The variations occurring in segregating populations of corn are attributable to three main sources: namely, additive genetic effects, nonadditive effects due to dominance and interaction of nonallelic genes, and environmental effects. The term genotypic variation is used throughout with reference only to the additive genetic or heritable variation which is the portion of the variation responsible for progress resulting from selection. Phenotypic fluctuations may result from combinations of all of these types of variations. Since the breeder is concerned with selecting superior genotypes, but of necessity must choose individuals from their phenotypic expressions, estimates of the genotypic and phenotypic variances for various characters are needed. Furthermore, since most of the characters of economic importance, such as yield, are complex in inheritance and may involve several related characters, the degree of genotypic and phenotypic correlation of the characters is also important. To obtain these correlations it is necessary to have estimates of the genotypic and phenotypic covariances in addition to the variances for the various characters. These correlations are not only of interest from a theoretical consideration of the quantitative inheritance of the characters, but of practical value since selection is usually concerned with changing two or more traits simultaneously.

The experienced breeder has certain desired plant characteristics in mind when selecting for particular genotypes and thus must apply various weights to different traits as he makes his decisions. This suggests the use of a selection index which gives proper weight to each of the two or more characters to be considered. Hazel and Lush (3) showed that selection based on such an index is more efficient than selecting individually for the various characters. The basis for the development of the selection indexes has been provided by Hazel (2) with an example in animals and by Smith (7) who illustrates its use in plants. Simlote (6), applying this technique, concluded that tiller number and grain weight should be the basis for selection of higher yield in certain durum wheats in India.

The optimum weights to be assigned the characters in selection will depend upon the following factors:

1. Phenotypic variances and covariances between each of the characters to be involved.
2. The genotypic variances and covariances.
3. The relative economic values of the several characters.

The purposes of this paper are: (1) to present estimates of additive genetic variance and covariances of eight characters of prolific corn; (2) to present phenotypic variances and covariances, and a particular situation, can be constructed dominance and environmental variances and covariances; and (3) to demonstrate the construction of a selection index from a few of the characters using yield of a particular situation, can be constructed and phenotypic variances and covariances of eight characters of prolific corn; (2) to present phenotypic variances and covariances, and demonstrate the construction of a selection index from four to four plants used as female parents. Details of the design of the experiment, estimates of the nonenvironmental portion of the intra-plot component of variance, and the relative economic values of the several characters, are presented involving various combinations of several of the characters using yield of the ultimately desired product.

These selection indexes are not to be considered the best available or even applicable for corn. They are presented to illustrate the type of data that is possible from such data. The conditions of the usefulness of an appropriate selection index vary with individual plant breeders. Considering the premise that could easily lead to the development of unsatisfactory plant types. A completely satisfactory index would need to include such criteria as plant and ear types and lodging and disease resistance in addition to yield.

Materials and Methods

Biparental crosses were made within each of the parent lines in the generation of the F2 populations of prolific corn: CI 21 × NC 7, 5 and NC 34 × NC 45. Each of the plants used as female parents was crossed on three to four plants used as female parents. Details of the design of the experiment, estimates of the nonenvironmental portion of the intra-plot component of variance, and the relative economic values of the several characters, are presented involving various combinations of several of the characters using yield of the ultimately desired product.

An example of the analyses of variance of the data is presented in Table 1 for ears per plant. The components of variance describing each of these are symbolized in the last column to the right of the pooled error mean squares for "males in blocks" and "females in males in blocks."