

- Biochemical Engineering
- Fermentation
- Food Processing
- Nutrition
- Pesticides
- Plant Nutrients and Regulators

Research on Soil Surfactants Indicates Promising Future

Under proper conditions surfactants may speed seed germination, delay plant wilting, and improve plant growth

DALLAS.—Progress in the development of surfactants has been encouraging, said members of Atlantic Refining Co. at the annual joint meeting of the Soil Science Society of America and the American Society of Agronomy here on Nov. 19.

With long experience in the field of surface-active agents such as detergents, emulsifiers, and textile wetting agents, Atlantic's research and development department has now intensified its efforts toward the development of chemicals which will improve the wetting of soils.

The experimental material, says V. J. Keenan, is a flaky, light-colored solid derived from petroleum by treatment of certain hydrocarbons with sulfuric acid. It is applied to the soil surface in amounts ranging from 15 to 50 pounds per acre. Rain and irrigation water carries the water soluble surfactant into the small pores of the soil.

The surfactant, PR-51, is a soil pore agent. It has no effect on soil structure, it cannot be classified as a soil conditioner. Consequently, PR-51 has little or no effect in soils devoid of pores such as compacted subsoils and heavy clay top-soils unless they are first treated by mulching, or in acid soils, by liming.

This concept is important in the reclamation of alkaline soils in the West, and in tidewater marsh lands where large amounts of salts must be leached out by flooding before plant growth is possible.

Speeds Seed Germination. The product goes to work in the soil pores themselves, said Keenan. It moves to the soil-water surfaces (hence the name surfactant) where it speeds the movement of water. This is important because water moves with difficulty, if at all, through the smaller pores. By improving soil drainage, surfactants make earlier spring plowing

possible, particularly in the wet "heavy" types of soil.

Since a drier top-soil warms up more rapidly in the spring, faster germination of seeds is possible. Surfactants may also help by promoting more rapid absorption of water through the waxy coating of the seeds themselves.

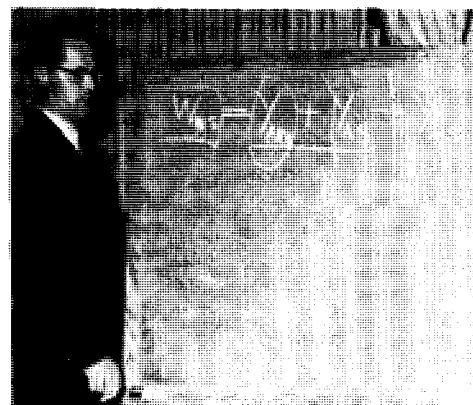
Delays Plant Wilting. Where surfactants increase the percentage of rainfall absorbed by the soil, some delay in the wilting of plants is encountered during subsequent drought because of the extra supply of water thus made available. Radioactive tracer studies have shown that PR-51 moves laterally as well as vertically through the soil. It facilitates the movement of soil moisture to the plant rootlets.

Studies are still in progress to determine how much PR-51 improves the movement of water-borne nutrients such as phosphates through and into the root zone.

Improves Plant Growth. In some of the heavy soils such as silt loams and silty clay loams, improved plant growth has resulted. Drainage is increased sufficiently to permit the necessary air to enter the pores formerly blocked by water. Increases up to 18% on corn and up to 76% on tomatoes have been noted on such soils, particularly in dry seasons.

Many cooperating farmers have reported that grazing animals seemed to prefer forage grown on treated pasture. This has initiated another study, still in progress, which indicates that PR-51 may be increasing the sugar and vitamin content of some plant species.

Caution. Care is advised in the application of surfactants to the soil. It is best applied, dry or in water solution, to the bare soil or to the seed bed.



V. J. Keenan of Atlantic Refining Co. uses the blackboard to explain how surfactants improve soil wetting properties

Careless application after the plants have emerged from the ground may lead to temporary stunting and burning, if concentrations in excess of the recommended amounts are mistakenly employed.

Since PR-51 is water soluble, it is eventually leached out of the soil. The effects of PR-51 will largely disappear in about one year in well-drained soils with high rainfall. In the heavier soils, the effect may persist through several growing seasons.

Soil Evaporation Losses. In another paper on surfactants E. R. Lemon of USDA pointed out that loss of soil moisture through evaporation in subhumid and semiarid regions amounts to a significant proportion of the total rainfall. A small percentage reduction in evaporation could greatly increase the amount of moisture available to crop production. Surfactants are being studied as a possible solution to this problem, says Lemon.

A simple method for evaluating the evaporation process in porous systems has been developed by the USDA which eliminates the troublesome variables of ambient humidity and mass air movement.

According to Lemon, the effects of surfactants on evaporation losses from porous systems indicate that more than one mechanism may be involved, depending upon the molecular structure of the surfactant.