Caryopsis Development in Several Grain Sorghum Varieties and Hybrids

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THE relationships between moisture content, stage of maturity, seed size, and number of days after blooming are very important to those working with crop seeds. Unfortunately these relationships are not well defined and usually vary with both environmental conditions and genetic differences within the crop. The purpose of this paper is to present data on caryopsis development in several grain sorghum varieties and hybrids during 1958 and 1959.

LITERATURE REVIEW

Aldrich (1), Andrews (2), Dessureaux et al. (4), Shaw and Thom (13), and Hallauer and Russell (6) defined maturity in corn as the point or time at which the grain reaches its maximum dry weight. The studies by Brown and Garrison (3) and Shaw and Thom (13) indicated that the interval from silking to maturity in corn appears to be fairly constant; however, Dessureaux et al. (4), reported that the interval from silking to maturity ranged from 52 to 64 or more days. They also found that an inbred line of corn high in moisture content generally increased in dry matter more rapidly or for a longer period of time or both. Shaw and Thom (13) found that maximum dry weights were absolute values and as such, were dependent on ear size to a greater extent than a percentage or ratio. They proposed a ratio of dry weight of sample to total or final dry weight as a measure of maximum dry weight accumulation. Hallauer and Russell (6) estimated maturity as the time when the maximum dry weight of a 100 kernel sample was obtained.

Kersting et al. (9) found that maximum dry weight accumulation in male sterile Combine Kafir-60 sorghum occurred at 45 days after pollination with 23% moisture in 1958 and at 33 days after pollination with 30% moisture in 1959. Winkler and Atkins (14) reported that maximum dry weights in 6 strains of sorghum were reached at moisture percentage ranges of from 31-35% to 34-39%. Harlan and Pope (7) reported that maximum dry weight accumulation occurred in barley at about 40% moisture and Scott et al. (12) found that wheat also obtained its maximum dry weight at about 40% moisture. Grabe (5) reported that maximum dry weight in smooth broomgrass was reached in about 18 days after anthesis with a moisture content of about 47%.

Hesketh and Musgrave (8) showed that respiration rates in corn ears increased as temperatures increased from 10 to 40° C. and decreased as moisture content decreased from 80 to 30%. Kersting et al. (10) suggested that respiration continued in sorghum for some time after physiological maturity of the kernel had been reached. Kramer (11) stated that plant water stress sometimes causes increased rates of respiration.

EXPERIMENTAL PROCEDURE

The strains of grain sorghum used in this study were grown at the Blackland Experiment Station near Temple, Texas, in 1958 and 1959 on uniform Houston Black clay soil. The varieties Martin and Combine 7078 and hybrids RS 610 and E 56a were grown in both years. Combine Shellu (SA 394) was grown in 1958 only and the male sterile strain of combine kafir (A3197) was grown in 1959 only. Hereafter the different varieties and hybrids will be referred to as strains.

Each strain was planted in 2 blocks of 4 rows 30 feet long. Row width was 40 inches and the blocks were randomized. Planting dates were March 25 in 1958 and March 4 in 1959. Good stands were obtained and each row was thinned to a uniform stand of about 4 plants per foot of row. Although the two growing seasons were different both development and growth of grain sorghum were normal for central Texas in both years.

Approximately 100 heads of each fertile strain were tagged and numbered the second day after initiation of anthesis. At this time the florets in the upper 25 to 40% of the head had bloomed. In 1958 all heads were tagged from June 25 to June 30 and in 1959 from June 12 to June 17. The sterile strain A3197 was bagged before anthesis and the bags were removed 7 days later at 8 a.m. on June 17. Anophele pollen was present and June 17 was used as the date of blooming for the sterile strain.

Head samples were taken first at 10 or 11 days after blooming and at 1 to 3-day intervals during the sampling period. During 1958 the sampling period was from July 7 to August 6. At each sampling date, 5 heads of each strain were selected at random, harvested, placed in bags, taken to the laboratory and 200 kernels from the top portion of each head were removed. These samples were weighed immediately and placed in an oven at 70° C. to obtain total dry weight. During 1959, the sampling period was from June 25 to July 24 and the sampling procedure differed slightly from that used in 1958. At each sampling date only a few branches from the top portion of 3 heads of each strain were removed, placed in glassine bags, and taken to the laboratory where 200 kernels were removed for use in determining dry weight. All heads from which samples were taken remained in the field until 45 days after blooming, at which time each head was harvested, threshed and final dry weight of 100 kernels was determined. In addition to the dry weight of 100 kernels, the percentage of the final dry weight also was calculated for each sample.

RESULTS AND DISCUSSION

A summary of several climatic factors from 30 days before blooming through the sampling periods of 1958 and 1959 is shown in Table 1. Open pan evaporation was included to show the combined effects of temperature, relative humidity, and wind movement. The combination of low rainfall, higher temperatures, and higher evaporation rates during 1958 were less favorable for grain sorghum production than the near ideal conditions during the 1959 season. Mean grain yields of the two hybrids, RS 610 and E 56a, were about 4,200 pounds per acre in 1958 and 5,200 in 1959.

Changes in moisture percentages and dry weights of 100 kernels of the various strains during the sampling period are shown in Figures 1 and 2. Although the samples were taken at 2- to 3-day intervals in 1958 and 1- to 2-day intervals in 1959, most points on the curves are smoothed averages of 3- or 4-day periods. This procedure reduced the variation due to sampling, particularly during the last half of the sampling period.

For convenience in reporting and discussing the results obtained, the sampling periods were divided into two 13-