

Soil acidity and fertilizers

Many fertilizer materials can have an effect on soil acidity. Some will make a soil more acid while other materials have a liming effect. The table below lists several fertilizers commonly used on turf along with the amount of pure lime required to neutralize 100 pounds of the material.

You will observe that those fertilizer materials which contain nitrogen in the ammonium form will contribute to soil acidity. If ammonium is oxidized to nitrate by soil bacteria (nitrification), H⁺s are

removed (September 1994). This absorption of H⁺ by living cells removes acidity from the soil solution which is the equivalent to adding a small amount of lime (indicated as 'B' in the table below). Any nitrate containing fertilizer will have an acid neutralizing effect unless it is added along with ammonium, e.g. urea-ammonium solution or ammonium nitrate. Because ammonium releases more H⁺s than are absorbed by cells along with nitrate, the net effect of an ammonium nitrate application is to make the soil slightly

Acidity or alkalinity of fertilizers and the amount of pure lime needed to neutralize 100 lbs. of each

material	nutrient supplied	nutrient content (%)	lime equivalent (lbs.)
Ammonium sulfate	N	20.5	110
Calcium nitrate	N & Ca	15.0	20B*
Sodium nitrate	N	16.0	29B
Urea	N	46.6	84
Urea-ammonia solution	N	45.5	82
Milorganite	N	7.0	12
Muriate of potash	K	51.0	0
Sulfate of potash	K	43.0	0
Superphosphate	P	8.0	0

* B indicates basic reaction and lime equivalent provided by fertilizer

released into the soil solution and that contributes to acidity. When ammonium is absorbed by grass roots, it essentially exchanges with H⁺ in the roots and that also makes the soil slightly more acid. The amount of acid produced by the fertilizer is roughly proportional to the amount of ammonium-nitrogen in it. Even if the nitrogen in a fertilizer is present as organic molecules not as an ammonium salt, e.g. urea or Milorganite, the nitrogen is released into the soil as ammonium when the organic molecules are degraded by soil microbes. For this reason, all organic sources of nitrogen will have an acidifying effect on the soil.

Fertilizers which contain nitrogen in the nitrate form actually make the soil a little less acid. This is because each nitrate ion enters plant roots or microbial cells along with two H⁺s (see TGT Sep-

tember 1994).

These contributions to soil acidity by ammonium containing fertilizers are not a serious concern. Compared to the total acidity of a soil, ammonium makes a small addition. However, if ammonium fertilizers are used regularly and in relatively large amounts, as would often be the case in turf management, lime applications may be required a little more often than if nitrate fertilizers were used. I would not recommend using nitrate fertilizers to avoid ammonium acidity because nitrate is much more likely to leach out of the root zone and contaminate ground water (see TGT February 1995). It is better to apply ground limestone a little more often and use the often less expensive and environmentally safer ammonium or organic fertilizers.