Climatology of Soil Water

By John Enz

In cooperation with Dr. John Enz, Department of Soil Science, NDSU, under project ND 2520, a long term study was initiated in August 1985 to determine the climatology of soil water on continuous spring wheat. The study is being conducted at the Carrington, Dickinson, Hettinger, Langdon, Minot, Streeter, and Williston Branch Experiment Stations and at the Fargo Station. A second objective was to develop a fall soil water recharge model.

Water content of 8 layers to a 48 inch depth was measured at 3 sites on biweekly intervals from spring thaw until fall freezeup in 1988 by station personnel. Precipitation was measured nearby. The soils were sampled in 1986 to determine bulk density, particle size, field capacity, and wilting point, which are used in the calculation of available soil water.

Soil water recharge during 1985, 1986, and 1987, was assessed for each station by analyzing precipitation variables and the change in total soil water at various depths (see Paul Brenk's M.S. thesis). Precipitation variables used were cumulative between sampling, cumulative but scaled, limited in quantity, and weighted by time before sampling. In general, cumulative precipitation was the better prediction variable, but all variables were useful. Differences between them depend on the characteristics of precipitation, especially the number of events.

Unfortunately, much of the data are from very wet periods when little recharge is evident. Fall recharge models were developed for Carrington, Dickinson, Minot, and Streeter, but more data are needed to improve the correlations. It is important to note that none of the variables work well when time between samplings is greater than about 14 days. In addition, they do not work well during the grand consumption stage of soil water in June and July.

Due to lack of time and personnel, analysis of the 1988 data has just begun. These data will be most interesting because of the 1988 drought. The project's future is bright because of the continued cooperation of Branch Experiment Station personnel. Given the wide range of conditions during the past four years this will be a very important long term data set.

Figure 1. Total soil water per sampling period, 1986.

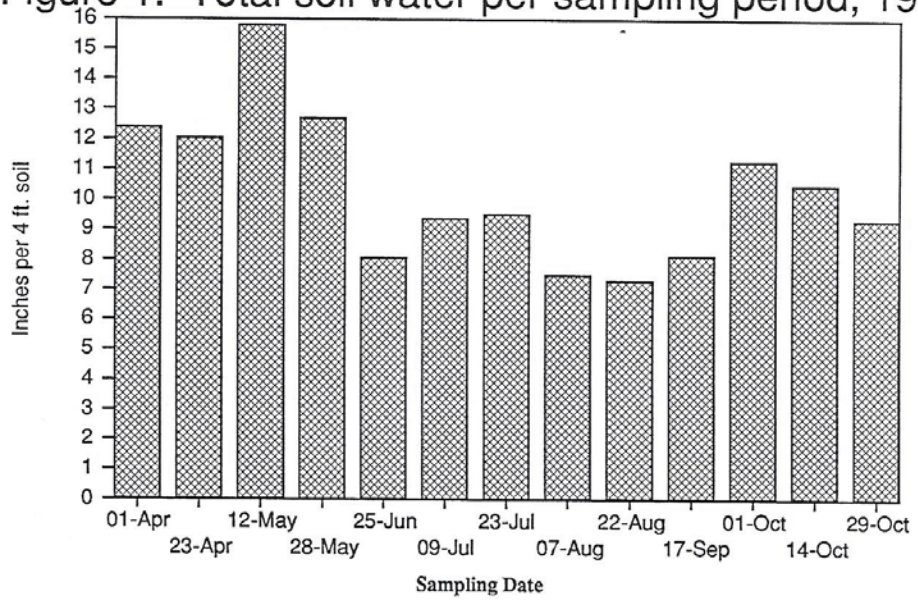

Figure 2. Total precipitation per sampling period, 1986.

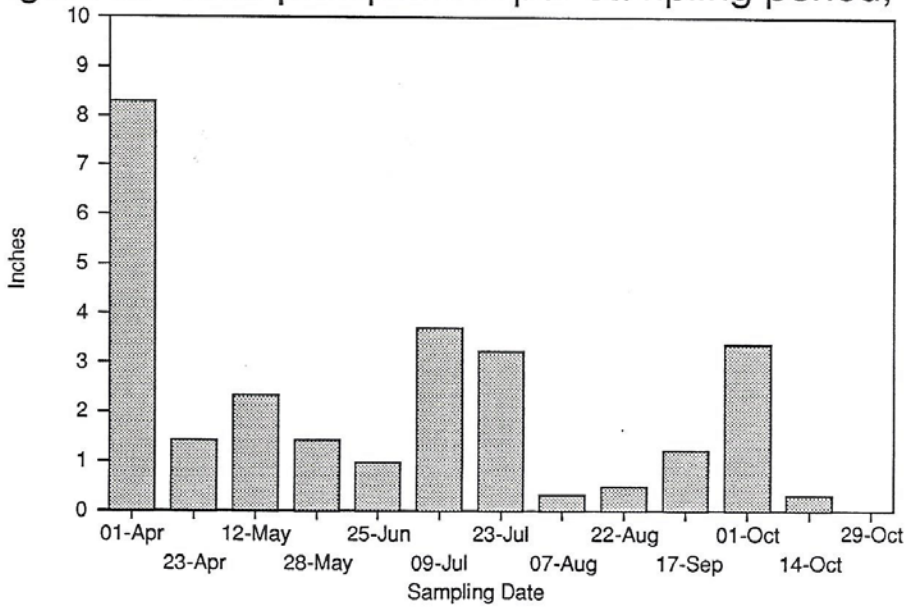

Figure 3. Total soil water per sampling period, 1987.

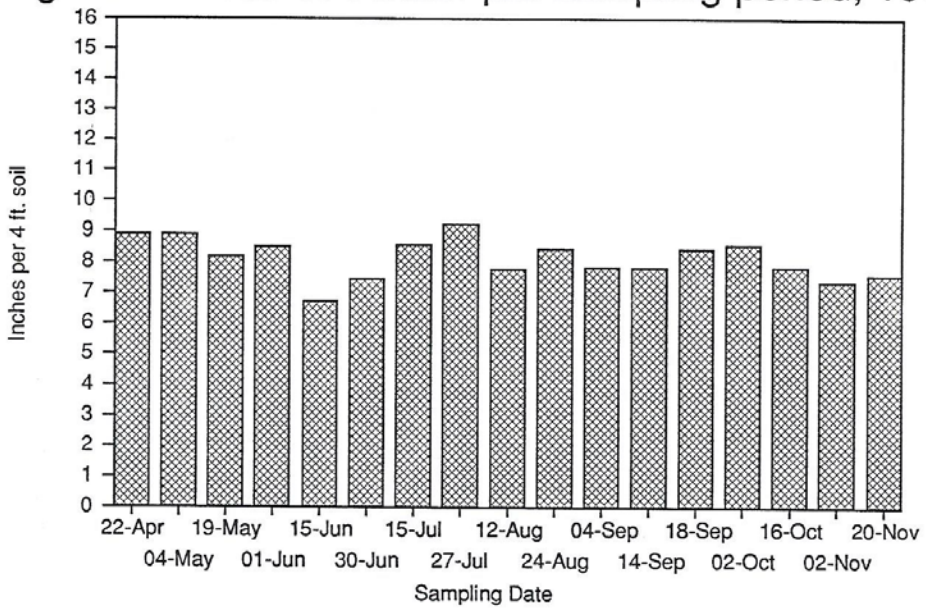

Figure 4. Total precipitation per sampling period, 1987.

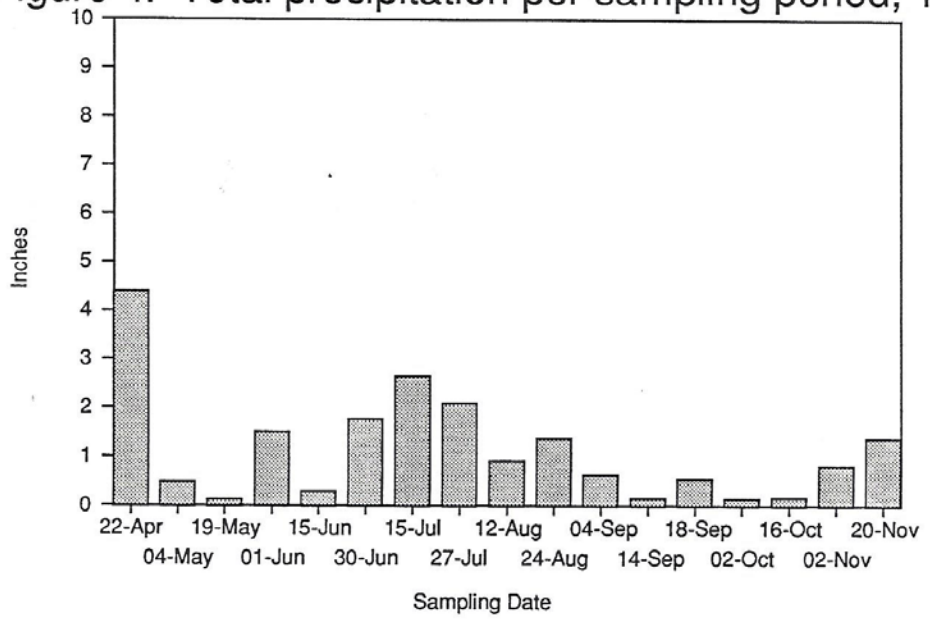

Figure 5. Total soil water per sampling period, 1988.

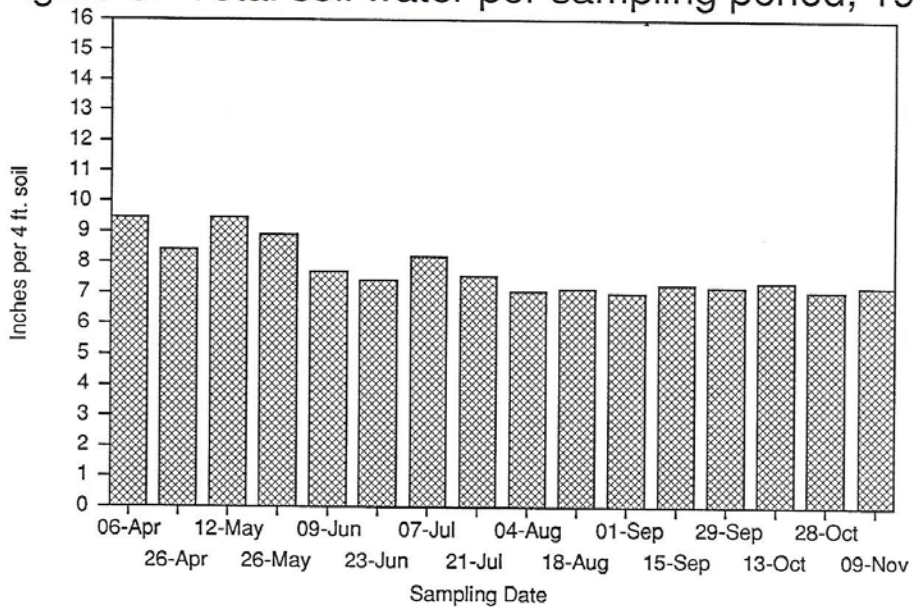

Figure 6. Total precipitation per sampling period, 1988.