WHY A FERTILIZER BURNS

by William Knoop

In the development of a nitrogen nutrition program, the turfgrass manager has the choice of applying soluble nitrogen or slowly soluble nitrogen, or applying a fertilizer that contains a combination of soluble and slowly soluble nitrogen sources. As a result of higher fertilizer prices and supply shortages during the past few years, turfgrass managers have tended to use more soluble nitrogen fertilizers than before.

One of the characteristics of soluble nitrogen fertilizers is their increased tendency to "burn" turfgrasses. The risk of fertilizer burn is one of the reasons why many turfgrass managers have tended to use nitrogen fertilizers that contain a high percentage of slowly soluble nitrogen rather than the totally soluble nitrogen fertilizers.

Soluble nitrogen fertilizers, if applied properly, can be just as effective (as a slowly soluble nitrogen source) in providing the turfgrass plant with the nitrogen it requires. The risk of burn may be minimized if the factors that contribute to a burn are understood.

Fertilizers contain salts. These salts are not unlike table salt except that they contain various plant nutrients. When a salt is added to water the osmotic pressure of the solution is increased. Osmotic pressure is, in a sense, a measure of how tightly water is held in a solution. When a fertilizer, either as a solid or a liquid, is applied to the surface of the soil, the fertilizer salts must sooner or later enter and become a part of the soil solution before the nutrients can enter the roots and be used by the turfgrass plant. The increase in the osmotic pressure of the soil solution associated with the application of a fertilizer may determine whether the plant will survive or will die from a fertilizer burn.

For a plant's root system to take in water, the water must pass through a root cell membrane. Water can pass through this membrane only when the osmotic pressure of the solution inside the cell is higher than the osmotic pressure of the soil solution outside the cell. Water moves from a solution with low osmotic pressure into a solution with higher osmotic pressure. If the osmotic pressure of the soil solution becomes higher than that of the solution inside the cell, water cannot enter the cell and may even move out of it. This results in the death of the cell. When root cells die, the whole plant may die. The end result is termed a "fertilizer burn."

An understanding of the potential salt effect of the various fertilizer materials can help prevent possible fertilizer burn. Salt index values are a measure of a material's relative tendency to increase the osmotic pressure of the soil solution as compared with the increase caused by an equal weight of sodium nitrate. The salt index of sodium nitrate is 100. The higher the salt index, the greater the potential of a material to increase the osmotic pressure of the soil solution and thus the potential for burn. As indicated in Tables 1 and 2, there are wide differences in the salt indexes of those fertilizer materials used.

Note that Table 1 also lists the salt indexes of selected nitrogen fertilizers in terms of single units of N. Nitrogen is applied on a unit basis (i.e., pounds per 1000 sq. ft.). Although a material such as ammonium sulfate has a lower salt index than urea, the salt effect of applied urea is lower because it contains a higher percentage of N.

The potential for burn is not totally dependent on the salt index of the fertilizer material. The moisture status of the soil and of the turfgrass plant is also important. If the level of the soil solution is low, a fertilizer will have a greater effect on increasing the osmotic pressure of the soil solution. When a fertilizer is "watered in," the volume of the soil solution increases and thus the osmotic pressure of the soil solution is reduced. In well drained soils, however, heavy applications of water, while having the beneficial effect of reducing the osmotic pressure of the soil solution, may also have the harmful effect of leaching nutrients past the root system.

The water status of the plant is affected by both the air temperature and the humidity, which is the amount of water in the air surrounding the plant. These factors to a large degree affect the plant's water requirements. As the air temperature increases, the plant requires more water and as the humidity decreases the plant requires more water. As the osmotic pressure of the soil solution increases, less and less water is available to the plant. Watering in a fertilizer material may increase the water available to the root system by decreasing the osmotic pressure of the soil solution, but may also aid in reducing the plant's water requirements by cooling the plant and increasing the humidity of the plant's microenvironment.

Soluble fertilizer materials may be used at any time of the year with minimal risk of damage to turf if the factors that contribute to a burn are understood. The salt index of a fertilizer material is extremely important, espeecially when the fertilizer is highly soluble. The rates of application must be lower when a fertilizer with a high salt index is used, basically because of the salt effect.

Fertilizers with a low salt index should be used when soil test results indicate the presence of excessive levels of soluble salts in the soil. □

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TABLE 1. Salt Index Values for commonly used nitrogen fertilizer materials.

Material	Approx. % N	Salt Index	Salt Index per Unit of N
Ammonium Nitrate	33	105	3.2
Ammonium Sulfate	21	69	3.3
Calcium Nitrate	12	53	4.4
I.B.D.U.	31	5	0.1
Potassium Nitrate	14	74	5.3
Natural Organic	5	4	0.8
UF	38	10	0.3
Urea	45	75	1.7

TABLE 2. Salt Index values for other commonly used materials.

Material	Approx. Nutrient Level	Salt Index
Superphosphate	20% P_2O_5	8
Potassium Chloride	60% K_2O	114
Potassium Sulfate	50% K_2O	46
Dolomite	30% CaO 20% MgO	1
Gypsom	33% CaO	8
Epsom Salts	16% MgO	44