Intraplant and Interplant Variation of Grain Protein Content in the Parents and the 
F1 of a Cross of Triticum aestivum L.1

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HIGH variability in wheat grain protein among plants of genetically similar material has been found by several researchers (1, 2, 4). Levi and Anderson (5) and McNeal and Davis (6) studied intraplant variation of protein and found wide differences in grain protein contents of heads, spikelets, and kernels. Gericke (3) reported that differences between two heads of the same plant were related to differences in flowering date.

Data presented in this paper are from a study of intraplant and interplant variation of grain protein in three wheat populations. Several sampling techniques were compared in an attempt to devise a method for reducing the magnitude of environmentally induced variation. Five additional plant and seed characters were studied to determine whether there might be associations of some of these characters with wheat grain protein.

MATERIALS AND METHODS

Wichita (C.I. 11952), a hard red winter wheat variety, Atlas 66 (C.I. 12561), a soft red winter wheat variety, and the F1 of a cross of these 2 varieties were used in the study. Atlas 66 produces grain with high protein content, whereas the grain of Wichita is generally low in protein. Each of the parental stocks originated from a single plant in which the heads were bagged to insure self-pollination.

The plants evaluated in the study were grown in a greenhouse soil bed. The seed was planted on November 14, 1959. A randomized complete block design with four replicates was used. Each replicate included 1 row, containing 22 or 23 plants, of each variety and the F1. Four plants nearest the end of each row were discarded at harvest time. In addition, Fa progeny and backcross progeny of the F1 to each parent were included in each replicate; however, data for the segregating material are not presented in this paper. Rows were spaced one foot apart. Spacing of plants within a row was three inches.

Following an 8-week vernalization period, the temperature was raised to 70° F. in 5° increments over a 4-week period. Eighteen 200-watt incandescent bulbs spaced evenly above the soil bed were used to supplement natural light. The effective photoperiod was increased gradually so as to approximate field conditions. Optimum soil moisture conditions were maintained with the application of approximately 11 inches of water by flood irrigation. Nitrogen at 120 pounds per acre was applied in the form of ammonium nitrate—applications of 40 pounds each being made at the commencement of the growing season, 2 weeks prior to flowering, and at flowering time.

Flowering occurred during the last week of April and the first week of May. During this time, individual plants were checked each day. When a head began to shed pollen, it was tagged to indicate its flowering date. At harvest time, single plants were pulled and individual heads were threshed and weighed separately. The height of a plant was determined by measuring its tallest tiller.

A Udy Analyzer7) in the Nebraska Experiment Station Wheat Quality Laboratory was used for protein analyses. Each head was analyzed individually. Also, several heads were divided into 3 equal portions, i.e., lower one-third, center one-third, and upper one-third. A protein analysis was made on the grain from each portion. All protein data are reported on an oven-dry basis.

RESULTS

The results of the protein analyses made on portions of heads are shown in Table 1. In each population studied,