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This Week's Citation Classic

Comstock R E, Robinson H F & Harvey P H. A breeding procedure designed to make maximum use of both general and specific combining ability. *Agronomy J.* 41:360-7, 1949.
[Inst. Statist., North Carolina Exp. Sta., Raleigh, NC; Div. Cereal Crops and Dis., US Dept. Agric.; Dept. Agron., North Carolina State Coll., Raleigh, NC]

A technique, designated recurrent reciprocal selection, for the improvement of commercial hybrids in diploid plants, is described and its potentialities are compared with those of (1) selection based on general combining ability with a common tester series, and (2) recurrent selection for specific combining ability as proposed by Hull.[1] The new method would be superior to the first method for loci at which there is overdominance and superior to the second method for loci at which there is partial dominance. [The *SCI*® indicates that this paper has been cited in over 105 publications since 1961.]

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"Capitalizing on hybrid vigor (heterosis) has contributed much to the productivity of US and world agriculture. Corn hybrids, first introduced to farmers in the late-1920s, were dominant in the US corn belt by the early-1940s. The important crossbreeding experiments with swine, completed by L.M. Winters[2] in the early-1930s, had made crossbreeding respectable and ever more popular in livestock production. Naturally, interest in the genetics of hybrid vigor was high. Until Hull[3] set out his arguments for the significance of overdominance, most agricultural geneticists (agreeing with Jones[4]) assumed partial or complete dominance of favorable alleles to be the prime basis for the phenomenon. It should be noted that, in addition to publishing his view, Hull was enthusiastic, untiring, and persuasive in promoting it.

"At an early-1948 workshop devoted to applications of statistics in plant genetics and breeding, Hull was invited to explain why he thought overdominance important relative to hybrid vigor and to review the selection procedure he had proposed[3] as most effective when genetic variance arises largely from overdominant genes. Discussion was lively and useful. The consensus emerged that (a) what then were conventional procedures in maize breeding are not optimum if there is a lot of overdominance, but (b) the procedure proposed by Hull is not optimum if most genetic variation is contributed by nonoverdominance genes. Unfortunately, the experimental evidence then, as now, was not decisive—it neither established nor eliminated overdominance as significant in the genetics of grain yield in maize. Moreover, how to obtain decisive evidence was not entirely evident.

"As he was leaving the conference, suitcase in hand, Merle Jenkins, senior maize breeder in the US Department of Agriculture, said to me that there was an obvious need for a breeding system that would be effective and efficient whatever the proportion of overdominant genes. His remark set my mind in motion. Within a few weeks, I had told H.F. Robinson that I 'knew' how to fill the need Jenkins had identified, Robinson had urged that I present the idea at the 1948 Agronomy Society meeting, and I submitted an abstract.

"My exuberance had 'painted me into a corner.' When I sat down to spin out the theory that would substantiate my intuition, I convinced myself that things would not go as I had imagined. At that point (my memory is vivid), I broke into the proverbial 'cold sweat'—amusing to me now, not then. Fortunately, the analysis that showed the fallacy of the scheme I had thought would work pointed the way to the one that would. In a recent paper[5] dealing with a suggested modification, I broadened the theoretical basis for our original proposal.

"Contributing to citation frequency have been the following factors: (1) the paper was sound and one of the first applications of quantitative genetic theory to plant breeding; (2) the method it proposed, like Hull's of which it is a modification, is distinct relative to the classical, more common procedure; and (3) the overdominance issue has remained a live one. In reports of corn breeding research it is cited both by those who use the method and those who don't but feel some obligation to explain why. It is cited as background in many papers dealing with overdominance and by many who discuss selection in plant or animal breeding."

1. **Hull F H.** Recurrent selection for specific combining ability in corn. (Abstract 996.) *Plant Breeding Abstr.* 15:236, 1945.
2. **Winters L M, Kiser O M, Jordan P S & Peters W H.** A six year study of crossbreeding swine. *Minn. Agr. Exp. Sta. Bull.* (320):1-18, 1935.
3. **Hull F H.** Recurrent selection for specific combining ability in corn. *J. Amer. Soc. Agron.* 37:134-45, 1945.
4. **Jones D F.** Dominance of linked factors as a means of accounting for heterosis. *Genetics* 2:466-79, 1917.
5. **Comstock R E.** Inbred lines *vs.* the populations as testers in reciprocal recurrent selection. *Crop Sci.* 19:881-6, 1979.