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Environmental Fact Sheet No. 5

Phosphorus — Key to Life

Phosphorus is found in every living cell and is essential for life. It is peculiar in nature because it forms so many insoluble compounds and substances such as the mineral apatite, bones, and teeth.

Most soils of the world lack sufficient available phosphorus to support even protective vegetation, let alone sustain a profitable agriculture without fertilization.

Discovery of phosphate fertilizers by Liebig, Lawes and Gilbert in England in the 1840's is one of the greatest discoveries of that century. Treating insoluble minerals and bones with sulphuric acid was the key man needed to facilitate recycling of nature's great stores of insoluble phosphates.

Using phosphate fertilizers, along with other essential nutrients, man has been able to grow high-quality food in abundance. Without these fertilizers there would be no means of supporting present world population. Ecologists and limnologists often say, erroneously, that phosphorus is the key to growth of algae, and the cause of the death of lakes. They seem to overlook the fact that algae require about 200 times as much carbon as phosphorus. One ton of algal tissue, which can grow in two months per acre of lake area, will contain 1000 pounds of carbon and only five pounds of phosphorus. The latter can easily be supplied by the water because of the vast phosphorus stores which have accumulated over centuries in bottom muds and organic deposits.

But, where does the 1000 pounds of carbon come from? Ordinary water contains only 0.4 to 1.0 ppm of CO_2, or the equivalent of 0.1 to 0.21 ppm of carbon. Normal water in equilibrium with normal air could never grow one ton of dry algae tissue per acre in a growing season.

The point overlooked is that organic matter, such as sewage, is necessary as a source of carbon. It is utilized by bacteria, which evolve the carbon dioxide necessary for massive growth of algae. Once the process gets going it's difficult to control, because as the algae die, their carbon also is consumed by more bacteria, which, in turn, evolve more carbon dioxide to grow more algae. As yet, all of the details of the complex "symbiosis" are not fully understood. We do know enough, however, to realize that removing phosphorus from water effluents will not control excessive growth of algae in natural or man-made bodies of water unless excess available carbon inputs also are controlled.

Environmental Fact Sheet No. 6

Place of Phosphorus Now Better Understood

Lack of understanding of the role of energy and carbon tends to explain:

(1) Why the Department of the Interior and U. S. Congress contemplate spending huge sums of money to remove phosphorus from effluents;

(2) Why, as an example, the Minneapolis Park and Recreation Board, a Minneapolis newspaper, and League of Women Voters are engaging in a campaign to halt use of fertilizers containing phosphorus on lawns.

True, a small amount of phosphorus may come from surface runoff, but very little will come from fertilizers. Dr. Robert Holt, USDA Soil Scientist, Morris, Minn., citing his studies of nutrient losses from dead grass, says, "Apparently, freezing of plant tissues during winter allows phosphorus compounds to be mobilized and washed off the land with spring runoff." In his studies, up to .2 pound of phosphorus washed off of an acre of hay land with snow melt water, whereas only one-half ounce was lost from a nearby corn field. Holt attributes the difference to the fact that soil in the corn field absorbed phosphorus out of the water and held it on the land.

Dead vegetation such as that on lawns will lose soluble nutrients in snow melt runoff. But, one should be sure such nutrients can be distinguished from other possible sources such as fertilizers. These are applied in the early part of the growing season, after snow has disappeared. Soluble nutrients in fertilizers move into the soil with the first rain that falls. Very small amounts, if any, will be lost in runoff under ordinary conditions.

But, even if part of it were lost in a certain city or watershed due to a sudden flood, no harm would be done, providing soil was not lost. There would merely be the slight cost and inconvenience of having to apply a second application of fertilizer, if the turf is to be kept healthy enough to control erosion.

Keep in mind that sewage and other organic matter sources cause excessive growth of unwanted water plants, which no amount of phosphorus could cause in the absence of available sources of carbon.