**How Air Pollutants Affect Plants**

The concentration at which each pollutant causes injury

to a plant varies with the plant and even with the age

of the plant or the plant part. As the duration that the

plant is exposed to the pollutant is increased, damage

can be caused by increasingly smaller concentrations

of the pollutant until a minimum dose-injury threshold

is reached. Plant injury by air pollutants generally

increases with increased light intensity, increased soil

moisture and air relative humidity, and increased temperature

and with the presence of other air pollutants.

In a given location, ozone fluctuates from 0.01–

0.03 parts per million (ppm) in the morning to

0.05–0.10 ppm at peak sunlight intensity in early afternoon

and decreases gradually afterward. There are,

however, frequently days of higher O3 concentration of

up to 0.15 ppm in most rural areas, whereas in heavily

populated and industrial areas such as the Los Angeles

basin, O3 peaks of 0.25 ppm are common.

Ozone injures the leaves of plants exposed for even a

few hours at concentrations of 0.1 to 0.3 ppm. Ozone

is taken into leaves through stomata and injures primarily

palisade but also other cells by disrupting the cell

membrane. Affected cells near stomata collapse and die,

and white (bleached) necrotic flecks appear, first on the

upper side and later on either leaf surface. Many crop

plants, such as alfalfa, bean, citrus, grape, potato,

soybean, tobacco, and wheat, and many ornamentals

and trees, such as ash, lilac, several pines, and poplar,

are quite sensitive to ozone, whereas some other crops,

such as cabbage, peas, peanuts, and pepper, are of intermediate

sensitivity, and some, such as beets, cotton,

lettuce, strawberry, and apricot, are tolerant.

Sulfur dioxide may injure plants in concentrations

as low as 0.3 to 0.5 ppm. Because sulfur dioxide is

absorbed through the leaf stomata, conditions that favor

or inhibit the opening of stomata similarly affect the

amount of sulfur dioxide absorbed. After absorption by

the leaf, sulfur dioxide reacts with water and forms

phytotoxic sulfite ions. The latter, however, are oxidized

slowly in the cell to produce harmless sulfate ions. Thus,

if the rate of sulfur dioxide absorption is slow enough,

the plant may be able to protect itself from the buildup

of phytotoxic sulfites.

Peroxyacyl nitrates are also taken into leaves through

stomata and cause injury at concentrations as low as

0.01 to 0.02 ppm. In large urban areas, concentrations

of 0.02 to 0.03 ppm are not uncommon, and in the

downtown areas of some cities, PAN concentrations of

0.05 to 0.21 have been measured. Once inside leaves,

PAN attacks preferentially the spongy parenchyma cells,

which collapse and are replaced by air pockets that give

the leaf a glazed or silvery appearance. The symptoms

on broad-leaved plants appear on the lower leaf surface,

whereas monocot leaves show symptoms on both sides.

Young leaves and tissues are more sensitive to PAN, and

periodic exposures of leaves to PAN often cause

“banding” and in some plants even margin “pinching”

of leaves because of discoloration and death of the most

sensitive affected cells, respectively.