Utilization of Phosphorus FROM SOIL ALGAE

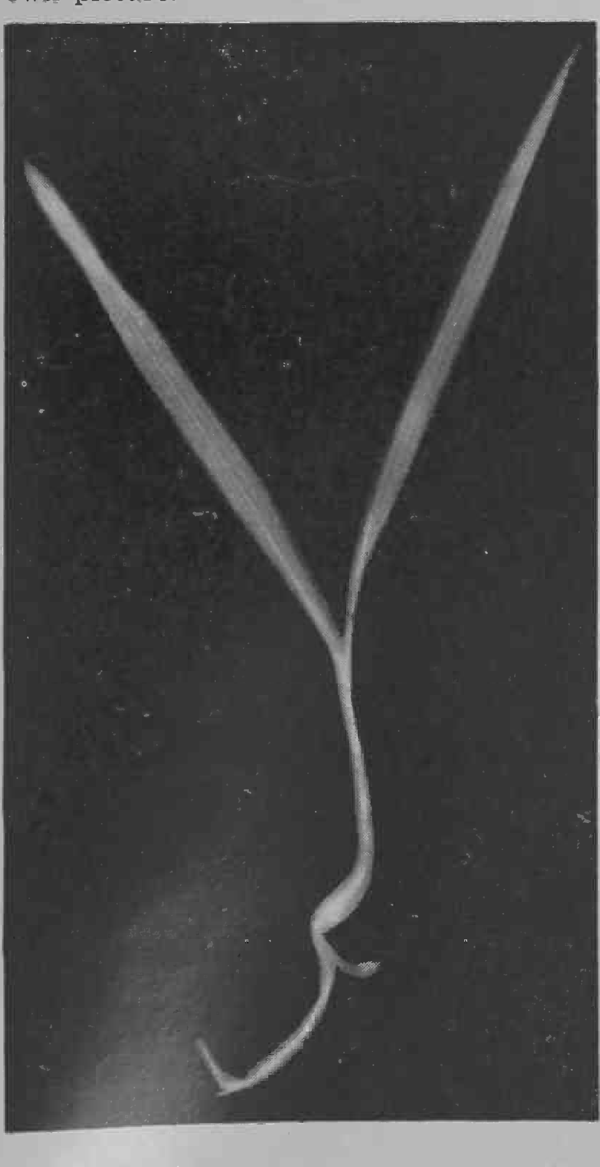
Radiophosphorus Tracer Techniques Measure Uptake and Subsequent Release

By W. H. Fuller and R. N. Rogers

Algae have been observed growing on soils and in irrigation canals since irrigation farming began. Their presence on soils as a green surface coating or in water-ways as green clumps or ropy masses is a common sight to the irrigation farmer, particularly during the warm summer months.

An increase of as much as 3 tons of carbon per acre-three inches of soil has been attributed to the growth of algae under favorable weather conditions in Arizona. This corresponds to about 6 tons of organic matter.

Radioactive barley plant. It took its own picture.



Algae reproduce rapidly upon the application of water to soils. At this time they may be expected to fix or immobilize plant nutrient elements in their tissue. Phosphorous is one of these necessary plant elements that is absorbed in great amounts by algae.

As soils become dry algae activity decreases, most of the algae die, and eventually decay. The decay or decomposition process is accompanied by release of the fixed elements for crop use. It is this process of decay and release of phosphorous that is the subject of this report.

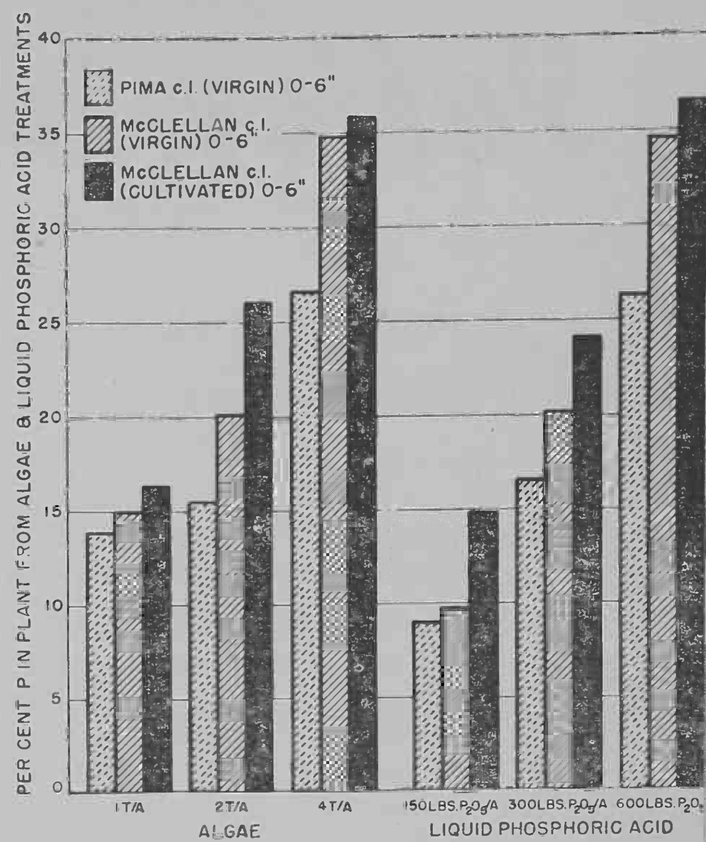
Radioactive Tracer Used

By use of radiophosphorous tracer techniques, the uptake of phosphorus by algae and its subsequent release, after being added to soil, for use by young barley seedlings was followed. The three soils used Pima c. l. (virgin). McClellan c. l. (virgin), and McCellan c. l. (cultivated) are high, intermediate, and low respectively in fertility and available phosphorus.

Algae (*Palmacea*), made radioactive by growing in nutrient culture with radiophosphorus, was added to the soils, at the rate of 1, 2, and 4 tons per acre six-inches of soil. This corresponds to phosphorus applications of 150, 300, and 600 pounds of P_2O_5 per acre, respectively. Liquid phosphoric acid was added to an additional set of the same soils and planted to barley for comparison. The barley was allowed to grow and then was harvested and analyzed for phosphorus.

Yields Higher

The results of the investigation clearly indicated that the more fertile the soil the greater the barley yield and the more total phosphorus taken from the soil. Pima clay loam for example yielded more barley plant material than the virgin McCellan clay loam. The least yield came from the poorest soil, cultivuated McClellan.



Finding that the phosphorus of algae was taken up or utilized by the plant to as great an extent as liquid phosphoric acid emphasizes the importance of algae in the phosphorus economy of the soil. Analysis of the algae tissue showed a very high proportion of the phosphorus to be in an inorganic form. The high amount of inorganic phosphorus found in the algae undoubtedly accounts for its high availability to plants.

Algae Needs Phosphorus

Additions of liquid phosphoric acid to irrigation water causes soil algae to grow profusely. The high demand by algae for phosphorus is shown by the high phosphorus content of the tissue. Algae may contain as much as 10 to 100 times as much phosphorus per unit dry weight as cultivated plants which again emphasizes the importance of algae to the phosphorus economy of the soil.

The graph at the top of the page shows percentage phosphorus taken by the plant from algae and liquid phosphoric acid. The three outstanding features of this graph are:

(1.) All soils do not absorb phosphorous from algae and liquid phosphoric acid to the same extent. The least fertile soils absorb a higher percentage of added phosphorus than the more fetile soils.

(2.) The greater the amount of P added as algae the greater the amount absorbed by the plant regardless of the soil.

(3.) Phosphorus of the algae tissue was utilized to as great an extent as that of liquid phosphoric acid.

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