A Uniformity Trial on Unirrigated Barley of Ten Years' Duration

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The theory and practice of field trials have grown tremendously during the last few years. To indicate just what assumptions should be made by mathematical statisticians to deal with yield trials under widely different crop and environmental situations requires extensive uniformity trials. The present study was designed to give information on the natural soil variation, as measured by crop response, over an apparently uniform plot of ground in different seasons.

UNIFORMITY TRIAL WITH UNIRRIGATED BARLEY

A barley uniformity trial was carried out on Field 2A of the University Farm, Davis, Calif., for 12 years, 1924–1935. However, in 1927 no crop was planted and the rainfall for the winter of 1930–31 was so low that there was not sufficient soil moisture present to produce a grain crop.

Field 2A had been planted to alfalfa for a number of years prior to the selection of the field by the Division of Irrigation as a site for irrigation experiments. In the fall of 1922 the field was leveled and divided into 57 tenth-acre (approximately) plots as shown in figure 1. Dwarf milo was planted in 1923 and the crop irrigated three times. The grain yield was very high, averaging about 3 tons per acre, but varied remarkably from plot-to-plot. Diagonally across the northern end of the field was an area that yielded low in some years. Inspection by soil sampling showed this area to be an old water course. Gravel was encountered at about 4 feet below the ground surface.

The variability in yields of milo emphasized the need to study the differences in crop producing ability of the soil under uniform cultural conditions and without irrigation, since irrigation can not be done perfectly uniformly. Professor B. A. Madson, of the Division of Agronomy, University of California, Davis, recommended barley as a plant to be grown without irrigation.

Table 1 gives the seasonal yields, expressed as pounds per acre of barley, for each plot. The manner in which yields are expressed indicates an accuracy that probably did not exist. However, the measurement of the area in each plot and the determining of the yields were done carefully. The accuracy of the results compares favorably with those in usual plot experimentation. Similarities are so great and the plots so large it seems that much of the observed variation is due to variation in producibility and not to harvesting errors, planting errors, and so on. It should be pointed out that there is a correlation between total seasonal rainfall and yields. The variability of the experiment is indicated in table 2. In general the land was disked for the next crop, although occasionally plowing was resorted to. After harvest the stubble was burned, then in the fall the land was disked or plowed. It seems to be no relation between yields and method of seedbed preparation.

DISCUSSION

If we measure the plot yields from the area, in terms of the annual standard deviation, the distributions are very similar from year-to-year, being normal although somewhat skewed.

The standard deviations varied greatly from one year to another without a very definite connection with the yield as indicated in table 3. The correlation coefficient is 0.52 with the lower confidence limit —0.21 at the 5% level. The data do not indicate that no correlation between mean yield and standard deviation exists. The relationship is not pronounced for these data.

The yields and standard deviations of the plots vary greatly from year-to-year and the possibility of retaining the same relative position or rank of the plots is remote. It was found that the average rank differs, on the average, from the rank of the average for the plot. These differences are large displacements in rank of yield occurrence. Certain poor and good areas are indicated clearly in some cases and not consistently from plot to plot.

It may be that the plots with smaller differences are less variable in yield from year-to-year and that the figure 2 the standard deviation of yearly yield is related with average yield of the plot. The regression is highly significant. The correlation coefficient is highly significant.

In agricultural field trials it is sometimes recommended (2, p. 215) that a uniformity trial be run for one or more years before the trials are started.

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