TREE FERTILIZATION TRIALS IN ILLINOIS

by Dan Neely

The application of mineral elements to soil to stimulate the growth of established trees has been a mainstay of arborists for years. Scientific studies to justify these practices are few in number. In the past 10 years some data have become available, mostly from van de Werken in Tennessee (6, 7), Smith in Ohio (4, 5), Whitcomb in Oklahoma (3, 8), and Neely and Himelick in Illinois (1, 2). Background data will probably never be adequate because of the limited funds provided for this research and the limited number of scientists involved. Thus, even small-scale research results are of value.

This 4-year project on fertilizing established trees was conducted in the Illinois Natural History Survey arboretum, 1 mile south of the University of Illinois campus, Urbana, Illinois. The soil in the arboretum is Flanagan silt loam. It is a moderately developed, grassland soil with a slope of 1-3 percent. The soil surface is dark; it has somewhat poor natural drainage and aeration and moderate profile permeability; the available water-holding capacity in the root zone is 12-16 inches; the nutrient-supplying power of P is medium and of K is high; it has a pH of 7.0.

Materials and Methods

Four tree species, each in a block of 100 trees, were selected for study. The pin oak, *Quercus palustris,* had been planted in 1969; the tulip tree, *Liriodendron tulipifera;* Norway maple, *Acer platanoides;* and honey locust, *Gleditsia triacanthos* f. *inermis,* had been planted in 1970 at 12-foot intervals.

Seventy-five trees in each block were selected for the test. A point on the trunk approximately 3 feet above the soil was permanently marked with paint and measured with a diameter tape in April, 1976. Average diameters in the spring of 1976 were pin oak, 2.4 inches; tulip tree, 3.0 inches; maple, 1.7 inches; and honey locust, 2.0 inches. An array based on tree diameters was prepared and the trees were divided into 15 groups of 5 trees with each group containing small, medium, and large trees. The treatment each group received was randomly selected.

The nutrient formulations selected for this study were high in nitrogen and low in phosphorus and potash. Three complete fertilizers, 20-4-8, 30-3-10, and 34-3-7, were compared with ammonium nitrate, 33.5-0-0. One hundred square feet of soil surrounding each tree were treated. The quantity of fertilizer each tree received was individually packaged.

Three rates of the complete fertilizers were applied based on actual nitrogen content. Nitrogen was used at 2, 4, and 6 pounds per 1000 square feet of area. Ammonium nitrate was applied only at the 6-pound rate. The measured quantity of fertiizer was broadcast onto the soil surface as uniformly as possible by hand.

One complete fertilizer formulation (20-4-8) was placed in holes in the soil. Holes were either drilled with an electric drill or formed by pushing a punch bar into the soil. Twenty-four holes 1 inch in diameter and 15 inches deep were placed around each tree to be treated in a 2 foot by 2 foot grid. A measured quantity of fertilizer was placed in each hole.

The dates for treatments were April 28-30, 1976; March 30-31, 1977; and April 13-14, 1978. The same trees received the same treatment each year.

Precipitation during April-June every year from 1976 through 1979 was below normal. Precipitation data from a weather station about 2 miles from the test plots are given in Table 1.

Tree growth was determined from trunk diameter measurements in October of 1976, 1977, 1978, and 1979.

Results

Fertilized trees grew more than unfertilized trees (Table 2). Fertilizer formulation had no effect: 20-4-8, 30-3-10, and 34-3-7 gave essentially the same response when equal quantities of

N were applied. The rate of 6 pounds per 1000 square feet gave significantly more growth than the 2- and 4-pound rates which in turn were not much better than no treatment. There was little or no advantage to placing the nutrients in soil holes. A slight advantage was gained from the use of complete fertilizers rather than nitrogen-only fertilizers in this study.

Differences in species responses to fertilizing were noted. The tulip trees growing at the rate of almost 1 inch in diameter per year increased only 5% following treatment at the 6-pound nitrogen rate. Honey locust and pin oak growing at ⅔ inch per year increased by 10% and 17%, respectively. The smallest trees in the test, the Norway maple, growing at less than 0.4 inch per year, increased diameter growth only 4% when fertilized.

Trees treated and trees not treated in 1976-1978 all grew at equal rates in 1979. There was no growth response from residual fertilizers.

Discussion and Summary

The trees included in this study were growing well with trunk diameter growth increases of ½ to 1 inch per year, and the trees appeared normal. It appears that nutrients were not a major limiting factor for plant growth.

Moisture was quite likely a growth-limiting factor. Nutrients applied to the soil surface are dependent upon rainfall to move them into the soil occupied by tree roots. Rainfall amount and

Table 1. Precipitation in Urbana, Illinois and deviation from normal.

	1976		1977		1978		1979	
Month	*da*[1]	*amt*	*da*	*amt*	*da*	*amt*	*da*	*amt*
April	0	.59 (−3.14)	0	.78 (−2.95)	1	2.62 (−1.11)	3	6.47 (+2.74)
May	3	4.56 (+ .59)	3	3.58 (− .39)	2	4.38 (+ .41)	0	1.47 (−2.50)
June	5	5.65 (+1.65)	1	2.30 (−1.70)	1	1.96 (−2.04)	0	1.01 (−2.99)
July	3	3.31 (− .23)	2	3.03 (− .51)	5	5.53 (+1.99)	3	8.75 (+5.21)

[1]Days with > 0.5 inches rainfall.

Table 2. Tree fertilization trials in the Illinois Natural History Survey arboretum in Urbana, Illinois — 1976-1978.

			Diameter growth (inches)					
Formulation	*Method of application*	*Rate per 1000 sq ft*	*Tulip tree*	*Honey locust*	*Pin oak*	*Norway maple*	*Average*	*Average % increase*
20-4-8	surface	2	3.02	1.78	2.14	1.15	2.02	3.6
		4	2.88	1.83	2.10	1.25	2.02	3.6
		6	2.69	2.33	2.21	1.26	2.12	8.7
20-4-8	holes	2	2.88	1.76	2.18	1.26	2.02	3.6
		4	2.78	2.02	2.05	1.22	2.02	3.6
		6	2.90	2.14	2.44	1.27	2.19	12.3
30-3-10	surface	2	2.67	1.77	2.11	1.16	1.93	−1.0
		4	2.72	2.08	2.08	1.17	2.01	3.1
		6	2.80	2.39	2.24	1.25	2.17	11.3
34-3-7	surface	2	2.66	2.00	2.21	1.19	2.02	3.6
		4	2.35	1.89	2.22	1.27	1.93	−1.0
		6	2.89	2.08	2.36	1.17	2.13	9.2
33.5-0-0	surface	6	2.67	2.09	2.18	1.19	2.03	4.1
No treatment		0	2.66	2.00	1.96	1.18	1.95	

number of days with 0.5 inch of precipitation were deficient in April, May, and June of every year in which this test was conducted (Table 1). Since the trees were growing in a bluegrass sod, the grass may have used most of the supplemental nutrients applied to the soil surface. It would be interesting to know what the tree response would have been in these dry years if the grass competition had been eliminated.

Soil in east-central Illinois, when not disturbed by construction activities, is normally an excellent medium for tree growth. Established trees perform well.

In an earlier tree nutrition study in Urbana (2), tree growth increased 15 to 55% with fertiization. In the earlier tests the trees were growing slowly and were more closely spaced and nutrients were probably the limiting factor.

Results from the present study indicate that supplementing the nutrients naturally available in these soil plots was not a suitable cultural practice. Arborists should not expect results from tree feeding when there are factors other than soil fertility that are primarily responsible for limiting tree growth.

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ABSTRACT

Kemmerer, Harleigh. 1979. **Pruning programs require accurate schedule management.** Weeds Trees & Turf 18(12): 35-36.

A well managed pruning program involves scheduling personnel, equipment, tools and handling of brush. It is also imperative the manager and crew know the names and identities of the various plants on the grounds. It is impossible to know when or how to prune if no one knows what is being pruned. Postponing pruning until there is a slacking of other grounds work or until the foreman is looking for something for the crew to do to keep busy causes problems. The delay can turn a potentially hazardous situation into a real danger. It may be responsible for damage to property or injury to people or animals. Allowing plants to grow completely out of bounds means that extensive cutting must be done to get the plant back to an acceptable size. The need for excessive pruning will often ruin the appearance of the plant until new growth covers bare spots. Sometimes, the plant's attractiveness is permanently ruined and it must be removed. The best approach for pruning is to schedule it on a frequent basis. This prevents the need to remove a lot of wood and also allows the pruning crew to see the plants on a regular basis. Potential problems can be corrected before a hazard develops.