Low-tension Electric Soil Warming

SOME years ago soil-heating cable for 230-volt operation was introduced. Although reasonably successful and safe with some types of cable, this type of soil-warming equipment has generally given way to bare galvanised iron wire with the use of low voltages up to 30 volts. Although the initial cost of the low-tension method of soil warming is slightly higher than that for the high-tension cable, the greater safety, flexibility, and ease of installation and replacement far outweigh the slightly higher initial cost. The operating costs for both methods will be the same for any installation. A great deal of research has been carried out in England on this type of installation, and a few have been installed in New Zealand, where the field of application would seem to be for the heating of propagating benches, propagating frames, and early-season warming of soil in tomato glasshouses. To ensure that any installation will be satisfactory both electrically and horticulturally the Department of Agriculture requested the co-operation of the Electric Supply Authority Engineers' Institute to prepare technical electrical data suitable for climatic conditions throughout New Zealand. This article has been prepared by I. R. Robinson, chief engineer and general manager of the Hutt Valley Electric-power Board, in association with A. A. Powell, Storage Specialist, and Horticultural Instructors of the Department of Agriculture.

BEFORE any commitments regarding equipment are made the local electric supply authority should be asked if electricity will be available for soil warming or space heating for horticultural purposes. The design of any installation is somewhat complicated and the local power authority should be consulted before any equipment of this type is installed. The written permission of the electric supply authority must be obtained for the electrical wiring work, and if any of this wiring is intended to operate at a pressure in excess of 20 volts, the work must be done by a registered electrician.

Experiments in England show that it is not necessary to have the power on continuously for soil warming, as a "dosage" method providing for a certain heat input each day is equally effective.

Commercial installations should be designed to provide by a time switch the necessary heat over 10 hours during the night to economise in the cost of power.

The transformer must be built to operate efficiently in the warm, damp atmosphere of a glasshouse. The low-tension terminals on the transformer should have ample capacity with brass lock nuts, because the current to be carried becomes quite high for large installations.

Thermostatic Control of Soil Temperature

In England a number of growers are using thermostatic control for their propagating beds, but a great many are controlling temperature by hand switching. The range of the thermostat should be 45 to 85 degrees F. with a temperature differential of 3 or 4 degrees. The thermostat should be fitted with a protective sleeve and it should be placed 1½in. above and across the warming wires.

For hand switching the use of an intermittent control device similar to those fitted to most electric cookers is suggested.

Propagating beds are usually maintained at a temperature of 60 to 63 degrees F. Tomato roots require a minimum temperature of 57 degrees F.

Installation Methods

No special knowledge of growing is required for the use of electric soil warming; good standard cultural practices should be applied.

Where boxes are used for seed germination and for seedlings the wires should be buried in sand and the boxes placed on the top of the sand, close together to conserve the heat as shown in Fig. 1.

When propagating is being done in pots 3in. or more of sawdust should be placed on top of the sand and the pots bedded in the sawdust. For this type of propagating bench the warming wires should be placed from 4 to 6in. apart, depending on the design of the installation.

When wires are being used for soil warming in frames or troughs or for warming tomato glasshouse soil the depth at which they should be buried will depend on the size of the installation and general horticultural practice. If the soil is replaced each year, the wire should be buried to a depth of from 6 to 8in., and when it is necessary to replace the soil the wires should be lifted and replaced. When it is not the practice to replace the soil, but to cultivate only, the warming wires should be buried to a depth of about 12in. This allows adequate depth for cultivation and sterilisation without disturbing the wires. The spacing of the legs of the warming wires should not be less than 4in. or greater than 12in. The greater the depth of the wires the wider the spacings between the wires.

For comparatively small propagating beds 2in. x ½in. timber battens about 2ft. apart can be laid across the width of the bed, and the wires can be stapled to the battens to prevent them coming together and forming a short circuit.

For mechanical reasons No. 10, 11, or 12 gauge (standard wire gauge) galvanised iron wire is used. The warming wires may be installed either on the single wire system for amateur or small commercial working or on the grid system with a simple form of tensioning device for the larger commercial installations.

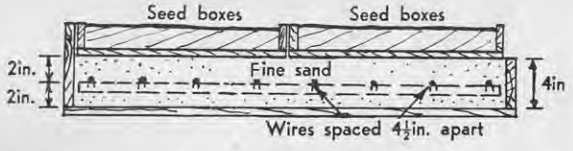

Fig. 1—Method of arranging seed boxes or seedling boxes over sand with soil-warming wire installation.

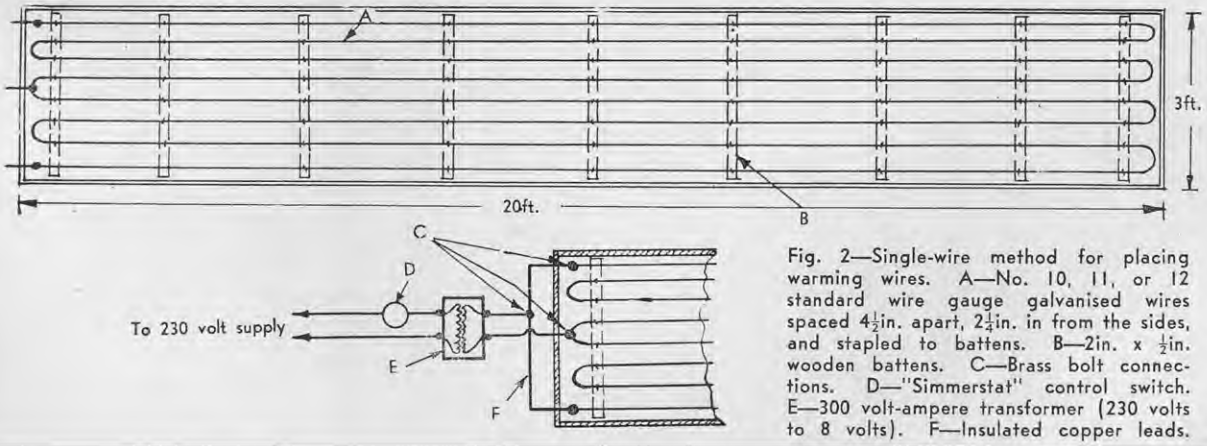

Fig. 2—Single-wire method for placing warming wires. A—No. 10, 11, or 12 standard wire gauge galvanised wires spaced 4½in. apart, 2¼in. in from the sides, and stapled to battens. B—2in. x ½in. wooden battens. C—Brass bolt connections. D—"Simmerstat" control switch. E—300 volt-ampere transformer (230 volts to 8 volts). F—Insulated copper leads.