Interest in the commercial production of hybrid sorghum seed has increased greatly since Stephens (4) discovered a male-sterile plant in Texas Blackhull kafir. This male-sterile factor is inherited as a simple recessive. Also, Karper and Quinby (1) reported some high increases in plant height, and forage and grain yields, in certain F1 hybrid combinations. Plant heights and forage and grain yields in excess of the totals of both parents were obtained in Blackhull kafir x hegari, Dwarf Yellow milo x Blackhull kafir, and hegari x Dwarf broom corn. Stephens and Quinby (6) found that in midsummer the stigma was receptive to pollen for 8 days, while in the fall the stigmas were receptive for 16 days. This permits a considerable spread in the period for the natural pollination of male-sterile plants.

It has been estimated that, from 1941 to 1943, 60% of the sorghum acreage of southern Arizona was devoted to hegari, 36% to Double Dwarf milo 38, 5% to Atlas, and 5% to other varieties. It seemed desirable to determine the yields and other characteristics of first-generation hybrids involving these and other varieties before undertaking a program of hybrid-sorghum breeding.

Materials and Methods

Yields and other agronomic data were recorded on experiments conducted at the University Farm, Tucson, Ariz., in 1941. Three-row plots 26 feet long were planted June 18, usually in three replications. The center row of each plot was harvested for yield. The plots of both the parental varieties and the first-generation hybrids were randomized, each group being in separate randomized blocks. In 1942 and 1943 the experiments were conducted at the Salt River Valley Experiment Station, Mesa, Ariz. There, four-row plots 21 feet long were planted on June 26 in 1942 and on June 28 in 1943. The methods of replication and randomization were the same as in 1941. The two inside rows of each plot at Mesa were harvested for grain and stover yield except where one of the two rows was cut in the hard dough for silage yields. Adjustments were made in the grain and stover yields whenever self-pollinated plants were found among the hybrids. There was some bird damage in 1941, more in the taller than in the shorter plant types. Attempts were made to cross varieties that flowered within a range of 8 days. The only exceptions were the crosses of feterita, Blackhull kafir, and Kalo, with hegari. Hybrids were made involving all combinations between hegari, Double Dwarf Yellow milo 38, Ajax, Kalo, Atlas, and Grohoma in 1942 and 1943. Several other hybrids also were tested.

All the emasculations were made by the hot-water method similar to that described by Stephens and Quinby. A temperature of 48°C for 10 minutes was used in immersing the flowers used to obtain crossed seed for 1941. Occasionally selfed plants were obtained, the time of immersion of the heads was increased to 12 minutes in 1942. Emasculations and pollinations were made at the University Farm, Tucson, Ariz. Nearly 100% of self-pollinated plants in the hegari x Ajax and Blackhull-kafir x Ajax and the Blackhull-kafir x Ajax crosses in 1943.

The number of leaves of the main stalk was determined at the University Farm, Tucson, in 1942 and 1943, following the method described by Sieglinger (3). The center row of one 3-row plot was harvested for yield.

Single rows at each replication of the hybrids promising for silage production, and also of the parents, were harvested at the hard-dough stage in 1942 and 1943. At that time, two stalks from each plot, both the parents and hybrids were cut up, bagged, and mixed. These samples were allowed to air-dry and then ground for chemical analysis. About 100 grams of each sample were ground for analysis for total sugars, protein, fat, ash, and starch. Although silage yields were not obtained in 1942, they were estimated as in 1942 or 1943. The analyses were made by the Department of Agricultural Chemistry and Soil Science, Arizona, Tucson, Ariz., and are presented here through courtesy of that Department.

Experimental Results

The data on factors that suggested the occurrence of hybrid vigor are shown in Tables 1 to 4, inclusive. The data on factors that suggested the occurrence of hybrid vigor are shown in Tables 1 to 4, inclusive. The summarized measurements also are reported as percentages above or below the means of the respective parents.

Grain Yields

The grain yields of the parental varieties are given in Table 1. Ajax had the highest 3-year average yield, exceeding hegari by more than 20%. Atlas had the lowest grain yields. The yields of all but 3 of the 19 hybrids exceeded the means of the respective parents.

Among the eight hybrids with hegari as one of the parents six had yields higher than the parent: the greatest increases, 37.6% and 54.2%, occurred in the crosses with Grohoma and Manko, respectively. Decreased yields were found in crosses with Ajax and Blackhull kafir. Among the five Double Dwarf milo 38 crosses, four crosses yielded less than the mean of the two parents. The greatest increase, 97.0%, occurred in the cross with Kalo.