Introduction. Abandoned farm land in the temperate latitudes of the eastern United States will frequently develop a dense stand of annual plants during the first growing season after soil disturbance (Keever, 1950; Bard, 1952; Booth, 1941; Oosting, 1942; Levin, 1966). In these situations seed-derived perennials, though present, are generally few, both in number and species, and reduced in size. They do not become abundant or attain normal size until the second, third, or later years.

Keever (1950) noted the same phenomenon when she reported that competition for water and light with the already existing annuals on first-year fields prevented the perennials, and particularly Aster pilosus, from reaching "maximum size" and dominance the first year. Besides the competitive influences, which were not conclusively shown, the relative slow first-year growth of the perennials, compared to the annuals, was another factor suggested as limiting perennial-plant size the first year.

Studies at the Waterloo Mills Field Research Station of the Academy of Natural Sciences, Philadelphia, Pennsylvania, suggested that perennial plants growing in the absence of annuals on first-year fields can indeed reach a "maximal size" that year and, in fact, commonly become abnormally large, as well as numerous. Perennials grown on plots

without annuals were 4.82 times as numerous as, and had 7.75 times the cover of, perennials grown on plots with annuals. In another study the average dry weight of tops of perennials from plots without annuals was 43 times that of perennials from plots with annuals. Average dry weight of roots showed a similar difference.

The suggestion drawn from these data was that annual plants in dense stands inhibit the size and number of seed-derived perennials growing among them. To determine the authenticity of these results and to initiate investigations into their causes, should they prove real, this study was carried out.

Three sources of suspected inhibition were proposed: shade, competition, and biochemical inhibition (allelopathy) through some toxic compound or compounds in the above-ground annual-plant tissues.

Location of Site. The study was conducted on an old field two miles south of Devon, Pennsylvania ($40^{\circ}02'N$; $75^{\circ}28'W$). The property is part of the Waterloo Mills Field Research Station of the Academy of Natural Sciences, Philadelphia, Pennsylvania.

Description of the Site. The L-shaped field, divided into thirty-seven experimental plots, each 70 feet long by 37 feet wide, slopes three degrees from northeast to southwest. The soil is a Glenelg channery silt loam, underlain

by Wissahickon and Peters Creek schist, and Baltimore gneiss.

Prior to plowing in 1963, sweet vernal grass (Anthoxanthum odoratum L.[1]) dominated the field, forming a pasture. Previous cultural treatment of the plots is summarized in Table I.

Three plots, 13, 20, and 28, were randomly selected for the study. Each was subdivided into twelve 14½ x 9-foot treatment sections (Fig. 1, a-c).

MATERIALS AND METHODS

Treatments. All plots were cultivated to a depth of 5.5 inches in late May. Each of the sections of a plot received one of eight treatment combinations, except the controls, which were undisturbed (Fig. 1). The treatments were assigned according to a 2^3 factorial design, the two levels of the three treatments being shading vs. not shading perennials (= Shade-No Shade), clipping vs. pulling annuals (= Clip-Pull), and leaving vs. removing annuals litter (= Leave-Remove).

Shading of perennials was carried out by constructing walk-in shade shelters of green Armex Saran shading fabric (.009 x .C[illegible] grade, available from X. S. Smith, Inc., Drawer X, Red Bank, N. J. 07701) around four contiguous sections on the south side of each plot. Of the various grades and

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[1]Plant nomenclature follows Gray's Manual of Botany, eighth ed.