PLANT breeders have generally assumed that nuclear effects are more important than maternal effects in governing character expression. There is little doubt that this has been a valid assumption. On the other hand, numerous examples are known of maternal inheritance and reciprocal differences in plants.

The present study was conducted to ascertain whether maternal effects on seedling vigor could be detected in crosses among diverse alfalfa plants selected for adaptation to northeastern United States. In addition, an effort was made to identify certain factors that contributed to maternal effect on seedling vigor.

REVIEW OF LITERATURE

Many reports of maternally inherited characters in plants are recorded in the literature. Alfalfa literature offers conflicting evidence. Buker and Davis, from an 8-clone alfalfa diallel produced by hand-pollination without emasculation, reported that reciprocal differences were not present for yield, leaf/stem ratio, natural height, natural width, and crown width, nor for visual estimates of vigor, Pseudoplea leaf spot, blackstem, or downy mildew prevalence. Davis and Panton (3) also reported that reciprocals of 6 hand-pollination crosses produced after emasculating 4 alfalfa clones did not differ significantly in seedling height at 2, 3, or 4 weeks, in plant height or crown width, plant vigor, or in dry forage yield. Tysdal and Kiesselback (7), on the other hand, reported highly significant differences in forage yield among reciprocals of 1 of 4 two-clone alfalfa combinations produced by bee pollination. Bolton (2), studied seed and forage yields of reciprocals involving 26 alfalfa clones each crossed reciprocally without emasculation with several other clones. Three of 26 clones showed significant reciprocal differences in average seed yield and only one parent gave reciprocals differing in average forage production. Frakes et al. (5) reported a significant variance for dry matter yield associated with reciprocal effects in 6 alfalfa crosses produced by hand pollination after emasculation. Wilcox and Wilsie (4) reported that reciprocals of certain alfalfa crosses grown as spaced plants in the field differed in total yield and in fall growth habit. They concluded that “analysis of several characters indicated that reciprocal differences may be of only minor importance as far as general and specific combining ability are concerned.”

Fleming et al. (4) found significant reciprocal differences for yield, silking, ear and plant heights, erect plants, and budworm damage in corn. Reciprocal differences were restricted to specific combinations as these authors were unable to demonstrate a consistent maternal effect of an inbred line in combinations with several differing genotypes. In the majority of cases of significant reciprocal differences hybrids deviated in the direction of the maternal parent, i.e., the taller hybrid was more likely to result when the taller inbred was the maternal parent. They concluded that possible cytoplasmic effects should be considered in producing commercial hybrids.

MATERIALS AND METHODS

The 110 heterozygous alfalfa clones used to produce reciprocal clone-crosses for experiment 1 of this study traced to 16 different maternal parents (cytoplasm sources). The parental clones were selected from a 7-year-old polycross progeny test at Storrs, Connecticut. Bacterial wilt and root-rots had reduced the stand to less than 50%. Vigor and relative freedom from root diseases provided the basis for selection. A maximum of 10 genotypes were represented within a particular cytoplasm. For example, 5 plants were selected from the polycrosses of C54, each selection having C54 as its maternal parent. These 5 selections, used as parents in the present study, were designated C54-1 to C54-5. Each of these clones was crossed with a clone from source other than C54 cytoplasm. In instances having more than 10 crosses within a cytoplasmic source, some parents were represented in 2 or more different crosses.