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FERTILIZER, IRRIGATION STUDIES ON AVOCADOS AND LIMES ON THE ROCKDALE SOILS OF THE HOMESTEAD AREA

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For the past two years, investigations covering rates of application and irrigation cycle have been in progress along with investigations as to type of nitrogen material and level for best production. The summary to date of these studies will be presented separately.

IRRIGATION CYCLE AND RATE OF APPLICATION

For many years there has been a great deal of discussion and variation of irrigation practices in this area. Some applied as much as two inches per application; some applied as frequently as once a week; while others applied about every two weeks and still others were of the opinion that irrigation was of no benefit. Some few who had used irrigation, have discontinued, the opinion being that it did not increase production.

Preliminary investigations on the amounts of water the surface layer would retain showed that, on virgin rock land, the material would absorb about one-half inch of water. On scarified areas in three crops, the layer, which consists of a mixture of limestone sand, clay or sand clay, will retain about one inch of water. Water which falls as rain or is applied as irrigation in excess of one-half inch on the virgin soils and one inch for the scarified tree or cropped areas, will percolate downward. When the land has been plowed (scarified), the deeper broken mixture of rock and soil material will retain a little over an inch of water as rain or irrigation.

On one grove, on which moisture readings were made and samples collected for nitrate level, two inches of water were applied to one block of two and one-half acres and the remaining three blocks in this grove received one inch of water. Moisture readings at the end of seven days were the same for all of the blocks. Analysis of samples collected prior to and after the application of water shows that the level of nitrates on the block receiving two inches of water dropped to half of the nitrogen, while the remaining blocks showed the nitrate level to be the same as it had been prior to the applications of water. In this case, not only was the extra water wasted but half of the nitrogen was leached.

Preliminary indications from our water table moisture studies show that as rainfall decreases in amount and frequency, to maintain moisture at a level for good plant growth, water must be applied, not on a fixed schedule, but as the season progresses, on a shorter cycle.

Root systems in this area are restricted to a rather shallow layer and very few roots can penetrate the underlying rock, so if moisture is not maintained in this shallow zone, the trees suffer.

The fact that, to maintain adequate moisture, the cycle of application must be varied, seems to be at least part of the answer to the question of whether or not irrigation is beneficial.

Toward the end of 1950 one of the local growers interested in whether or not irrigation was beneficial agreed to let us use an area of his grove for an irrigation cycle study.

The test was set up as follows. Five blocks of limes of about 20 acres each was set up as follows:

Block 2*	one inch of water per week.	
4	check.	
6*	½ inch twice a week.	
8*	½ inch per week.	
10	cycle.	When moisture dropped to near the wilting point, one inch of water was applied. This was determined by making moisture readings with the Bouyoucos direct reading and resistances meter.

* When rainfall occurred during the period only the deficiency was made up by irrigation.

The grower maintained the level of fertility by making periodic soil tests and also kept all records as to production, bloom and other pertinent data and supplied all irrigation and other equipment to maintain the grove.

Block 2	1″ per week.	.266	boxes per tree.
4	check.	.252	
6	½″ twice a week.	.234	
8	½″ per week.	.224	
10	cycle.	.434	

For the year 1951 production of the limes was as follows:

Block 2	1″ per week.	.726	boxes per tree.
4	check.	.590	
6	½″ twice a week.	.958	
8	½″ per week.	.668	
10	cycle.	.612	

All yields are based on the number of trees included in each block.

In 1951, block 10, where moisture was maintained at an adequate level, production almost doubled and it seemed that the inch and both one-half inch applications had added too much moisture so that good bacterial activity did not go on.

In 1952 a good bit of difficulty was encountered in getting the water applied at the right time. Several times 2 to 4 days lapsed before water was applied and as a result it appeared that the trees had been hurt whereas being a very dry winter with heavy

winds the area which received two ½" applications had better moisture conditions than the cycle block. Whereas, the previous year, due to climatic conditions, the 1" and ½" applications kept the area too moist, while this past year, it required the addition through irrigation of approximately an inch every 5 to 7 days to maintain adequate moisture on the lime blocks.

Data to date indicates that if production on limes is to be maintained or increased, water must be applied when needed to maintain adequate moisture. On block 10, the cycle of application to maintain moisture above 22% the initial wilting point for that soil varied from 3 to 14 days.

In this same grove, three blocks of avocados were selected, each having an area of approximately 20 acres. The application of water was set up as follows:

Block 3 cycle.
5 check.
7 1″ of water every two weeks.

For the year 1951, the production on the avocado blocks was follows:

Block 3 .615 boxes per tree
5 .468
7 .557

It will be noted that production was one third more for the cycle irrigated over the check block and somewhat higher than the block which received 1" of water every two weeks.

In the year 1952, production was as follows:

Block 3 1.402 boxes per tree
5 1.048
7 .798

Because it wasn't necessary to apply the water on as close a cycle it was possible to get the water applied when needed on the avocado cycle block.

It will be noted that the application of water on a fixed cycle did not give good response. The first year, when overall climatic conditions were more favorable, block 7's production was higher, but in 1952 under more adverse conditions, the block receiving the 1" every two weeks was apparently affected adversely.

Indications from the past two years on application of water is that if precautions are not taken so that an adequate moisture level is maintained, little or no benefit from water

applied, will be derived.

NITRATE LEACHING STUDIES

The opinion in the area as when to apply, how much and what kind of fertilizer was as variable as the opinion expressed on irrigation. Some men seemed to get results with all mineral, while others questioned this and used mixtures of organic and mineral. Also the question as to what level of fertility a grove should be maintained was extremely variable.

Preliminary work was started where we attempted to cover as many of the practices as possible. A thirty acre grove was selected as the standard. This grove was maintained at a high level of productivity by using cyanamid as the main source of nitrogen. Other than this, the practices covered groves where such materials as ammonium sulfate and 30 to *50%* organic were used.

From earlier work and about a year's sampling of the grove on which cyanamid was used it was decided that if the level could be maintained at 40-60 PPM of nitrates and applying again when the level dropped to 25 PPM of N and held there, so far as N, good growth and production could be expected.

Preliminary work showed that it was very difficult to maintain the nitrogen at a good level when chemical materials were used. Most of these materials are readily available and are leached out of the surface layer very rapidly. Materials as ammonium sulfate, NuGreen, for a period of several days, can be completely leached if rains of 3 to 5 inches occur during this period. If only a light rain or rains occur during this period, most of these materials will be absorbed by the organic layer in mature groves.

Most of the materials used had a high initial release most of the time, well over 200 PPM, and a rapid decline so that there were periods of several weeks to a month where the level was extremely low whereas with materials such as cyanamid, a relatively uniform level could be maintained. Though production figures were not available it seemed that on areas where a uniform level was maintained better, more uniform production occurred.

Late in 1950, in cooperation with a local grove caretaker, studies were started on a mature grove covering irrigation and fertilizer practices. Ten blocks of trees approximately one acre each having 85 to 90 trees were used. The following is the layout of the plots.

Block 1. No irrigation, but the area will be fertilized in accordance with general practices maintained by the grower.

Block 2. By use of soluble materials, attempt will be made to maintain the nitrate level at 100 PPM or more.

Block 3. Nitrogen derived from Nitrea (P K and MgO), same as applied to the remainder of the grove, applied twice a year, in June and late December or early January.

Block 4. Nitrea, same as block 3, except NuGreen, at the rate of 5 pounds per 100 gallons, applied as a foliage spray, as buds are breaking and when the fruit is setting.

Block 5. Regular fertilizer, plus NuGreen as foliage spray, 5 pounds per 100 gallons of water every 30 days.

Block 6. Regular surface feeding until fruit is set, then sprayed every 10 to 14 days with 10 pounds of NuGreen per 100 gallons of water.

Block 7. Regular grove fertilizers, trees mulched with tobacco stems or scrap paper.

Block 8. Check, regular grove practices

Block 9. Regular fertilizer applications plus spraying at bloom with Napthalene acetic acid

Block 10. Nitrogen derived from Cyanamid otherwise P K and MgO. same as regular treatment.

Until completion of the work, only 2, 3, 4 and 10 will be summarized.

For 1951, production records were not available. By tree count the fruit for blocks 2, 3 and 4 were as follows:

Block	2	47 fruit per tree.
	3	72
	4	72

Production records were available in 1952 and were as follows:

Block	2	43 fruit per tree.
	3	58
	4	49
	10	48

As will be noted, production was lowest on block 2, on which the source of nitrogen was a readily available material. Though nitrogen fertilizers were applied five times during the year the area could not be maintained at a constant high level and fluctuated widely, while the level on block 3 and 4 remained quite constant.

Indications are that when an adequate level of nitrogen is maintained along with a good supply of other elements as P K and MgO, production is higher than where the level of N varies widely.

On non-irrigated groves our data show that during the drier part of the year, more readily available material will give better results. To get maximum benefit from organics, an adequate level of moisture must be maintained.