

CONTROLLED ENVIRONMENT CABINET USERS MEETING

22nd October 1974

Record of Proceedings

This was held at the Plant Breeding Institute, Cambridge by kind permission of the Director, Professor R. Riley.

The following were present: -

Dr. K. Bambridge	Dept. Physiology and Environmental Studies, Sutton Bonington, University of Nottingham.
Mr. M. Yeomans	"
Mr. D. Dickenson	Dept. Agriculture and Horticulture, Plant Environment Laboratory, University of Reading.
Dr. E. Minchin	"
Dr. J. Casley	Weed Research Organisation, Yarnton, Oxford.
Mr. R. Simmons	"
Mr. A. P. Gay	Glasshouse Crops Research Institutes Littlehampton,
Dr. R. Hurd	"
Mr. R. E. Randall	"
Mr. F. Douglas	"
Mr. C. Hole	National Vegetable Research Station, Wellesbourne.
Dr. J. Brewster	"
Dr. R. Parsell	Institute of Terrestrial Ecology, Nature Conservancy, Norwich.
Dr. G. N. Thorne	Rothamsted Experimental Station, Harpenden.
Mr. A. T. Young	"
Mr. I. Pearman	"
Dr. G. Hussey	John Innes Institute, Norwich.
Dr. Hedley	"
Mr. D. Harvey	"
Mr. L. E. J. Piper	Dept. of Education and Science, London.
Dr. A. Evers	Flour Milling and Baking Research Association, Chorleywood.
Dr. C. Eagles	Welsh Plant Breeding Station, Aberystwyth.
Dr. C. G. Gutteridge	Dept. Agriculture and Horticulture, Long Ashton, University of Bristol.
Dr. J. Skerrett	"
Mr. D. Filby	National Institute of Agricultural Engineering, Silsoe.

Dr. P. Hayes	Dept. of Agriculture, Queen's University, Belfast.
Dr. R.E. Taylor	ADAS, Coley Park, Reading.
Mr. R.B. Austin	Plant Breeding Institute, Cambridge (Chairman)
Mr. V. Hyde	"
Miss M.A. Ford	"
Dr. R. Johnson	"
Dr. M. Gale	"

1. Minutes of previous meeting

These had been circulated after the last meeting. There were no matters arising.

2. Cost of running controlled environment facilities

Energy costs. R. Simmons (WRO) explained that the overall charge per unit of electricity in regions operating a "peak demand" tariff varied from month to month and that in January electricity costs could be eight times as high as in July. He suggested that as far as possible cabinet maintenance should be carried out in the period December - January at institutes where this tariff operated. Also at this time of year the chances of experiments being lost through power shortages caused by industrial disputes were greater.

It was thought desirable to record the consumption of electricity, especially for project-costing. Equipment for monitoring total consumption and maximum demand could be obtained on loan from the regional electricity boards.

For project-costing purposes WRO make estimates of power consumption for each project involving cabinets. At Rothamsted a quarterly return was made showing the percentage allocation of the cabinets to different projects.

Scope for phasing the use of cabinets to take advantage of 'cheap' electricity. Some savings might be made by the adjustment of cabinet 'days' to coincide with the times of low demand by the Institute as a whole. The cabinets at Rothamsted tended to be used mostly in the winter by people who were occupied with field work in the summer months. To close down the cabinets completely during December and January would be to deny the use of the facility by these people.

Waste heat. Excess heat from the lamps could be used for heating adjacent rooms out at Reading where this was done to heat an office complex the project had to be discontinued as the noise level in the offices was too great. Noise was transmitted along the ducting. NVRS were hoping to divert hot air into an adjoining room and were warned about the use of ducting for this purpose.

3. Cultural methods

Growing media. At most institutes compost or vermiculite was the growing medium commonly used in controlled environment work. At Long Ashton, coarse grit was used which was flushed eight times a day with nutrient solution.

It was becoming difficult to obtain horticultural vermiculite. Reading ordered it by the lorry-load (60 bags minimum quantity) from Dupre Vermiculite Ltd., Tamsworth Road, Hertford (£61 a load in July 1974). G. Hussey (J.I.) used insulation-grade vermiculite, adding peat to counteract the alkalinity. Addition of 10-15% peat produces a suitable growing medium. No troubles with heavy metal toxicity had been noticed.

Watering systems. Reading had designed a flood-irrigation system, details of which are in J. hort. Sci. (1974) 49, 161-166 "Versatile irrigation systems for controlled environment growth chambers" by Summerfield, Cockshull, Dickenson and Richardson which also describes a trickle irrigation system.

Automatic watering was used by I. Warrington, Plant Physiology Division, Palmerston North, New Zealand and this design had been used by Dr. Hayes (Belfast): details were available from R. Parsell, Norwich.

R. Taylor (ADAS, Reading) used a Cameron system coupled with a wick arrangement to subirrigate. A hazard with this method was that weak or dying plants could become waterlogged.

R. Simmons at WRO found it helpful, when using subirrigation, to put a layer of polystyrene granules on top of the vermiculite. This reduced evaporation from the surface of the rooting medium and subsequent build-up of nutrients there.

Pests and diseases. Red spider mites were controlled by predators at Reading. These were obtained from N. Scopes (GCRI). At Rothamsted methyl bromide was used to kill red spider mites in cabinets. The gas was removed by being blown outdoors through tubing.

"Mushroom flies" or "fungus gnats" could be a problem in composts containing peat. Control was difficult.

4. Environmental monitoring and recording

Humidity. NVRS had a psychrometer in each cabinet connected to a data-logger. The units were designed by Dr. H. Rowse (NVRS), cost about £17 each and used a Braun fan which ran continuously.

Delta T Devices Ltd. had produced a similar unit costing about £30 which used a 6 volt motor and was quite compact. These were used at WRO. They switched on automatically when the chart recorder initiated a scan and thus ran intermittently.

GCRI found that wet/dry thermistors were unreliable for continuous use and now have an aspirated system produced by Rosemount Engineering, Bognor Regis.

Light recording. D. Fitter, GCRI, had designed equipment to measure PAR and hoped to publish the details. It was found necessary to use optical cement in the construction of the unit rather than Araldite which discoloured with age.

CO₂ monitoring. NVRS were still using the system for controlling CO₂ concentrations in cabinets which was designed and built by I.D.B. It controlled to within 10 ppm of the ambient concentration.

GCRI found that some Wösthoff pumps were unreliable. Different sets of pumps gave different results.

J.I. found that "standard" gases supplied by BOC were not suitable for calibration of IRGA's. It was generally recognised by those concerned with IRGA's that for calibration, gas mixtures should be prepared from pure CO₂ by dilution, using Wösthoff pumps.

5. Light sources

Most cabinets were equipped with 'warm white' fluorescent lamps. Some used de-luxe warm white types which had a red : far-red ratio of 3.5 : 1 (warm white c 20 : 1).

High pressure sodium lamps (SONT) were used at J.I. Some plants, e.g. Antirrhinums, grew well under this light but others such as peas, grew better under mercury vapour lamps.

Grolux tubes were used at J.I. for tissue culture work at low temperatures but are not an efficient light source.

It was to be noted that Philips HLRG lamps are now issued at HLRGN and give a pinker light than the original HLRG type. HLRGN's were used at Sutton Bonington in growth rooms and in growth cabinets.

6. Pollutants

At J.I. toxicity problems still existed in the cabinets after six years of use but were not as bad as when the cabinets were first installed.

The Chemistry Department at Rothamsted had pointed out that the filter unit supplying air to the cabinets removed much of the sulphur dioxide normally present in the air and that plants may have been suffering from incipient sulphur deficiency. They recommended that users at RES should add extra sulphate to nutrient solutions to compensate for this deficiency.

7. Spares, Replacements, Maintenance

There was a long delivery time for the tungsten strip lamps used in some EAC cabinets

R. Hurd (GCRI) was concerned about maintenance and monitoring of their 20 cabinets and had suggested that one person be appointed to take responsibility for monitoring the conditions. At present users did this. J. Caseley pointed out that for project costing purposes the time of the Staff involved in cabinet running and maintenance should be determined.

It was felt that there was much variation between Institutes in these overhead costs. R. Hurd agreed to send out a questionnaire covering the points raised to assess current practice and users' opinions.

Environmental Air Conditioning Ltd. still had not supplied GCRI with wiring diagrams for their cabinets.

8. Lamp log programmes

NVRS and GCRI had devised computer programmes to enable users and/or maintenance engineers to keep track of the ages of the tubes in the cabinets.

Tubes were usually discarded after 6000 hours use

9. New makes and designs of cabinets

ARC Daylit-cabinets (Rothamsted). EAC had been asked to simplify the humidity control system in order to reduce costs. The prototype had not yet been constructed.

WRO had ordered controlled environment rooms from Votsch (UK agents - Tar Residuals Ltd., London).

10. Date and place of next meeting

A request had been received from Dr. Govier (Belfast) that the next meeting be held during the vacation to enable users engaged in university teaching to attend.

It was agreed that permission be sought from the Director of Long Ashton Research Station, Bristol to hold the next users meeting there in September or October 1975.

11. Tour of PBI controlled environment facilities

Participants inspected the suite of EAC cabinets, a CONVI RON (Winnipeg) cabinet, 'home-made' cabinets, a unit for carrying out controlled freezing tests for evaluation of winter hardiness in cereals and a glasshouse facility for controlled photoperiod studies.

12. The meeting closed at 15.30 h.

Addendum

It was noted that the following report was available from the ARC, ref. AG 45/45:

"Characteristics of fluorescent lamp types for C.E. facilities"
T.R. Constantine, Applied Research Section, Department of Agriculture and Horticulture, University of Reading (June 1974).