

# Nitrogen on California Cotton

proper fertilization contributes to good return  
per dollar invested in San Joaquin Valley farms

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**Nitrogen** is the most important single fertilizer element in the economic production of cotton in California.

For economically sound fertilizer practices, a dollars-and-cents evaluation of the benefits of fertilization is essential because the native fertility and response to nitrogen vary widely among soils.

Fertilizer trials conducted in areas of continuous cotton production—and a study of the organization and operation of 43 cotton farms—in the San Joaquin Valley provided production practice and cost data on nitrogen fertilization.

Acala 4-42 cotton was grown in all these tests, and the fertilizer was side-dressed while the plants were in the two-leaf stage. The tests were arranged in a randomized block design, and each four-row treatment was replicated at least five times. Yields of seed cotton were obtained by mechanical harvester.

A large number of soil series are found in the San Joaquin Valley, but the important cotton-producing soils are largely alluvial in origin, calcareous in nature, and usually well supplied with the fertilizer elements, excepting nitrogen.

In this article, similar soils with common major characteristics and soil-forming materials are designated as series-groups. Four soil series-groups—characteristic of some major cotton-producing soils—illustrate the response of cotton to nitrogen fertilization. They are the Cajon series-group of Red Desert alluvial soils, the Panoche series-group of Gray Desert alluvial soils, the Metz series-group of Calcic Brown alluvial soils, and the Foster series-group of Wiesenboden soils.

Rates of nitrogen fertilization are available for some specific cotton soils, with these four series-groups being typical. The nature of their response to nitrogen determines how much nitrogen to apply. In principle, nitrogen should be applied to the point where any additional amount would produce a return below the cost of the fertilizer and its application. It is difficult for the individual cotton producer to control within narrow limits the amount of fertilizer that he applies, yet he can approximate the most economic rate of application when he knows this rate.

The Foster series-group—typical of

soils in the northern and central cotton area of the San Joaquin Valley—reach their economic limit of nitrogen application after a relatively small amount of nitrogen has been applied. For example, when seed cotton has a value of 12¢ a pound and nitrogen can be obtained for 15¢ a pound, it pays to apply approximately 40 pounds of nitrogen per acre. If the application is increased to 50 pounds, the return falls below the cost, indicating that the last 10-pound addition does not pay its way. If the value of seed cotton is only 6¢ a pound, then the economic rate of nitrogen application to cotton on this soil type is reduced to less than 30 pounds.

The Cajon series-group—typical of the soils in the south central cotton-producing area of the San Joaquin Valley—gives a greater response to nitrogen. Nearly three times as much nitrogen can be economically applied on soils of this group as on the Foster series-group for any typical cost of nitrogen and seed cotton value. When it takes 1.25 pounds of seed cotton to buy one pound of nitrogen, it pays to apply nearly 120 pounds of nitrogen on the Cajon soil-series group. At that rate, the added cost of 17¢ a pound for nitrogen and harvest costs is offset by the added return.

Typical of the western San Joaquin Valley cotton-producing area is the Panoche series-group. These soils have a relatively high natural productivity and have given excellent response to nitrogen. Both the Panoche series-group and the Metz series-group—which is found in the southern end of the valley—have demonstrated net returns over costs to nitrogen applied at the 150-pound level. This is true for both present and recent historical cost-price relationships. For applications beyond 150 pounds, limited data indicate that the rate of increase in yields declines rapidly as further nitrogen is added.

At the 150-pound level of nitrogen application on the Panoche series-group, for each added pound of nitrogen at a cost of approximately 19¢, the added return in seed cotton is about 50¢.

On soils of the Metz series-group tested, the added cost per pound resulting from the nitrogen application at the

150-pound rate was 22¢, and the return was 76¢.

The importance of these variations in physical response and economic returns to nitrogen fertilization is even more evident when compared in terms of net returns per acre. Soils with low native fertility, such as the Foster and Metz series-groups, exhibit relatively low net returns as would be expected when not fertilized. Soils which show relatively high nitrogen response yield high net returns per acre over the entire range of nitrogen application—Panoche and Metz series-groups. Net returns per acre on the Cajon series-group, where response is slightly above 100 pounds, indicate that costs increase more than returns as nitrogen application approaches 150 pounds. Net returns reach their maximum level very soon on the Foster series-group, where the nitrogen response is limited.

These data are particularly significant in the light of acreage restrictions on cotton in 1954. Historically, a farmer faced with acreage restrictions has planted his allotment on his best land and has attempted to farm this allotment to the best of his ability.

The result of acreage restriction on cotton in 1950 was further evidence of this fact. The average yield of lint per acre in California in that year was 805 pounds, in comparison with the 10-year average of 606 pounds from 1941 to 1950 and the 1951 production of 640 pounds.

The areas in California that suffered the largest cuts in cotton acreage as a result of 1954 allotments are those where soils are largely of the Panoche and Metz series-groups. It is also in these areas that economically feasible alternatives to cotton are most limited. Fortunately, these soils not only produce excellent yields but also bring high returns to added nitrogen fertilizer. This will help to offset in part the reduced income these producers are likely to experience this year.

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