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10 nights temperatures were sufficiently below the critical level that there can be no doubt that the protection averted damage. On two nights in 1955 and two in 1963 the protection available markedly reduced damage, especially in certain areas of the grove, but was inadequate in preventing freezing of some fruit, as well as leaves and small twigs.

Flood Irrigation Helps

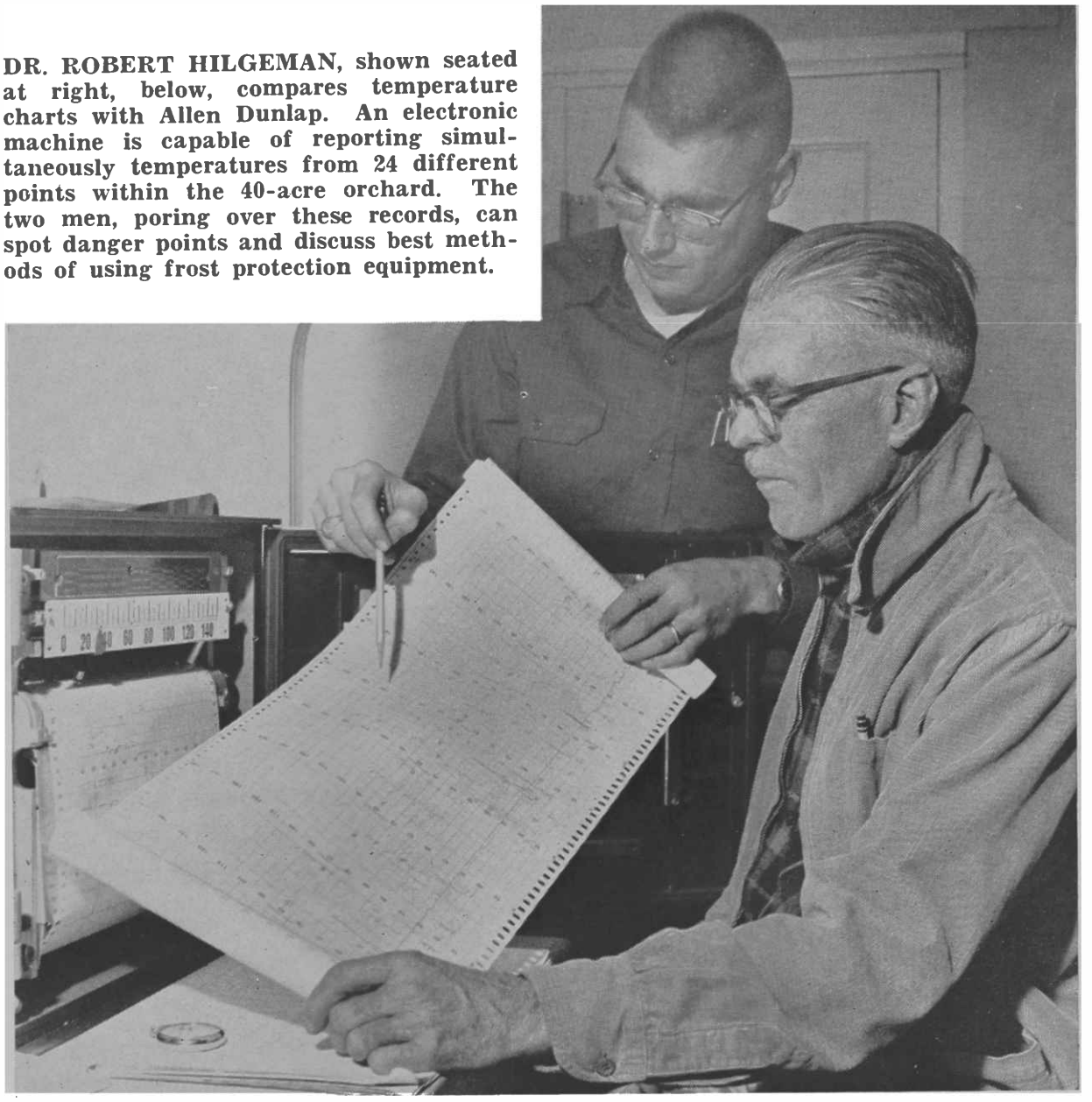
Irrigation water at temperatures of 65° F to 70° F flooded over most of the soil, has repeatedly produced increases of two to three degrees of temperature. It is a dependable source of heat, but the area that can be flooded is limited by the available water supply. Irrigation, as frost protection, is most effective when it is applied during the coldest period of the night.

Effectiveness of wind machines is directly dependent upon existing meteorological conditions involving the velocity and temperature of the upper air. Under favorable conditions of less than three miles per hour wind drift, with upper air temperatures 6° F to 10° F warmer than at five feet in the grove, wind machines have raised temperatures to 4° to 6° F near the machine. A maximum gain of about 65% of the inversion can be expected near the machine. Gains 300 to 400 feet away from the machine depend upon wind drift conditions.

Return stack orchard heaters placed 15 per acre with one per tree on borders, have provided from 1.5° F to 2.0° F increase in temperature when operated with wind machines.

It Was Cold Last January

On the extremely cold night of Jan. 13, 1963, temperatures dropped to 16.5° F in unprotected areas and to 23.5° at the 50 foot elevation. Four wind machines, spaced one for each 10 acres, were operated after 10 P.M. and orchard heaters at the rate of 15 per acre with one per tree on the border rows, were lit between 12 and 3 A.M. This equipment induced 2 to 3° F minimum protection at 100 feet upwind of the machine and a maximum increase of 5° to 6° F in about a 10 acre zone downwind from the machines. (EDITOR'S NOTE: Pictures accompanying this article were taken that cold night of last Jan. 13 by Charles Hilgeman, son of the Citrus Station superintendent.)



DR. ROBERT HILGEMAN, shown seated at right, below, compares temperature charts with Allen Dunlap. An electronic machine is capable of reporting simultaneously temperatures from 24 different points within the 40-acre orchard. The two men, poring over these records, can spot danger points and discuss best methods of using frost protection equipment.

In the warmest zones about 90 percent of the grapefruit was not frozen and about 55 percent of the Valencia oranges were slightly injured and passed state frost tolerance standards.

In the coldest upwind heated zone, temperatures dropped to 19° and were near 21° F for five hours. Here fruit was frozen within six feet of the heaters. Leaves were protected on the sides adjacent to the heaters, but froze on the opposite side of the tree. It is evident that many more heaters per acre will be required to assure ample protection during severe freezes.

Offers Good Advice For Ariz. Cattlemen

By Abbie Keith

in ARIZONA CATTLELOG

At the State Cattle Association Secretaries' meeting in Denver we heard many bits of information. Some were interesting; many are worrisome. One thing for sure, beef production is not a hit-and-miss business any more — it's more a "miss" business, unless great care and skill are used in the operation, whether it be ranching or feeding, buying or selling cattle, slaughtering or merchandising the beef; it must be done practically and sensibly, with a satisfied consumer as the final factor.

Some recommendations that sounded good enough for any cattleman to follow included:

1. Increase the efficiency of your operation.

2. Decrease the average age of your cows by closer culling.

3. Increase your feed reserves, especially have extra feed, or extra cash reserves in the bank to buy feed if needed, so you won't have to dump cattle on the market.

4. Don't get in a situation where you are at the mercy of your banker.

5. Take an impartial view of your cow operation; look at it as you would if the outfit belonged to your neighbor.

6. Sell cows when they should go; keep a good young heifer for she will stand a drought better, and be easier to sell if you get in a bind.

7. Discourage speculative enthusiasm.