ably due in large part to temperature and total irradiation differences. The favorable growth of the phytotron plants shows that if the air temperature is controlled, no obvious adverse effects follow the application of large quantities of infrared radiation from incandescent lamps (equivalent to 77 per cent of direct summer sunshine in intensity and extending over more time than sunlight).

In the phytotron, about two-thirds of the total light reaching the plants was from the incandescent lights, which extended the day length, the remaining one-third being from the sun. About 15 per cent of total outdoor sunlight reached the plants. The table above summarizes the relationships of visible light to infrared, or heat radiation for the entire experiment. These plants received the equivalent of about one-half the total outdoor light (quantity per day). Much more efficient designs of phytotron are now being planned to utilize sunlight more fully and incandescent light more efficiently.

LIGHT-INFRARED RELATIONSHIPS

During First 5 Weeks (Feb. 15 to March 21)

Ratios of Solar to Incandescent Radiation at Plant Level

Total radiant energy	1st 3 weeks	1st 5 weeks
Light	0.48	0.55
Infrared	0.094	0.11

Ratios during daily intensity maxima on clear days (up to 8 hours duration):

	Minimum ratio	Maximum ratio
Light	0.33	3.0 and higher
Infrared	0.065	0.58 and higher

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BRIEFS

short reports on current agricultural research

EUROPEAN ALFALFA AND RED CLOVER

During the past growing season, the Department of Agronomy has had under test 16 varieties of alfalfa and 36 varieties of red clover from western Europe. The purpose of these trials is to determine their seed producing capabilities under California conditions. Agriculturalists from western Europe who have traveled in California have been favorably impressed with the yields and quality of seed produced under California conditions. This has often been in sharp contrast with results in many parts of Europe where frequent rains reduce yields and damage quality.

These trials were conducted in cooperation with both private and government officials in Europe as well as in the U. S. Varieties which show favorable seed producing ability would be increased under specific arrangements with the breeder or European governmental officials and in most cases would be produced for export purposes only.

Tests have shown wide variation in seed producing capabilities. In general, red clover varieties from northern Europe have been unsatisfactory while some from central or southern Europe have produced good seed yields. European alfalfa varieties also show large differences in seed yields.—*Maurice L. Peterson and Luther G. Jones, Dept. of Agronomy, University of California, Davis.*

ELECTRON MICROSCOPY AIDS PHYSIOLOGICAL STUDIES

Changes in cell structure caused by boron deficiency can be observed in great detail by electron microscopy. In contrast to the light microscope, which magnifies up to about 1500×, the electron microscope commonly magnifies from 1000× to 50,000×, with even higher magnification possible.

Research at Davis on tomato roots and leaves shows that boron deficiency profoundly affects the mitochondria, those parts of the cell in which respiration is centered. Other cell membranous systems such as the endoplasmic reticulum are shown to be much altered by boron nutrition, but proplastids and chloroplasts are relatively little affected. Effects of boron on cell wall formation are also revealed. Under deficiency the inner surface of the walls is much more irregular than normal, suggesting a relationship to carbohydrate metabolism. Such observations at the fine structural level of organization contribute to a more complete picture of the effects of deficiency of an essential element. Information of this type gives further clues to the function of boron in the plant and aids in the diagnosis of mineral deficiency disorders.

Other phenomena of special interest to vegetable production, such as fruit ripening, the action of growth regulators, and compatibility problems in the production of hybrid seed, should all be given closer scrutiny by use of the electron microscope.—*Arthur R. Spurr, Department of Vegetable Crops, University of California, Davis.*

CROP, SOIL RESPONSE TO WATER APPLICATION

The application of irrigation water to agricultural soils, whether by surface flooding or sprinkling, may adversely affect the structure of the surface soil. If this is the case, the distribution of water and nutrients in the soil and consequently the uptake of nutrients by plants and plant growth may be affected by the method of water application.

To investigate the magnitude of these effects a study has been initiated at the West Side Field Station on Panoche Clay Loam soil. Water is applied to row crops on a given schedule by furrow irrigation and by sprinkler irrigation using two different water application rates for the sprinklers (0.1 and 0.2 inch per hour). During the irrigation season, analyses of water stable aggregates, bulk density, and modulus of rupture are made on soil samples taken from the bottom of the furrow and the bed. Nitrate concentration of these surface soils is also determined. Complete analysis is made of plant tissue samples taken before each irrigation and before harvest. Crop yields will be obtained at the end of the season for each method of irrigation.

Preliminary studies in 1960 show that infiltration of water in the soil was significantly greater for the sprinkled plots, both in rate and total water infiltered up to 200 minutes. After 200 minutes time the rate of infiltration was not affected by the method of water application, but the total depth of water infiltered to 600 minutes was greater for the sprinkled plots.—*A. W. Fry, Assistant Engineer, Department of Irrigation, University of California, Davis.*