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Honeycomb Breeding: Principles and Applications

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I. INTRODUCTION

Conventional plant breeding has made startling advances in improving the productivity, stability, and quality of major crop species. The development of modern statistical methods and the use of biotechnology and genetic transformation add precision and rationality to breeding decisions, but art and experience are still the most useful practical tools for plant breeding progress. According to Duvick (1996), "Every 20 years or so some new promise of great assistance appears from genetics or an allied science. We have watched the rise and fall of enthusiasm for polyploidy from colchicine, induced mutations from irradiation or chemical mutagens, and for the ideotype concept and other applications of physiological genetics. Some have called these successive enthusiasms 'bandwagons' in less than respectful sense. Some utility has come from all of them, but the first bandwagon, practical plant breeding based on art and experience, has rolled on with very little change in its basic structure. The other bandwagons, the other tools, have not been very useful."

Although biotechnology will be one of the most important tools to applied plant breeding and will greatly aid our understanding of fundamental biological knowledge, there is still an urgent need to improve the efficiency of conventional breeding methods currently in use. As Duvick (1996) reports, "Breeding techniques today would be immediately recognizable to a breeder from the 1930s. Cut-and-try is still the best genetic procedure in corn breeding." We must develop more efficient plant breeding methods that will allow us to apply selection for yield and stability as early as in the F_2 and F_3 generations. This is critical because there is a substantial decrease in the expected frequency of higher-yielding genotypes with each generation of selfing without selection.