IN RECENT years improved fertility practices have permitted the use of higher plant populations of hybrid corn. Under optimum climatic conditions the results from high density plantings have been inconsistent. This has been due largely to the poor standability and the barrenness of many varieties under stress conditions. The extent to which production practices may be utilized is controlled by the yield potential of the available hybrids. The potential of double-cross varieties may be predicted from the performance of inbreds in single-cross combinations.

The present study was made to gain information on the performance of inbred lines in single-cross hybrids at various population levels and within-row spacing patterns.

REVIEW OF LITERATURE

Lang (6) tested 9 single-cross hybrids at 3 fertility and 6 population levels. He obtained the highest yield with a high nitrogen treatment and a population level of 20,000 plants per acre. The hybrid WP9 × CI03 was most adversely affected by high density planting. Nelson and Dumenil (8) found that, with good moisture and fertility conditions, highest yields were obtained with stands of 15,000 to 19,000 stalks per acre. When these conditions were not present, highest yields were obtained with stands of 11,000 to 15,000 stalks per acre.

Dungan (3) reported that corn grown in single-plant hills yielded more than corn in multiple-plant hills at the same population level. Rounds et al. (9) reported an average yield increase of 23.5% in 31 hybrid varieties when seeded with 3 plants per hill as compared with 2 plants per hill. They found yield increases up to 7.0% for drilled corn over hill planted corn. Kiesselbach et al. (4) found no significant yield differences between drilled and check-planted corn at a rate of three plants per hill. In tests where plants per hill ranged from 1 to 5, best results were obtained at the 3 plants per hill level.

Lang et al. (7) concluded that population level was a more important factor in determining barrenness than were hybrids or nitrogen levels. Kiesselbach et al. (4) have also shown an increase in barren stalks with increases in planting rate.

Lang et al. (7) and Kohnke and Miles (5) found a 1-day silking delay for each 3,500 to 4,000 kernels planted per acre. Drilled corn silked from one to several days earlier than hill planted corn.

Bryan et al. (1) reported no significant changes in weight per bushel or shelling percentage due to different spacing patterns.

Materials and Methods

The data reported herein were obtained from a split-split-plot experiment that was conducted in 1959 and repeated in 1960 at the Agronomy Farm, Ames, Iowa. Main plots consisted of 3 population levels, subplots contained 3 spacing patterns, and sub-subplots consisted of 6 single-cross hybrids.

All plots were over-planted and later thinned to give plant populations equivalent to 16,000, 20,000, and 24,000 plants per acre. These populations will be referred to as P1, P2, and P3. Three spacing patterns (S1, S2, and S3) were arranged at each population level. After thinning, S1, S2, and S3 had 1, 2, and 4 plants per hill, respectively. In rows, hill spacings were approximately 10, 20, and 40 inches for P1; 8, 16, and 32 inches for P2; and 6.5, 13, and 26 inches for P3.

The 6 hybrids consisted of 4 inbreds, WP9, B14, M14, and CI03, in all single-cross combinations. Previous studies with these lines indicated that their relative performances did not remain the same as stand density increased.

The smallest plot unit consisted of 2 rows spaced 40 inches apart. Because of the different within-row spacings, plot lengths could not be uniformly maintained. In 1959 the average plot length was 26 feet and in 1960 it was 20 feet. These differences were recognized in the yield determinations. Two border rows separated adjacent plots having different populations. The plots were replicated four times each year. Just prior to silking in 1960 a severe windstorm caused considerable stalk breakage in 2 replicates. The data reported in this paper were taken from 4 replicates in 1959 and 2 in 1960.

Planting and harvesting dates were May 12 and October 21 in 1959 and May 31 and October 30 in 1960. In 1959, 400 pounds of 4-7-7 and 200 pounds of 33.5-0-0 fertilizer per acre were broadcast and disked in prior to seeding, and 200 pounds of 33.5-0-0 per acre were applied as a side-dressing treatment on July 6. In 1960, 400 pounds of 16-9-0, 80 pounds of 0-0-50, and 200 pounds of 33.5-0-0 were broadcast and disked in prior to seeding.

The plots were checked daily during the pollination period and the date recorded when 50% of the plants in a plot were shedding pollen. The same was done for silking.

Studies of seed sizing characteristics were included in the experiment in 1960. A small quantity of seed from each plot was passed over a scalping screen to remove chaffy kernels and foreign material. A 500-gram sample was separated into 8 fractions by passing it through the following screen sizes: 24/64, 15 × 3/16, 22/64, 14 × 1/4, 20/64, 13 × 7/32, and 18/64. Seed too large to pass through the 24/64 sieve or so small that it passed through the 18/64 was discarded. The remaining fractions in the order removed from the screens were: large round, large flat, medium round, medium flat, small round, and small flat.

To facilitate the statistical analysis of the data on seed sizes, a coding system devised by Ramirez was used. Two numerical values designated as "sample value" and "total value" were established. Each kernel size was assigned a relative value based on the actual dollar value. The relative amount of each size was calculated from the weight of each in a 500-gram sample. The "sample value" for each plot was obtained by summation of the cross products of the relative value and relative amount for each size as follows: