LOIS sees the light: A Brief History of LOIS

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When Dr. Hans Peterson arrived from Denmark to study at Cornell, he nurtured a concept that had long intrigued plantsmen. Plant growth is dependent upon sunlight. Growth is correlated with light intensity. Why not apply water and fertilizer in proportion to light?

Dr. Sid Waxman appreciated both the concept and the inventiveness of his classmate, Dr. Peterson. So when he came to UConn, he brought the idea along and, with the help of Prof. James Whitaker and Mr. Paul Farnham, a light operated interval switch (LOIS) was built. It provided control of mist for propagation systems.

For $75 one could buy the parts for LOIS. Assembly was not that simple. Mr. Phil Liebel built a few for his customers for ca $200 each. But this was no way to make a revolutionary new product available to the industry.

After checking with many companies, Control Circuits agreed to manufacture the unit but using quite different circuitry, nearly all solid state. Since they were solely manufacturers, these LOIS units, now called Solatrol (Sun-control), would be made available to the industry by the General Scientific Company of Hamden, Connecticut (who now also manufacture the units).

The response of plants to light is not linear. Light is more efficiently utilized at relatively low intensities, so the Solatrol was designed with a curvilinear response. After 3 designs were tested in as many years, one with a desirable response was chosen which provided a desirable mist frequency on both cloudy and bright days.

The Solatrol is a relatively simple machine. A photoelectric (PE) tube meters a trickle of electricity through it with a magnitude in proportion to the light that strikes it. In the original LOIS units, half of a ping pong ball was used to collect, subdue and diffuse the light which passed through a paper filter before reaching the PE tube. The Solatrol uses a milk glass dome and polarized plastic filters to provide a coarse but simple control over light response.

This trickle of electricity passes to a large capacitor in which it is stored. Under normal misting patterns, the capacitor is charged in about 3 to 6 minutes on a bright, sunny day (it may take hours on a dull, dark day). This rate of charging is adjusted by the coarse adjustment of light at the dome and by a variable resistance in the circuit to give a fine adjustment.

When the capacitor is charged, an automatic reversing switch allows the electricity to flow quite rapidly from the capacitor. This exit flow activates the mist system. The exit flow is controlled by variable resistance in the circuit so that the mist duration can be adjusted from a couple of seconds to perhaps 20.

Without light at night, the Solatrol is in effect inactive since it doesn't call for mist. This works well for indoor propagation areas. For use outdoors where an occasional spray is required on dry nights, a night switch allows a trickle of electricity to bypass the PE and provide a minimum cover of mist in the darkness.

Another feature provides control of carbon dioxide (CO_2) injection. When light intensity increases to a certain level, a circuit is activated which can begin CO_2 introduction. In the early years of CO_2 research, the CO_2 introduction was controlled by the LOIS signal. This gave accurate metering to maintain a level of 600 ppm.

With the widespread use of higher CO_2 levels from propane burners rather than compressed gas, accurate metering was not essential. Furthermore, injection should begin at or before dawn even on cloudy days. Now outdated, this "CO_2 switch" gives a bit of valuable information, but not for the purpose for which it was intended.

Monitoring solar radiation produces a signal that is of value for control of many plant growth functions. The water use by plants in the greenhouse will be within 10 to 20% of the solar radiation measurement. Outdoors, the correlation will be nearly as good. Fertilizer utilization is correlated with water (only perhaps 1/4-1/3 less fertilizer is utilized per unit of water under conditions of high transpiration loss). The light to CO_2 relationship is, of course, absolute except for the limitations to photosynthesis experienced by the plant cell.

With this in mind, two signal sets may be programmed that are useful in greenhouse water programs; one for propagation and one for pot watering. (Bench watering may also be programmed but it is barely worth the effort.) Details on simple systems for programming series of signals will appear in later issues.