M A L E  sterility in plants is associated with a variety of physiological and morphological abnormalities: e.g., vestigial, petaloid, and reflex stamens; poreless anthers; and degeneration during various stages of microsporogenesis and microgametogenesis. The genetic abnormalities leading to male sterility are similarly diverse and include chromosome abnormalities, cytoplasmic factors, interactions between cytoplasmic factors and nuclear genes, and dominant and recessive nuclear genes (see Jain, 3).

The use of male sterility as a means of controlling cross pollination in hermaphroditic species has long been known. Systems governed by the interaction of genes and cytoplasm have been used in the commercial production of F₁ hybrids. This report, which is limited to the genetic control of male sterility, is part of a larger program designed to determine the feasibility of utilizing male sterility in carrots for the production of F₁ hybrid seed.

LITERATURE REVIEW

Jones and Clarke (5) found that male sterility controlled by genic-cytoplasmic interaction can be used for the production of pollen-sterile inbreds required in the large scale production of F₁ hybrids. They demonstrated that pollen sterility in certain lines of onions results from the interaction of the recessive gene, ms, and a cytoplasmic factor S. In this system pollen-sterile plants (Smms) when pollinated by a pollen-fertile plant with the cytoplasm-genotype Nmsms give rise to completely pollen-sterile progenies, all with the cytoplasm-genotype Smms. These pollen-sterile progenies have been used extensively and successfully for the commercial production of hybrid onion seed. The method proposed by Jones and Clarke is now commonly used for the production of hybrid seed in other crop plants; e.g., corn (4), sugar beet (6), and sorghum (7).

The possibility of similarly utilizing the hypothesized genic-cytoplasmic male-sterile system in carrots has been suggested by Welch (3) and Gabelman (1). Thompson (8) reports that a genic-cytoplasmic system very likely exists in this species and suggests that at least 4 and probably 5 genes are involved (3 dominant male-sterility genes, Ms₁, Ms₂, Ms₃, and one or more dominant epistatic factors). However, results from critical tests of these complex hypotheses have not been reported.