between the ripe fruit and the preclimacteric fingers. The set-up was made within six hours after harvest. In this experiment the flow rate was 50 ml per minute for 22 hours, and then 200 ml for the 2-hour respiration run. This was done to allow for accumulation of ethylene for measurements. After the 7th day the ripe bananas were removed and the flow rates were continuously 200 mls/min.

Figure 2 shows that the ripening banana vapors stimulated the climacteric rise of these 'Dwarf Cavendish' bananas and that Purafil removed the ethylene coming from ripening bananas.

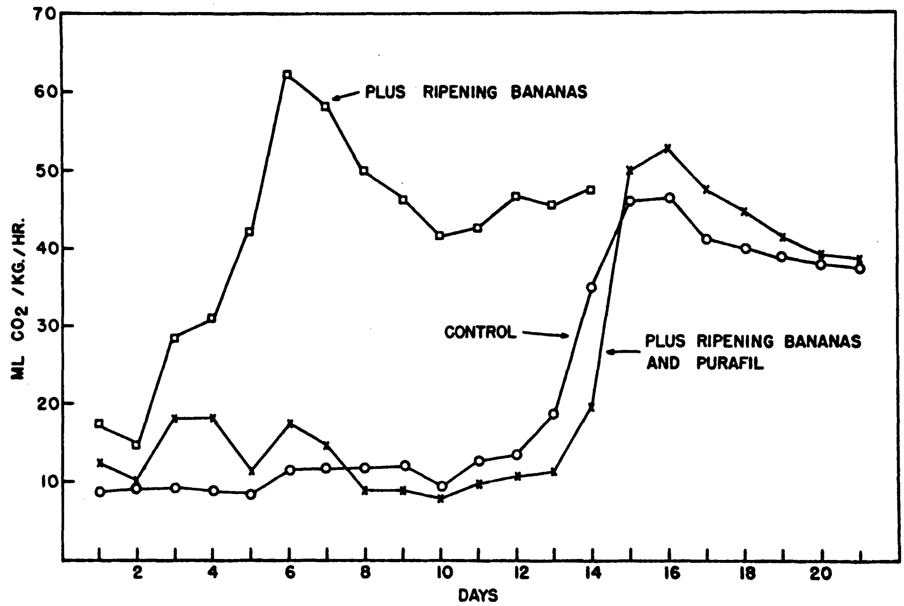

Fig. 2. Respiration rates of detached Dwarf Cavendish banana fingers as influenced by ripening bananas and Purafil.

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The Relationship of Sulfur Fumes to Defoliation and Fruit Drop of Apples[1]

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In early September 1963, extensive leaf drop on Winesap apple trees was reported from an orchard in Yakima County, Washington. Later a high percentage of fruit dropped prematurely, and the remaining fruit failed to color and mature normally.

In 1964 similar symptoms occurred in several orchards in Yakima and Chelan Counties. The first appearance of abnormality was noted in early September in some orchards but in others the first symptoms did not appear until early October. Leaf discoloration, defoliation, and fruit drop occurred on all apple varieties examined, but the most extensive and severe injury was to Winesap followed by Rome Beauty and Yellow Newtown. Damage was less extensive on Red and Golden Delicious.

The first sign of abnormality was a darkening of the upper surface of the leaves, primarily on the lower limbs (Fig. 1A). While portions of some leaves developed this dark or purplish pigmentation other portions of the same leaves lost green pigment, resulting in contrasting yellow and black or purple coloration. Frequently, the yellow developed at or near the leaf margin (Fig. 1B). In other leaves the green pigment faded with no distinct pattern and abscission occurred when about half of the leaf was yellow (Fig. 1C). In some leaves a pronounced yellowing along the midrib and major veins occurred as an early symptom (Fig. 1D) with or without the early, dark pigmentation. Leaf drop began two or three weeks following the appearance of symptoms. More mature leaves dropped first leaving the shoot bare except for a few leaves at the tip. Leaf drop often progressed until 90% or more of the leaves had fallen with the lower leaves on the tree generally dropping first. With heavy defoliation fruit did not

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mature normally and often loosened and dropped prematurely.

The affected trees were frequently in air drainage channels. The trees in the bottom of the channel were completely defoliated while those on the sides of the channel had only the lower portion of the tree affected.

There was no relationship apparent between any treatment in the apple orchard and the defoliation. However, after several orchards were examined it became apparent that there was always a nearby pear orchard at a higher elevation than the affected apple orchard. Fumes from lime sulfur sprays applied in the post harvest period to Bartlett pears were suspected of causing the injury to adjacent apple orchards.

In 1965 symptoms identical to those listed above were induced on Winesap apple trees by spraying with lime sulfur (3 gallons per 100 gallons of water) under the trees or on adjacent trees.

In 1967 these symptoms were again produced by spraying with lime sulfur on adjacent trees or on the grass between trees. Damage from fumes drifting from a sprayed plot 50 by 100 feet could be seen on trees 200 feet distant from the plot.

McCallan et al. (1936) reported that hydrogen sulfide caused injury identical to that produced by lime sulfur. However, they observed no appreciable injury to apples at concentrations below 400 ppm and the injury appeared as a scorching of young shoots and leaves, marginal scorching of middle-aged leaves, and no effect on mature leaves. Sulfur dioxide on the other hand, caused injury which appeared as light-colored specks in the interveinal areas or along the margins of the leaves, with young leaves most resistant to injury (Zimmerman and Crocker, 1934). Concentrations of sulfur dioxide as low as 0.1 ppm were believed to cause injury to crab apple when this concentration persisted for several days (Leone et al., 1962). The susceptibility of apple leaves to sulfur injury increased with the age of the leaf (Turrell and Bentley, 1957).

Abbott (1945) reported that both hydrogen sulfide and sulfur dioxide are evolved from lime sulfur and that sulfur is precipitated. Turrell (1950) reported that both hydrogen sulfide and sulfur dioxide are evolved from the biological reaction of sulfur with plant materials. These two gases represent the principle toxic factors in fumes from lime sulfur sprays.

Although the above reports of injury symptoms caused by either sulfur dioxide or hydrogen sulfide were not identical to those occurring in the present observations, it is concluded that the injury was caused by gases from the lime sulfur. The injury pattern more closely resembles that of sulfur dioxide than hydrogen sulfide but both gases could be active since any hydrogen sulfide absorbed by the leaf would be oxidized and act as sulfur dioxide.

It is presumed that the gases were generated over a period of days and drifted down-slope in night air and acted on sensitive maturing apple foliage producing symptoms somewhat at variance with those previously observed.

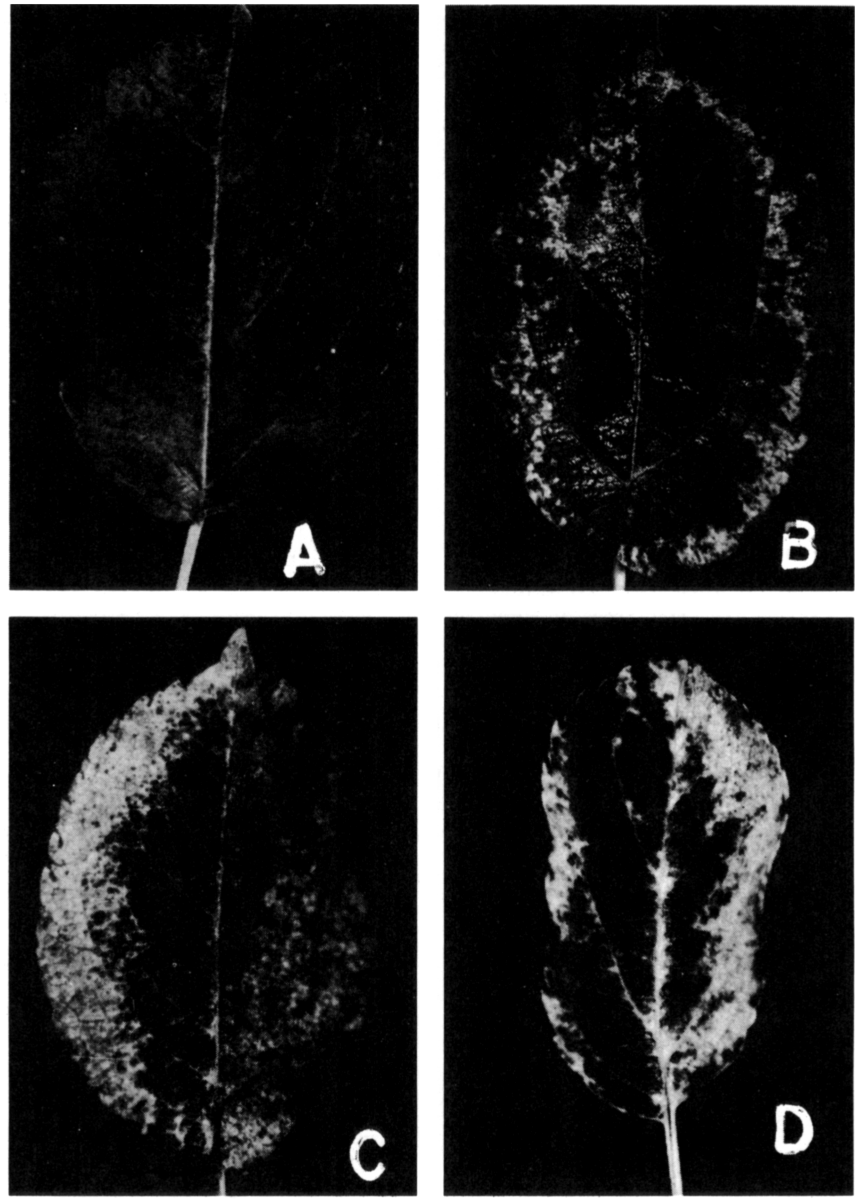

Fig. 1. Pigmentation and chlorosis of Winesap apple leaves in early fall when exposed to drifting fumes from lime sulfur sprays. A. First symptom to appear was a darkening of the upper surface of the leaf. B. Continued exposure to fumes resulted in extensive darkening of the leaf and often a loss of green pigment in portions of the leaf, usually along the margin. C. Some leaves developed very little dark pigmentation but much loss of chlorophyll. D. Other leaves developed a striking chlorotic pattern along the midrib and some major veins with a varying degree of marginal chlorosis.

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