

# SOIL AERATION and the GROWTH of ROSES

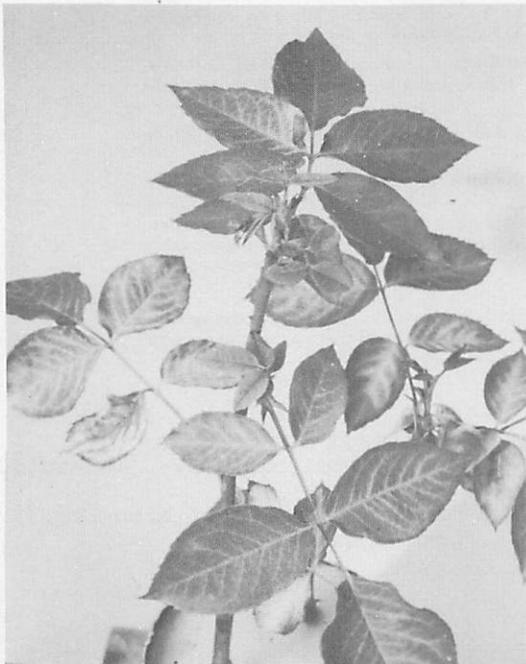
Soil structure may deteriorate, resulting in poor aeration and retarded growth of roses after the plants have grown in it for four to six years, according to Dr. John G. Seeley, Cornell. The plants may not show actual symptoms of injury but the growth may be slow with a low oxygen supply to the roots.

The normal oxygen content of the air is near 21 per cent. Soil varies in oxygen content from that of normal air to much lower amounts.

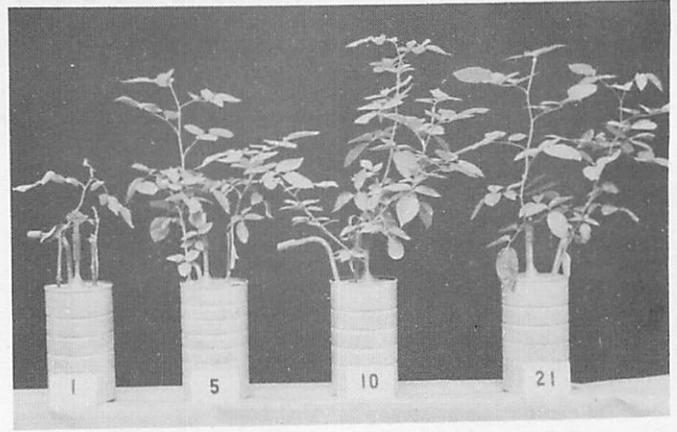
When the soil was aerated with nitrogen gas containing 1 per cent oxygen, the plants grew very little. The foliage remained dark green for three weeks but after this time the older leaves became light green. The injury progressed from the older leaves to the younger. The leaflets became yellow along the midrib and veins and finally the entire leaf became yellow. The yellowed areas became brown in the same order as they yellowed.

Young shoots stopped growing and were blind. Most of the roots were dead after 6 or 7 weeks.

When the soil air contained 5 per cent oxygen, the plants grew almost as rapidly at first as with more oxygen. After 42 days the growth rate was reduced considerably compared with growth at higher oxygen concentrations. These plants had good foliage color after 81 days even though growth was less than with higher oxygen.



Oxygen deficiency symptoms in leaves and shoots of roses in soil.



Roses in soil aerated with gas mixtures containing 1, 5, 10, and 21% oxygen.

The roots were well-branched with many new roots but the total root system was smaller than in higher oxygen.

Practically no differences were evident between the plants in soil having 10 and 21 per cent oxygen in the atmosphere. Both concentrations gave good shoot and root growth.

## OXYGEN IN NUTRIENT SOLUTIONS

It is almost impossible to determine the amount of oxygen present in the solution around the roots in the soil solution. Plants were grown in nutrient solutions aerated with 1, 5, 10 and 21 per cent oxygen gas. These gas mixtures gave respectively 0.35, 2, 4 and 9 parts per million of oxygen in the nutrient solution.

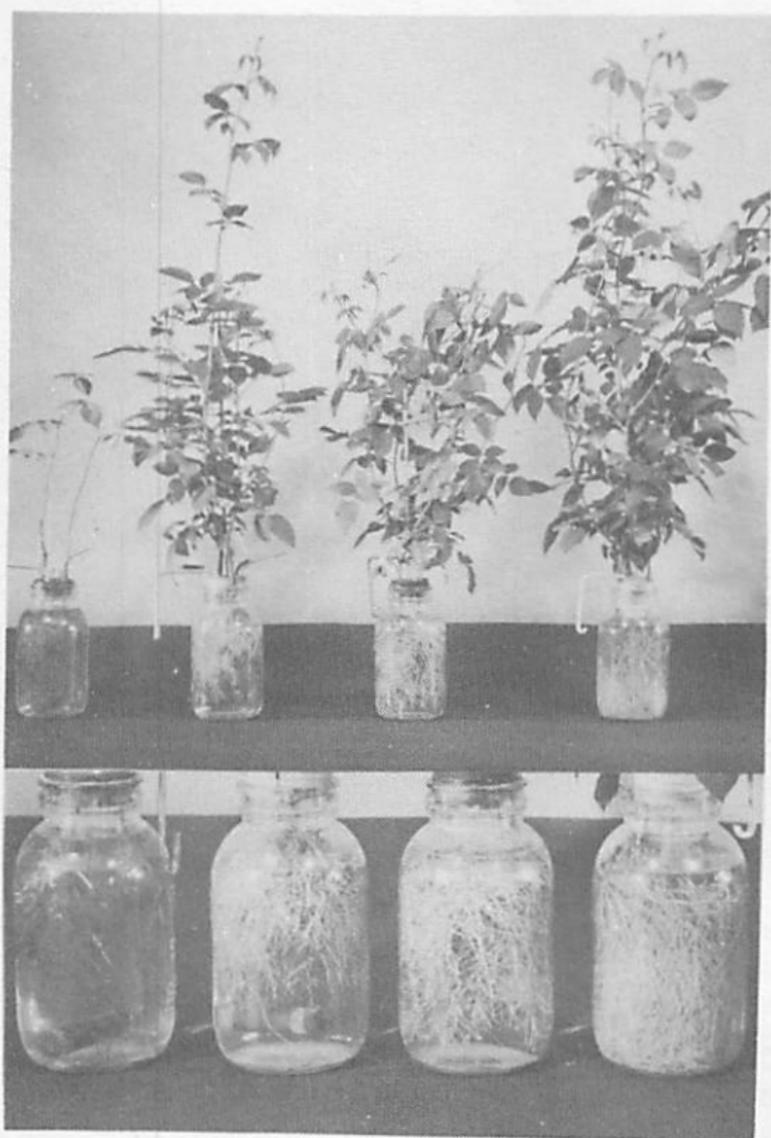
Rooted cuttings were placed in the solution on September 25, 1947 and by October 20 very little growth was evident on plants aerated with 1% oxygen gas. Both the 1 and 5 per cent mixtures were giving less growth than 10 and 21 per cent after 6 days. The new growth on these treatments became yellowed between the veins similar to injury produced with iron chlorosis. Iron was not lacking in the nutrient solutions.

The roots were dead at the close of the experiment in both treatments. The 1 per cent treatment caused injury before the 5 per cent. Plants in the solutions aerated with 10 and 21 percent oxygen did not become chlorotic. The growth and branching was best with 21 per cent oxygen running through the solution. The roots were white and extremely well branched. The roots as well as the tops of plants in the solutions aerated with 10 per cent oxygen weighed less at the close of the experiment than those in solutions with 21 per cent oxygen.

Some previous investigations have given conflicting results with soil aeration for roses. It has been impossible to determine the oxygen content of the soil air immediately adjacent to the roots. Samples of air so far drawn from soils have not given as low as 10 per cent oxygen. These samples have naturally been removed from the larger pore spaces and the oxygen content of the air near the roots could be less.

The amount of oxygen dissolved in the solution bathing roots in soil increases as the temperature is lowered. The dissolved oxygen decreases as the oxygen content of the soil air decreases. The soil aeration problem may be quite complicated but the grower should be conscious of this oxygen relationship. Greenhouse soils should be well prepared and handled to obtain and maintain good soil structure so that the soil oxygen supply will be as good as possible.

This story appears in full in the trade papers.



Left to Right: Roses grown in nutrient solutions aerated with 5, 10, 15 and 21% oxygen gas mixtures.