range of particle sizes between 8 and 24 mesh is used to increase the rate of nitrogen release over a longer period. Particles greater than 2mm in diameter are slow to hydrolyze and are more likely to be picked up by mowers than smaller particles.

The influence of IBDU on soil salinity and pH is minimal. At excessive rates, however (e.g., 6 lbs N per 1,000 sq. ft.), ammonia gas may be absorbed by the turf, resulting in temporary chlorosis. IBDU's reliance on water for nitrogen release may be absent or stimulated at a time when it is least desired.

Ureaformaldehyde (UF). Ureaformaldehyde is a generic designation for several products formed when urea reacts with formaldehyde, creating first monomethylol urea and then soluble methylene urea and ureaform. The polymers of methylene urea that make up these products have varying lengths and range from water-soluble to highly water-insoluble molecules, providing controlled nitrogen release. The smaller the ratio of urea to formaldehyde, the longer the chain of polymers formed. As the lengths of polymers and the number of longer polymers increase, solubility decreases, resulting in a slowed release of nitrogen. For example, a methylene urea with a 1.9:1 urea to formaldehyde ratio is 2/3 water-soluble and 1/3 water-insoluble. Ureaform fertilizers, which contain 38% nitrogen, are commercially available as *Nitroform, Ureaform,* and *Blue-Chip.* These sources are intended for soil application only and not for use as liquids, except *Powder Blue,* which can be applied as a suspension. They are more costly than soluble nitrogen fertilizers.

All UF products depend on microbial breakdown for nitrogen availability. Therefore, environmental conditions favoring microbial activity (e.g., temperatures >55°F, neutral soil pH, and adequate levels of soil moisture and oxygen) promote nitrogen release. Conversely, low temperatures, acid soils, and low levels of soil oxygen inhibit the release of nitrogen from UF. Ureaform fertilizers that contain appreciable amounts of water-insoluble nitrogen polymers do not perform well during cooler weather. Quickly available sources are usually applied alone or in combination with ureaform fertilizers during cool periods.

Since water-soluble polymers with shorter chains are readily digestible by soil microorganisms, they release nitrogen to the soil as ammonium in a relatively short time. Polymers with longer chains contain water-insoluble nitrogen, which is digested more slowly by soil bacteria. Unlike IBDU and SCU, which return nitrogen to the soil as urea, methylene urea and ureaform gradually convert nitrogen to ammonium via mineralization throughout the growing season. Therefore, a lag in nitrogen availability may occur with the use of UF. Accumulation of "residual" nitrogen may take several seasons and will result in a more uniform response. During this lag phase, adequate shoot color can be maintained by applying higher rates of UF or by using a supplemental soluble nitrogen source.

As with any nitrogen source, UF losses due to mowers may be significant, especially immediately after application. To avoid this problem, grass should be allowed to dry and remain uncut for several days after application. Alternatively, grass catcher boxes may be removed to allow clippings and fertilizer granulars to return to the soil surface.

UF loses less nitrogen through leaching and volatilization than do readily available nitrogen sources. Over time, UF sources are approximately equivalent to soluble sources in terms of nitrogen use efficiency. Under conditions favoring leaching and volatilization, however, UF sources often are more efficient. Labor costs for fertilizer applications also must be considered, since UF is applied less frequently. UF has little effect on soil pH or salinity and its potential for burning is low.

A product similar to UF is *Nutralene,* a soluble methylene urea source containing approximately 40% nitrogen. It is more readily available than UF because it has less methylation. Nutralene's