ARC CONTROLLED ENVIRONMENT USERS GROUP

Thursday 25 October 1979

This was held at the University of Reading Plant Environment Laboratory by kind permission of Professor E H Roberts. The agenda and other preparations were made by Dennis Dickinson who also chaired the meeting.

People present included:

Miss M A Ford	**P.B.I. Maris Lane Trumpington Cambridge**
Mr K Bambridge Mr M Yeomans Mr L Heathcote	**University of Nottingham School of Agriculture Sutton Bonington**
Dr J L Brewster	**Wellesbourne N.V.R.S. Warwick**
Dr F Sandwell	**Plant Pathology Lab., Hatching Green Harpenden Herts**
Dr C G Guttridge Dr E A Baker Dr J Skerrett	**Long Ashton Research Station Long Ashton Bristol**
Dr J Caseley Mr R Simmons Mr L Harvey	**W.R.O. Begbroke Hill Yarnton Oxford**
Mr T S Crosby	**Department of Plant Sciences (Baines Wing) University of Leeds, Leeds**
Dr C F Eagles	**W.P.B.S. PIas Gogerddan Aberystwyth**
Mr C H Walter	**ARC Letcombe Laboratory Letcombe Regis Wantage Oxon**
Mr P Knapp Mr C Holbourn Mr C Mountfield Mr J Horridge Mr R E Randall	**G.C.R.I. Rustington Littlehampton Sussex**

Mr D Dickinson — **University of Reading**
Dr F Minchin — **Shinfield Grange**
Mr P Hadley — **Reading Berks**
Dr R Summerfield
Mr A E Canham

Mr I Pearman — **Rothamsted Experimental Station Harpenden**
Mr A A Strange — **Herts**

Dr G Hussey — **John Innes Institute**
Colney Lane
Norwich

Dr P Hayes — **Queens University**
Dept of Agriculture
Field Botany Division
Newforge Lane
Belfast BT9 5PX

The meeting started with a short colour film of the PEL controlled environment facilities illustrating some of their contract work and was accompanied by a commentary from Dr Rod Summerfield.

1. Minutes of previous meeting

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

Light Sources

Alan Canham (University of Reading) displayed a new reflector from Poot Elektra BV., (Netherlands) together with some light distribution graphs illustrating a remarkable uniform light distribution pattern. Complete units including lamps and control gear are available from the UK agents: Brinkman Horticultural Service UK Ltd. Dunswell Lane, Dunswell, Hull, N. Humberside, but are rather expensive. They are available as PL 1078N for the 400 watt type SON/T lamp or PL 1078K for the 400 watt metal halide lamp type MBI/H. Corresponding fittings for 1 kw lamps are PL 1079K respectively.

Ken Bambridge (University of Nottingham) reported that HLRG lamps at Sutton Bonington were now being replaced by Thorn MBFI Kolorarc lamps. These use the isothermal bulb of the MBF/U lamp but with a metal halide arc and require a deep bowl reflector for reasonable light distribution.

Alan Canham has used the lamp in one experiment with supplementary light on young tomato plants in a glasshouse. Results were satisfactory but no better than with MBF/U. Its 2000 h output of 24,000 lm (vertical burning) is the same as that of their 400 w type MBI and compared with 21,500 lm for the MBF/U. Used horizontally the outputs of all these are the same.

Referring to the discussion on UV measurement and damage at the previous meeting, Alan Canham described the problems experienced in the Zoology Section at Reading University. A new installation of HLRG lamps had resulted in considerable UV damage on a wide range of species. The makers had replaced them with new lamps from a different production batch but with no improvement. The suppliers in turn replaced those with Thorn MBFR/U lamps with similar results, and in due course Philips supplied a small number of HLRG lamps of a different design, with an oxide internal reflector and a clear glass bulb. These were a little better but still not satisfactory so to date the problem remains unresolved.

Alan Canham reported that Messrs Wotan Ltd (Wotan House, 267 Merton Road, London SW18 5JS) make a range of lamps including a metal halide lamp type HQI/D using dysprosium iodide with a spectral output very similar to that of daylight. They have been used for photosynthesis research in leaf chambers at the GCRI by Dr Lugwig and appear to be somewhat variable in colour (visually). They are available in 250, 400, 1000, 2000, and 3500 watt sizes. They also supply a 250 w type NQI/R/NDL lamp with a rather different spectral quality but with a built in reflector. Their range also includes "Maxilux" triphosphor fluorescent tubular lamps in 'white', 'warm white' and 'daylight', with increased efficiency but rather different spectral qualities from those of normal lamps of the same designation. They are slimmer than the normal range (25 mm cf 38 mm dia) and slightly lower wattage. The 58 watt lamp is a direct replacement for the 65 watt normal lamp and has an output of 4800 "lighting design lumens" ('white') compared with 4750 for the 65 w and 5200 for the 80 w versions.

Philips also supply a triphosphor tubular fluorescent lamp known as the MCFE 34 in the 20, 40 and 65/80 w sizes. They are also available with an Indium amalgam for "maintained performance" at elevated temperatures in the TLH range. Tube diameter is also 25 mm.

Philips also offer an electronic starter (ref. E506) for starting 8 ft. 125 watt in situations where starting is difficult with normal starters.

Chester Guttridge (LARS) has compared standard 125 watt 8 ft lamps with the newer, more efficient Thorn 100 watt lamp, advertised as giving 5 to 9% less light but using 14% less power. It is less widely known, however, that the two lamps have very different temperature characteristics. The 125 watt lamp has a rather flat temperature response curve, and in tests gave peak light emission when the growth room temperature was 15°C. The 100 watt lamp gave peak emission at about 26°C but light output fell steeply with lowered temperatures. At 10°C the 100 watt lamp emitted only some 55% of peak, whereas the 125 watt lamp at 10 C gave about 90% of peak. These measurements were made with an EEL photometer.

100 watt lamps appear suitable for temperature-controlled lamp houses, but on this evidence the 125 watt lamps are the better choice for use within growth rooms where lamp temperature may be lower. The 100 watt lamps may be operated in twin lead/lag circuits which have a much greater power factor than the 125 watt single circuits have. The greater power factor saves on Maximum Demand tariffs. Compromise is possible by using 125 watt lamps in the leading and 100 watt lamps in the lagging circuits. Incidentally when considering running costs fluorescent lamps use less power when light emission is lowered by temperature drop.

Control and monitoring

Richard Simmons (WRO) found the Imp logger flexible in use as it allowed general monitoring of conditions plus alarm monitoring of contrasting day and night conditions with alarm suppression during the changeover. However, access to the clock by program is not good. The logger is made by Micro Consultants Ltd., Caterham, Surrey.

David Fitter (GCRI) has built a precise CO_2 injection system using a micro-processor to pulse control the valves.

Dennis Dickinson (PEL) is evaluating a logger based on a Datron DVM digital volt-meter control by a PET computer, supplied with software by PPM, Hermitage Road, St John's, Woking GU2 11TZ (04867 80111). GCRI already have this system and after some easily resolved problems it is operating satisfactorily.

Roy Randall (GCRI) reported microprocessor controlled heating and ventilating regulators were more precise and cheaper than electro-mechanical devices. GCRI propose to try one of these Dutch controllers supplied by Endal, Viterstegracht 35, 2312 TB, Leiden, Holland or Van Vliet, UK agents :- Glasshouse Automation Ltd., 42 Stockbridge Road, Elloughton,Brough, Yorks.

Humidity measurement

During the past year Roy Randall (GCRI) has had satisfactory performance from two humidity measuring instruments.

a) The Novasima 83/4 sensor is described as an electrolytic resistor which is protected against saturation and operates in the range 10 - 100% RH. Together with the associated electronics and temperature and humidity outputs it costs over £1,000. The Swiss equipment is supplied by Humitec, Peter Greaves & Associates Ltd., PO Box 30, Horsham, West Sussex RH13 6DE.

b) The Therm Digital Model 2246 is a psychrometer with aspirated wet and dry thermistor sensors and a digital meter indicating RH. An analogue output is available for connection to a separate recorder. This instrument is supplied by Texcel Electronics Ltd. 13 Cunningham Hill Road, St. Albans, Herts, AL1 5BX.

   A similar type of instrument, but without analogue output is obtainable from Ultrakust, PO Box 20, West Drayton, Middx.

Other developments in humidity measurement include:-

c) A new 'drift free' Vaisala sensor obtainable from Vaisala (UK) Ltd. 2 Lome Road, Northampton. Roy Randall will test one of these this year.

d) Another digital display RH meter using the standard PCRC (sulphonated polystyrene) sensor is available from Ancom, Devonshire Street, Cheltenham.

UV monitoring

Ken Bambridge (Sutton Bonington) reported that polysulphone film (see 1978 minutes) was not suitable for determining 'safe' exposure time for personnel working in areas with mercury lamps since this type of detector also responds to non-harmful wavelengths. The National Radiological Protection Board (NRPB), Harwell, Berks, checked the Sutton Bonington growth rooms and suggested 15 minutes exposure in 8 hours would not be harmful. UV was determined using an International Light IL730 meter which meets the requirements of the American Conference of Governmental Industrial Hygienists (ACGIH). These standards are recommended by NRPB. International Light instruments are imported by Auriema, Bath Road, Slough. The HMSO book "Protection against ultraviolet radiation in the workplace" (price 40p) contains useful information and the NRPB hold workshops and courses on UV radiation hazards, precautions etc.

Toxicity

Francis Sandwell (MAFF) suspected spilt glycol may have caused phytotoxicity. Others present felt this was unlikely. John Caseley (WRO) had tested glycol in a closed container with wheat and turnip seedlings and found it to be non-toxic. Paul Knapp (GCRI) reported that Iconel and Monel metal sheathed heaters contaiminated nutrient solution with nickel resulting in phytotoxicity to tomatoes.

Chester Guttridge (LARS) reported zinc had been detected leaching from butyl rubber.

Alternatives and spares

Both PEL and GCRI find the Nobel (1979 minutes) dew point and temperature controllers excellent replacements for the Satchwell Duotronics on the Saxcils cabinets. However, GCRI have found the Nobel controller sensitive to electrical interference when fitted to a Fisons cabinet.

Dennis Dickinson (PEL) locates the dew point sensor in the glycol line to prevent overshoot. Use of electronic control on the heaters does away with the need for background heaters. Richard Simmons (WRO) has satisfactorily replaced the Saxcil glycol pumps with domestic central heating pumps (SMC Cadet or Grundfoss super 4).

Ian Pearman (RES) reported Saxcil perspex ceilings were becoming milky opaque and ICI considered 10-11 years a reasonable life for their plastic under Saxcil lamp housing conditions. Ken Bambridge (Sutton Bonington) has replaced the Saxcil perspex ceiling with double glazed glass which was cheaper, sag free and incombustible.

Manning and service survey

Ted Baker (LARS) commented that the technical input needed for a CE facility is self evident, but that P&TO pay was not good enough to keep career technicians. He suggested that CE installations should be run by someone in the scientific grade where there was some hope of promotion.

Replacement of Saxcils

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Roy Randall reported that GCRI are considering Fisons, Vötsch and Weiss for 3 Saxcil replacements. Their specification includes:

a) dimensions close to that of the Saxcil,
b) flexible light control circuitry, and
c) microprocessor based master controller and programmer for light, temperature and humidity.

The prices range from £19 - 23,000 per cabinet. Fisons Scientific Apparatus, Bishop Meadow Road, Loughborough, Leices LE11 ORG. (Weiss Technic GmbH) Westlairds Ltd., North Green, Datchet, Slough SL3 9JH. (Vötch) TR-Heraeus Ltd. TR-House, 134-138 Borough High Street, London SE1 1LB.

Any other business

Chris Hole (NVRS) requires results from uniformity trials in Saxcil cabinets.

Chester Guttridge (LARS) drew attention to a paper by Beryl & Mitchell (1977). J. Amer. Soc. Hort. Sci. 102, 591-594, which reported the dwarfing effect of vibration on plants, and suggested that vibration and plant movements caused by air flow may cause variation in plant growth.

Alan Canham (Reading) drew attention to the following papers:-

Warrington, I.J. and Mitchell, K.J. (1975).The suitability of three high intensity lamp sources for plant growth and development. J. agric. Engng. Res. 20, 295-302.

Warrington, I. J. and Mitchell, K.J.(1976).The influence of blue- and red-biased light spectra on the growth and development of plants. Agric. Meteorol. 16, 247-262.

Warrington, I.J. Mitchell, K.J. and Halligan G. (1976) Comparison of plant growth under four different lamp combinations and various temperature and irradiance levels. Agric. Meteorol. 16, 231-245.

Warrington, I.J. Edge, E.A. and Green L.M. (1978). Plant growth under High Radiant Energy fluxes. Ann. Bot. 42, 1305-1313.

Place of next meeting

Francis Sandwell agreed to hold the next meeting at MAFF Plant Pathology Laboratory, Harpenden. The date is to be fixed later.

PEL Facilities

After the meeting there was a tour of the PEL facilities.

1. A suite of 12 'Saxcil' cabinets incorporating Nobel controllers for temperature and dew point control.

2. Two heated plastic film houses (floor area 188 m^2, height 3 m) where an IGRA system was displayed for continuous monitoring of whole shoot CO_2 exchange as an adjunct to growth analysis experiments in controlled environments. (Hadley, P. Boxall, M.I. Richardson, A.C. Dickinson, D. Minchin, F.R. Summerfield R.J. and Roberts, E.H. (1969) Reading University - International Institute of Tropical Agriculture Tropical Grain Legume Project - Publication 20).

3. An aluminium framed glasshouse sub-divided into four sections (each with a floor area 27.6 m^2 height 5 m) each with two trolleys and 'night time' garages allowing control of day length and day and night temperature. Night temperatures can be set above or below those of the glasshouse compartments.