

## Plant Nutrients in Municipal Leaves

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Application of collected municipal leaves to agricultural land improves soil quality and provides a solution to a disposal problem. Farmers are permitted (New Jersey Register, NJAC 7:26-1.12. Nov. 7, 1988) to apply up to a 6-inch layer of leaves annually. Application at this rate, which is equivalent to approximately 800 cubic yards/acre or 20 tons/acre of dry matter, will increase soil organic matter content, and improve soil tilth and water holding capacity.

A chemical analysis of 100 municipal leaf samples collected from across New Jersey shows that leaves are a valuable source of all crop nutrients (Table 1). Although nutrient concentration values vary considerably, the application of 20 ton/acre of leaves would add on average 400 pounds of nitrogen, 40 pounds of phosphorus, and 152 pounds of potassium. Assuming values of \$.30/pound N, \$.23/pound P, and \$.18/pound K, the nutrients from this example are worth \$156.56.

Application of leaves at 20 ton/acre would also add on average 656 pounds of calcium, 96 pounds of magnesium, 44 pounds of sulfur, 1.5 pounds of boron, 58 pounds of iron, 22 pounds of manganese, 50 pounds of chloride, 4 pounds of sodium, 0.3 pounds of copper, and 3 pounds of zinc. The actual amounts of nutrients applied can vary considerably as shown by the concentration ranges in Table 1.

Although leaves add agronomically significant amounts of nutrients, only a portion of the nutrients are available immediately after application for use by the crop. The increase in the soils total nutrient content will, however, contribute to the long term fertility of the soil as the nutrients are released over time.

Much of the nutrients in leaves are part of the organic structure of the plant tissue and require microbial decomposition to release them. The carbon-nitrogen ratio of an organic material undergoing decomposition is an important indicator factor in the rate of release of its nitrogen in available form. The average carbon-nitrogen ratio of leaf waste is 50 and it ranges from 27 to 72. For comparison, the carbon-nitrogen ratio of compost is generally about 25.

The abundant carbon (carbohydrates which provide energy) content of leaves leads to extensive development of fungi and bacteria in the soil which uses up the supply of available nitrogen for the production of microbial cell tissue. As decay proceeds, the carbon-nitrogen ratio decreases and some of the nitrogen becomes available to plants. Because of the high carbon content of raw leaves relative to their nitrogen content, there will likely be very little of the organic nitrogen in leaves available to crops for a period of time after application. Observations of crops (including legumes) planted on soil to



**Table 1. Nutrient concentrations in municipal leaves (dry weight basis).**

Nutrient	Minimum	Maximum	Average	Average
----- Concentration % -----				lb/ton
Carbon	36	52	47	940
Nitrogen	0.66	1.62	1.00	20.0
Phosphorous (P <sub>2</sub> O <sub>5</sub> )	0.02 (0.05)	0.29 (0.66)	0.1 (0.23)	2 (4.6)
Potassium (K <sub>2</sub> O)	0.09 (0.11)	0.88 (1.06)	0.38 (0.46)	7.6 (9.1)
Calcium	0.13	3.04	1.64	32.8
Magnesium	0.02	0.46	0.24	4.8
Sulfur	0.01	0.21	0.11	2.2
----- parts per million -----				lb/ton
Boron	7	72	38	0.076
Iron	46	9800	1461	2.922
Manganese	19	1845	550	1.100
Zinc	22	392	81	0.162
Sodium	36	325	110	0.220
Chlorine	68	3995	1264	2.528
Copper	2.8	31.5	8.1	0.016
Cobalt	0.9	10.9	2.7	0.005
Nickel	1.1	57.9	5.3	0.0106

which leaves have been applied indicate that plants suffer from a temporary N deficiency unless additional N fertilizer is added.

Crops grown on soils the year after leaf application likely will need additional N fertilizer. Legume crops, such as soybean, may benefit from 20 to 30 pounds of starter N banded beside the row at planting. This will supply a readily available N source to be used by the legume until it forms nodules to supply N by fixation. An additional 50 to 100 lbs of N fertilizer is recommended for corn grown the first year after leaf application. The additional fertilizer that is required increases the cost of crop production on the soil the first year after an application of leaves.

The amounts of P, K, and other nutrients present in leaves are not easily translated into

nutrient credits that may be used to reduce fertilizer application. These nutrients are relatively stable in soil and can be monitored simply through soil testing. As soil fertility levels increase as a result of leaf applications, take credit for these nutrients by fertilizing accordingly.

Of the three major nutrients, potassium is the most easily released from leaves and is the most readily available to crops in the first year after leaf waste application. A minimum nutrient credit of 50 lbs K<sub>2</sub>O per acre may be used for 20 tons of leaves.

Application of collected municipal leaves to soil should not significantly change its agricultural limestone requirement. Three years of municipal leaf application caused no decrease in the soil pH compared to unamended soils.

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