Plant breeding

Mankind has selectively bred plants for thousands of years with the aim of improving their quality. Experimenting with cereal crops, breeders have aimed to enhance their yield of grain, the quality of their flour, and their resistance to disease and drought. With other plants, breeders have tried to improve the perfume and color of the flowers.

Improvement of plants, particularly food crops, is obviously important and genetics has contributed to a better understanding of the benefits and disadvantages of particular breeding programs. Many cereal crops such as corn are now planted largely as hybrid seed, produced by outbreeding between different inbred varieties. The vigour of the hybrid plant is probably a major contribution to the increased corn output in the United States. This increased output represents a major achievement for applied genetics. In 1929 practically no hybrid corn was grown among the 100 million acres of corn in the United States. But by 1970 the vast majority of 67 million acres was planted with the hybrid variety, yielding twice as much corn.

Plant breeders have a definite advantage over animal breeders, because they can often produce fertile varieties - indeed, new species - by crossbreeding between species. This is because hybrids are often polypoid.

Polyploidy, as we know, can occur naturally in the wild. Some species of cotton that we grow are polypodies that probably arose originally by accidental crosses between different species of cotton.

But breeders do not have to rely on accidents. They can attempt to produce fertile polypodies by crossbreeding between different species. One early attempt to produce another hybrid species was made in 1927 by the Russian geneticist G. D. Karpechenko, who crossbred two quite distantly related species, a radish and a cabbage. Each species has eighteen chromosomes (nine pairs); the hybrids had the same number (nine radish chromosomes and nine cabbage chromosomes) and were sterile. However, some
polyploids arose by chance. These had thirty six chromosomes (nine pairs of radish, and nine pairs of cabbage), and were fertile. Unfortunately, the hybrid was not commercially successful because as luck would have it, the plant had the leaves of a radish and the roots of a cabbage!
Breeders can artificially encourage polyploidy by treating the hybrids that result from crossbreeding between species with a chemical called colchicine obtained from autumn crocuses. This chemical allows the chromosomes to reproduce, but prevents the formation of two separate cells.

The number of chromosomes in the nucleus is therefore doubled. Several of these new polyploid varieties promise to be very useful. For example, a new hybrid cereal, called triticale, produced by crossbreeding rye with species of wheat, adds rye's resistance to cold winters to the usual properties of wheat.

Recent breeding programs have led to highly inbred wheats. Much of the

genetic variability, that accumulated over nine thousand years of wheat cultivation, is missing from present day varieties. If a new disease should arise, or if the climate were to change suddenly, much of the wheat might be damaged and lost. So it is a good idea to introduce other genes into wheat by outbreeding. One way of doing this is to crossbreed the inbred varieties with their wild relatives, which may be resistant to viruses, insects, or drought. For this reason, some wheat breeders believe it is essential to conserve some stocks of primitive wheat in seed banks, from which they will be able to take a transfusion of genes, if and when the need arises.

Varieties of the same species of the cabbage family have been selectively cultivated for their differing features of taste and appearance. Some varieties became hard headed, like a modern cabbage, some
made masses of flower buds, as in cauliflower and broccoli, and some made clusters of leaf buds, as in Brussels sprouts.