The challenge of the plant breeder is to develop better varieties. In this chapter we are concerned with the methods by which new varieties of self-pollinated crop plants originate. Before we proceed into a discussion of these methods, let us consider the question, “What is a variety?”

WHAT IS A VARIETY?

The variety, or cultivar (cultivated variety), as an agronomic unit is familiar to breeders and farmers alike. The breeder develops and tests new varieties. Seed of the new varieties is increased and made available to the farmer. From the available varieties farmers choose those they wish to grow. In spite of its common acceptance, the variety concept is exceedingly difficult to describe with accuracy. This requires an understanding of the system by which the plant kingdom is divided into taxonomic groups of similar and closely related plants. In this scheme families of plants are divided into genera, which in turn are subdivided into species; within the species there may be numerous agricultural varieties or cultivars. The agricultural or cultivated variety is a group of similar plants, which by structural features and performance may be identified from other varieties within the same species.

Perhaps this relationship can be clarified by using a common crop plant, the soybean, as an example. The soybean is a member of the legume family. The scientific name of the common cultivated soybean is *Glycine max*; the first word designates the genus, the second word the species. All of the cultivated soybeans are classified within this single species, but not all of the soybeans are exactly alike. They differ in maturity, seed color, pubescence color, plant type, disease resistance, oil content, and a host of other ways. Within the species *G. max* there are many cultivated varieties that are distinguished from
each other by heritable traits such as these. A classification of the soybean would thus read as follows:

Family: Leguminosae  
Genus: Glycine  
Species: max  
Variety, cultivar: Forest, Williams

Innumerable genotypes are possible within any single crop species. Populations increased from a single genotype or a mixture of genotypes may be variously referred to as strains, experimental strains, or lines. Thousands of strains are tested experimentally by the plant breeder each year. Once a strain is identified as being superior; it may be named, increased, and made available commercially as a cultivated variety, or cultivar. The term “cultivar” was coined to serve as the international equivalent of “cultivated variety.” Variety and cultivar may be used interchangeably. Cultivar is commonly used in scientific literature but variety is the term used by U.S. farmers and the seed trade and will be used in this text. The distinction of being named and made commercially available serves to set apart the variety from the experimental strain or line.

Two essential characteristics of a variety are identity and reproducibility. Identity is necessary so that the variety may be recognized and distinguished from other varieties within the crop species. The distinguishing features may be morphological characteristics, color markings, physiological functions, disease reaction, or performance. Reproducibility is needed so that the characteristics by which the variety is identified will be reproduced in the progeny.

How much genetic variability will be found within an agricultural variety? That depends upon the mode of fertilization within the crop and the circumstances under which the variety was developed. Most agricultural varieties are pure for those characteristics that identify the variety. For example, one variety of soybeans may have yellow seeds, whereas another variety has green seeds. A variety with a mixture of green and yellow seeds would be unattractive to the grower and would be considered as mixed or lacking in purity. Thus the breeder strives for uniformity in characteristics that affect the appearance and performance of the plants. It is not necessary, however, that a variety be pure for all of its characteristics. In self-fertilized crops, where individual plants tend to be homozygous, the range of purity within a variety will depend upon its origin and genetic stability. Some varieties of self-pollinated crops are increased from a single homozygous genotype (pure lines) whereas others are increased from a mixture of genotypes (mass selections). The origin of pure lines and mass selections will be discussed later. In cross-fertilized crops, where individual plants heterozygous for many characters interpollinate, the range of purity within a variety may be quite wide and may vary from one generation to the next. For this reason the “variety” is less of a distinct entity in the cross-fertilized crops than in the crops that are self-fertilized. This contrast in varietal purity should become clearer as the methods of breeding self-pollinated and cross-pollinated crops are studied.