THE successful development of improved corn hybrids is dependent upon the improvement of the foundation lines involved in their production. The problem is primarily one of locating suitable sources of superior germplasm, desirable fractions of which can be incorporated into the line genotypes the breeder is seeking to improve. The most common source of new germplasm for improving widely used lines has been other established lines. This approach rapidly increases the relationship among the better lines available, thereby restricting the use of the improved lines in hybrid combination.

The continued use of open-pollinated varieties as a source of new germplasm has been largely bypassed due to the extremely low frequency of superior genotypes in these populations. The need for further sampling of the varieties has been pointed out by Stadler (7). He suggested the use of a scheme in which the gamete is the unit of selection, thereby greatly increasing the efficiency of sampling superior germplasm in these varieties. The technic can be illustrated as follows: If in a double-cross hybrid \((A \times B) \times (C \times D)\), line \(A\) is selected as needing improvement, it is first outcrossed to a varietal population. The resulting \(F_1\) plants differ only with regard to the gametes contributed from the varietal source. Individual \(F_1\) plants designated as \(A/variety\), are selfed and testcrossed to the \(C \times D\) single cross against which the new lines may be ultimately used. Those \(F_2\) plants having higher testcross yields than line \(A\) with the same tester are assumed to be combinations of \(A\) with gametes superior to \(A\) in yield genotype in this particular combination. Further inbreeding and selection within the superior \(A/variety\) plant progenies should permit the extraction of higher combining lines for use in this particular hybrid without having used up, as it were, other genotypes already isolated and identified. The type of improvement sought through the gamete sampling method is, then, specific in nature. To the extent that specific combining ability is important in obtaining maximum yields, the suggested procedure should act as a guide in developing new lines in such a way that studied showed evidence of superiority compared to the sampler inbred in yield and maturity. A sampling of agronomically desirable \(F_2\) lines where gametes from varietal sources were compared with segregating material from crossing inbred lines.

Results obtained in studies on early testing have demonstrated the existence of extremely low frequency of superior genotype of individual plants in a population. The study reported herein was based upon the observation that the gamete sampling procedure is highly efficient if applied to a selected fraction of variety plants as determined by preliminary performance rather than sampling from unselected gametic populations.

**MATERIALS AND METHODS**

Two three-way cross hybrids—one a popcorn hybrid, the other a dent hybrid, Nebraska 501—were studied. Both hybrids are produced and grown in the state. In the production of seed of three-way cross hybrids constituting a hazard in many years in this region, it was thought desirable to attempt the selection through gamete sampling of two related lines for each hybrid which, when crossed and used as testers, would overcome the production hazard and at the same time in a hybrid as good or better than the original hybrid.

**Popcorn hybrid** \(K_4\), \((Sg 18 \times Sg 30 A) \times Sg 24\), was planted in 1946 on a seriated sample of the South American Crossing Block. The South American was planted with SA 24 as the pollen parent. The crosses were detasseled, and at harvest, 60 of the best crossed plants were selected for further study. The seed from these 90 plants was planted in a replication with the crossed progeny of each selected South American constituting an entry. On the basis of the yield from the topcrosses from each end of the yield range within each family were selfed and outcrossed to SA 24 as the tester. The testcrosses were planted in 1950, but due to severe wireworm damage the tests were discarded.

In order to continue the study, six of the original three from each end of the range) having sufficient remnant seed were resampled in 1951 and outcrossed to \(Sg 30 A\).