bureaucracy. We are self-sufficient in only four strategic mineral commodities; molybdenum, phosphate, borate and bituminous coal. We will have to compete with other countries for scarce raw materials. We will be self-sufficient in phosphate and nitrogen and, with the help of Canada, can have an adequate supply of potash and sulfur. But western Europe and Russia are also in need of potash and sulfur. To be an efficient turfgrass manager, you will need to know more about the utilization of fertilizers by the grass plant and the type of sand or soil series you have under your supervision. You will need to get maximum utilization from the fertilizer to keep your golf course in first class condition at the lowest possible cost at all times.

Turf management for golf, along with the entire turfgrass industry, will have its ups and downs in the years ahead. Indeed, the U.S. Department of Agriculture has a Committee on Land Use Policies. Its mission is to preserve prime lands. Land use planning by local and state authorities will become more pronounced and could influence future sites for golf courses. But the golf course plays an important role in green belt area development, and even if, as some predict, the coast lines of the United States become one line of continuous lights by 2000 golf will still be there and enjoyed. The golf course superintendent will contribute much to the growth, health and happiness of our future generations.

A GREEN SECTION SUPPORTED RESEARCH PROJECT

Nitrogen Losses From Golf Greens

by
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Although only a small portion of a golf course is devoted to putting greens, they are given first priority for fertilizers and irrigation. Poorly constructed greens often have low infiltration rates and excess water may run off the surface. Greens constructed to USGA Green Section specifications have higher infiltration rates and excess water moves through these greens quickly. Water lost from golf greens through runoff or leaching carries with it nitrogen from the fertilizer as either nitrate or ammonia.

Nitrate is known to cause eutrification of lakes and can be harmful to humans and livestock if consumed in drinking water. The Federal Water Pollution Control Administration (now the EPA) has established limits for the concentrations of nitrate in drinking water. These regulations call for not more than 45 ppm (parts per million) nitrate in water.

The amount of nitrate that may be lost from golf greens will depend on many factors. Among them are the following: the nitrogen source in the fertilizer applied, the time between fertilizer applications, the amount of irrigation or rainfall, the infiltration rate of the greens mixture, and the season of the year (soil temperature).

Research was therefore undertaken at Texas A&M University, under the sponsorship of the USGA Green Section, to obtain data on the amount of nitrate lost. If pollution hazards do not exist, the data would serve to protect the golf superintendent from undue scrutiny; and on the other hand, if hazards do exist, recommendations can be developed to reduce or eliminate the hazards.

Individual isolated golf greens 10 feet on a side, with gravel underdrains, were constructed on a raised subgrade. The drains and, in the case of the greens with low infiltration rates, the runoff collection troughs were fed into collection barrels. Top mixtures included pure sand, sand-soil-peat mixtures which met USGA specifications, and a fine sandy loam soil typical of many older greens. Treatments were designed to provide information on all the factors mentioned above.

When soluble forms of fertilizer, including ammonium nitrate and ammonium sulfate, were applied, high concentrations of nitrate were found in the leachate from all greens. The concentrations were highest and occurred earliest in the greens constructed of sand alone. As much as 22 percent of the applied nitrogen was lost during the first three weeks after application and concentrations in the leachate reached over 300 ppm for periods of two weeks. Such concentrations are six to

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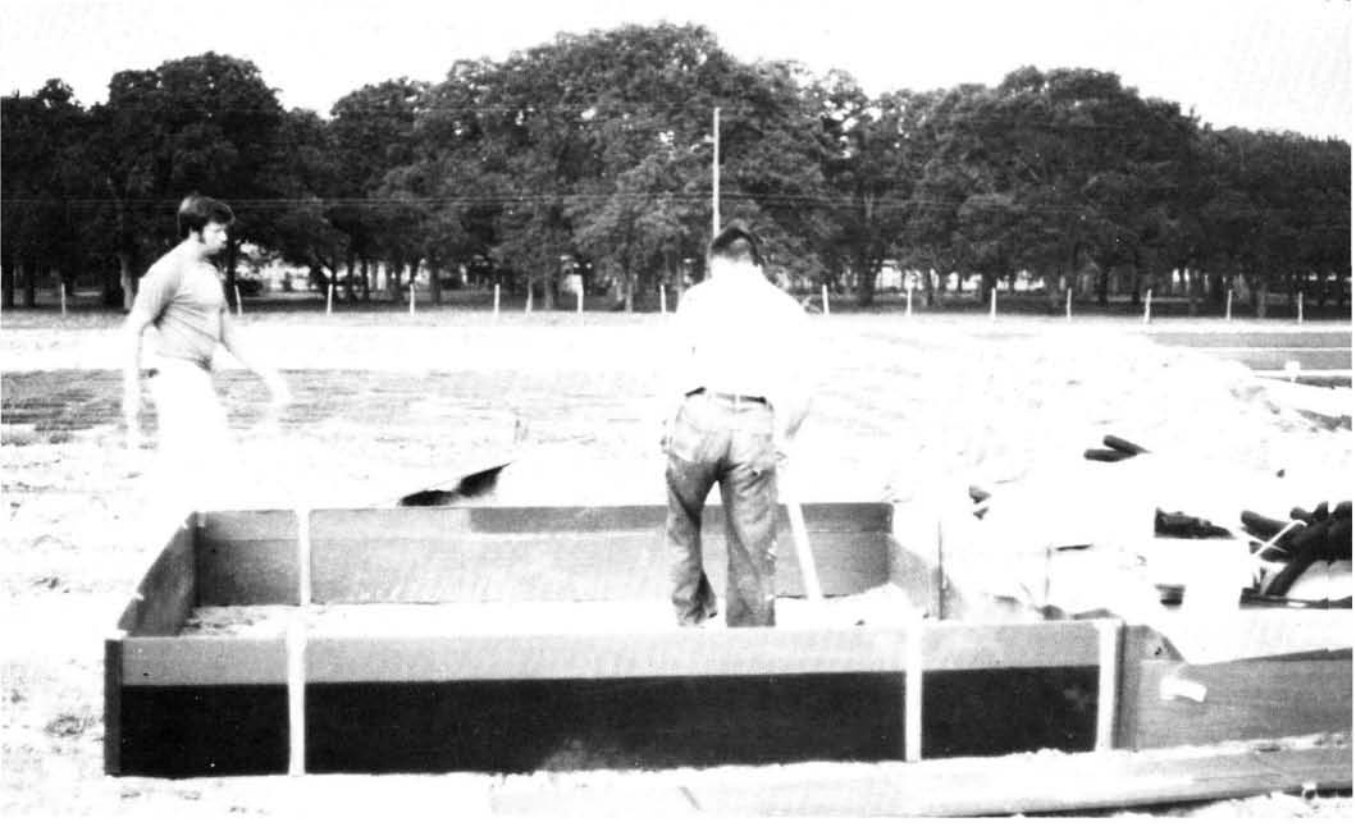


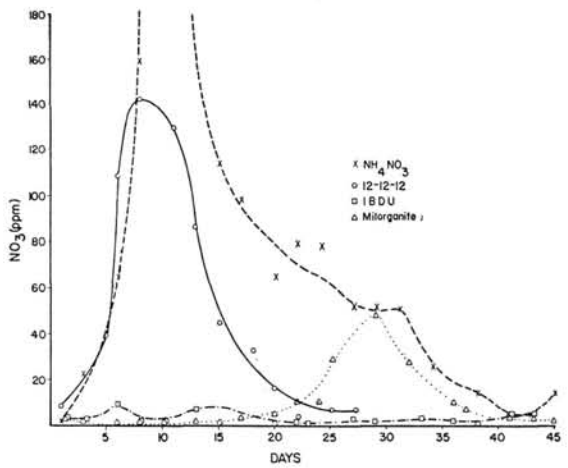
Construction of individual golf greens.

seven times the permissible limit for drinking water and constitute a pollution hazard as well as a significant fertilizer loss.

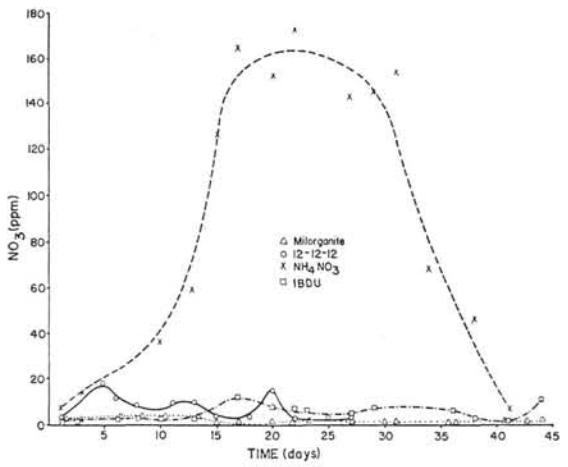
When organic or slow release forms of fertilizers, including IBDU, urea formaldehyde and sewage sludge (Milorganite), were applied, the concentrations of nitrate found in the leachate were always low and the water met EPA standards for drinking water. Less than 2 percent of the nitrogen applied as IBDU and urea formaldehyde was lost, mostly in the form of nitrate, while 10-14 percent of the nitrogen applied as sewage sludge was lost. It was evident from these results that the use of inorganic fertilizer sources results in economic loss and environmental hazards that can be avoided by the use of slow release organic forms.

More careful management schemes must be developed to maintain greens in top shape and minimize nitrogen losses. Small applications should be scheduled on a routine basis so that a continual supply of nitrogen is available at all times to maintain a healthy green playing surface. With proper planning, it should be possible to reduce the need for applications of soluble nitrogen sources to stimulate a weak turf. Applica-

Concentrations of nitrate in the leachate from sand plots treated with different sources of nitrogen fertilizer.



Concentrations of nitrate in the leachate from soil plots treated with different sources of nitrogen fertilizer.



Experimental test site at Texas A & M University.

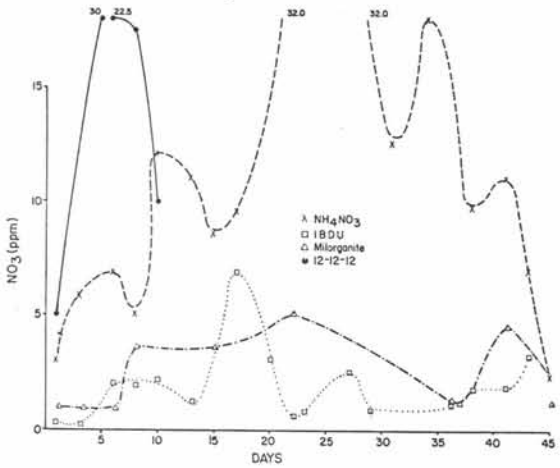
tion of rates of soluble nitrogen fertilizers should not exceed ½ pound per 1,000 square feet per application.

Although other factors studied do not have a major influence on the conclusions, it is interesting to note that greater irrigation rates resulted in the greater concentrations and more rapid loss from the quick release sources of nitrogen. Irrespective of the source applied, the losses could be minimized by controlling irrigations to cut down runoff and leaching. This will not, however, completely eliminate the problem because of occasional heavy storms.

More nitrate was lost from ammonium nitrate during the winter when the grass was nearly dormant than during the summer. Seasonal trends for the other sources were less evident. The amounts lost always increased as the application rate increased.

Thus, the use of organic and slow release nitrogen sources, light applications of soluble nitrogen sources and controlled irrigation will help reduce nitrate losses in golf greens constructed to USGA specifications.

Concentrations of nitrate in the runoff from soil plots treated with different sources of nitrogen fertilizer.



Concentrations of nitrate in the leachate from mixed plots treated with different sources of nitrogen fertilizer.