High Rubber Yielding Selections from a Natural Population of Guayule

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In his report on seed collections of guayule from Mexico and the Trans-Pecos Area of Texas, Powers (9) lists 434 collections which are described as non-selected samples, mass selections, and individual plant selections. Collection 65 (accession 4265) from the State of Durango is described as a mass collection “from 5 plants growing in an isolated area along the road from La Mancha to Pasaje. - - - The plants were large and of exceptionally good guayule type”.

Accession 4265 was included in two experimental plantings established by the Guayule Research Project at Salinas, Calif., in 1943. The present report deals with the performance of this accession as compared with that of commercial variety 593 in these plantings and presents data to show that accession 4265 may be classified into three predominant types, two of which are of promising commercial value.

Variety 593 developed by Dr. W. B. McCallum for the Intercontinental Rubber Company is the strain of guayule most widely grown commercially, owing largely to its high rubber content. From a test of seven commercial varieties at Salinas, Calif., Federer (3) obtained results which showed that for 1-year old plants variety 593 had a significantly higher percentage of rubber per plant on a dry weight basis than any of the others and that it ranked as one of the two highest in total yield of rubber per acre. Subsequent data on the same seven varieties tested at Salinas, Calif., Phoenix, Ariz., Anthony, N. M., and Edinburg, Texas, showed that for 2-year old plants as an average of all four locations variety 593 was significantly higher than any of the others both in percentage of rubber per plant and total yield of rubber per acre.

Materials and Methods

The first experimental planting from which data were obtained on accession 4265 and variety 593 featured eight replicates having 12 plants per plot for each of 49 entries. The entries consisted of nonselected collections, mass selections, and individual plant selections together with four commercial varieties. The second experimental planting featured 20 replicates having 24 plants per plot for each of 25 entries. These entries consisted of 21 mass selections together with the same four commercial varieties. The experiments were established in the field in February and March 1943 from plants reared in the greenhouse.

The time of first bloom was determined on an individual plant basis in the first experiment only. This was based on the number of days from April 1 until the first blossoms opened. Measurements of plant height and plant spread were taken on the first 10 replicates in the second experiment and on all of the first experiment in February and March 1944. Rubber and resin content (percentage of rubber and percentage of resin on a dry weight basis) was determined for 2-year old single-branch samples harvested from each plot from samples harvested in January 1945. Similar determinations were made for 3-year old plants of accession 4265 in the second experiment in January 1946. The rubber determinations for variety 593 were obtained on a dry weight basis from a composite sample consisting of samples from each of the 24 plants in the plot. The rubber samples as compared with whole plant samples yield of rubber has been discussed by Federer (3). “Reliable estimates of the relative yield of rubber strains can be obtained from plant spread and height measurements and rubber content of the branch samples.”

Variety 593 and accession 4265 in both experiments were classified for morphological types. In the case of variety 593 the plants were identified as follows: Variety 593, leaf shape and color were designated as 4265-I, 4265-II, and 4265-III. Two plants of a fourth type, 4265-IV, occurred in the first experiment and a total of 15 plants of a type described by Powers (9) as “intermediate” were found in both plantings. These “intermediate” plants, as well as the aberrant types described by Rollins (12, 13), have resulted from hybridization between guayule and mariola (Parthenium incanum B.)

In determining the least difference required between the means of accession 4265 and commercial varieties the data were reduced by the analysis of variance between the plot means, the between-plot variances for accession 4265 and variety 593 in both experiments being tested for homogeneity by the use of Bartlett’s test (14). In those cases (spread 1944, spread 1946, rubber content 1945, and resin content 1945) where the between-plot variances were found to be nonhomogeneous, the least differences required for significance were calculated from the separate between-plot variances for accession 4265 and variety 593. In the analysis of variance using the separation of components shown in Table 3. In those cases (time of first bloom 1945, rubber content 1946) where the within-plot variances were found to be nonhomogeneous, the least differences required for significance were calculated from the separate within-plot variances for accession 4265 and variety 593.

The within-plot variances for accession 4265 and commercial varieties were used as measures of their variability. The differences between these variances was tested by the use of the F-test in which F was calculated as the ratio of the between-plot to the within-plot variance. The within-plot variances were found to be nonhomogeneous in all cases and the least differences required for significance were calculated from the separate within-plot variances for accession 4265 and variety 593.