Fertility Evaluations and their Relationships to Clonal Performance and Combining Ability in Orchardgrass, *Dactylis glomerata* L. 

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**S**elf- and cross-fertility have been the object of much consideration in the breeding of cross-pollinated perennial forage crops. Some degree of self-fertility is essential for establishment and maintenance of inbred lines, whether such lines are used directly in strain building or for progeny testing. Cross-fertility and resultant outcrossed seed are of importance in both progeny testing and commercial seed production. Since emasculation generally is not feasible in grasses in production of singlecross, polycross, topcross, or open-pollination progenies, proportions of selfed and crossed seed produced in such instances could influence results of progeny testing. Existence and consequent effects of genetic associations between self-fertility and vigor have been postulated but never demonstrated conclusively.

Procedures for evaluation of combining ability have received major emphasis in the orchardgrass breeding program at Iowa State College. These investigations, summarized in part by Kalton, *et al.*, allowed certain related problems to be studied concurrently. The extent and results of these related studies are reported herein and consisted of: (1) experiments to determine the degree of association among self- and cross-fertility, vigor, and combining ability of selected non-inbred clones, (2) comparisons among methods of determining self- and cross-fertility, (3) relationship between self- and cross-fertility, and (4) interannual correlations for each mode of pollination.

**LITERATURE REVIEW**

Many workers, including Beddows (1), Wolfe and Kipps (21, 22), Nilsson (11), Stapledon (15), Schultz (13), Keller (6), Smith (14), and Myers (8, 9) have found *Dactylis glomerata* much less self-fertile than cross-fertile. In general, however, degree of self-fertility has varied from complete sterility to almost complete fertility and has been of sufficient magnitude to enable breeders to practice some inbreeding.

Keller (6) recommended measurement of self-fertility of a species upon a basis of number of seeds per panicle, as frequency distributions of such data would coincide with seeds per floret if size of panicle was normally distributed and self-fertility was independent of size of panicle. Expression of selfed seed set as a percentage of open-pollinated seed set was utilized by Myers (8) because such a measurement avoided differences in general fertility and number of florets per panicle. Raab (4) investigated several possible methods for evaluating open-pollinated seed set in brome.

Plant material used in this study consisted of clones of orchardgrass, originally isolated as single plants in long-time stands from various localities in singlecross, topcross, and polycross progenies. Earlier workers had indicated that these parental clones differ in agronomic characteristics. All clones were selected for similarity in date of flowering, to facilitate making of singlecrosses.

Twenty clones were planted in the fall of 1948 in a planted crossing block consisting of all possible pairs of clones. This arrangement allowed each clone 19 times within the crossing block. One clone was discarded. Two panicles per bag per clone planted in the crossing block were used for determining seed set per bag in 1949. Seed set under bag in 1950 and bag set in 1949 and 1950 were each determined on one panicle per clone set. Winter injury reduced production both years at some locations within the crossing block, and yield was decreased. A few less than 19 locations existed for selection of progenies of similar size was practiced to size as constant as possible.

One of the two selfed panicles per clone per bag in 1949 was used for a composite sample of 19, 19, 19, locations. This composite sample of panicles was threshed, and weights of seed, stem, and chaff were determined. Milligrams per panicle. Weights of ten unthreshed panicles also were obtained from the