SCIENCE NEWS

THE STIMULATION OF GROWTH BY ELECTRIC LIGHT

Science Service

THAT electric light may be used in place of sunlight and that it does not pay to use it are two of the first lessons taught by the experiments being carried on at the Boyce Thompson Institute for Plant Research recently established at Yonkers, N. Y. The new laboratories give the experimenter for the first time opportunity to change one by one all the various factors affecting plant growth in the open, for in the enclosed underground rooms the temperature, humidity and composition of the air can be varied at will and so also can the amount, intensity, duration and character of the light.

In the experiments on the optimum length of illumination a variety of plants were exposed to electric light for periods of 5, 7, 9, 17, 19 and 24 hours. The dark periods were secured by wheeling the carts bearing the plants into a constant dark room having the same conditions as the light room. Remarkable differences appeared in the rate of growth of the plants and the age and stature of the plants at the time of flowering with the different lengths of day.

Varieties of tomato, snapdragon, sunflower, coleus, radish, lettuce, clover, geranium and chrysanthemum bloom much earlier in constant light than in shorter daily illumination. Buckwheat, aster and soy beans bloom much later in constant light than in shorter days. Salvia, cosmos and four o'clock failed to bloom at all in constant light.

Tomato grew faster and made better plants as the daily illumination increased from five to seventeen hours. Nineteen hours daily illumination was injurious to the tomato and constant illumination finally killed it. Some other plants were injured by nineteen hours illumination and constant illumination. With some plants then there seems to be a limit to the possibility of forcing by lengthening the day. It is not known whether this is due to the need of daily rest from growing activity, or to some other cause.

But the complete replacement of natural by artificial light shows no prospect of being profitable, according to Dr. William Crocker, director of the institute, who gives out the following figures as to the costs of illuminating the constant condition room:

"On the matter of the economic possibility of using artificial light for growing plants I will mention the costs of illuminating our constant condition light room. This room is eleven feet by eleven feet and is illuminated by twenty-four 1,000 watt tungsten lights. They give about 500 foot candles in the growing room after the rays have passed through the water screen to remove heat. Sunlight at noonday in June gives 4,000 to 10,000 foot candles. With the current at 4½ cents per kilowatt hour the cost of lighting this room is $1.12½ cents per hour; $27.00 per day; or $2,430 for 90 days. It is evident that one would have to grow something of the order of value of pearls to make the use of this house commercially profitable. The reasons for this are clear. The tungsten lamps convert only seven per cent. of the electrical current used by them into light. The sun is much more efficient as a light source. Thirty-seven per cent. of the energy value of the sun's rays reaching the earth are light rays. The plant uses only the energy of the light rays for making its foods and probably the average plant in this room stores no more than 10 per cent. of the light energy falling upon it in the form of carbohydrates and other organic foods. This means that less than one per cent. of the energy paid for as electrical current is recovered by the plant. Even a portion of this is used by the plant in its own respiration.

"The plant is a very inefficient machine for the transformation and storage of energy. The only reason man can afford to use it at all is because the sunlight from which it stores the energy in nature, like salvation, is free. It might be added, however, that in spite of this inefficiency man can not only afford but must use it, for up to date the plant alone can synthesize many organic materials necessary to life.

"Now what is the excuse for experimenting with the growth of plants under artificial light, if the plant is such an inefficient machine for the conversion and storage of energy? The institute has a very good excuse. It is trying to establish the laws of plant development. The only way to establish such laws is by growing plants under controlled conditions. Artificial light makes accurate control possible. I would not imply that artificial illumination has no possibility of profitable use in the growth of plants commercially. I do mean to imply that with the present inefficiency of tungsten lights and the present price of electrical current, we can not afford to grow the bulk of the plant (and bulk is a measure of the amount of energy stored) with artificial light even if the plant could be sold at a fancy price."

In the meeting of the Illuminating Engineering Society held at the institute, Victor A. Tiedjens reported the results of his work on stimulating the growth of lettuce by electric light of varying intensity. A pair of lamps, ranging from 50 to 300 watts, was suspended about five feet over each plot of eight feet square and turned on for various periods after sunset. In general, it was found that the rate of growth increased with the intensity of the illumination.

"The length of the growing period, from seedling to head formation and seed production, was shortened by two and four weeks respectively for the higher intensities, but the growth was not always beneficial to good head formation. The seed stalk was started before a good marketable head was formed in the varieties commonly grown by market gardeners."

ETHYL GASOLINE

Science Service

WHEN tetraethyl lead is added to gasoline in the usual commercial concentration of one part in a thousand automobile exhaust gases result that have produced no ill effects on animals under study by the U. S. Bureau of Mines at Pittsburgh.

The government experts point out that the industrial hazard during the manufacture of the anti-knock compound and the possible danger from its use in automobiles are quite different due to the low concentrations in the exhaust gases.

To test the possible hazard due to the exhaust gases from automobiles using ethyl gasoline as ordinarily sold, pigeons, guinea pigs, rabbits, dogs and monkeys, over 100 animals in all, were exposed to a definite concentration of exhaust gas from an engine using ethyl gasoline. The concentration of exhaust gas in air used was that which, when coming from the average automobile, would be four parts carbon monoxide in ten thousand parts of air; a concentration allowable for but a period of one hour exposure from the standpoint of carbon monoxide, and exceeding that known to exist in ordinary traffic of a city street.

Two groups of animals were exposed for daily periods of three and six hours, respectively, and the third group not exposed. The animals were observed throughout the test period of eight months for symptoms of lead poisoning, as colic, paralysis, loss of appetite and loss of weight, and there was no indication of lead poisoning. At various times animals were killed and the entire tissues examined for effects of lead and analyzed for stored-up lead.

Observations made on man showed that most of the lead in exhaust gases coming from ethyl gasoline when inhaled is again exhaled. The investigation indicated the seeming remoteness of any danger of undue lead accumulation in the streets through the discharging of scale from automobile motors.

The opinion of Dr. Yandell Henderson, of Yale University, as reported to *Science Service,* is as follows:

"The amount of tetraethyl lead added to gasoline is small yet if all cars used it a person on Fifth Avenue, New York, in eight hours would inhale about the minimum amount sometimes inducing symptoms of lead poisoning. I pointed this out to representatives of General Motors two years ago. They claim that most of the lead is accumulated in the muffler of a car and is not discharged. Obviously, however, when a cylinder misfires, as in cars in repair shops and garages, while warming up and even on streets, undecomposed tetraethyl lead may be discharged.

"It is reported that the method of dispensing tetraethyl lead to the public is to attach a small tank of the highly concentrated substance to the gasoline pumps at roadside filling stations. A small amount is added to each gallon of gasoline and it is pumped into the tank of a car. A warning accompanies each tank but the names reported as commonly used for the substance such as ethyl gas and ethyl alcohol are not indicative of an acute poison.

"Lead by preventing premature explosions increases efficiency. It makes possible engines using much higher compression than at present. The introduction of cars with such engines would put all present automobiles out of date, so that the market could be resold. We should all want one of the new ones.

"I have been trying for many months past to warn the health authorities and the general public of this new hazard. When the outbreak of poisoning at Bayway was reported in the newspapers and when the officials of the company adopted a policy of secrecy I stated that the mysterious insanity gas is tetraethyl lead."

TUBERCULOSIS AND DIABETES

Science Service

THE curious fact that diabetes can sometimes be cured by tuberculosis has led a prominent Swedish specialist, Dr. Erik Lundberg, to researches and discoveries which promise to have important effect on the future treatment of both diseases. This is of special interest in connection with the widely-heralded use of insulin in the relief of diabetes. Proceeding on the theory that in the case of consumptive patients insulin, or something similar, is secreted outside of the pancreatic gland, Dr. Lundberg experimented with mice which he infected with tuberculosis and then dosed with insulin. He succeeded in producing insulin poisoning which led to instant death, except where he made injections of grape-sugar along with the insulin. He found that the injection of about one half cubic centimeter of a solution of 10 per cent. grape-sugar resulted in immediate recovery from the insulin poisoning.

From these experiments Dr. Lundberg has concluded that insulin is secreted by the tubercular granular tissue, and that this substance is everywhere present in the human organism in very small quantities, where the secretion is greatly stimulated in some way under the influence of tuberculosis bacilli or their toxins.

MALARIA AND PARALYSIS

Science Service

REMARKABLE results in the treatment of a hitherto incurable disease and discoveries of the highest importance for the conquest of another widespread malady have been announced by Dr. Warrington Yorke, professor of parasitology of the Liverpool School of Tropical Medicine.

For the first time in the history of mental hospitals there and in other sections of Great Britain, patients suffering from general paralysis have been discharged and returned to their former occupations apparently cured. These cures were accomplished by fighting disease with disease, malaria being used to conquer paralysis.

The malaria-carrying mosquitoes, dread enemy of civilization, were enlisted by Dr. Yorke and his co-workers as allies in the fight. Patients were infected with malaria by the bites of these mosquitoes and then the malaria was conquered by the use of quinine.

Out of 84 patients infected, 14 died, 20 showed no change, 10 were improved physically but not mentally, 17 showed definite mental and physical improvement, and 23

were so much improved that they were discharged from the hospitals.

In treating the patients by this method, new and striking information was obtained about malaria itself. The experiments of the Liverpool School indicate that quinine will not protect persons from malaria. Giving quinine before a person is bitten by an infected mosquito was found to be useless.

In order to prevent malaria from developing, quinine must be administered for at least ten days after the mosquito bites. The size of the daily dose of quinine given was discovered to have but little influence, except for the fact that with very large doses of 30 grains, the period for which the drug had to be given to prevent development of the infection was slightly shortened.

According to Dr. Yorke, the quinine invariably destroys large numbers but not all the malaria parasites in the blood of an infected patient and sets free a soluble substance which stimulates the tissues of the patient to form an immune-body. This immune-body in turn destroys the remaining parasites, thus resulting in the cure of the patient. When for any reason, an insufficient amount of the immune-body is produced, the infection is not sterilized and a relapse occurs.

RIPENING CANDY

Science Service

CANDY filling may be kept soft for months inside its chocolate coating by a process discovered by H. S. Paine and J. Hamilton, of the U. S. Bureau of Chemistry. They have found that the addition of invertase extract makes unnecessary the ripening process which causes delays in candy manufacture.

Invertase is an enzyme found in nature that has the power of changing cane sugar back to simple sugar like dextrose. While fondant seems to be a solid it is really composed of microscopic bits of sugar held together by a film of syrup. It is about the consistency of putty and has a number of its physical characteristics. When fondant is stretched out it looks dry and stiff. When it is worked together between the fingers it becomes oily and moist.

The action of the invertase dissolves a number of the sugar crystals making the syrup film constant around them. This assures the creamy center which is so much to be desired.

Cream of tartar added to the candy would give the same creamy filling but the addition of the acid spoils the taste, and does not do away with the process of ripening, however, as invertase does.

According to the old rule for fondant, handed down from master to apprentice, fondant had to be cooked slowly, allowed to cool thoroughly, beaten with a wooden paddle. Then it was put into stone jars and allowed to ripen for several days. After this it was taken out, melted and poured into starch molds. It was allowed to ripen in the molds for several days before it was dipped into chocolate. The chocolate coating acts as a protection against drying. Inside this air proof case inversion takes place to a slight degree, that is, the sugar particles dissolve somewhat in the syrup.

By the addition of invertase when the flavoring is added the ripening process is not necessary. The fondant is cooked, beaten with a wooden paddle, remelted, poured into molds, and dipped in chocolate all in the same day. Chocolates treated in this way have been tested after six months and 6.8 per cent. of water has been found present in the fondant.

ITEMS

Science Service

A HEAVY dripping fog rolled in from the Pacific ocean and put out effectively a fierce forest fire which had been burning for days in the Olympic peninsula southwest of Port Angeles, Wash. This is the only time recorded in northwest forestry of the occurrence of such a phenomenon. With no indication of rain and lacking water with which to fight the advance of the flaming menace, foresters watched the fire making progress toward the town of Quilcene, beyond which lay valuable tracts of big trees, when suddenly the wet fog descended. Like a huge gray cloud it settled down upon the forest enshrouding everything. The fire fighters fled in terror lest they become bewildered and lost on the mountain sides. Soon the pungent smell of cedar and hemlock smoke disappeared and by mid-afternoon when the fog lifted there remained but a few smoking dead logs, while all about the charred trunks of former merchantable trees dripped with water from the providential fire extinguisher.

AN unknown object has been sighted in the heavens. What may be a new comet or a new minor planet or asteroid has been discovered by the astronomer Dr. Baade at the Hamburg Observatory, at Bergedorf, Germany, according to a cablegram received at the Harvard College Observatory. It is a comparatively faint object and visible only in large telescopes. The discovery was made on October 23, when the astronomical constants of the newly discovered object were reported as follows: Right ascension 21 hours, 5 minutes and 16 seconds, declination north 15 degrees, 28 minutes, magnitude 10. The astronomical newcomer will probably soon be detected by American telescopes near the constellations of Cygnus, the Northern Cross and Aquila, now visible in the northwestern part of the evening sky. The object is reported to be moving at a fairly rapid rate.

A FLOWER species found in early American colonial days and not seen again for 175 years has been rediscovered at Upper Marlboro, Md., near Washington, by two Washington naturalists, Dr. E. T. Wherry, of the U. S. Department of Agriculture, and Dr. J. E. Benedict, of the U. S. National Museum. The plant is the Pink Turtlehead, known to botanists as *Chelone obliqua*. It grows in wet ground, reaching a height of two and a half or three feet, and bears large, handsome pink flowers of an odd shape that have suggested its English name. It was first found in the early eighteenth century by John Clayton, a noted English-American botanist, and sent by him to Linnaeus, the great Swedish scientist who founded modern botany. Since that time it has not been seen again until its recent rediscovery.