Estimating Crop Yields at Seeding Time in the Great Plains

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INFORMATION at seeding time regarding prospective crop yields would be of major significance to farmers in the subhumid area of the Great Plains. Crop yield variation within the entire Northern Great Plains is much greater than for other areas due to the fact that average precipitation is at the margin of enough to produce profitable yields. In years of below average precipitation there is a marked deficiency in the amount needed, and in the driest years this deficiency results in complete crop failure. The recent years of high precipitation should not be considered as an indication that there has been any major change in the long time weather pattern for this area. Normal precipitation for South Dakota is 19.10 inches. Average for the 10-year period 1929 to 1938 was 16.19 inches, and for the 10 years 1939 to 1948 20.00 inches. The argument that dry years are a thing of the past and will not come again can be motivated only by wishful thinking. Dry years have occurred periodically over the entire period for which data are available, and we should expect their return.

To the extent that we can define the risk in crop production, farmers can prepare for such contingency through adjustment of their farming program to comply with weather conditions or possibly through a crop insurance program and so reduce the uncertainties in farm production that have been particularly troublesome to farmers within this subhumid area.

Amount of precipitation received appears to be one of the major factors and possibly the most significant limiting factor for which we have factual data affecting crop production within this area of limited rainfall. The study as presented includes only South Dakota data. South Dakota, as a result of its central location in the Great Plains, may well be considered to represent conditions for the entire area. Certainly many conditions in this state are typical of the entire Great Plains.

The Division of Dry Land Agriculture of the Bureau of Plant Industry of the U.S.D.A. found the quantity of water used in the production of wheat and corn within the semiarid regions to be governed by the amount stored in the soil at the beginning of the growing period. Other publications indicate that within the areas of deficient rainfall the moisture in the soil at seeding time makes a significant contribution to crop production.

In some of these studies soil moisture is determined through tests of individual fields. Other investigations of amounts of precipitation on the crop year basis, are referred to as preseasonal precipitation. Precipitation for the month of August is not used in this study because small grains are harvested during July. Then, too, August precipitation promotes fall vegetation growth and due to the high temperatures during August a percent of precipitation received during that month is lost by evaporation. August precipitation does not appear to make a significant contribution to the following year's crop.

This study develops a method of evaluating soil moisture at seeding time as a separate independent variable from precipitation records that may be used to indicate the availability of moisture at the time of planting. As will be emphasized in the analysis, preseasonal precipitation as an indicator of the amount of precipitation that may be expected during the growing season and seeding time in the area under consideration, is an indication of the available moisture at the time of planting. As will be emphasized in the analysis, preseasonal precipitation as an indicator of the available moisture at the time of planting is as significant as is shown in the following tables. The method to be successful should be restricted to those areas where the amount of seasonal precipitation as an average year is definitely a limiting factor in crop production.

More detailed analysis by types of soil within the area would add to the value of the study, but by soil type are too limited to do so at present. In case a crop insurance program was attempted in this analysis, it would be desirable to restrict the areas. Precipitation data, to be representative of an area, must be secured from three or more locations within that area to eliminate the effect of local storms at the point of location of the station; unfortunately in South Dakota more than one big county within South Dakota with more than one weather bureau station. With data available at present, the following analysis seems to be about as far as we can go.

The following analysis covers data for spring wheat, oats, and barley for 25 years from 1923 to 1948. The Weather Bureau and Crop Reporting Service records were used throughout the study. Precipitation data for each year were obtained from records of the Weather Bureau for each of the weather bureau stations within the areas of study.

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