HETEROSIS for yield and certain other characters has been reported in all of the cultivated species of cotton (Gossypium hirsutum, G. barbadense, G. herbaceum, and G. arboreum). Loden and Richmond (12) in 1951 reviewed the literature pertaining to heterosis in cotton. A few of the more notable presentations on this specific subject since that time are those of Jones and Loden (10), Turner (19, 20), Christidis (2), Fryxell et al. (6), Barnes and Staten (1), and Stroman (18). These writers reported on a wide range of hybrids, both inter- and intraspecific, with varying degrees of expression of heterosis for yield and other agronomic characters. As a basis for measurement, they used the mid-parent, the better parent, or a commercial variety.

Cotton lacks many of the attributes which adapt certain other economic crops to hybrid seed production. Cotton plants produce perfect flowers which require a tedious (though simple) operation to effect their emasculation. The pollen is relatively heavy and sticky, and the flowers must depend on insects for the crossing that takes place. Although cross-fertilization ranging from 1 to 80% has been reported in cotton, the predominant situation in commercial production is self-fertilization. Cotton plants produce relatively few seeds per inflorescence. Thus far these traits have contributed enormously to the problem of producing adequate amounts of hybrid cotton seed at a commercially feasible cost.

In the face of such seemingly insurmountable obstacles, researchers during this century have been somewhat hesitant to enter the quest for hybrid cotton. Selection of suitable parents and studies of combining ability were not pursued with great enthusiasm as these were thought to be rather fruitless tasks. Lately, however, certain scientific advances have given cotton workers a measure of encouragement. A chemical compound, sodium 2,3-dichloroisobutyrate (Rohm and Haas FW-450), showed promise as a male gametocide, or a "tool" for increasing the percentage of hybrid seed produced under otherwise natural conditions (3). While this possibility is being investigated (13), an increasing amount of time is being spent on the search for genetic-cytoplasmic male-sterility. Two genetic male-sterile genes have been found and designated ms, and ms2, the former is a gene conditioning partial male sterility (11), the latter is a gene conferring complete male sterility (14). Although the desired interaction of these genes with a fertility-restoring cytoplasm has not been found, workers over the Cotton Belt are continuing to screen many stocks for the cytoplasmic-genetic type of male sterility. The bumble bee is the most efficient pollinator of cotton, but studies elsewhere (8) have shown that the use of supplemental colonies of honey bees in hybrid production fields to effect adequate cross-fertilization may be feasible. Green1 suggested that seedling marker genes might be employed to aid in roguing non-hybrid cotton plants or in selecting the hybrid plants to leave for a stand.

These developments in methodology emphasize that if hybrid-cotton production is to be a reality in the foreseeable future similar advances must be made in combining ability and parent selection. An amiable controversy is now in progress among cotton geneticists and agronomists on the relative position research on hybrid cotton should occupy with respect to other breeding efforts. The status of hybrid cotton in the research programs of these workers now varies from a high-priority endeavor to a low-level methodological niche. The research reported here was conceived with the objective of adding to present information more evidence on the expression of heterosis and the measurement of combining ability for yield and other agronomic and fiber characters among relatively widely related Upland stocks of cotton, G. hirsutum.

MATERIALS AND METHODS

Five parental stocks were selected to use in a combining study based on a diallel crossing system. These were MUEb, a Cambodia type selected by Hutchinson in Central India in 1935; Texas 468, a punctatum collected in Mexico by Richmond and Manning in 1946; CB5150, a Russian Upland obtained through H. D. Loden; Texas 63, a latisulcum collected in Mexico by Richmond and Manning in 1946; and 2-8-7-6, the F1 of a cross between DPL-14 and Texas 324, a palmeri collected in Mexico by Ware and Manning in 1948. These stocks will be referred to in this paper by code letter (A through E, respectively) while their F1 hybrids will be designated by appropriate letter combinations. In the selection of these parents, the principal criteria which influenced the choices were the following precepts: (1) degree of hybrid

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1 Contribution from the Department of Soil and Crop Sciences, Texas Agr. Exp. Sta. and the Crops Research Division, ARS, USDA. Part of a dissertation submitted by the senior author as partial requirement for the Ph.D. degree. Received July 27, 1962.

2 Instructor, Texas Agr. Exp. Sta., and Research Agronomist, Crops Research Division, ARS, USDA.

3 Green, J. M. Possibilities for use of seedling markers for increasing the stand of hybrid plants. Second Cotton Improvement Conference, Biloxi, Miss. 1950. (Mimeo.)