considerable development work has been achieved with machines which lift the beets first and subsequently top them. Topping beets in place has been a difficult task to accomplish satisfactorily, particularly where stands are thick and with the beets spaced more or less regularly, due to inequalities in crown elevation and beet sizes.

While I have a feeling of optimism toward the ultimate success of the harvesting machinery problem, I also realize there can be no definite forecasts of the ultimate outcome. It is a most difficult problem on which many excellent and capable persons have worked without complete success.

We now come to the third phase of this discussion: Suggestive methods of attainment? While I perhaps lack the courage and foresight to forecast the ultimate outcome I do believe a carefully planned cooperative project involving science, industry and agriculture offers more promise than any other of bringing to fruition the objectives sought.

The time has arrived to depart from the independent and perhaps the unrelated method of approach by some cooperative arrangement which will bring about a pooling of talent, funds, equipment, and ideas for a common purpose, that is, to get the best answer possible in the shortest time.

It would appear feasible, sensible and appropriate for these various agencies to get together on a program which would make possible the fullest utilization of facilities and talent at our experimental stations supplemented by special research grants from the industry, to work on these vital problems.

LIGHT AND BIOLOGIC EFFECTS

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Everything of material value comes to us on a beam of sunshine. An abundance of sunshine means health, happiness and prosperity. Absence of sunshine results in darkness, ignorance, sickness and eventually death. Since sunshine means so much to everyone it is important to know about sunshine.

Practically all of the energy on earth arrives in the form of light from the sun center of our planetary system. The sun radiates in every direction through space while our earth intercepts only a small portion of the total energy. However, that portion amounts to one horsepower for every square yard of the earth's surface, or to about one man-power for each square foot on which we stand when the sun is shining down. Every second the total sun energy reaching our earth is more than was in all the coal ever mined in America.

The sun energy is radiated in the form of light, not as heat. There is no heat present until the light waves are stopped by the earth or the earth's atmosphere. Without sunlight we would all perish within a few hours. Sunshine keeps us well and, properly used, sunlight will cure our sicknesses.

Captured Sunshine: For years we have known that green leaf chlorophyll uses sunlight in the chemical manufacture of starch and sugar and all our foods, but not yet is the process fully understood. Nor have the most effective wave lengths for that purpose been determined. We do know that infra-red alone is insufficient. Red makes plants tall and spindling. Blue does the opposite, and ultra-violet light can make green apples red. Very short waves may be harmful, Bio-chemistry of light is little understood. Do you know which color of sunlight makes the best beet seed? And why? Humans like yellow light. Perhaps plants prefer some certain color of light. When such mysteries are solved we may learn how to manufacture foods directly from air and water with the assistance of light and electricity.

It has been found that plant seeds treated with X-rays produce changed plants and entirely different flowers. Maybe monochromatic light may have a similar effect. Mr. C. N. Moore of the G.E. Research Laboratory treated bulbs of regal lilies with varying doses of rays. Among the plants from treated bulbs were a few monstrosities which offered no desirable possibilities; progeny of two of the bulbs that had received doses of X-rays produced flowers with non-shedding anthers. Each succeeding year has seen the new strain continue true. Bulbs and bulblets from these two bulbs have continued to bear nondehiscent flowers--the property is now a fixed character, and a new variety of the regal lily exists. (Show Photograph.)

Photo-chemical effects which enable the retina to stimulate the optic nerve occur in a substance called "Visual purple" which is bleached by light but quickly regenerated or resensitized in normal eyes.

The retina is supposed to have evolved from ordinary skin. And we find that skin on all other portions of the body has certain photo-chemical reactions. Vitamin "D" is evolved from ergosterol and this energized compound seems to have a catalytic action stimulating other important chemical reactions.

In a similar way ultra-violet is believed to cause Vitamin "A" in the yellow pigment of grains, called carotin; and to generate Vitamin "B" in the outer layers of rice grains.

Moreover it has been found that irradiation of milk, cheap fats, fish meat, and bran, make better food values. And these are stronger for ricket prevention than ordinary codliver oil.

Ultra-violet increases egg production by poultry, milk by cows, and work by humans. It increases the bacteria destroying white corpuscles in blood. Photo-spectrographic analysis is now being used in place of direct chemical method! It is quicker and in many cases is more accurate. Photography by invisible light has overcome many optical difficulties. Microscopy with ultra-violet and infra-red has revealed organisms which are invisible by visible light. Infra-red filters which stop ultra-violet rays have made possible long distance photography by excluding the obscuring blur due to moisture and dust in t he air.

In summertime ultra-violet sunlight prevents sickness and helps keep us well. The infra-red rays are very helpful in curing sprains, bruises, coughs, colds, and other congestive diseases. It happens that infra-red and visible light can penetrate into the human body a distance of about one inch. When we have long exposure to sunshine or to "heat" lamps, this penetrating

light energy reaches the muscles, is transformed into heat energy which expands the capillaries, lets new blood course through the veins to wash away the congested poisons of disease and bring new strength to the sick parts.

(Here follow experiments with infra-red light, filters, radiometer, photo-cells, et cetera.)

THE IRRIGATION OF SUGAR BEETS

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The preliminary work on sugar beet irrigation has been conducted at Davis, California. For the past four years thirty 20th-acre field plots have been used in the experiment. Experimental procedure has been to maintain widely different soil-moisture conditions and to measure the effect on growth, yield, and sugar content of beets. In some of the plots the soil moisture content has been maintained at a high level by frequent irrigations. In others the beets have been allowed to deplete the moisture to the permanent wilting percentage and irrigation has been withheld until a decided evidence of water shortage could be observed. Other treatments include plots in which the soil-moisture content was allowed to drop to a certain percentage within a specified depth of soil.

The results obtained the first four years are in agreement. Representative results for the four outstanding treatments for the four years are given in the following table.

Yield, percent sugar, number of irrigations, acre-inches water, dates of irrigation, for four irrigation treatments of sugar beets at Davis.

Treatment	Yield tons per acre	Percent sugar	Number irrigations	Acre-inches water applied	Dates of irrigation
			1933		
1	13.3	15.3	1	15.0	June 15
2	24.4	15.5	7	35.9	May 24, 26, June 6, 15, 22, July 1, 12
3	22.6	15.2	4	33.8	May 14, June 6, 22, July 12
4	22.5	14.2	3	32.2	May 26, June 22, July 12
			Harvested July 20		
			1934		
1	28.7	17.4	1	13.2	June 28
2	41.6	17.1	8	46.0	April 20, May 10, 31, June 15, 29, July 6, 24, August 7
3	42.4	16.7	4	37.1	May 9, June 8, July 9, Aug. 3
4	37.3	17.5	3	32.0	May 17, June 20, July 16
			Harvested August 20		

(Continued next page)