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NITROGEN NUTRITION OF THE AVOCADO IN SOUTH AMERICA

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Fertilizing avocado trees on the rocky soils of South Florida is an expensive operation. Due to the lack of research on the fertilizer requirements of avocado trees in this area, fertilizer programs developed for other species and other areas have been used. Although these programs have resulted in satisfactory growth and bearing [of avocados, there is reason to believe that much of the fertilizer applied was beyond the needs of the trees. A leaf analysis survey of avocado groves in Florida by Popenoe *et al.,* (1) showed that the nutritional status of the trees was equal or higher than in other avocado growing areas. The following experiment was set up to evaluate sources, and indirectly rates, of nitrogen.

A block of avocados of the Booth 7 and Lula varieties was selected for this test. The trees had been planted for a previous test and were arranged so that plots could be set up with five trees of each variety in a plot and buffer rows between plots. The trees were spaced 30 feet apart in the row and between rows. Chemical analysis of the leaves in January 1960 showed that the trees were fairly uniform as far as nutritional status was concerned. The trees were 12 years old at this time, and a good natural mulch of old leaves had developed under the trees. These treatments were applied and each was replicated four times. In other words, 20 trees received each treatment. One treatment consisted of two pounds of nitrogen per tree per year applied as ammonium sulfate. The second treatment was the same except that Uramite was used as a source. The third treatment was a check and received no nitrogen. The nitrogen was applied twice a year (late spring and late summer) at the rate of one pound per tree per application. The only other fertilizer these trees received was foliar sprays of copper, manganese and zinc. No potash, phosphate, or magnesium was applied to the trees during the test. Although the trees were disturbed considerably by the hurricane of September 1960, leaf samples were taken regularly for analysis and yield records were obtained for the 1961 and 1962 crop.

Table 1. Leaf Analyses of the Lula Variety of Avocado. (Sampled in January.)

	%N	%P	%K	%Ca
	Check (no N until 1962, then mixture)			
1960	1.89	.311	1.24	2.02
1961	1.40	.177	0.80	1.10
1962	1.00	.137	1.10	2.85
1963	1.42	.151	0.85	2.17
	NH_4SO_4			
1960	1.87	.325	1.25	1.95
1961	1.52	.186	0.74	1.04
1962	1.20	.132	0.96	2.87
1963	1.39	.122	0.82	2.79
	Uramite			
1960	1.89	.291	1.41	2.08
1961	1.54	.186	0.81	1.00
1962	1.17	.135	0.95	2.74
1963	1.43	.119	0.83	2.15

Table 2. Yield of Avocados, 1962, Average Number of Pounds Per Tree.

Variety	Treatment		
	NH_4SO_4	Uramite	Mixture
Lula	245	151	194
Booth 7	313	260	284

RESULTS

Analyses of the leaves of the Lula variety sampled in January for four years are presented in Table *1.* Only a few analyses were made of the Booth 7 variety but those obtained were similar to those for Lula and are not presented. In both treatments and check the nitrogen levels in the leaves decreased during 1960 and 1961. By early 1962 it was evident that the trees were not receiving enough nitrogen for satisfactory growth. The leaves were getting smaller and yellower and the growth flushes were short. This type of growth results in sunburning of the fruit and probably smaller crops. Consequently, an additional application of nitrogen was made during 1962, increasing the total amount of nitrogen applied to each tree to three pounds per year. Since the check trees were becoming too deficient in nitrogen to be of much value to the experiment, a mixture of uramite and ammonium sulfate with half a pound of nitrogen from each source was applied to each tree beginning in 1962. An increase in nitrogen was obtained in the leaves during 1962 and the analysis of the leaves in January 1963 showed that all of the treatments had about the same level of nitrogen in the leaves. In addition, the leaves were greener and the trees had a healthy appearance.

The yields in 1962 are presented in Table 2. The fruit was lost in 1960 due to the hurricane, and yields in 1961 were light and very erratic as a result of hurricane damage to the trees. Therefore, they are not presented here. The yields in 1962 were erratic and show little variation between treatments with the exception of a somewhat higher yield with the ammonium sulfate treatment with the Lula variety. Although this increase was significant at the five percent level, the nitrogen level in the leaves of the trees receiving the ammonium sulfate treatment was not much different from the other two treatments, so it cannot be concluded that the higher yield was a result of the nitrogen source. It is possible that there was less damage to some of these trees from the hurricane. The yield in 1962 is considered satisfactory for trees of this age.

CONCLUSIONS

The results of this experiment indicate that two pounds of nitrogen per tree per year were not sufficient to maintain an adequate level of nitrogen in mature avocado trees and obtain good growth and yields. Three pounds of nitrogen per year (207 pounds per acre) appear to be more adequate, and perhaps represent a minimum level. Further research will be needed to de' termine the optimum amount of nitrogen. The results of this work also indicate that uramite is not superior to ammonium sulfate and that probably the sources are of about equal value. From a practical standpoint, however, the ammonium sulfate is considerably cheaper than the uramite and, therefore, would be preferable. This experiment also indicates that avocado trees which are deficient in nitrogen due to having received no fertilizer for two years can be brought back to good bearing status by a regular fertilizer program. Potassium and phosphorus levels in the leaves (Table 1) decreased during the period, since the trees received neither of these elements.

Nevertheless, according to a previous survey (1), they were still at satisfactory levels and there is no indication that benefit would be obtained by applying potash or phosphate at this time.

SUMMARY

Ammonium sulfate and uramite were compared as sources of nitrogen for avocado trees. They were found to be equally effective. It was found that two pounds of nitrogen per year were insufficient to maintain adequate levels of nitrogen in the leaves and promote growth. Three pounds of nitrogen were better and perhaps represent a minimum requirement under South Florida conditions. Trees that received no nitrogen for two years were brought back into healthy condition in one year with three applications of nitrogen, using one pound per tree per application.

LITERATURE CITED

1. Popenoe, John; P. G. Orth; and R. W. Harkness. 1961. Leaf analysis survey of avocado groves in Florida. Proc. Fla. State Hort. Soc. 74: 365-367.

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