INADEQUATE OXYGEN

Low oxygen conditions in nature are generally associated with high soil moisture or high temperatures. Lack of oxygen may cause the desiccation of roots of different kinds of plants in waterlogged soils, as was mentioned in the section on moisture effects. A combination of high soil moisture and high soil or air temperature causes root collapse in plants. The first condition, apparently, reduces the amount of oxygen available to the roots, whereas the other increases the amount of oxygen required by the plants. The two effects together result in an extreme lack of oxygen in the roots and cause their collapse and death.

Low oxygen levels may also occur in the centers of fleshy fruits or vegetables in the field, especially during periods of rapid respiration at high temperatures, or in storage of these products in fairly bulky piles. The best known such case is the development of the so-called blackheart of potato, in which fairly high temperatures stimulate respiration and abnormal enzymatic reactions in the potato tuber. The oxygen supply to the cells in the interior of the tuber is insufficient to sustain the increased respiration and the cells die of suboxidation.

Enzymatic reactions activated by the high temperature and suboxidation go on before, during, and after the death of the cells. These reactions abnormally oxidize normal plant constituents into dark melanin pigments. The pigments spread into the surrounding tuber tissues and finally make them appear black (Figs. 10-7A and 10-7B).