BARLEY PRODUCTION

Under Different Nitrogen And Moisture Levels

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In a desert Arizona soil, barley yields may be increased by increasing one or more yield components (plants per acre, tillering or heads per plant, seeds per head, and weight per seed). Plants per acre and weight per seed weren't affected much, but heads per plant and seeds per head were almost doubled by nitrogen (N) fertilization.

Much of this was accomplished with the first 60 pounds per acre applied. Most of the resulting yield increase was from 120 pounds of nitrogen, although a maximum of 240 pounds of nitrogen per acre were applied. (Figure 1) Nitrogen application itself increased barley yields about sixfold above no nitrogen application.

The "wetter" moisture level, actually irrigated oftener than a farmer customarily does, increased yields only about one-third (36%) above the "drier" moisture level, slightly less than farmers' customary irrigation schedules. However, when adequate nitrogen fertilizer and the "wetter" moisture level were both applied together, barley yields increased almost eighteenfold, showing the value of wisely managing fertilization and irrigation together.

This is a joint contribution from the Southwest Branch, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, and the College of Agriculture, University of Arizona. The co-authors are Research Soil Scientist and Professor, Agricultural Chemistry and Soils, University of Arizona; and Physical Science Aid (deceased), USDA, respectively.

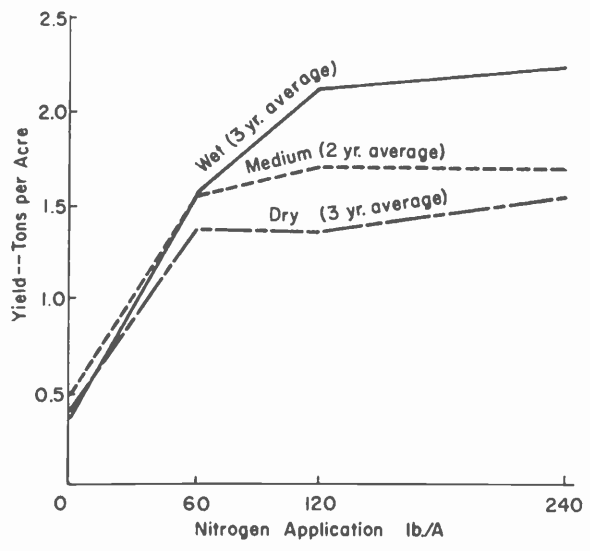

FIGURE 1 — Yield of barley grain for the dry, medium and wet irrigation treatments as affected by the rate of supplemental nitrogen application.

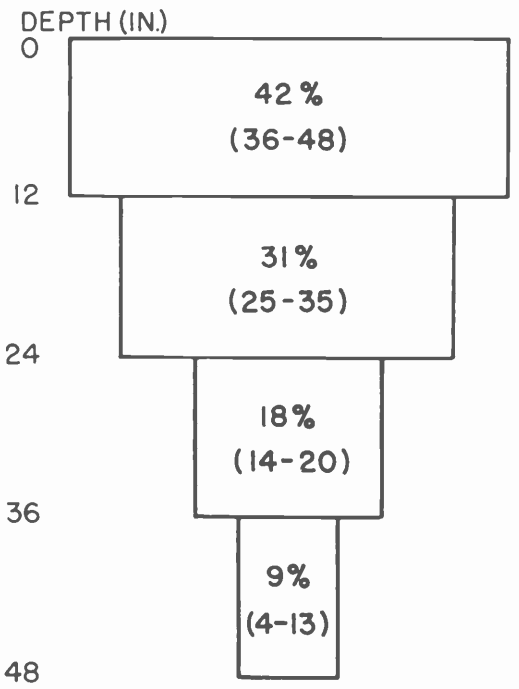

FIGURE 2 — Zone of moisture extraction by barley roots from the surface four feet of Superstition soil. Values for different moisture (irrigation) levels, nitrogen sources, years and varieties were averaged. Values given on chart are mean and extremes of the percentage of total moisture obtained from each vertical quarter of the rooting zone.

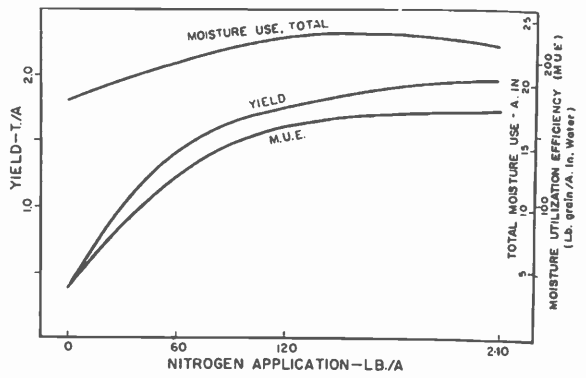

FIGURE 3 — Barley grain yield, moisture use and M. U. E. as affected by the rate of supplemental nitrogen application.

Where Do Roots Feed?

During the three-year barley study, several thousand soil samples were obtained to reveal where barley roots actually obtained moisture needed. Formerly D. R. Shockley found that if a plant's rooting depth was divided into quarters, the plant obtained 40, 30, 20, and 10 percent of its needs from the surface quarter, second quarter, third quarter, and bottom quarter, respectively.

We determined in an open Superstition fine sand that barley obtained nearly all of its water from the surface four feet of soil. After each irrigation the wet soil was sampled by 12-inch depths to 48 inches, to see how much moisture was held by the soil. Then, just before the following irrigation, the soil was again sampled to learn how much had been used. Shockley's claims were supported by our work as shown in Figure 2.

Moisture utilization efficiency (M.U.E. — pounds of grain per acre inch of water) was highest for the limited water application, "dry." However, this resulted in reduced grain yields. Except for limited water applications, however, cultural treatments increasing barley yields increased M.U.E. proportionally.

Use Water Efficiently

Barley producing less than 500 pounds per acre required almost as much moisture for evapotranspiration as that producing 4,000 pounds per acre. This favors good cultural treatments, resulting in high yields for efficient water use. The relationship between moisture, yield, and M.U.E. may be seen in Figure 3.