OBJECTIVES IN BREEDING FOR IMPROVED QUALITY IN HARD WHEAT

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In the early years of purposeful plant breeding the primary aim was the development of high-yielding varieties and it was not until after a general world trade in wheat had been established that the industrial quality of the grain became a factor of importance in determining the profits of the producer. In fact, it was not until after the wide-spread adoption of the roller milling process in the United States in the late 1870's that hard wheats came to be favorably regarded. Wheat breeders seeking to develop suitable varieties for the Great Plains area then began to pay more attention to the development of vitreous high-quality types of spring and winter wheats. The importance of considering industrial quality became greater as the milling industry passed from local custom milling to large efficient centralized organizations and also with the trend towards the concentration of baking in large plants. The increase in the number of large mechanized bakeries which gradually established scientific control made it necessary for the miller to pay more and more attention to uniformity and quality in wheat. These requirements were reflected in premiums for certain types of wheat and it became necessary for plant breeders to consider quality, as well as yield and other desirable characters, in their wheat-breeding programs.

During the closing years of the last and the early part of the present century, the more progressive experiment stations in important wheat-growing regions installed experimental testing equipment as an aid to plant breeders in selecting those varieties and strains which possessed desirable baking characteristics. Examples of the early application of milling and baking tests to plant breeders' material may be found in the reports of Hays and Boss (9), Guthrie (7), Harcourt (8), and Saunders and Shutt (19). The experimental milling and baking equipment described by Saunders and Shutt undoubtedly played a significant part in the development of Marquis wheat by the late Sir Chas. E. Saunders—a hard red spring wheat which was commercially established in 1911 and rapidly became the standard of quality on the world's markets for bread wheat. Since these early studies, the science of cereal chemistry has advanced rapidly and an increasing measure of scientific control must be exercised by the millers in producing flour which will meet the rigid and highly specialized requirements of the baking trade. The difficulties of the hard wheat breeders are increased by the necessity of developing high-yielding wheats which will not only resist or escape as many cultural hazards as possible but will also meet the exacting and complex re-

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3Figures in parenthesis refer to "Literature Cited", p. 502.