Tropical Crop Breeding*)

By William D. Storey**)

The principles which apply to the breeding of temperate zone crops apply just as well to the breeding of tropical crops. For the most parts the chief objectives are the same, the basic knowledge of plant science and supporting science is the same, and the methods used are the same. Only the biology of the plants is different, there is no good reason, therefore, why a person competent in the breeding of temperate zone crops cannot adapt readily to the breeding of tropical crops.

Plant breeding can be an art, a science, or, at the best, as a combination of both. Regardless of how one endulges in it, however, he must be guided by a cardinal tenet: "Know your plant." One may expect to be reasonably successful in attaccing objectives only when he is thoroughly familiar with such characteristics of his species as: the biology of flowering and fruit seeting; the morphology of flower, fruit, and seed; whether it is a naturally self- or cross-pollinating species; whether it is self-compatible or not; the requirements for seed germination; cultural requirements for proper growth and development; and many others.

Plant breeding originated at least 6 000 years ago as attested by evidence left by the lake dwellers of Switzerland, by prehistoric Mesopotamians and Egyptians and by early inhabitants of the British Isles. Doubtless, it began with recognition and selection of better types among wild and cultivated species, which were perpetuated in the early agriculture. Eventually, it developed into an art which became a vocation for many persons and an avocation for many others.

Plant breeding as an art consists usually simply of the recognition of and selection of new and different types among the progenies of wild and cultivated species, and crossing and selecting with certain objectives in mind. The breeder generally has to by quite familiar with the biology of his species, but may or may not have any fundamental knowledge of botany and genetics. One cannot deny that great progress was made in the way. He need only to reflect on the fact that many of our food crops were selected and improved by prehistoric plant breeders and have come down to us essentially unchanged through the centuries; some have not been improved since.

In a sense, the era of plant breeding reached its peak in the late 1800's and early 1900's, which is best exemplified by the prodigenus success of British orchid breeders in the field of floriculture and of the American Luther Burbank in the fields of food and fiber crops, as well as ornamentals.

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It was during this era that plant exploration and introduction as a purposeful adjunct to agriculture was initiated. Botanical gardens and plant introduction gardens were founded to establish and maintain plant collections. One of the earliest of such centers was the Royal Botanical Garden at Kew which was established in 1760. The United States Department of Agriculture entered into active plant exploration with the organization of a Bureau of Plant Introduction in 1890. Among its more famous members were David Fairchild and Walter P. Swingle. Plant introduction made new types of plants available for testing as crop plants in various ecological situations, as well as extending the range of variation of many special to the benefit of breeding programs. It is still an important part of plant improvement programs.

Plant breeding began to develop into a science soon after 1901, the year in which Correns, de Vries and v. Tschermak independently brought Mendels classical paper, which was published in 1866 but remained unappreciated for 35 years, to light. Mendels discoveries gave rise to the science of genetics, upon which virtually every plant breeding program now depends. Impetus was added to the science of genetics, and therefore to dependent sciences, by four other important developments in the late 1800's and early 1900's. One was the discovery of chromosomes, and an increasing awareness of their probable relationship to heredity. They were first described by Hofmeister in 1848 and were named by Waldeyer in 1888. About the same time, Strassburger postulated the meiotic process in all sexually reproducing organisms. The second development was Weisman's idea that cell behavior was in some way related to heredity (1887). The studies and postulates by Weisman, his contemporaries, and his predecessors led to intensive development of the science of cytology. The third development was Suttons clearly setting forth in all its significance the true relationship of chromosome behavior to Mendelian heredity, thereby consumating the marriage of cytology, to genetics which gave birth to the hybrid science, cytogenetics. The fourth significant development was the emergence of the mathematical science, of statistics which Galton and an Irish barley breeder who published under the pseudonym "Student" adapted to studies of biological material thereby creating the science of biostatistics. This is now an important tool in virtually all sophisticated and critical breeding programs.

An unfortunate modern tendency is for the scientific plant breeder to become too much scientist and not enough breeder. He becomes too engrossed with theoretical genetical aspects of a problem to give much attention to the practical aspects. In other words, he forgets that the first responsibility of a plant breeder is to breed plants.

Too often, also, the breeder may be a scientist but not a plantsman. He has all the requisite scientific knowledge he needs to conduct an effective programm, but lacks the common gardening skills he needs for implementing it. It is because of this that the point needs to be emphasized: to be a good plant breeder, one should acquire proficiency in the art as well as science of breeding.

An additional maxim deserves emphasis, that is: set limited objectives for yourself both in hoped — for attainments and in duration of your project, and then, try to adhere to them. Long — term continuing projects tend to branch out in many directions, to cause one to lose sight of prime objectives, to dilute ones concentration, and to end up less productive than short — term definite projects.