endotoxin is not toxic to normal tissues under the conditions of therapy and in concentrations 4 times as great.

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Male Sterility in the Carrot

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Male sterility has been reported in several crop plants including tomato (*3, 6, 9*), flax (*2*), corn (*4, 8*), onion (*5*), sorghum (*1, 10*), barley (*11*), and sugar beet (*7*), and the possibility of utilizing this character in the production of hybrid seed for commercial planting has been pointed out by several investigators. Present horticultural varieties of carrots lack uniformity when environmental conditions deviate from the optimum. By studying the combining ability of paired inbred lines, one in each combination possessing the male-sterile character, it is theoretically possible to obtain extremely uniform carrot varieties which are also superior to those now available in general appearance, productivity, quality, and nutritional value. The feasibility of using inbred lines of corn in producing seed for commercial planting is due to the monoecism of the plant and the ease in making cross-pollinations. In perfect-flowered plants like the carrot it is impractical to employ inbred lines in this way without male sterility.

An apparently male-sterile carrot plant was found in a collection of several dozen being grown for inbreeding in a greenhouse planting in the winter of 1945–46 at the U. S. Regional Vegetable Breeding Laboratory, Charleston, South Carolina. This plant was grown from a root selected in a commercial stock of the variety Tendersweet in the spring of 1945. Caging of certain umbels took place a day or so before the first flowers normally would open, and the caged umbels were observed daily for the appearance of exserted stamens, the stage at which blowflies are introduced into the cages as pollinating agents. The first flies were placed in the cage on February 25, 1946, even though no stamens were evident. A few days later microscopic examination showed that the anthers of this plant were shriveled and brown in color before any petals unfolded. No exserted stamens were found. On March 9, 1946, an umbel of the variety Nantes Strong Top, grown from a root selected from a commercial stock in the spring of 1945, was placed in a test tube of water and introduced into the cage with the apparently male-sterile plant. This procedure was continued with fresh umbels from the Nantes plant. Later the two entire plants were isolated in a single large cage. The seed on the selectivity caged umbels was harvested separately from the other umbels because some seed had set on the male-sterile plant outside the small cage by open pollination before the whole plants were enclosed. The pollen parents of these seeds were unknown. Female fertility of the male-sterile plant appeared normal.

On September 6, 1946, a portion of the hybrid seed was planted under good conditions. The 67 roots which were produced were harvested on January 6 and 28, 1947, and held at 32°–35° F. until they were planted in the field between February 21 and March 18, 1947, at 5 different locations. The histories and internal characteristics of all roots were recorded.

Classification of the flower types of these F_1 plants between June 6 and July 7, 1947, showed 39 male-sterile and 15 normal. The balance of the plants to make the total of 67 planted either had not flowered when the last notes were taken or were lost before classification. No difficulty was encountered in distinguishing between male-sterile and normal plants. The abnormal specimens appeared like the parental male-sterile plant found in the winter 1945–46 greenhouse planting. The mode of inheritance of the male-sterile character is unknown, because so far only a relatively small segregating population has been studied. Further breeding tests will be required before a genetical explanation can be proposed.

In order to determine whether male-sterile plants produce any self-fertile pollen, umbels of four segregates were caged with blowflies. Three of these plants set a few seeds. If enough plants can be grown from these seeds, proof should be obtained as to whether these were really selfed seeds or were cross-pollinated from normal plants by thrips, ants, or some other very small insects that penetrated the fine-mesh cloth cage covering. Umbels were not allowed to touch the cloth, thus eliminating the possibility of insects outside the cages pollinating enclosed flowers pressed against the inside of the cloth. Isolated plantings of single male-sterile plants and other plantings with several male-sterile plants would give further information on the possibility of viable pollen production.

At the time the F_1 population involving male sterility was being classified, several dozen plants in other carrot breeding lines were examined for flowering habit. Four plants were found to possess varying degrees of apparent male sterility. Each plant produced some exserted stamens, but the number was only a small percentage of those which would normally be exhibited. Two of the specimens shed pollen, the viability of which was not determined, but no pollen production by the remaining two plants was observed. All four set an abundance of open-pollinated seed. This partial male sterility was not encountered in classifying the F_1 population which was segregated for the male-sterile character.

The mode of inheritance in the carrot of the male-sterile character, for which segregation data were presented, and the partially male-sterile types with which no controlled crosses were made will not be known until additional breeding tests are completed.

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