THE PROPAGATING INFLUENCE OF HIGH-TENSION ELECTRIC CURRENTS UPON PLANTS.

From time to time interesting experiments have been made to determine the influence of electric currents upon the growth of plants. The majority of such investigations, however, have been carried out only upon a limited scale, but the fact has been accepted that the artificial supply of electricity does increase the rapidity and assist the amount of growth. In order to test this theory upon an extensive practical scale, Mr. J. E. Newman of Gloucester, a well-known British agriculturist, completed arrangements for such an experiment, and approached Sir Oliver Lodge, F.R.S., to assist him in completing the electrical details of the project and to secure the maintenance of the requisite continuous high-tension discharge for hours together every day over a large area. The proposal was accepted by Sir Oliver Lodge, who in conjunction with his son, Mr. Lionel Lodge, carried out the electrical part of the scheme. The experiments were commenced in 1906 and have been continued ever since. Through the courtesy of the investigators we have been enabled to secure details concerning the equipment and the results that have been achieved.

The field selected for the operations was 11 acres in extent. It was sown with English and Canadian red fife wheat respectively. The overhead system of wires covered about 19.5 acres. The poles, for which larch was selected, were about 15 feet in height, so that the wires offered no interruption to loaded wagons and other agricultural implements passing beneath. The poles were disposed in parallel rows about 102 yards apart, the span between each post in each line being about 71 yards. By this arrangement about 22 poles were sufficient for the whole acreage representing approximately one pole per acre. The current was carried down each row by means of stout telegraph wire carried on elaborate high-tension insulators of special design, while thin galvanized-iron wires placed some 36 feet apart were stretched between the rows to act as the discharge wires over the crops beneath. For the purpose of securing comparative data concerning the influence of electricity upon the crops a small section was left without wires to serve as a control.

Owing to the flexible suspension the risk from breakage has been found to be very slight. During the two years the wires have been up, apart from a few breakages owing to extra high wagons with their harvest load coming into contact with the network and causing a few breakages, only one wire has fallen, so that the maintenance charges and repairs of the wires have been insignificant.

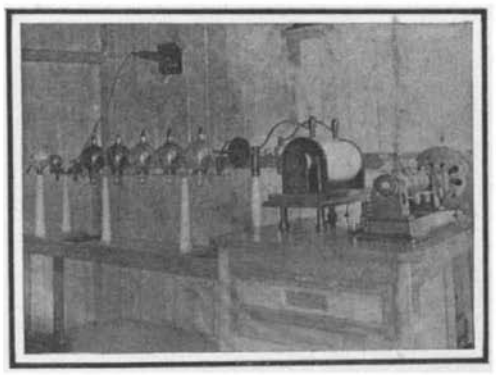
The electric current for such a purpose, as Sir Oliver Lodge points out, can be generated in several ways. It can be generated by the revolving glass plates of the Wimshurst machine, or by transforming up to high tension and rectifying to one direction the current of the dynamo. In this particular experiment both systems have been used but the former while in many respects the simplest, is not adapted to continuous or rough use, such as it is subjected to upon a large sized farm.

The experiments were commenced in 1906, but owing to delay in delivering some portions of the electrical equipment work had to be carried on with a somewhat improvised generating station. When, however, the electrical apparatus was received and the installation completed work was carried out upon the originally projected lines. The power is furnished by a 2-horse-power oil engine driving a dynamo placed in one of the out-buildings of the farm. The current so generated is transmitted by the usual overhead system to a corner of the field where in a weather-proof hut the transforming and rectifying apparatus is erected. The dynamo furnishes direct current of about 3 amperes at 220 volts. Upon reaching the transforming and rectifying station it passes through the primary of a large induction coil with a make-and-break contact interposed in the circuit. From the secondary of the coil the high-tension current passes through the rectifiers which comprise vacuum valves in accordance with the patented device evolved by Sir Oliver Lodge. From the rectifiers the current, now raised to a potential of about 100,000 volts, is conducted to one pole, by which it is distributed over the whole system of overhead wires. The negative electricity is conveyed direct to earth except when retardation is desired or during drought. By this arrangement the overhead insulated wires are maintained at continuous high positive potential.

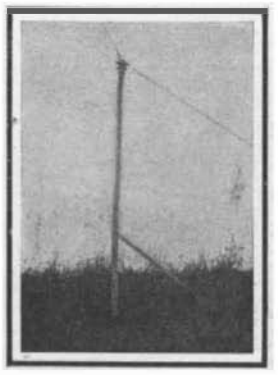
When the current is switched on leakage immediately begins from the overhead wires. At times the action is plainly audible, while at night it can be seen, a slight glow just being visible in the darkness. Evidence of the discharge can be experienced by anyone walking beneath the wires, the hair of the head being slightly stimulated owing to electrification.

The current is maintained for some hours each day but is shut off at night. Sir Oliver Lodge considers that it is probably only necessary to supply current during the early hours in summer time, and for the whole day in spring and in cloudy weather. In bright sunshine he considers it unnecessary, if not harmful.

At what stages of the growth the electrification exercises the most stimulating effect has not been ascertained, this phenomenon affording an especial field for investigation. He considers that the greatest benefits are secured during the early stages of the plant's growth, and since in the case of wheat both the ear and straw are valuable, electrification should be applied for a time each day during the whole period of growth until stooling begins.

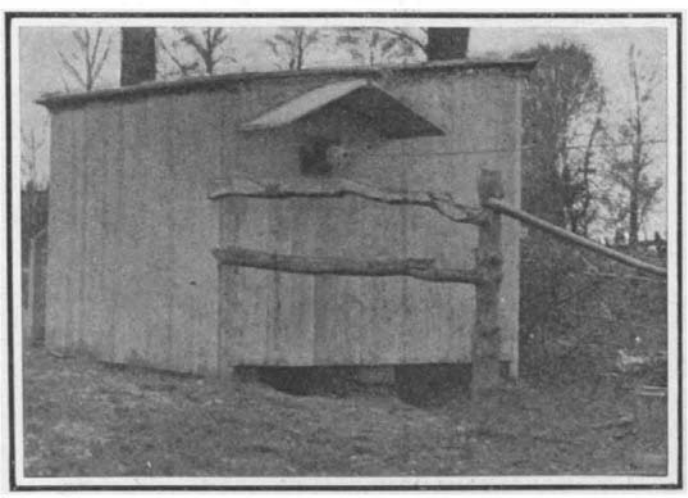


Generating and Transforming Apparatus. Note Mercury Converters Changing Alternating to Direct Current.



A Post Supporting the Discharging Wire.

Electrified vs. Wheat Grown Under Ordinary Conditions.



Transformer Shed and the Wire Which Carries 100,000 Volts, Direct Current, to the Field and Stimulates Plant Growth.

Insulator for Supporting Discharging Wire Compared with the Ordinary Telegraph Insulator.

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In the wheat field the effects of electrification were observable at an early date. In the opinion of expert observers the young blades of the cereal in the treated area were of a darker green color, while the crop was judged as considerably heavier, the straw being on an average from 4 to 8 inches higher. Both the electrified and control area came into ear about the same time, but the Canadian wheat in the former section was ready for cutting some three or four days before that in the control area. During the 1906 season current was supplied for an aggregate of 621.75 hours, spread over 90 days. The average electrical pressure corresponded to a 0.75-inch spark, the current being shut off after the ears were in bloom. The results from the electrified and control acreage in 1906 in bushels per acre were as follows:

	Electrified plot.	Control plot.	Increase.
Canadian	35.5	25.5	39.2 p.c.
English	40	31	29 p.c.

This shows a heavy increase in the yield attributable to electrification, since the control was grown under precisely similar conditions. Moreover, the electrified wheat realized higher prices by some 7.5 per cent, several millers in baking tests finding that it produced a better baking flour. The increase, in the opinion of those concerned, appears to be mainly due to better stooling; no marked difference being observable so far as the development of the ears was concerned.

In 1907 wheat was grown in the same field, while 2.75 acres of an adjacent strawberry field were similarly provided with a wire network, with magnolias planted between the strawberry rows for the purpose of ascertaining the effect of such electrical stimulation upon fruit and root vegetables. In each instance a small control section was retained under precisely similar conditions for affording comparative data.

During the 1907 season the current was maintained for 1,014 hours, spread over 115 days, the average pressure corresponding to a half-inch spark, the current being kept on until harvest time. The effect of electrification was the production of 41.4 bushels per acre of Canadian red fife wheat from the electrified area as compared with 32 bushels per acre from the control section, showing an increased yield of 29 per cent attributable to electrification. In regard to the strawberry field this was not carried out under the most advantageous conditions, inasmuch as it was the first year of the planting, but the experiment was made to determine whether any increase could be secured by electrification. The results proved highly satisfactory, an increase in yield of 35 per cent being attained, while the fruit was observed to ripen more quickly under the action of the current. In regard to the mangolds, it being impossible to weigh the product, a rough estimate only was made, but this pointed to an augmentation of 25 per cent. Analysis showed an increase in the sugar percentage, but these results varied. In experiments with raspberries a marked improvement in growth was shown while small crops of tomatoes similarly treated showed a large increase in the crop. In regard to the raspberry canes a curious point was observed. The foliage and fruit on the old canes showed no difference, but the new growth particularly after pruning showed an enormous difference in favor of electrification, manurial treatment being the same in each case.

Baking tests with the wheat grown upon the electrified and unelectrified areas showed that the average of dry glutens in the two classes was respectively 11.5 and 10.35 per cent. Sir Oliver Lodge points out that although no theoretical conclusions can be drawn from the fact that the electrified wheat produces a superior baking flour owing to the uncertainty existing as to what factors determine the strength of wheat, it is interesting to note that greater strength is usually accompanied by increase in percentage of total nitrogen.

The power required to generate the electricity is very small, for although the potential is high the quantity is insignificant and the energy is comparatively trivial. So far as the expense incurred in carrying out a practical installation of this character is concerned the initial outlay is the most important item, maintenance and operating charges being very small, and the beneficial effects produced both in the quality and quantity of the cereals and other agricultural produce should soon result in the preliminary expenditure being recouped.

The experiments are being repeated during the current year the results of which will no doubt be published in due course. The application is being extended to other produce while some additional 20 acres of field have been equipped with the overhead wire network, the crops in which are being similarly treated this year.

France is to have two motor shows this year, one each for private and commercial vehicles; both will take place in the Grand Palais, and the annex across the Seine is to be abandoned. The show for pleasure cars will be open from the 28th November to the 13th December, and that for commercial motors from the 22d to the 29th December.