

CABINET USERS MEETING

9th October, 1973

This was held at the Letcombe Laboratory by kind permission of the Director, Dr. Scott Russell. The Agenda and other preparations were made by Mr. Colin Walter and the meeting was chaired by Dr. D. Clarkson.

The following were present:

<u>NAME</u>	<u>DEPARTMENT</u>	<u>INSTITUTE/UNIVERSITY</u>
Kenneth Bambridge	Environmental Physics	University of Nottingham (S.B.)
A.S. Bedwell	Electrical Maintenance	Letcombe Laboratory
Allen Canham	Horticulture (E.R.S.)	University of Reading
John Caseley	Environment	Weed Research Organisation
David Clarkson	Plant Physiology	Letcombe Laboratory
K.E. Cockshull	Plant Physiology	G.C.R.I. Rustington
Richard Constantine	Horticulture (E.R.S.)	University of Reading
David Coupland	Environment	Weed Research Organization
Dennis Dickinson	Horticulture (P.E.L.)	University of Reading
Frank Douglas	Plant Physiology	G.C.R.I. Rustington
Winifred Dullforce	Agriculture & Horticulture	University of Nottingham (S.B.)
C.J. Ellis	Electrical Maintenance	Letcombe Laboratory
R. Farrow		G.R.I. Hurley
Margaret Ford	Physiology	P.B.I. Cambridge
A.P. Gay	Plant Physiology	G.C.R.I. Rustington
Chester Guttridge	Pomology	Long Ashton N.V.R.S.
Richard Hardwick	Physiology	N.V.R.S.
Christopher Hole	Physiology	P.B.I.
V.R. Hyde	Physiology	Cambridge
R. Macdonald		S.C.R.I. Invergowrie
Reuben Mercer	Deputy Director	Letcombe Laboratory
F.R. Minchin	Horticulture (P.S.L.)	University of Reading
P.H. Needham	Botany	Rothamsted
Roger Parsell	Coastal Ecology Research Station	Nature Conservancy Norwich
Ian Pearman	Botany	Rothamsted
J.M. Rice	Electronics	Letcombe Laboratory
Richard Simmons	Environment	Weed Research Organization
E. John Skerrett	Physical Chemistry	Long Ashton
J.R. Stansfield	Control Department	N.I.A.E., Silsoe, Beds
Colin Walter	Plant Physiology	Letcombe Laboratory
Mike Yeomans	Physiology & Environmental Studies	University of Nottingham (S.B.)
Andy T. Young	Botany	Rothamsted

Technical matters

1) Temperature control in Saxcil cabinets

Several users encountered problems with temperature control e.g. difficulty in reproducing the same temperature on successive days (2-4°C drift) and 'hunting' at low temperatures. D. Dickenson (P.E.L.) found that corrosion of the Satchwell resistance thermometer was a frequent cause of

loss of temperature control especially under wet conditions (resistance should be 1,000 ohms). Deterioration of the Satchwell Duotronic Controller also leads to loss of control. Relays with worn contacts can be replaced by Type 120N 7300 G2/240 from Magnetic Devices Ltd., Newmarket (warning - different base connections - not plug-in replacement). Other factors such as amplifier drift can result in unstable control and replacement may be necessary. Satchwell Duotronic controllers are still available but they employed dated electronics and the possibility of using solid state controllers was discussed. Variable angle phase firing thyristor controllers give accurate control, but have the disadvantage that they do not switch at zero voltage and are electrically noisy interfering with other control and recording devices. Complete angle burst firing controllers switch at zero and overcome this problem. Both types of device (up to 6KW) are obtainable from:

- (1) S.K. Instruments Ltd
Greenhay Place
Gillibrands
Skelmarsdale, Lancs

Tel: Tawd Vale 3711-15

- (2) Nobel Engineering Ltd
Clare Works
Woods Way
Mulberry Industrial Estate
Goring-by-Sea, Sussex

Tel: Worthing 40777 (contact N.W. Foleman)

F. Douglas (G.C.R.I.) has used and recommends Nobel controllers.

This type of device can be used to give proportional control of the Saxcil background heater (on/off on standard cabinet) which should improve temperature and humidity control at high temperatures. D. Dickenson (P.E.L.) plans to evaluate this application.

2) Humidification and measurement of RH

R.E.S. have installed a humidification system similar to that used at WRO except that the wet bulb mercury thermometer has been replaced by a Sauter humidity sensing device (cotton element) obtainable from Ronald Trist Controls Ltd., Slough, telephone Slough 34646. This device is not very sensitive, but is adequate for maintaining a minimum humidity. Other types of humidity sensing devices were discussed such as sulphonated polystyrene, but all had disadvantages. The Assman psychrometer is still the most reliable and accurate means of measuring temperature and humidity. P.B.I. and N.V.R.S. are fitting aspirated psychrometers for monitoring controlled environments and N.V.R.S. are feeding output into a data logger.

3) CO₂ analysis and control

Analysis - No radical new developments but Feedback Instruments, Park Road, Crowborough, Sussex, Crowborough 3322, make a rugged reliable IRGA with a single chopped beam and Peltier effect cooled solid state detector.

- Conductivity cell type. The Gas-o-Mat CO₂ indicator/controller is no longer supplied by Jacobson van den Berg but by:

Hampden Test Equipment Ltd
Rothersthorpe Avenue
Northampton

Tel: Northampton 62660 (contact Mr. Miller) - current price £240 ex VAT

Control sampling and injection systems - R. Hardwick (N.V.R.S.) reported that the Bangor designed and constructed CO₂ sampling and injecting system had performed well for 2 years.

CO₂ removal - With a number of people in a controlled environment room with a low fresh air intake the level of CO₂ could lead to stomatal closure and possible risk to personnel. This could be avoided by workers wearing a respirator containing CO₂ absorbent. Although not a standard production item these can be obtained from:

Siebe Gorman and Co Ltd
Davis Road
Chessington
Surrey

Tel: 01-397-6171 (contact Mr.J. Whitton)

An alternative suggestion is that the CO₂ controller, when the CO₂ level is too high, should divert part of the air over soda lime or other CO₂ absorbent.

4) Other gases

A problem that is encountered in controlled environment facilities where the intake of fresh air is low is that toxic vapours tend to accumulate e.g. plasticisers from PVC. At WHO, Porton activated charcoal cloth has undergone limited evaluation for removing herbicide vapours and appears to be effective for several common herbicides, but compounds of relatively low molecular weight such as ethylene are not removed. Methods for removing ethylene from the air are being sought.

5) Lighting

Comparison of standard and VH0/SH0 (very high output/super high output) fluorescent tubes - T.R. Constantine (Reading University) found that 5 ft x 80W and 8 ft x 125W standard lamps have similar light output depreciation. The light output of US made 8 ft 1,500mA SHO lamps fall more rapidly, but their starting output was greater than the standard tubes. The 1,500mA lamps produce peaks at 410, 435 and 550mA with 5-10% more output (relative to 580mA) than standard tubes. Variation between ballasts had a negligible effect on lamp output.

Allen Canham said that Westinghouse claim that their Agrolamp has 'spectral composition for proper plant growth', but was not worth considering for cabinets as only 40W.

Sources of red and far red - C. Walter (Letcombe) said soft tone (Colour 27) tubes from Philips provided sufficient red and far red for acceptable growth of several grasses and cereals and tomatoes were currently being evaluated.

Most tungsten lamps have a designed life of about 1,000 hours and vibration and heat in lamp housings shortens this considerably. Under run lamps e.g. 260V pigmy lamps (power station indicator board lamps) last longer and the same result may be achieved by dropping the voltage with standard pigmy lamps. WRO found that 240 volt vacuum cleaner lamps (Osram) (vibration and high temperature tolerant) last well without special precautions.

Mercury vapour lamps

The lamps used at Letcombe are Philips HLRG (400 watt). These are mercury vapour lamps with integral reflectors. The transparent portion of the outer bulb is coated with a phosphor selected by Philips to absorb the majority of the U.V. emission and to give a relatively high proportion of red light, making these lamps particularly suitable for plant growth. The air surrounding the lamps is controlled between 30°-40°C. 24 lamps equally spaced over a ceiling are 7 ft x 7 ft give a light intensity of 24,000 lux at 32 ins below the lamps.

These lamps have been found highly suited to the growth of cereals; however a degree of supplementation by incandescent lamps is needed for the successful growth of certain dicots, e.g. marrows, tomatoes.

6) Letcombe low cost cabinets

Prefacing his remarks on low cost cabinets, Reuben Mercer posed the question "How many users who specify tight control of temperature, humidity, or light intensity etc had or endeavoured to obtain evidence that variations introduced by less stringent control (and cheaper construction and operation of cabinets) would be signified in comparison with inherent biological variation in an experiment?".

Cheaper cabinets had been built in situ at Letcombe. The lamp housing was cooled by drawing fresh air between two non-inflammable plastic ceilings immediately beneath the lamps, the upper being slotted to allow air to impinge on the lamps. This method served also to reduce heat transmission into the bench area beneath. The temperature in the cabinet was regulated by a commercial air conditioner mounted on the back wall. Where this is an outside wall, the compressor is integral with the air conditioner; elsewhere, a remote compressor is used. No attempt was made to control humidity.

The system allows temperature control to $\pm 2^{\circ}\text{C}$, including variations across the bench. Light intensities are best when all internal surfaces are painted white, which, in an empty cabinet the intensity is about 2,200 foot candles. The cost, in materials and salaries (winter 1972) for a cabinet with usable growing area 10 ft x 2½ ft was about £600.

Other matters

1) ARC Advisory Committee on controlled environment facilities

Dr. C. Guttridge (Long Ashton) outlined the objectives of this committee and Mr. J. Stansfield (N.I.A.E.) reported on the first meeting. The secretary of the committee, Dr. B.G. Jamieson, prepared the following summary:

"A five-man advisory committee on controlled environment facilities has been set up by the Agricultural Research Council to make sure that the most appropriate C.E. facilities are provided within the agricultural research service.

The committee members:

Dr. J.V. Lake (chairman), ARC headquarters.
Dr. C.G. Guttridge, Long Ashton Research Station.
Mr. J.R. Stansfield, National Institute of Agricultural Engineering.
Dr. H.P. Taylor, Systemic Fungicides Unit.
Dr. G.N. Thorne, Rothamsted Experimental Station.

held their first meeting at ARC headquarters on 28th September. Representatives from the University of Leeds, the Hill Farming Research Organization, Long Ashton, Rothamsted and the Weed Research Organization described proposals for new C.E. facilities in their research laboratories. Technical specifications and manufacturers' quotations were analysed and compared, with the result that some proposals will probably be modified to obtain better facilities. The committee heard that one square metre of effective space in a controlled environment cabinet may cost between £300 and £3,200, depending on design and specifications.

The committee was set up to advise on the widely ranging requirements of institutes and units for C.E. facilities which vary from small, off-the-shelf growth cabinets to complexes of growing rooms and will meet only when proposals are made which need to be assessed in detail. It is expected that information will be exchanged with the informal Saxcil Cabinet Users Group."

2) Next venue

We have been invited to hold the next meeting at P.B.I. Cambridge in the autumn of 1974.

John Caseley
Co-ordinating Secretary