Response of Field-grown Peaches to Strontium Sprays

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The application of a strontium chloride spray to peach trees eliminated a marked chlorosis of the leaves. The trees, Red Elberta variety, were planted in 1946 on a sassafras loamy sand. This soil is marked by a low organic matter content and low exchange capacity. For the past several years the trees have grown rather poorly, and there has been considerable dieback.

This past year a fertility program was initiated in an effort to improve vigor of the trees. A dormant spray of zinc sulfate at the rate of 10 lbs/100 gal water was applied in February. The trees had been fertilized in March 1951 with 1000 lbs/acre of a 5-10-10 containing 10 lbs borax, 20 lbs Tecmangam, and 10 lbs copper sulfate per ton. Since early growth was still showing dieback, additional borax was applied in April as a spray at the rate of ½ lb/100 gal. These treatments were evidently effective, since later growth was much more vigorous. The trees set a heavy crop of fruit, and there was every indication that previous symptoms had been eliminated. There were indications by late June, however, that the trees were beginning to suffer from lack of nitrogen. There were only 5 lbs of available soil nitrogen per 2,000,000 lbs of soil as measured by rapid tests (*1*); also, leaves were a pale-green color, and new growth had been slowed. An application of 150 lbs sodium nitrate/acre was made in an effort to correct this situation.

In a few weeks most of the trees showed excellent response to the applied nitrate. However, about 20% of the trees showed a peculiar chlorosis (Fig. 1, *A*) of new leaves. This resembled to a marked extent advanced iron deficiency, with its characteristic lack of green color between the veins. Accordingly, a spray of 0.05% (by weight) of ferrous sulfate + 0.025% sulfuric acid was applied to leaves of a few trees. There was no beneficial response to this spray or to a manganous sulfate spray of the same concentration. A relatively complete nutrient spray[1] containing N, P, K, Ca, Mg, Fe, Mn, Zn, Cu, B, S, and Mo was applied, but this too had no effect on the chlorosis.

A spectrographic analysis of normal and chlorotic leaves of the same physiological age from the same tree revealed that normal foliage had 10 times as much strontium as chlorotic leaves. There was 0.002% strontium in the ash of normal foliage, but only 0.0002% in chlorotic foliage.

Strontium chloride (0.05% by weight) was sprayed on both upper and lower surfaces of leaves and branches of portions of several trees on August 5, 1951. Unsprayed portions of these trees, as well as unsprayed trees, were left as checks. Within 3 days a definite response was noted on all sprayed leaves. They were markedly greener, with little or no areas without normal color. By August 18, all sprayed leaves were normal in appearance (Fig. 1, *B*); unsprayed leaves still exhibited typical chlorosis (Fig. 1, *A*).

FIG. 1. New growth of Red Elberta peaches photographed August 18, 1951: *A*, check, unsprayed; *B*, sprayed with 0.05% strontium chloride on August 5, 1951.

Examination of strontium-sprayed trees in late September 1951 still showed superiority of sprayed branches over unsprayed portions, and the marked chlorosis that was exhibited earlier was no longer present. This improvement was also noted in unsprayed trees and, therefore, cannot be due to migration of strontium from sprayed branches to other areas of the tree.

Upon noting response to strontium in this location, strontium chloride sprays were also applied to portions of several trees in two other orchards. Sprayed trees were weak, with considerable dieback, and had poor, thin leaves, but they did not show chlorosis. Strontium sprays in these latter orchards failed to give any visual sign of response.

[1] A commercial mixture sold under name of Plant-Thrive applied as a spray at rate of 4 lbs/100 gal water.

The results shown by this brief study would indicate that strontium chloride sprays have a definite value for peach leaves under certain conditions. Leaves benefited showed a definite pattern of chlorosis and a relatively small amount of strontium in the ash. It is believed that new growth stimulated by sodium nitrate application forced a deficiency which otherwise might not have revealed itself.

The response of plants to strontium has been reported by several authors (*2–4*). It has been indicated that in some of this response strontium took the place of calcium when the latter element was present in short supply. In the particular peach orchard where we obtained response to a strontium chloride spray, the calcium as measured by rapid soil tests (*1*) was 450 lbs/2,000,000 lbs of soil, or a comparatively poor test for calcium. It is of interest to note that the ash of normal leaves contained 0.9% calcium, whereas that of chlorotic leaves contained 0.04%, or about 1/20 as much. It is possible that here, too, strontium was replacing calcium, although calicum in the nutrient spray and 450 lbs soluble calcium in the soil failed to bring about normal growth.

The failure of calcium in both the spray and the soil to correct the condition noted raises the question as to whether strontium has specific value to the plant. If it does, is it then possible that we are adding large quantities of calcium in the form of lime, etc., in order to supply a small amount of strontium as well as calcium and to influence pH? Spectographic analyses of limes and gypsum have revealed the presence of strontium as an impurity. These analyses indicate that it is possible to add significant quantities of strontium to the soil by large applications of lime or gypsum. (For example, a ton application can easily supply about 2 lbs of strontium.)

These facts may help to explain why large quantities of calcium in the soil are usually associated with higher yields. Best yields are associated with calcium in amounts of several thousand pounds per acre, and yet most crops remove less than 50 lbs calcium/acre. The value of calcium in the form of gypsum or lime as soil conditioners is not lost sight of. However, it would be of interest to determine whether the extra value of calcium is due in part to the strontium carried as an impurity.

References

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Comments and Communications

The Role of Vision in the Alighting of Birds

Alighting is a critical point in the flight of birds. Only precise control can prevent destruction when a body designed for swift travel in a gaseous medium is brought into contact with solid earth, and both birds and aircraft approach a landing point into the wind to decrease landing speed. But, whereas conventional airplanes need to make landing runs at relatively high speed, the mobile wings of birds actually permit alighting motions functionally equivalent to those of a helicopter's rotors. In fact, the landing speed of a bird *must* be low, because it has no wheels to roll on and take up the alighting impact on a shock-absorbing landing gear.

This paper concerns the means of determining wind direction that may be available to an alighting bird. Whenever the wind approaches 10 mi/hr, birds turn into the wind at the moment of contact with the earth. Do they do so visually (a pilot without special instruments observes a wind sock at the airport), or do they feel the wind on their feathers or on their very large eardrums?

Here it must be pointed out that a bird aloft is part of the airstream, a fact missed by the writer in a recent paper(*1*). It feels no wind, whether it is in a hurricane or a light breeze. Aircraft navigation proves that ground speed is obtained from air speed by simply adding or subtracting the wind vector. A bird flying at an air speed of 30 mi/hr, with a 20-mi tail wind, is making a ground speed of 50 mi/hr—with a 20-mi head wind, 10 mi/hr. There is a theoretical weakness, therefore, in the idea that flying birds "feel" the wind, so it was decided to test the role of vision in alighting. If wind direction were determined visually, birds would have no way of knowing on a dark night if they are flying 50 mi/hr or 10 mi/hr, yet this would be very important in alighting. In the former case, when the bird had reduced its air speed to zero, it would still have a ground speed of 20 mi/hr from the tail wind, and it might be killed.

In an effort to solve this problem, 21 birds were flown blindfolded: 16 pigeons (*Columba livia*), 3 English sparrows (*Passer domesticus*), and 2 juncos (*Junco hyemalis*). The most effective blindfold was a narrow sleeve of thin black rubber, drawn over the head. A long, light cord was tied to one leg to prevent an occasional individual from flying off. The birds were flown in unfamiliar surroundings on dull days and were hand-released at heights of 6′ or so. Three pigeons and 2 English sparrows flew straight up and attempted to escape blindfolded, but tired of this shortly and fluttered to the ground like the rest. The