

# This Week's Citation Classic

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Eberhart S A & Russell W A. Stability parameters for comparing varieties.  
*Crop Sci.* 6:36-40, 1966. [Iowa State University, Ames, IA]

A model was proposed to describe the relative performance of varieties over a series of environments as a way of improving plant breeding methodology. Data from three experiments were examined to evaluate the usefulness of the model and to obtain some preliminary information on inheritance. Considerable genetic variation was noted for the first stability parameter, response to environmental conditions, which appeared to be primarily under additive genetic control. [The SC<sup>i</sup>® indicates that this paper has been cited over 115 times since 1966.]

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"In our research program (US Drug Administration and Iowa State University cooperating) to develop and evaluate methods and techniques to improve the effectiveness of corn breeding programs, Dr. Russell and I had concluded that one of the major difficulties was genotype by environmental interactions; i.e., the failure of hybrids to give the same relative performance under different environmental conditions. We recognized that an appropriate statistical model was needed involving an independent index that was obtained from environmental factors such as rainfall, temperature and soil fertility. However, current knowledge did not permit computation of an appropriate index. From our previous experiences with corn yield trials in Iowa, we concluded that the mean yield of all hybrid varieties at a trial location would provide an index of that environment. As environmental conditions changed from those giving very low yields to very high yields, the varieties responded differently to im-

proved environmental conditions. We felt if we could remove this varying response to environmental conditions from the genotype-environment interactions and characterize each variety accordingly, we would have a useful selection criterion. Furthermore, we had noted that, even when the response to varying environments was estimated, certain varieties were very erratic in their yields around their characteristic environmental response whereas others were relatively stable with small deviations. Linear regression on the environmental index and deviations from regression provided the statistical tool to develop the model and the parameters.

"We used two rather extensive diallel experiments, as well as one set of three-way crosses, to determine if there was a genetic basis for these stability parameters. We were pleased to note in all three experiments the response to environments was primarily under additive genetic control, which meant that it would be relatively easy to select varieties with the desired response. The deviations from regression for a specific hybrid also seemed to be under genetic control, but the inheritance was much more complex.

"I believe that the numerous citations of this paper indicate that it has been found useful by a large number of scientists for a problem that is of major importance to all plant breeders.

"As I accepted responsibility for the development of improved corn and sorghum hybrids for Funk Seeds International, the problem of differential responses of varieties over environments became an even more important part of my responsibilities. The use of this model involving stability parameters for comparing varieties has been extremely valuable in improving the effectiveness of our breeding programs."