MULTIPLE CONVERGENCE AS A MEANS OF AUGMENTING THE VIGOR AND YIELD OF INBRED LINES OF CORN

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THE concept of convergent improvement in corn by a system of crossing and reciprocally backcrossing, with selection, originated in an effort to devise a means for comparing crucially two theories of the cause of hybrid vigor (5). The results of experiments with convergent improvement (2, 4, 6) have favored one of these unanimously, namely, the interaction of dominant favorable genes (1, 3), as the more probable. These results also have indicated that at least some of the genes concerned were only partly dominant, as had been suggested might be the case (5). Finally, the results have shown the method to have value in the practical improvement of inbred lines of corn for use in hybrid combination. An extension of the underlying idea to include what may be termed, "Multiple Convergence", seems to have added practical possibilities. Reciprocal operations are not involved in this extension. Rather, the idea is to cause the convergence of several small streams of germ plasm as tributaries to one larger stream.

THE CONCEPT

When two nearly homozygous lines of corn, as A and B, are crossed, and the cross is backcrossed through successive generations to B, the germinal constitution of line B is recovered gradually so that, as an average for the several lines, the increment from A will decrease from \( \frac{1}{2} \) in the original cross, to \( \frac{1}{4} \), to \( \frac{1}{8} \), and so on. This is true, of course, only for the average. The quantitative increment from A in any individual line in any generation of backcrossing to B will be either more or less than the corresponding value in the fractional series, depending upon the chances of random sampling and the effects of selection, if any. In addition to variation in its quantitative contribution, the qualitative contribution from line A also will differ from one to another of the partially recovered B lines. Accordingly, several lines recovered from the same original cross by backcrossing to the same homozygous parent will differ among themselves in the quantitative and qualitative contributions remaining from the non-recurrent parent. It follows that crosses among such partly recovered lines should exhibit some hybrid vigor, which would be related in degree to the differences obtaining between the lines crossed. Similarly, if line B were crossed with two different lines, A and C, and these crosses then backcrossed to line B, there would be decreasing contributions from the two non-recurrent parents, A and C, as noted above. The lines derived from the cross \((A \times B)\), however, would differ as a

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3Figures in parenthesis refer to "Literature Cited", p. 940.