

Goleta tests probe

Effects on Lemon Production

by accumulated soil nitrogen

Nitrogen is a necessary element in the production of fruit but there is considerable confusion as to the most economical amounts to use and the most satisfactory timing of the applications.

A survey conducted in 1954 revealed that the amounts of nitrogen applied annually by growers ranged from one pound to six or more pounds of actual nitrogen per tree. Timing of the applications varied from a single application in the fall to small amounts applied with each irrigation.

A wide range in practices is justified, in part, by differences in irrigation practices, climatic conditions and soil texture found in the citrus growing areas of California. Simple and readily available means of determining the nitrogen needs of a particular grove are often not available and the grower is forced to accept some generally recommended schedule of nitrogen application. All too often, it is assumed that a decline in production or general appearance of the trees may be corrected by applying more nitrogen fertilizer when in fact the trees may be receiving an adequate or even excessive amount of this element.

Under favorable conditions a reserve of nitrogen can accumulate in the soil from excessive applications in preceding years. Such a condition apparently existed in a lemon grove near Goleta, which was selected for an experiment with three levels of nitrogen fertilization, two fertilizer timing schedules, and two sources of nitrogen. In these plots, the reserve nitrogen was apparently at or above optimum required to maintain production without further applications of nitrogen fertilizer during the succeeding six years of the experiment. The soil was classified as Sorrento loam and the orchard was cultivated, winter cover cropped, and furrow irrigated. The trees were an old-line Eureka bud, on rough lemon rootstock; symptoms of lemon tree decline were showing toward the end of the experiment. Also, the orchard had been replanted on old citrus soil,

without treatment; other blocks on this same ranch and soil type have shown marked benefits from replant soil fumigation.

The trees were planted in 1946 and had received nitrogen fertilizer as a normal ranch practice, until the fall of 1953. In May 1954, the average total nitrogen content of the soil in this experimental block was 1320 ppm—parts per million. The average nitrate nitrogen content of the soil was about 13 ppm, and the nitrogen content of leaf tissue was about 2.5% on a dry weight basis at the beginning of the experiment.

Annual applications of nitrogen to the fertilizer plots at rates of 1.5 and 3.0 pounds per tree did not significantly affect production of lemons when compared to trees which received no additional nitrogen fertilizer during the six years of the experiment. There was some indication that the heaviest applications of nitrogen—3.0 pounds per tree per year—may have reduced lemon production slightly but the differences were not statistically significant.

The nitrogen content of leaf tissue from the plots which received very little or no nitrogen during the experiment tended to decrease slightly while the nitrogen content of leaf tissue from the plots which received the heaviest applications remained relatively constant. Heavy fertilization resulted in a pronounced increase in nitrate nitrogen in the soil, but this did not cause a comparable increase of nitrogen in leaf tissue. Apparently the available nitrogen content of the soil in the experiment block was above that required for optimum performance and the lemon trees did not respond to luxury amounts of nitrogen.

The winter cover crop of vetch and weeds—principally malva—may have been a factor in maintaining high available nitrogen in this soil during four of the six years that fertilizers were withheld from the check plots. A cover crop was not grown in this experimental block in the winters of 1957–58 and 1958–59.

Under ideal conditions, a heavy crop of vetch has been reported to add as much as 180 pounds of nitrogen per acre to the soil each year. Thus, up to about one and one half pounds of nitrogen per tree could be added by the cover crop depending on the tonnage of vetch grown.

Small amounts of nitrogen may also have been picked up from cultivation and tail water, but this was considered insignificant since guard trees were used, and a check on the irrigation water showed no nitrogen content. Considerable variation in tree size, vigor, and productiveness existed, which led to the discontinuance of the trial. It is possible that for trees of this limited vigor adequate nitrogen was stored in the soil for many years. Another orchard of a vigorous new-line parentage without nematodes and fungi, might have responded quite differently. At no time did the average leaf nitrogen of the trees go below 2.2%, and during most of the experiment, it was around 2.4%. These leaf nitrogen levels suggest that optimum levels for lemons fall below 2.4%.

There was no particular advantage in applying nitrogen with each of the four irrigations compared with a comparable amount of nitrogen split into two applications—one in June and one with the last irrigation in the fall.

The results of the experiment at Goleta cannot be applied generally in all areas. In warmer regions with coarse textured soils, the amount of irrigation water applied would greatly exceed that applied in the three or four irrigations necessary at Goleta. Leaching of nitrates from the soil under these conditions might reduce soil nitrates more rapidly than was the case in the Goleta tests. However, the Goleta tests do indicate that excessive applications of nitrogen apparently are not beneficial and could be detrimental.

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