degree of protection. For ordinary use a single layer will suffice. In the illustration the cover used weighed 5 pounds and protected a surface of 60 square feet, which area could be extended to 80 square feet. The covers can be made in any size. There is a small central frame of wood, cross braced, to which the paper is tacked. From the central frame flaps of the cloth paper extend, and there are suitable lacing strings provided to bring the ends of the flaps together and also to fasten the cover edges to the tree trunk, so that the cover remains in place should wind aries during the night hours.

The thermograms herewith show the difference in temperature during nights when frosts occurred, on the inner and outer side of the cover. The records were obtained by two similar thermographs and show that on an average there is a gain of 4° F. even where no special effort is made to wrap the tree closely. Nor was the cover placed in position until 8 p. m., when of course there had been a considerable loss of heat, except on November 19, when the cover was in place a little before 5 p. m.

Prof. E. J. Wickson makes the following editorial comment on the above paper:

Mr. McAdie is going back to test out the practicability of saving sun heat enough by checking radiation, which was perhaps the earliest horticultural recourse, and was employed, as he says in his essay, before men thought of the possibility of heating all out of doors. It is exceedingly desirable to have this thing accurately measured as Professor McAdie is doing it. Readers will doubtless be surprised that so much heat can be saved by such a slack shelter. Our correspondent who asked recently whether he could cover the orange trees nearly as tightly as they do for fumigation without injury to the tree, may take from Professor McAdie's demonstration the hint that it is not at all necessary to muffle his trees to closely to hold the temperature up enough degrees to avert frost. If she proposition works out as well as the preliminary experiments promise, there will remain, of course, much to be done in the way of contriving covers which will be in themselves cheap and cheap also in their handling. In this line the California inventive genius may be expected to work as great triumphs as it has in other phases of fruit protection. While the matter is still in its experimental stage, many of our readers may like to undertake experiments with various covers and give us their results for publication.

FOG AND FROST IN THE SAN GABRIEL VALLEY.

By ALEXANDER G. MCADIE.

One of the most important districts in California is that lying immediately south of the Sierra Madre and sometimes known as the Great Valley of southern California. Extending from the Pacific Ocean, in the vicinity of San Pedro Bay, eastward a distance of more than 60 miles to the foothills of the San Bernardino Range, it embraces an area particularly well suited for citrus fruit growing. The land is gently rolling for the most part, but traversed by the Puente Hills and the Santa Ana Mountains, running in a northwest-southeast direction. The San Gabriel Mountains lie to the north and rise somewhat abruptly to elevations exceeding 5,000 feet. Some of the best known peaks, such as Mount Lowe, Mount Wilson, 5,800 feet, and San Antonio, commonly known as old Baldy, 10,080 feet, can be seen from elevated places in the valley. On the eastern side the area is bounded by the San Bernardino Mountains, with an average elevation exceeding 6,000 feet. Some of the best known peaks in this range are San Bernardino, 10,630 feet, and San Gorgonio, 11,485 feet. There are numerous cities and towns in the district, including Los Angeles and its various suburbs, also Pasadena, Alhambra, Sierra Madre, Monrovia, Azusa, Glendora, San Dimas, Covina, Lordsburgh, Pomona, Ontario, Chino, Corona, Riverside, Redlands, and San Bernardino.

The southern half of the whole district is drained by the Santa Ana River, which has its source in the San Bernardino Mountains, traversing San Bernardino Valley and breaking through the Santa Ana Mountains between Rincon and Yorba, after which it is diverted for irrigation in the comparatively level lowlands around Orange, Santa Ana, Anaheim and Fullerton. The northern portion is drained by the San Gabriel River, which rises near the backbone of the Sierra Madre and flows westerly through various canyons, reaching lower levels near Azusa. It then flows southerly through the San Gabriel Valley and the Los Angeles Valley, emptying into the Pacific Ocean in a delta east of Long Beach. A third stream is the Los Angeles River, formed by a number of small creeks uniting east of Los Angeles and entering the Pacific west of Long Beach.

It is thus plain that the topography favors a drainage of the air from the mountains seaward at certain hours and a return flood, or movement of the surface air from the sea inland at certain other hours. In other words, the conditions are extremely favorable for the development of air streams which reverse their direction at least twice in each 24-hour period.

In general the lower air flows to the southwest during the night and early morning hours and to the northeast during the afternoon hours. During the winter months when areas of high pressure pass over the Great Basin, the surface air apparently moves south crossing the northern flank of the Sierra Madre and descending with some momentum into the Great Valley. The wind movement is particularly marked in the vicinity of the mountain passes, a good illustration being near Cajon Pass, 3,823 feet. During these so-called "northers," also locally known as Santa Anas, the temperature rises and the humidity falls. The existence of a low pressure area south of the Valley of the Colorado seems to intensify the condition. Heavy frosts occur as a rule after a period of boisterous north wind; and are undoubtedly traceable to the displacement of the warm air of the valley by air that is not quite so warm, but remarkably dry and comparatively free from dust. During the stillness of the morning hours and before the return flow of air from the sea can be effective, the soil, which in places consists principally of river wash, coarse sand, and gravel, or else a light sandy loam, loses heat rapidly by radiation through the dust-free dry air; and it is not unusual on January mornings to have temperatures of about 26° F. in the orange orchards. At many points, especially in the lower lands, care must be taken to protect oranges and lemons from both the fall in temperature and the rather rapid rise which occurs about 8 o'clock in the morning. In various papers published by the Weather Bureau the best methods of protecting fruits have been discussed.

On November 26, 1910, the general conditions of pressure temperature and humidity were somewhat as above described, although not as pronounced as those likely to prevail later in the season. The accompanying photograph, "Fog in the San Gabriel Valley," showing conditions about 8 a. m. is reproduced through the courtesy of Director Hale of the Solar Physics Observatory on Mount Wilson, Cal. The photograph with many others was made by Prof. Ferdinand Ellerman of the Observatory, who states that the fog enveloped the mountain about half an hour after the photograph was taken. The view is looking south and the line of fog close to the ground passes over the Arcadia race track. The Puente Hills project above the blanket of fog beyond. The temperature near the Snow telescope was 38.1°. The temperature at Los Angeles at 5 a. m. was 46°, the wind northeast and frost was reported.

The photograph in addition to being one of the most beautiful of fog pictures, is of extreme interest as showing the condensation of the water vapor at various levels, from the ground to 2,000 meters. Attention is called to the sharply marked plane of condensation of the line of cumuli clouds at the top of the picture. The main blanket of fog lies rather close to the ground, averaging about 200 meters for the upper surface. The fog in the foreground, over the orange grove, shows stream lines in the lower air.

The photograph clearly shows the existence of air currents at different levels and the mixing of the same. While we lack accurate records of temperature and water content of the air at various levels, it is something to be able to look down upon the condensed vapor and have a permanent picture of the process of cloud condensation in the free air at critical times.

FIG. 1.—FOG IN THE SAN GABRIEL VALLEY, CAL., NOVEMBER 26, 1910, AS SEEN FROM THE SUMMIT OF MOUNT WILSON. BY DR. F. ELLERMAN.