

Cabinet Users Meeting - June 29th, 1967.

Topics for Discussion

- 1) Bibliography of Controlled Environments
- 2) Summary of Usage Questionnaire -
 - a) Equipment
 - b) Plant Species
 - c) Anomalous growth in plants transferred from G.H. to cabinet and vice versa.
- 3) Methods of Humidification
- 4) Frequent faults
- 5) Spares Policy - obsolescent components
- 6) Alarm Systems .
- 7) Spectral energy distribution as a function of age, voltage and overheating
- 8) Inspection of Mk. II Cabinets (introduced by Mr. I. K. Saxton - p.m.)
- 9) A. O. B

Cabinet Users Meeting June 29th, 1967.

Imperial College - Chelsea Physic Garden.

There were present: Professor Whittingham, Drs. Morgan, Hurd, Bishop, Jewiss, Martin, Austin, Dart, Orchard, Hughes and Messrs. Acock, Bambridge and Dickinson.

1) An annotated bibliography of controlled environment facilities has been prepared by the Commonwealth Agricultural Bureau of Horticulture. This is generally available from them at East Mailing Research Station at their standard price.

2) Usage Questionnaires. There were 43 cabinets of the MK. I type, of which all except those at G.H.R.I. and Glasgow University have been serviceable for about 90% of the time since they were considered fit for their first experimental use. Details of the growth of 21 varieties of plants showed that most of them grew satisfactorily, but some anomalies were recorded. There was strong support for maintaining a summary of information on the growth of plants which Dr. Hughes will co-ordinate.

Various colours of fluorescent lamps have been used, alone or in combination with various amounts of tungsten, either in the lamp housing or inside the cabinet. Dr. Hughes presented spectral energy distribution curves for warm white fluorescent lamps which indicate that there was no shift of spectrum with ageing from 1000 hrs. to 6000 hrs. nor in a voltage change from 240 to 230V. Older lamps (12% fall between 1000 and 6000 hrs.) and lamps run at a lower voltage (fall proportional to fall in voltage from 240 to 230V) had lower total emissions. Lamps of a new batch at 2 hrs. showed a slightly higher value around 400 nm. These measurements were direct observations with an Isco spectroradiometer. Other measurements involving combinations with tungsten were consistent with the theoretical results of Carpenter et al (J. agric. Eng. Res. 1965, 10, 212) which showed the relationship between the 660/730 ratio and the nominal wattage tungsten/fluorescent. For tungsten lamps within the plant space the 660/730 ratio is relatively smaller for any given ratio of wattage. An investigation of the spectral changes during dimming will be made as soon as possible.

All users had some form of alarm. N.V.R.S. have installed an automatic telephone system through a firm called Securitas.

The claims on the time of technicians for emergencies and maintenance varied widely.

The costs of running a cabinet for a year was estimated at between £125 and £200 (average for 4 sites = £171). An initial allowance of about £100 per site for a stock of spares, including lamps, appeared general. The recurrent cost would depend on the actual rate of failure, and something like £15 per cabinet per annum seems to be emerging.

The refrigeration plant of 17 cabinets is covered by regular maintenance. Most sites have organised an internal maintenance schedule on the basis of the recommendation in the manual.

There were diverse methods of maintaining humidity. Most workers found that once there was a fair amount of leaf surface (say L.A.I. > 0.20) the plants transpired sufficiently. Where there was less cover, adequate moisture was maintained by one or more of the methods discussed at previous users meetings (spray the cooler bank, trough with wicks at the high level exit slit from the plant space, evaporation from water in the troughs used to irrigate the plants).

Some 36 pages of publication and part of the experimental work for 10 research students have resulted from the use of the cabinets to date (May, 1967).

3) Frequent faults. The most frequent faults after commissioning are:

- a) Failure of main fan or lamp housing fan, usually due to capacitor failure. Carry spare capacitors or a whole spare motor for the lamp fan.
- b) Failure of cooling pump due to capacitor failure or jamming. Carry spare capacitor. Penetrating oil is usually effective in freeing a jammed rotor from the stainless steel cylinder. It can be worked in with an old feeler gauge. An exchange motor body (no need to break the plumbing line) can be obtained from Anglo-Nordic Burner Products Ltd., 74, London Road, Kingston-on-Thames, Surrey. The replacements are a new type, interchangeable except that a different capacitor is required. Exchange motor + capacitor = £6.3.6.
- c) Failure of day-night c/o relay to hold in. Symptom is that servo motor of offending relay motors wide open or full shuts. May be relieved by banging the controller box, but the fault may come on at any time, not just following change-over. Polishing contacts of the relay and gentle bending of the springs may help, but the relay is not really well suited to this application. A replacement relay is:

Relay Type 590 H14HX1/5520/G 1X2/230 £2 each.

Magnetic Devices Ltd., Newmarket, Suffolk

- d) Lamp housing thermostat. These are not as accurately set as is required and the setting is very tricky. A check to ensure that the cut out works at all can be made with a warm hair drier. It is not a good idea to turn off the lamp fan and let the whole housing heat up because of fault (e) below. This fault and rectification/replacement is being worked on at Reading.
- e) In one cabinet in which the lamp thermostat failed to operate the lamps overheated and were permanently damaged, both as to their total emission and their spectral distribution. These lamps were noticeably blue at the ends in the same way that fluorescent lamps in the old domestic/office type shades which have no ventilation slots appear noticeably blue. There is circumstantial evidence that these overheated lamps caused marginal leaf burn on chrysanthemums.
- f) The rectifier to relay No. 8 has an inadequate heat sink and may fail in conditions of high ambient.
- g) The connections on the main switch and the wires to them are inadequate for the current passing and the insulation may melt. These should be checked. The extension terminals, if present, should be taken off.

15-amp lugs should be sweated or crisped to new wires and the lugs connected directly on to the isolator.

- h) Heater elements. These have given considerable trouble and the matter is still unresolved. Reading are looking into the matter with a view to finding a more reliable source of supply.
- i) Corrosion of the glycol chiller. Bad rusting has been observed in one chiller. Anyone having cause to drain a chiller tank is asked to inspect as fully as possible and report on the condition of the tank. In view also of the jamming of glycol pumps by a lime-like deposit, it is suggested that the glycol chillers be filled with deionised, distilled or rain water.
- j) Odd cabinets at various sites control less well than the majority. Considerable improvement has been obtained in one such case by using an immersion detector in the pipe leading to the chiller bank instead of detecting in the airflow off the cooler coil. In this case the air was blowing round the end of the cooler bank and being funnelled along the detector by the heat shield.

4) Spares Policy and Maintenance Contract. These were discussed at some length and no clear course of action emerged. It was felt that exchange of information and occasional direct help went a fair way towards covering the matter. Workers within the A.R.C. were able to help each other fairly easily, but the workers in Universities with only two or three cabinets felt very vulnerable. Dr. Hughes agreed to maintain a list of modifications to overcome faults and obsolescent components.

5) Check list. N.V.R.S. showed a routine check list for use by the cabinet technician.

6) The following plants have been grown and anyone wanting details should contact Dr. Hughes. It is hoped to keep this information up to date in a punched card format.

Barley, Cauliflower, China Aster, Chrysanthemum, Clary, Cowpea, various Grasses, Lettuce, Lolium temulentum, Onions, Pea, Phaseolus vulgaris, Potato, Red Beet, Soybean, Stocks, Tobacco, Tomato.

7) Next meeting. There will be another meeting in the autumn at a place to be decided.
