, use of wooden leveling board, trimming of bunds, application of FYM, cattle penning, application of tank mud as manure, the practice of having water continuously in the field to control weeds, use of Calotropis procera to control thrips in nursery, use of bow traps to control rats, use of cowdung cake gas as a burrow fumigant to control field rats, storage of paddy seeds in kottai and storing in wooden bins were the main practices. In a study conducted in four villages of Hisar district of Haryana, Verma et al. (1988), identified 26 units of traditional dry farming technologies related to bajra (Pennisetum typhoides), gram (Cicer arietinum) and mustard (Brassica napus).
Gogoi (1989) identified some traditional plant protection practices in Sali rice in Jorhat district of Assam. These were use of neem (Azadirachta indica) twigs and leaves by putting into the water of insect affected rice field and use of citrus fruits to control some insect-pests in field.

In medium land standing rice field inter-culturing is done manually by a three-bladed local made hand hoe. In lowland standing rice crop after about one month of transplantation inter-culturing is done through kneading the weeds by legs into the dough soil. In this process large plants are also uprooted by hand. Since inter-culturing is not possible through khurpi and hoe, kneading through feet breaks the crust and severs the weeds in to soil, which after decomposition acts as manure. To remove water-loving weeds from low land rice fields standing water is drained out and after 10 to 15 days, rice field is again irrigated. Weeds like Echinochloa colonum and Echinochloa crus-chall grow faster in water logging condition are controlled through this practice.

Padaria & Singh (1990) have given an excellent account of risk adjustment and traditional wisdom in dryland farming. Indigenous practices such as “germination test performed by wrapping and soaking of seeds in leaves” (Richards, 1983), “preservation of maize seeds in which the whole cob was hung under the roof such that smoke from cooking oven fire even fumigated it daily preventing pest attack and pauta system of drainage” (Gupta, 1985), non-application of chemical fertilizer (Joshi and Singh), use of low seed rate as well as local indicators for mustard sowing (Verma, 1985) and use of local seeds (Hariss, 1984) and local implements (Virmani and Sindhwani, 1972), were reported to be in practice.

Balasubramanium (1992) identified several traditional practices in dry lands of Coimbatore district. Some of them are coating red gram with red soil for storing, practice of keeping the cattle herd overnight on the cultivated land, use of cow-dung cake as burrow fumigant, soaking sorghum in cow urine to induce drought tolerance of seeds, summer ploughing, mixing green gram with ash to control storage pests, beating empty iron drums to ward off birds, use of carcass to drive away the birds, storing the grain in mud kudhir, dusting ash on the sorghum to prevent the pest incidence, tying black cloth to a long pole to drive away the
birds. *Karanj* (*Pongamea pinnata*) cake is applied in the field after the first ploughing during preparatory tillage followed by planking.

Peacock (1995) highlighted the importance of community participation and role of women in farming and the conservation of local landraces. Sahai et al. (2005) studied farmers' perception of agro-biodiversity in North India. Study shows the response of the farmers to the loss of traditional varieties. They observed that an overwhelmingly large proportion of farmers are nostalgic about the lost varieties and regret the fact that these varieties are no longer with them or grown by them. In Sitamarhi district of Bihar, as many as 94 per cent of the farmers are nostalgic and regret the loss. The reason as to why they regret this loss could be due to the fact that those varieties may have been better in taste or were more resistant to weather fluctuations or to pests and diseases, etc. Probably they missed these traits in the new varieties that have replaced.

Kshirsagar and Pandey (1996) observed that (i) farmers perceive that improved cultivars perform better under better fertility regimes (ii) improved cultivars perform better only when chemical fertilizers are applied (iii) the performance of traditional cultivars is superior to that of improved cultivars under low fertility condition and (iv) traditional cultivars are better in sustaining the fertility of soils.

### 3.2 Nutritional and Medicinal Value of Rice

Grist (1959) explains that the rice grain is the most rapidly growing food source in Asia and has a major influence on human nutrition and food security all over the world. The rice grain enclosed in glumes is generally separated by traditional hulling methods by the small farmers and tribal people. The nutritional value of traditionally hulled rice grains (husked rice) is more than the modern method of milling (polished rice). Losses of nutrients resulting from milling and polishing rice vary considerably. The degree of milling and polishing determines the amount of nutrients removed. Protein, fats, vitamins and minerals are present in greater quantities in the germ and outer layers than in the starchy endosperm. The removal of the protecting pericarp also facilitates the extraction of soluble substances from the aleurone layer during washing immediately before cooking the grain. Losses on polishing are reported...
to be 29 per cent of the protein, 79 per cent of the fat, 84 per cent of the calcium and 67 per cent of the iron.

The farmers generally parboil the paddy before hulling (Grist, 1959). In this process paddy is soaked in water for three or four days, after which it is steamed for a short period. The parboiled paddy is then dried, hulled and pearled. In parboiling, some of the vitamins are driven into the endosperm and by gelatinizing the starch of the outer layers seals the aleurone layer and the scutellum, so that they are not readily removed in milling. Milled parboiled rice contains two to four time as much thiamine and niacin as milled raw rice and rather more riboflavin.

One cup of cooked brown rice (195 gm) has 216.4 calories, 1.76 g of fat, 0.64 g of monosaturated fat, 0.63 g of polysaturated fat, 0.35 g of saturated fat, 44.8 g of carbohydrate, 5.03 g of protein, 0.66 g of fibre, 0.19 mg of thiamine (B1), 0.05 mg of riboflavin, 2.98 mg of nicotinic acid, 0.28 mg of pantothenic acid, 0.28 mg of vit. B6, 7.80 mg of folic acid, 19.50 mg of calcium, 0.82 mg of iron and 1.23 mg of zinc (Atukorale, 2002). Besides nutritional value, rice is considered to possess medicinal value also. In Ayurveda the medicinal properties of rice have been described as acrid, oleaginous, tonic, aphrodisiac, fattening, diuretic and useful in biliousness (Oudhia, 2000).

Red yeast rice has been used in China for centuries both as a food and as a medicinal substance. It is made by fermenting a type of yeast called Monascus purpureus over red rice. In Chinese medicine, red yeast rice is used to promote blood circulation, soothe upset stomach and invigorate the function of the spleen, a body organ that destroys old blood cells and filters foreign substances. In addition, this dietary supplement has been used traditionally for bruised muscles, hangovers, indigestion and colic in infants (Jacqueline and Hart, 2001).

3.3 Agriculture in relation to religion and social ceremonies

The relationship between rice and people has inspired songs, paintings, stories and other modes of communication. Festivals have been dedicated to rice and rice cultivation – for example, the Land Opening Festival in China, which marks the beginning of the rice season. Rice was considered divine by many Asian emperors and kings in ancient times.
The Japanese, even today, refer to rice as their "mother" and regard rice farmers as the guardian of their culture and the countryside.

Kandulna (1998) reported that tribal/rural people and forest dwellers have acquired practical knowledge about the ecosystem function; interdependence of flora and fauna, reproductive growth and productivity, and ecological relationship between human society and their living and non-living environment. For example tribal faith, taboos and practices have helped in conservation of many species, viz; sacred plants like tulsi (Ocimum sanctum), bel (Aegle mameleos), pipal (Ficus religiosa), etc. All of them have ethnobotanical significance as well as valuable in indigenous system of medicine. Tribal people are the repository of accumulated experiences and knowledge of indigenous flora and fauna. Thus, in the rural scenario, local or folk health traditions, which are self-reliant in nature, socially and environmentally closer to the masses, are rooted deep in the community’s traditions and knowledge systems.

Kujur (1993) discussed in detail the importance of rice and many other plants which are used in socio-religious ceremonies among the Oraon tribe of Jharkhand. Hariyari Pooja is celebrated in the month of Asharh when some crops are in full bloom and some are being harvested like Buna Dhan (Broadcasted Paddy), Beera Dhan (Transplanted Paddy), Maize, Bhudai dhan, Gondli etc are harvested. The pooja is celebrated for good harvest, good monsoon and for the security of men, women and animals. Other festivals and religious ceremonies in which different plants are worshiped/used are Karma festival, Bamba Karma, Kadoleta pooja etc. Kujur (1993) further stated that the tribal treat rice as a boon from God, therefore, in any pooja or worships, it is offered first to the God. This is the reason for putting so much emphasis on the offering in the form of rice. Two types of rice are used in the worship i.e. Arwa and Usna. Arwa rice is treated more sacred than the other therefore; it is used in the worship more often.

The Korean peninsula (hankooki.com) is blessed with beautiful scenery, a mild climate and fertile soil. Koreans have inhabited this propitious land for several millennia depending on agriculture as the major means of livelihood. Rice has been and still is the staple grain of Koreans. From ancient times they have sowed seeds in the spring, nurtured rice plants in the summer. Harvested crops in the autumn and preserved cereals through the winter. This cycle of farming has become part of Korean culture and influenced many of the customs of the
Korean people. While engaging in agriculture, Koreans developed annual events and found it convenient to observe according to the lunar calendar. It was at the turn of the century that the Gregorian calendar was introduced to Korea, setting the standard for all official events, yet some events and customs of traditional origin are still observed on lunar days.

3.4 Germplasm Collection, Characterization and Evaluation

Some of the most exciting rice research work in India was done under the guidance of Dr R.H. Richharia in the Chhattisgarh region of Madhya Pradesh. Over 17,000 cultivars of rice were collected from the Chhattisgarh region, several improved selection were made, several indigenous high yielding varieties – tall as well as dwarf were discovered and an exciting program for increasing rice production based on this indigenous germplasm was evolved (Dogra, 1991). Yield is not the only criterion used by farmers while selecting varieties for cultivation in their fields. Apart from yield, factors like duration, medicinal properties, nutritional characteristics, eating performance, religious and cultural factors, pest/disease resistance, market demand, ability to withstand drought, processing and milling characteristics, other feature like aroma, etc. are generally considered while selecting any varieties. Realistic evaluation of any indigenous varieties along several parameters is necessarily to understand its true worth (Khedkar, 1996).

The importance of germplasm conservation for the use of present and future generation needs no emphasis as this has been stressed many times at both national and international levels, particularly in the context of fast spreading of high yielding varieties resulting in large scale erosion of useful genes (Singh, 1993). Germplasm is a sum of total hereditary material or genes present in a species and therefore to combat many edaphic, climatic and other problems breeders are looking for new source of genetic material for incorporation of multiple resistances for which traditional indicas have been found to be major donors. The genetic conservation workshop, jointly sponsored by the IRRI and International Board of Plant Genetic Resources (IBPGR) held at IRRI in December, 1997 recognised the extreme urgency of collecting, preserving and evaluating all of the older, unimproved cultivars and wild relatives of Oryza sativa and O. glaberrima wherever they exist. IBPGR has identified about 2330 indigenous rice varieties collected from different countries, which are resistant to Pyricularia oryzae and Corticium sasakii. A collection of 780 varieties have been collected
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from Nepal which are adapted to growth at different altitude and which differ in their sensitivity to photoperiod, types with resistance to *Xanthomonas oryzae* or which contain more than 13% protein have been identified. Around 900 varieties collected from various regions of Pakistan like Punjab, Sind and North-West Frontier Province were tolerance of cold, salinity, high temperature and Zinc deficiency and for resistance to *Pyricularia oryzae, Leptosphaeria salvinii* and *Tryporyza incertulas*. About 1500 indigenous varieties reported from Philippines, most of which are *indica* types, are adapted for uplands. A number of varieties have been collected from mangrove swamps in Sierra Leone, from deep-water and flooded areas in Mali, from irrigated areas in Senegal and from the upland areas of Ivory Coast. Indigenous rice varieties collected from Brunei were tested for their suitability under conditions of water logging. Rice germplasm from Liberia were collected, maintained and evaluated. Height, tillering, growth period, photoperiod sensitivity and grain size and shape had high genetic variability. Variants including dwarfs and semi-dwarf photoperiod insensitive types with purple culm bases and *O. glaberrima* types among *O. sativa* were founded in the progenies indicating that out crossing had occurred.

The first effort in rice germplasm collection in India was made during 1911 when an economic botanist of rice was appointed at Paddy Breeding Station at Tamil Nadu state at Coimbatore. This station also served as national centre for rice until the Central Rice Research Institute (CRRI) came into existence in 1946 when 82 rice research stations were established in various agro-climatic regions of the country. The National Bureau of Plant Genetic Resources (NBPGR) has played a very significant role in collection of rice germplasm. They collected about 2000 varieties by 1946-47 from Bihar, Orissa, Madhya Pradesh and Uttar Pradesh. The existing collection has been evaluated for quality and resistance to environmental stress and disease. Total 292 varieties collected from the Almora district of U.P. in 1973. Out of 292 varieties, 11 varieties were resistant to *Pyricularia oryzae*. The *indica* varieties collected from Sikkim Himalayas region include early and cold tolerant, mostly medium grained and medium coarse grained, scented, rarely glutinous, glabrous and very small grained and red kernel types. The Assam rice collection is made up of 6630 land races collected during 1967-72. Some of the results of evaluations carried out at Hyderabad for morphological characters, resistance to the pests and diseases and tolerance to stress conditions are summarized. There are 20,000 rice germplasm accessions at the Indira Gandhi Agricultural University, Raipur (Chhattisgarh). The evaluation work has resulted in the
identification of Bacterial blight, Gall midge, Stem borer, Brown planthopper, white-backed planthopper and brown spot resistant donors (Singh, 1993).

Singh (1993) describes the collection of *gora* rice from South Chhotanagpur region of Jharkhand and studied the grain size, husk colour and kernel colour. Gora rice could serve as excellent donors in the evaluation of drought tolerant varieties. Similarly, the author reviewed the Arora and Mehra and Richharia’s work on characterization and evaluation of germplasm and reported that the Arora and Mehra’s (1978) collection of the rice varieties considered mostly of hairy, glummed, tall, leafy, upland, rain fed types which varied in husk and grain colour. Richhria (1979) reported on the genetic diversity and resources of rice with particular reference to the resources available in M.P. He further described about the richness of rice germplasm and its classification, varietal diversity in rice varieties and their probable centres of origin and a consideration on origin and parallel evaluation in rice. The germplasm maintained includes material useful for breeding for high yield, scented grain, drought tolerance and resistance to disease pests, such as *Orseolia oryzae*, *Nymphulia depunctalis* and *Xanthomonas oryzae*. Some rare germplasm is also mentioned including *Goonda Jhuli*, which forms as many as 759 grains per panicle, and the long grained variety *Dokra Dokri*, with some grain measuring up to 15 mm.

Singh and Srivastava (1994) analyzed the traditional wisdom of shifting cultivation and plough agriculture, which are being followed by tribal of plateau region of Chhotanagpur and Santhal Pragana in Jharkhand. They reported that farmers had selected drought-resistant crops or less susceptible to inadequate rainfall due to very erratic rainfall and intermittent cessation of monsoon during the peak period of crop growth. Such crops and varieties possess the characteristics of maturity period of about 100 days with early vigour, extensive root system, taller in height, capability to compete with weeds, responsive to low fertility level, comparatively resistant to pests and diseases and having yield stability. In low lands where irrigation is not needed, rice cultivation is done as *Bhadai* rice and *Aghani* rice in which finer quality rice, viz., *Kalamdani, Tilasar* etc. are grown. In uplands, which are not so fertile coarser varieties like *Gora* rice as well as pulses, millets, oilseeds and other minor crops are grown in rotation.
Goradhan is of coarse type and medium in size, white in colour, very tasty, higher in yield with average quantity of straw and resistant to disease as well as more resistant to pest, drought and water. Laldhan is medium-long in size, red in colour, very tasty, higher in yield with relatively more quantity of straw and average in resistance to diseases. The variety was perceived relatively to be more resistant to pests, low resistant to drought and no resistant to water. Regarding Telasair variety, it was coarse, small in size, light yellow in colour, very tasty and relatively higher in yield. The variety was perceived as high straw yield, resistant to disease and pests as well as low resistant to drought and average in resistant to water. Dhusri was thin small in size of light yellow colour, normal in taste, average in yield and straw as well as average in resistant to diseases.

Singh et al. (1995) carried out a field experiment during the kharif season of 1983 and 1984 at Birsa Agricultural University Farm, Kanke, Ranchi with rice genotypes Gora local and Brown Gora (improved genotype). It was found that plant height was positively correlated to grain yield of rice. It was further reported that plant height and tillering was most important variables and correlated with plant height at flowering and independently influenced the rice yield. Watson (1952) suggested that leaf area index (LAI) is the determinant of dry matter production and it is extensively used in the studies on analysis of dry matter production. Species with erect leaves should have much higher critical LAI or optimum LAI value than species with flat leaves. Singh et al. (1977) found that LAI had positive correlation and association with flowering and meet unity duration. In addition, LAI was also positively associated with seed size and yield. They also mentioned that leaf area associated with seed yield much closer that LAI.

Jeena and Mani (1990) studied the flowering behaviour in some upland rice varieties and reported that days to 50% flowering was maximum, i.e., 82 days in Jaya followed by 78 days in rice genotypes UL 206. The minimum days to 50% flowering was recorded at 57 days under the genotype UPR-79-118. Wang et al. (1998) studied the stability of yield of Japonica rice lines and reported that yield stability was related to the variability of productive panicles per area, total spikelets and grains per panicle. Filled grains/panicle was the most beneficial character in rice genotype.
Park (1987) compared the biological yield and harvest index in relation to major cultivation methods in rice plant. The various genotypes showed higher increase in grain yield with high co-efficient of variation for biological yield and low for harvest index. Potential grain yields of three rice genotypes, based on maximum biological yield and harvest index were 5.9 - 9.3, 9.3 - 11.5 and 8.0 - 11.0 t/ha, respectively. Biological yield generally affected grain yield. Number of spikelets/m², which was directly related to number of panicles/m² was the most important yield component.

Yolanda and Das (1995) observed that grain yield was significantly and positively correlated with panicle length. Other characters studied were spikelets per panicle, grain per panicle, 100-grain weight and harvest index. Grain per panicle was the main character-affecting yield directly.

Kandulna (1998) documented the farmers' perception on attributes of some traditional as well some improved rice varieties. Variety IR-36 is medium in seed size, light white in colour, normal in taste, high grain yielder and average in straw yield. This variety was perceived as resistant to diseases and pests, low resistant to drought and resistant to water. Regarding Sita variety, the seed size was long, white in colour, very tasty and average in grain and straw yield and resistant to diseases. However, this variety was low resistant to pests and drought and resistant to water. Similar findings have also been reported by Kshirsagar and Pandey (1996). Kandulna (1998) reported about the 16 traditional rice varieties, which are still being grown in different type of land situation in villages of Jharkhand. The farmers grow Tilasair, Rariya and Ribramanjhi varieties in Don - I type of land. In Don - II type of land varieties like Dhusari, Lal Dhan, Hardisal, Kariya Kansi Phool, Barhasal, Siyarmuri and Bachcha Kalam were found to be grown. In Tanr - I Gora Dhan and Neta were grown. In Tanr - I Dhanigora while in in Tanr - III, Manidhori and Karhaini are more popular.

There are so many traditional aromatic rice varieties. Though Basmati has dominated the domestic and international market for aromatic rice, it is surely not the unchallenged king of fragrant rice. Many other indigenous varieties of scented rice excel equally as far as aroma and cooking qualities are concerned (Sud, 2003). But, unfortunately, these have somehow not got the attention of rice scientists and traders, including exporters, to the extent that Basmati has. As a result, most of this valuable wealth has either already vanished or is on a decline.
The cultivation of non-Basmati scented rice (their number still runs into hundreds) is now confined to limited pockets where farmers grow them either for self-consumption or for special occasions. Only a few of this aromatic rice are traded domestically, leave alone the international market.

One of the factors that set Basmati apart from other aromatic rice is its long grains. The other scented rice usually have medium to short grains. But then, the global market for long-grained scented rice is only a creation of promotional efforts and not of any natural preference for grain length. The demand for medium and short-grain rice is far more than that for long-grain ones. That is where lies the scope for pushing non-Basmati scented rice in the domestic as well as the global market. Some of the outstanding examples of short-to-medium grain length indigenous aromatic rice are Kalanamak (popularly called, the "black pearl of eastern Uttar Pradesh"), Shakarchini and Hansraj of UP, Dubraj and Chinoor of Chhatisgarh, Kalajoha of northeast, Ambemohar of Maharashtra and Randhunipagal of Orissa and the West Bengal region. Bindli, a small-grained aromatic rice grown under waterlogged conditions in UP is known to possess aroma and cooking qualities much superior to Basmati. It elongates more than 200 per cent on cooking, surpassing the Basmati in this respect. Similarly, Randhunipagal has such strong and intense aroma that people fear that over-exposure to it can render the cook insane (pagal in Hindi) -- and hence its name.

Mishra (2002) has reported a number of indigenous rice varieties that can withstand the severest of climatic conditions. West Bengal alone grows 78 varieties of rice that are suited to dry conditions, according to a 'Register' prepared by the NGO Navdanya as part of its movement to fight for farmers' rights on seeds. According to the Register, farmers in India have also developed rice that can survive submergence of over 12-15 days while two to three days of submergence is enough to kill ordinary rice. Farmers of Uttarakhand are not far behind and they grow around 54 drought-resistant varieties of rice, which have been conserved through regular growing and consumption. In Kerala around 40 drought-resistant varieties have been developed while Orissa, notorious for starvation deaths, is also the home to a few drought-resistant varieties of rice.

As for resistance to salinity, what tougher test for rice than to be grown in the salt-rich mangrove lands of West Bengal? There are three varieties grown in the tidal waters of the
mangrove area, which can bear up to 14 per cent salinity. And the soil is so fertile that the crop needs no attention from the farmer, who after transplanting the paddy can abandon it till harvest time. Orissa, Kerala and Karnataka too grow a wide variety of salinity-resistant rice cultivars, according to the bio-diversity register.

Dogra (1991) explains the work of Dr R.H. Richharia in reference to indigenous rice varieties with specific characters. The rice variety yielding 3705 kg and above of paddy grain per ha is to be accepted as a high yielding variety the standard accepted by the Madhya Pradesh State Agricultural Dept. "A survey has indicated the about 9 per cent of the indigenous varieties including some clustered types in the state fall under his category under the soil fertility, as maintained by the growers. Such varieties remain confined in sole isolated localities in some blocks or even with some individual growers. Improved selections of most of them are now available. Some varieties with the specific properties are dwarf varieties e.g., Badal Phool, Dhour, Ram Karouni. Early maturing varieties e.g., Lallu type. Drought resistant varieties like Chilkat, Kanakchudi, Bansgati, scented varieties - Chinnor, Dubraj, Muchh., superior varieties - 'Til Kasturi, Sanudra Chini, Motichur, Katki Kamel and long grain varieties - Dokra Dekri, Raja Bangla. Dokra Dekri is the world’s longest recorded rice. Chilko variety of rice was found to be used by adivasi (tribals) for making good chapatis. Khowa variety of rice had the taste of dried milk.

The possible reason of these varieties scoring over genetically engineered ones may be that they are in sync with the ecology. After all, farmers have tried and tested them over hundreds of years. Whereas the effects of genetically engineered rice varieties on the ecology is not so well understood. Moreover, the farmers' varieties, if not used regularly, would become extinct, as did a number of such cultivars during the green revolution which made thousands of indigenous varieties, that were not only capable of withstanding harsh climatic conditions but also gave consistent yields.

3.5 Bacterial Leaf Blight (BLB) of Rice

Rice production is mostly constrained by disease of fungal, bacterial and viral origin. Bacterial blight or Bacterial leaf blight of rice, caused by Xanthomonas oryzae pv. Oryzae (Xoo) is one of the oldest known diseases and was first noticed by the farmers of Japan in
1884. Subsequently, its incidence has been reported from different parts of Asia, northern Australia, Africa and USA. The disease is known to occur in epidemic proportions in many parts of the world, incurring severe crop loss of up to 50%. Crop loss assessment studies have revealed that this disease reduces grain yield to varying levels, depending on the stage of the crop, degree of cultivars susceptibility and to a great extent, the conduciveness of the environment in which it occurs.

Bacterial blight is a vascular disease resulting in a systemic infection that produces tannish-grey to white lesions along the veins. Symptoms are observed at the tillering stage, disease incidence increases with plant growth, peaking at the flowering stage. Kresek is the more destructive manifestation of the disease, wherein the leaves of the entire plant turn pale yellow and wilt during the seedling to the early tillering stage, resulting in a partial or total crop failure. Plants less than 21 days old are the most susceptible and temperatures between 28 and 34°C favour kresek development. Bacterial blight is characteristic of yellow lesions with wavy margins on leaf blades that may extend to the sheath. These lesions acquire a whitish straw colour over a period of time. The occurrence of bacterial ooze from infected leaves has been observed in warm and humid climates, which contributes to the spread of this disease. Though leaf blight does occur at all growth stages, it is most common from maximum tillering until maturity. While damage is extensive when kresek precedes BB, post-flowering infections have very little effect on grain yield. However, when infection occurs during panicle initiation or subsequently during stages that precede flowering, a severe impairment of grain development and a consequent increase in sterility was observed (Gnanamanickam et al., 1999).