MAXIMUM productivity in alfalfa is obtained in the first-generation hybrid progeny of a cross between two genotypes with high combining ability. The phenomenon of hybrid vigor is thereby most effectively utilized. Through the use of highly self-sterile, cross-fertile parental clones of alfalfa, the resultant seed may rather closely approach a pure F₁ hybrid constitution. Such a single-cross may be used directly for commercial plantings or the seed of two single-crosses thus obtained may be planted under isolation in alternating rows or as a mixture to produce the commercial double-cross alfalfa seed. Double-cross seed produced in this manner will contain some selfed and some sibbed seed, but these will be in the minority. With these qualifications and limitations understood, the progeny is appropriately known as hybrid alfalfa in distinction to the synthetic variety which may be developed by a similar breeding procedure but whose seed is definitely synthesized in advanced generations for use in commercial plantings. The cooperative breeding program at the Nebraska Agricultural Experiment Station has both the F₁ hybrid and the synthetic variety as objectives, but it is believed that the former has the greater possibilities. The use of hybrid vigor may find its expression in the form of either single or double crosses.

The perfection and testing of parental stocks may require several years before release, but the needed basic information is at hand and foundation stocks and hybrid combinations are under test. Improvement in yield of seed, yield and quality of forage, and resistance to certain diseases and insect pests seems assured. It is the chief purpose of this paper to report the underlying information and to describe the procedure of alfalfa improvement by the method of controlled hybridization involving known high-combining ability of the component genotypes.

MODE OF REPRODUCTION

As naturally constituted, alfalfa is normally a cross-fertilized crop, although self-fertilization may also occur except where limited by self-sterility. As an average for three Nebraska tests during 1936 to 1939, 89% of the seed resulted from cross-fertilization (g).² Knowles (6) reports 94.2% crossing in Canada, and Burkart (2) found 84.5%