Reproduction in Crop Plants

The breeding procedures that may be used with a particular crop species are determined by its mode of reproduction. This relationship will become clearer as the breeding methods used with the various crop species are studied in more detail. It may be illustrated here quite simply by comparing two common crop plants, wheat and corn, which differ in their pollination method. In wheat, a self-pollinating crop, pollen normally fertilizes the flower in which it is borne; no new genes are introduced during pollination that may affect the purity of a variety. The seed of an improved variety of wheat may be harvested and planted over and over again if, during its production, reasonable care is exercised in the maintenance of varietal purity. Contrast this with corn, a cross-pollinated crop. In corn the pollen-bearing organ is borne in the tassel and the seed-bearing organ is borne in the shoot. Pollen is transported through the air from the tassel to the portion of the silk extending from the shoot before pollination and seed production are consummated. The pollen may be carried by the wind for large distances, with seeds borne on a single ear of corn arising by pollination with pollen grains originating from many different plants, so there is a constant mixing of different genes for particular traits of the corn plant. This results in a different reproductive system operating in a field of open-pollinated corn than in a field of self-pollinated wheat.

Without an understanding of the details of pollination, fertilization, and seed development for a crop species it would not be possible to develop orderly and efficient breeding procedures before initiating a breeding program. It is necessary that breeders become thoroughly acquainted with the details of the mode of reproduction in the particular crops with which they are working. Knowledge of the details of reproduction also provides a basis for understanding the mechanism of heredity in plants. Basically, it is from the knowledge of its genetic behavior that the breeding procedures for a particular crop species are devised.
SEXUAL REPRODUCTION

Reproduction in crop plants may be by seeds, sexual, or by vegetative parts, asexual. With sexual reproduction specialized reproductive cells called gametes are formed, a process known as gametogenesis. Fusion of the male and female gametes leads to the development of an embryo and eventually the seed. In asexual reproduction new plants arise from specialized vegetative organs such as tubers, rhizomes, runners, bulbs, corms, or by various artificial means of propagation such as rooting of plant cuttings, grafting, layering, or tissue culturing. Field crops such as corn, wheat, rice, or soybeans normally reproduce sexually and are multiplied from seeds; other crops such as sugarcane, potato, bermudagrass, or cassava may reproduce sexually but are normally propagated asexually.

SEXUAL REPRODUCTION IN CROP PLANTS

In conventional breeding procedures, genetic variability is created and exploited in plants by the breeder through sexual reproduction. The importance of the reproductive process to the breeder is so great that it is reviewed here in detail.

Parts of the Flower

The flower contains the sexual reproductive structures of the plant. It commonly consists of four floral organs: sepals, petals, stamens, and pistil (Fig. 2.1). Typically, the petals are large and brightly colored; the sepals are small and inconspicuous. Petals and sepals are not necessary for reproduction—only the stamens and the pistil function in the production of seeds. The stamen usually consists of a slender stalk or filament, which supports an anther. Within the anther the pollen grains develop. The pistil commonly consists of an enlarged base or ovary in which the seeds are formed, an elongated stalk or style, and a stigma, which is receptive to pollen deposited on it. Within the ovary are found the ovules, which, after embryo formation within, develop into the mature seeds. The number of ovules within an ovary may vary from one, as in wheat or barley, to several hundred, as in tobacco.

Kinds of Flowers

Complete flowers contain all four floral organs (sepals, petals, stamens, pistil). Incomplete flowers lack one or more of these floral organs. Complete flowers are borne on cotton, flax, tobacco, rape, potatoes, soybeans, red and white clover, alfalfa, birdsfoot trefoil, vetch, and many other crop plants (Fig. 2.2). Crops belonging to the grass family, including corn, sorghum, millet, wheat, triticale, barley, oats, sugarcane, rice, and the common hay and pasture