

It should be understood, however, that the reversion to a completely insoluble form such as tricalcium phosphate is a multi-step chemical process which may take years for completion. In the first few months the initial compounds produced may be only slightly less soluble than the material added as a fertilizer. The greater the amount of these initial forms in the soil, the more rapidly the concentration of phosphorus in the soil solution can be recharged and the greater the fertility of the soil for grass.

Researchers have attempted to increase the efficiency of phosphate fertilizer use by cultivated crops by placing the fertilizer in band, proving a localized zone of higher phosphorus concentration. To a degree this practice is copied for turf managers in the suggestion that a high phosphate fertilizer should be surface-applied and worked into the top 2 cm. just prior to seeding a new stand.

### Phosphorus and pollution

The chemistry of phosphate in soil, which is based on the formation of compounds of relatively low solubility, results in a very low concentration of phosphorus in the soil solution. Furthermore the formation of these compounds prevents any significant downward movement of phosphorus in the soil. Research at the Univ. of Guelph, using radioactive phosphate fertilizer applied in May, demonstrated that the phosphate had not migrated downward more than one cm by the end of the season (Table 2). Pollution by phosphorus in percolating ground water, therefore, seldom occurs.

Water pollution by phosphorus from

land surfaces is primarily from the erosion of phosphorus-enriched soil particles into water systems. The number one system for the prevention of soil erosion is a bluegrass sod. Hence phosphorus pollution by surface flow from turf areas is also as close to zero as is feasibly possible.

### Efficient phosphate use

A turf manager should be concerned most about the phosphorus levels in his soils at the time of establishment of a new stand. At that time phosphate applied at least at the rate recommended by a soil test is one of the best insurance moves he can make for the rapid establishment of a vigorous sod. This phosphorus should be worked into the top inch of soil during the final seed bed preparations.

Subsequent phosphorus applications, of necessity, are applied to the soil surface. Furthermore clippings continually returned to the surface tend to concentrate the phosphorus at the surface. This is not a problem. Research using radioactive phosphorus to identify the source of the phosphorus found in the grass has shown that in one growing season up to 30% of a surface application of fertilizer phosphorus may be utilized by the grass plants. This percentage utilization is as high as that recorded for band applications for cultivated crops.

While phosphorus only needs to be applied once each season most turf fertilizers contain some phosphorus. The amount required for a full season may be estimated from a soil test. Since the fertilizer rates used are generally set by the amount of nitrogen required at any one application, a knowledge of the

number of nitrogen applications planned for the year and the rate of material application should allow the calculation of the concentration of phosphorus required in the complete fertilizer.

Remember for established turf it is not necessary to include phosphorus every time you make a fertilizer application.



### Space Age Mowing

Thomas Noonan and partners John Fisher and Barry Bryant have won a U.S. patent for an automatic, self-propelled lawn mower that stores a map of terrain and a cutting route in its microprocessor.

"Basically, it can memorize a lawn and then reroute itself," Mr. Noonan, a salesman for Minnesota Mining & Manufacturing Co. in Havertown, PA., said of the mowing robot he and his partners call MOBOT.

The gas-powered mower relies on three navigation systems. First, the computer map tells it where to turn or slow down for a hill. Because mechanical problems, such as wheel slippage, can still knock it off its route, it adjusts its position by using sensors to detect metal markers or guide paths buried at intervals in the lawn.

If the mower cannot find its way, it shuts itself off. Ultrasonic sensors also tell the mower to shut down if there is an obstacle in its path. An alarm would alert the mower's owner to put down the ice tea and check out the problem.

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Table 2: The downward movement of fertilizer phosphorus in one season from a surface application on grass.

Depth of sampling (cm)	Concentration of applied fertilizer phosphorus (ppm)
0 - 1.5	275
1.5 - 3.0	41
3.0 - 4.5	11
4.5 - 6.0	3
6.0 - 7.5	1