IN PROF. SHIVE'S GREENHOUSE

All these plants are grown in pots of sterile sand, by the flowing-culture method developed by Prof. Shive and his associates. In the foreground are the ornamental velvet plants; back of them are tomatoes; on the right, covering a pillar, are long trailing stems of Kenilworth ivy.

PLANT PHYSIOLOGY

Plants Grown in Sand Given Mineral Nutrients in Solution

Sterile Grains in a Jar Provide Anchorage for Roots; Method Has Proved Practical in Commercial Gardening

SAND, pure sand, nothing but sand, can supply no food materials to plants. It is itself a rather simple chemical compound, almost insoluble in water and containing nothing that a plant can eat even if it could be dissolved. Sand can therefore furnish something for roots to hold on and support their plant in, but no nourishment.

This reduction of soil functions to the single one of furnishing mechanical support for the roots is exploited to scientific advantage in the experiments of Prof. John W. Shive of the New Jersey Experiment Station, New Brunswick, N. J. He grows plants for his researches in pots of sterile white sand, through which slowly trickles a water solution containing the necessary nutrient salts.

The mineral nutrients are supplied through an ingenious tube arrangement that permits the solution to drip out slowly, just fast enough to keep the sand well moistened. Except that the roots are nestled among the sand grains, they might as well be floating free in water, so far as their nourishment-relations are concerned.

Prof. Shive's plants grow well and are thrifty on this regimen of sand plus water plus a measured diet of mineral salts. So well did they do under his strictly experimental conditions that a newcomer on the horticultural staff of the same institution, Dr. G. T. Nightingale, considered the system worth trying on a practical, semi-commercial basis.

He tested it with a large number of plants, particularly flowers, such as carnations, azaleas, lilacs, etc., and got most astonishing results. Greenhousemen who saw the test plantings at New Brunswick hastened to try it out, and now sand has taken the place of black soil on a good many greenhouse benches. Prof. Nightingale has left the New Jersey station for a position in Honolulu, but his work goes on. And Prof. Shive continues the basic researches from which it all started.

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Air cooling for henhouses is to be tried in the hot weather in California's Sacramento valley.

Want to Try?

It's rather difficult for the beginner to make plants grow in a solution culture. But if you want to try your luck, here's how to go about it:

Use an ordinary quart fruit jar. Tie across its mouth a piece of mosquito netting, letting it sag about half an inch at the center. (It's a good idea to dip the netting in melted paraffin first.) Fill up with Shive solution (formula given below) until it just touches the netting. Put seeds on netting and cover with moist blotting paper until they sprout; then remove paper. Have a rusty nail at the bottom of the jar, to supply the iron the plants need.

To make the Shive solution: Have your druggist weigh out the following, very accurately:

24.50 grams of potassium acid phosphate.

12.28 grams calcium nitrate.

36.98 grams magnesium sulphate.

Dissolve each of these portions in half a liter of distilled water and keep in separate bottles. They are your stock solutions.

Take five cubic centimeters of each stock solution, pour into the culture jar, and add plain water enough to fill. Then plant seeds on the netting, and hope for the best. As (and if) the plants grow, keep adding diluted solution to hold water level to cover their roots.

BOTTLE-FED

The pot contains only sand, completely without soil mineral nutrients. These are added in solution from the jar as it flows, drop by drop, from the tube.

METALLURGY

Produces Cheap Pig Iron From Poor Ores in New Way

A BRITISH iron maker has been successfully producing cheap pig iron suitable for producing steel from relatively poor ores for two years now by a new and basically different treatment of the ore in the blast furnace, Prof. Richard S. McCaffery of the University of Wisconsin told the American Iron and Steel Institute.

Forced to make use of British ores low in iron and high in undesirable alumina by the great demand for iron and steel brought about by Europe's armament race, the British firm has successfully applied an American suggestion. The process, Prof. McCaffery indicated, holds great promise of industrial use in this country and elsewhere where ironmakers are forced to turn to similar inferior ores.

Technicians handling the treatment of the low-grade ore used disregard its varying and undesirable sulfur content during the blast furnace operation itself, an "omission" never before made in commercial production of pig iron, the raw material from which steel is made. Instead they use a combination of chemicals to remove the sulfur in a separate step.

Forgetting about the sulfur content during the blast treatment, technicians operating the furnace are able to go ahead and produce the maximum amount of pig iron at minimum expense in the form of coke consumed and wasteful slag produced. This procedure is necessitated by the poor quality of the ore. If the usual method had been followed, it was indicated, production at a cost comparable to that of iron from higher grade ores would have been impossible.

The sulfur is removed by soda ash and fluorspar in a hot ladle into which the molten pig iron is poured. Many other technical advantages follow from the new procedure, Prof. McCaffery also pointed out. The British plant is at Corby, Northamptonshire, very close to the ore supply.

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ENGINEERING

Oil Refinery Piping Damaged By Salts Formed by Acids

By-Products of "Dosing"—50,000,000 Pounds of Them—Are Reported as Exacting a Tremendous Economic Toll

WIDESPREAD use of acids to boost production from oil wells has brought in its wake a major trouble for the petroleum industry in the form of thousands of miles of ruined pipelines and hundreds of ruined refinery units, petroleum engineers report.

Salts, 50,000,000 pounds of them, produced largely as by-products of the acid "dosing" of wells, are eating the walls of expensive pressure piping and plugging refinery tubes, exacting a stupendous economic toll, they reveal.

They are in addition lowering the value of residual oils and tars, eating up in waste a considerable portion of the increased income earned by the use of the acid process which increases the wells' yield.

Greater even than the cost of replacement parts and labor is the loss caused by equipment being out of service while repairs are made.

Petroleum engineers are turning increasing attention today, however, to this problem and report a number of desalting methods.

Can Be Reduced

Heat, pressure, and the addition of fresh water remove some of the salt from commercial crude oil, increasing the life of piping and refinery equipment greatly at a low cost. A Michigan installation, described (*Petroleum Technology,* May) by Dr. Gustav Egloff and a group of petroleum engineers of the Universal Oil Products Company, reduced the salt in incoming crudes from 220 to 5 pounds per thousand barrels.

Incoming oil was mixed with about 10 per cent. of water, then heated to 250 degrees under a pressure of 60 pounds. The salt removal, 212 pounds for each 1,000 barrels of oil handled, reduced corrosion from a continual cause of breakdowns to a very minor maintenance factor.

Chemicals to break up the shell of emulsion which protects brine globules from the surrounding oil have been used with some success. Once this protective coating is destroyed, water particles settle out of the mixture very rapidly, carrying the salt with them. Different chemicals are needed in each oil-producing area, and the search for a general desalting chemical agent, suited to all types and mixtures of oil coming to a refinery, is still going on.

Electrical Method

Electrical desalting, in one plant, decreased the salt content of the crude oil from 200 to 8 pounds per 1,000 barrels. This particularly corrosive crude oil, from an Arkansas field, was mixed with water, then subjected to an alternating potential of 16,000 to 32,000 volts. Before the desalting equipment, still tubes were completely blocked with deposits of solid salt after turns of only three to six days, and corroded excessively. After desalting, runs of 60 to 70 days without shutdowns were the regular thing, with less corrosion per run.

Whirling an oil-salty water mixture to remove the salt water offers considerable future promise, the engineers report. In test runs, centrifuges have removed all but a half pound of salt from oil originally containing 160 pounds per 1,000 barrels.

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