cent of the crop plants are allopolyploids. Some of the important allopolyploid crop plants are wheat, tobacco, cotton, sugarcane, oats (*Avena* sp.), rai (*Brassica juncea*), rapeseed (*Brassica napus*), etc. Origins of wheat, tobacco, cotton, and oats have been extensively investigated. Common bread wheat (*Triticum aestivum*) is an allohexaploid, while cotton (*Gossypium hirsutum* and *G. barbadense*) and tobacco (*Nicotiana tabacum* and *N. rustica*) are allotetraploids. There is evidence to suggest that *N. tabacum* originated from chromosome doubling of the F_1 hybrid from *N. sylvestris* × *N. tomentosa*. *Triticale hexaploide* is a man made allopolyploid developed by chromosome doubling of the F_1 between rye (*Secale cereale*) and tetraploid wheats. Triticale has shown much promise particularly in areas of moisture or temperature stress.

2.3. GERMPLASM

The genes required for crop improvement are present in different lines, varieties, strains or populations of the crop species and their relatives. Some useful genes, often critical genes, are contributed by the wild relatives of crops. The various lines, strains, populations of a crop species and its related wild species constitute the germplasm of the crop. Thus the ***germplasm*** *of a crop may be defined as the sum total of hereditary material,* i.e., *all the alleles of various genes, present in a crop species and its wild relatives.* Therefore, germplasm consists of the following five types of materials: (1) land races, (2) obsolete varieties, (3) varieties in cultivation, (4) breeding lines, and (5) wild forms and wild relatives.

2.3.1. Land Races

These are primitive varieties, which had evolved over centuries or even millenia through both natural and artificial selection, but without a systematic and sustained plant breeding effort. They are storehouses of genetic variability and, ordinarily, are adapted to the local soil type, climatic conditions, etc. They are sources of many valuable genes, including those for adaptation. Genetic variation is present both within and between varieties. They are adapted to survive under unfavourable conditions and have low but stable yields.

2.3.2. Obsolete Varieties

These varieties were developed by systematic breeding effort, were once commercially cultivated, but are no more grown. They, however, do have some desirable features. For example, wheat varieties K65, K68, Ph591, many NP series varieties, etc. are obsolete varieties.

2.3.3. Varieties in Cultivation

The varieties in cultivation are the easiest to use in breeding programmes. They form a major part of a working collection (Section 2.11.2.2). They are good sources of genes for yield, quality, etc. They can be introduced in a new area, and directly released for cultivation. These have been evolved through planned plant breeding, are ordinarily highly homogeneous and highly genetically variable.

2.3.4. Breeding Lines

These are lines/populations developed in breeding programmes. They often contain valuable gene combinations. This group includes nearly homozygous lines, mutant lines, lines derived from biotechnology programmes and, now, transgenic lines. These lines usually have narrow genetic base. These lines are ordinarily maintained as working collections by breeders.

2.3.5. Special Genetic Stocks

The germplasm in this category includes those carrying gene mutations, chromosomal aberrations and markers genes, etc. These stocks are useful in genetic analyses and may find use in breeding programmes as well. An example of such a material will be the set of monosomic lines or trisomic lines. These lines may have been obtained spontaneously or, often, induced artificially.

2.3.6. Wild Forms and Wild Relatives

Wild forms are the wild species from which crop species were directly derived. They are easy to cross with the concerned crop species. The ***wild relatives*** include all other species, which are related to the crop species by descent during their evolution. Wild relatives are much more difficult to hybridize with crops than are the wild forms. Both these groups are sources of valuable genes for insect and disease resistance, tolerance to abiotic stresses like drought, cold, salinity, etc., and even for quality traits and yield.

Germplasm is also termed as genetic resource. Genetic resources can be broadly grouped into two types (1) cultivated germplasm and (2) wild germplasm, depending on the state of their domestication. Alternatively, they may be termed as (i) indigenous (from the country in question) or exotic (from another country) based on their place of origin.

2.4. GENE POOL CONCEPT

The concept of gene pools was proposed by Harlan and De Wet in 1971. ***Gene pool*** consists of all the genes and their alleles present in all such individuals, which hybridize or can hybridize with each other. In some sense, gene pool describes a concept similar to germplasm. The gene pool is classified into three groups: (1) primary (GP_1), (2) secondary (GP_2) and (3) tertiary (GP_3) gene pools.

2.4.1. Primary Gene Pool (GP_1)

It includes all the strains of the concerned crop species. Crossing between members of GP1 is easy; the resulting hybrids are vigorous, show normal meiotic chromosome pairing and recombination, there is normal gene segregation, and seed fertility is complete. The members of primary gene pool are the most commonly used in breeding programmes; most groups base their breeding programmes primarily or entirely on this material.

2.4.2. Secondary Gene Pool (GP_2)

Members of secondary gene pool are all those species that hybridize with the members of the primary gene pool with some to considerable difficulty and the hybrids are at least partially fertile. These species are difficult to hybridize with those of GP1 due to ploidy differences, chromosome alterations or genetic barriers. Gene transfers from GP_2 to GP_1 are possible but usually difficult. Members of this group are often used in breeding programmes.

2.4.3. Tertiary Gene Pool (GP_3)

The species belonging to this group represent the extreme outer limit of the potential germplasm; they cross with the members of primary gene pool with considerable to great difficulty, and hybrids, if produced, are anomalous, lethal or completely sterile. Gene transfers from this group to the primary gene pool are extremely difficult and require special techniques. Gene transfers from GP_3 to GP_2 are relatively easier. GP_3 is used only occasionally in breeding programmes, and that too by a group of researchers having the competence and the patience for tackling the associated problems.

2.5. GENETIC EROSION

The gradual loss of variability from cultivated species, and their wild forms and wild relatives is called ***genetic erosion.*** This variability had arisen in nature over an extremely long period of time. Therefore, if allowed to be lost, it would be impossible to create it again during a short period. Genetic erosion is a creation of man since, ironically, man's success in plant breeding is the chief cause of genetic erosion. The varieties created by man using the natural genetic diversity are destroying the latter. The main causes of genetic erosion are briefly summarized below.

1. *Replacement of genetically variable land races ('desi' varieties) by the improved, genetically uniform pureline or hybrid varieties.* This has caused the disappearance of many land races, open-pollinated varieties, etc., which were reservoirs of genetic variability.
2. Improved crop management practices have virtually eliminated the weedy forms of many crops. In several crops, they existed as the so called *crop-weed complexes* in which gene introgression occurred from weed to the crop and *vice-versa.* Thus these complexes were sources of considerable genetic diversity.
3. Increasing human needs have extended farming and grazing into forests, the habitats of most wild species. This has led to the extinction of many wild relatives of crops.
4. Developmental activities like hydroelectric projects, roads, industrial areas, railways, buildings, etc. have also disturbed the wild habitat. Often wild relatives of crops are destroyed due to these activities.
5. Sometimes, introduction (deliberate or accidental) of a weedy species may result in the invasion of wild habitats by this species and lead to the elimination of the native wild relatives of crop plants. Even the cultivated forms derived from such introduced species may contribute to genetic erosion.

It is impractical to curb human activities to the extent necessary for the prevention of genetic erosion. The only practical, though not ideal, solution to the problem of genetic erosion is collection and conservation of the germplasm of cultivated plant species.