Sunland Analytical
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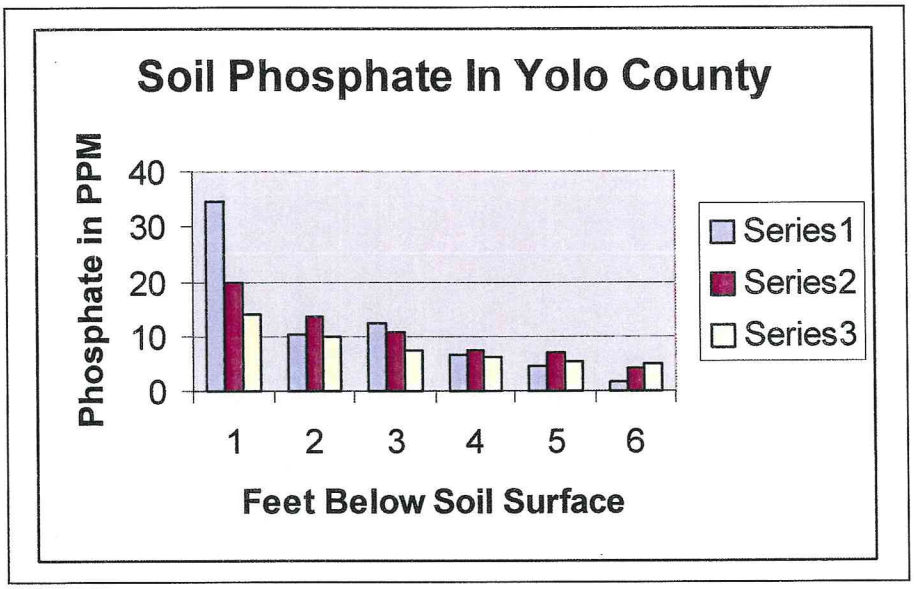
Where's the Phosphate?

The answer is right where you put it. It has been estimated that at field water capacity, phosphate can effectively move in the soil about 0.0016 inches per day. This means that it would move little more than one half inch in an entire year. Up front a take home message is that you need to put the phosphate where it will be accessible to the plant roots. Figure 1 shows phosphate analysis results from samples taken at varying depths from three areas of a Yolo County field. Though phosphate fertilizer has been being applied to this field for decades, it has apparently only penetrated to the two to three foot level.



This apparent lack of movement is a function of the insoluble compounds or complexes that are formed by the soil phosphate. As a result of the insolubility of the phosphate the water in the soil (soil solution) doesn't even contain enough phosphate to provide for one day of normal plant growth. Rather, as the plant removes the phosphate from the soil solution, more phosphate can enter the water, which is in turn removed by plants.
This will occur several times in any day to provide for plant nutrition. This equilibrium between the insoluble phosphate and the small amount in the soil solution effectively prevents the phosphate from being leached out by rains or irrigation.

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Acid conditions in the soil result in the phosphate being precipitated as Iron and Aluminum compounds that make the phosphate unavailable as a plant nutrient. Formation of these complexes typically start at soil pH values of 5.5 and the rate of formation of the complexes increases as the pH decreases.

The typical form of phosphate in a calcareous soils (soils containing high calcium carbonate) is extremely insoluble, less than 10 parts per billion (ppb), at pH above 7. This can be somewhat overcome, by supplemental phosphate fertilization. These supplements form a different calcium phosphate complex that can release the phosphate over several months to years before becoming forming the complex tha is u available for plant use.

How much phosphate will plants use in a growing season? As Table 1 shows this varies to some degree with the type of plant. But again, the important aspect is to place the phosph te where the ant c n have ac ss o it. T is means that the landscaper, like the farmer, must thoroughly till in the phosphate to prepare the land. Unlike the farmer, the landscaper is preparing ground that may not be tilled again for some years and thus must provide adequate phosphate for longer p riods of time. On the other hand, e farmer m y w t to take advant e of phosphate starter strips that maximize the seedling exposure to the phosphate and minimize the expenditure in phosphate fertilizer.

TABLE 1. PLANT PHOSPHATE UTILIZATION

Plant Type	Pounds /AC (P_2O_5)	Pounds /1000 SQ.FT (P_2O_5)
Alfalfa	120	
Apple or Peach	40	1
Bermuda grass	40	1
Bluegrass	55	1.3
Grape	36	0.9
Lettuce	40	1
Tomato	60	1.5
Potato	100	2.5

When you get a soil analysis you do not get a total value for the amount of phosphate in the soil. Instead, the value that is reported is a small portion present in the soil that can be extracted under very defined conditions.
The amount extracted has been correlated to the ability of plants to grow

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maximally or respond to added phosphate fertilizer. Once the plant has sufficient phosphate, response to added phosphate fertilizer is improbable. Of course, with different plants needing different amounts of phosphate the adequate range for soil phosphate may shift, but generally follows the values in Table 2. A reasonable rule is to remember 15 ppm as the break between adequate soil phosphate and soil needing phosphate.

TABLE 2. SOIL PHOSPHATE LEVELS (Bicarbonate Extract.)

Phosphate Analysis Results	Soil Evaluation
0 to 5 ppm	Very Low
5 to 15 pm	Low
15+	Adequate