CONTROLLED ENVIRONMENT USERS GROUP

25TH ANNIVERSARY MEETING, 17-18 SEPTEMBER 1991

AT LANCASTER UNIVERSITY

PROGRAMME

Recent Developments in Controlled Environments

17 September 1991

12.00 - 14.00	Buffet lunch and Registration
14.00 - 14.05	Opening Remarks
14.05 - 14.35	**T.A. Mansfield and P.W.Lucas** (Division of Biological Sciences, University of Lancaster) Solardomes : principles and practice.
14.40 - 15.10	**N. Paul** (Division of Biological Sciences, University of Lancaster) Controlled environments with UV Supplementation.
15.15 - 15.45	Afternoon Tea
15.45 - 16.15	**Z. Chalabi** (Process Engineering Division, Silsoe Research institute) Optimal control of the greenhouse environment.
16.20 - 16.50	**R. Woodfin** (Department of Biology, Imperial College at Silwood Park) The Ecotron - artificial climates for whole ecosystems.
16.55 - 17.25	**A.G. Worthington** (Department of Physiology and Environmental Science, University of Nottingham, Sutton Bonington) Microclimate in open-top chambers.
18.30	Dinner
20.00	Business Meeting: Agenda see next page (Items 3-13 will only be discussed in response to demand by members)

18 September 1991

8.00 - 9.00	Breakfast
9.00 - 10.15	Guided tour of controlled-environment facilities (2 sites)
10.15 - 10.45	Coffee and changeover
10.45 - 12.00	Guided tours continued
12.00	Lunch

END OF PROGRAMME

Transcribed from duplicated copies by L.D. Incoll, 5/03/2009

MINUTES OF THE 1991 BUSINESS MEETING OF THE CONTROLLED ENVIRONMENT USERS GROUP

The annual meeting of the CE Users Group was held at 8.00 pm on Tuesday 17 September, 1991 at Lancaster University.

Chairman: L D Incoll

Apologies: S Cranston, P Jarvis, A S Johnson, I Pearman, R Randall, J Aldous

1. MINUTES OF LAST MEETING

The minutes of the meeting at Wye College were approved.

2. MATTERS ARISING

There were no matters arising from the minutes.

3. FUTURE MEETINGS

a) Date
A discussion of the date of future meetings was prompted by a letter from Professor P Jarvis (Edinburgh Univ.), in which he asked the group to consider holding its meetings on occasions other than the traditional September date and suggested January, February and November as alternatives. The general feeling was that these dates had some disadvantages, such as potentially poor weather conditions for travel and conflict with terra time at Universities. It was agreed that a questionnaire covering various periods of the year be sent out with the minutes and the matter reconsidered next year.

b) Venue
Three possibilities were considered:
(i) John Innes Institute. Theme: Genetically engineered plants and their Containment in CE.
(ii) Leicester University. Theme: Cabinets for research into the effects of red/far red ratio.
(iii) Edinburgh University. Theme: Open top chambers and branch bags.

The offer from John Innes Institute was accepted for the 1992 meeting. The date and details would be arranged by JII, but the general format would be along the lines of this year's meeting.

It was felt that Leicester University might be suitable for the 1993 meeting, but that it would be more interesting if the topic were broadened to consider the spectra of artificial illumination in relation to plant spectral responses.

Transcribed from duplicated copies by L.D. Incoll, 2/04/2009

c) Administration costs
For the Lancaster meeting a registration charge had been made to cover administration costs of providing and sending Minutes etc to participants. The Chairman asked the group to consider whether in future they wished this to be spread over all members (i.e. make a subscription charge to those on the membership list) or whether it should remain as a charge on registration. There was no clear conclusion to the discussion, but no objection was raised to the procedure adopted for this meeting.

OTHER BUSINESS

4. Management, staffing, running costs
It was suggested that new electrical safety regulations might entail substantial additional time and effort in CE because of the great dependence on electrical installation.

The large CE facility at JII is serviced and maintained by site electricians and engineers and not by a specifically-appointed CE technician.

5. Maintenance, servicing, spares
G. Crowhurst (HRI) reported that on one of the Saxcil cabinets at Wellesbourne, the multi-way plug and socket connecting the lamp-housing to the choke-frame had overheated and smouldered, causing extensive damage to the wiring. This had since been rewired through fixed connections. Regular checking for security of these and similar items may be preventative.

JII at Norwich are currently introducing a computer-based planned-maintenance programme, though this particular one is very expensive. It was suggested that some PC databases might be suitable for this purpose e.g. Paradox, Deltabase.

6. Control systems
J. Franklin (RES) informed the meeting that Rothamsted ES now owned the rights to the Envirocon controller. They ~would be continuing the use of these machines at RES, and it was possible that they would be able to sell machines, but this had yet to be decided. The contact at RES is Richard Lefevre.

R. Woodfin (IC) was interested in controlling CO_2 concentrations by CO_2 removal in large volumes as well as supplementation and asked the group for advice. No members had experience of this.

7. Humidification, irrigation
R. Woodfin (IC) asked if anyone was attempting rain simulation. A suggested sources of information was the Plant Pathology Dept at Rothamsted.
A Nichols (JII) is currently using an ultrasonic system

for humidification, developed by Sanyo-Gallenkamp. The device had worked well for 9 months. Humidities of 90% had been achieved at a wide range of temperatures. G Taylor (Sanyo-G) said that these would probably be generally available soon and that the price was unlikely to be as high as ultrasonic devices currently on the market. He was asked if he could provide details for sending out with the minutes.

8. Lighting
C Hole (HRI) asked whether users were incorporating UV light into CE facilities. No-one present was. However, it was mentioned that addition of uv light had been used to improve tomato growth in cabinets at Littlehampton. (See accompanying notes.)

9. Instrumentation, sensors
R Woodfin (IC) had made low cost PAR sensors using Caltex B filter over a Silicon B photodiode. There was some interest in this and he agreed to provide details for the group.

A Nichols (JII) requested information on sensors for anticipating rainfall. None was available, but it was suggested he might try the Environmental Science departments at Sutton Bonington and Lancaster and possibly the Met. Office.

R Hughes (LARI) has recently successfully used super-absorbent sponge ("Supersorb") as wick material for aspirated psychrometers and had found this much better than the usual cotton shoe-lace type. This material can be purchased through advertisements in the magazine of the "Mail on Sunday". It does however require cutting into thin strips and forming into a tube. R Hughes agreed to provide information to send out with these minutes.

10. Fabrics, glazing, reflective material
Long Ashton (R Hughes) have still not found a suitable replacement for their 'Melinex' ceilings, which are degrading under the influence of UV from 250 W metal halides (Wotan).

11. New equipment, recent advances
R Hughes has designed and installed a 2-way mobile bench in growth rooms. This has improved the amount of available growing space. These can be made by Fordingbridge Engineering of Littlehampton.

IEGR-WPBS, Aberystwyth (C Eagles) have a new 30-compartment glasshouse which is computer controlled. There is no cooling, but temperature is controlled by use of shades and vents, though the effectiveness of the latter is limited by the presence of aphid screens.

12. Plant growth problems.
W Hamilton (AGC) explained that seedlings of oilseed rape had been dying in their rooms until they removed a filter housing that was made of chipboard and incorporated extensive flexible mastic bonding material. It appeared that this was probably another example of volatile plasticiser. They are now able to grow from seed to flowering.

It was suggested that a list of products known to have caused problems in the past be kept in the minutes, so that users would be aware of the need to avoid or re-test in their particular application. One item mentioned was Hammerite paint which had been identified as causing toxicity problems when applied to a boiler in the glasshouses at Wellesbourne. It was noted (G Crowhurst, HRI) that the green version of this had been tested at Wellesbourne recently and had not proved toxic.

There being no other business the meeting was closed at 10.05 pm after a vote of thanks to the chairman for arranging the interesting programme of speakers during the afternoon session and the general organisation of this meeting celebrating the 25th anniversary of the Group.

C C Hole, G E Crowhurst
Recorders
10 October 1991

Additional Notes

The use of uv light at HRI-Littlehampton (with thanks to Ken Cockshull)

The older grade double perspex ceilings of Saxcil cabinets filters out the uv light produced by fluorescent tubes. (There is apparently a very sharp cut-off at the uv-A boundary.)

When tomato plants were grown in these cabinets at high humidity (90%) they develop small (2mm diam) yellow pustules on both upper and lower leaf surfaces. This had previously been observed in the USA and termed 'intumescence'. Anatomically, intumescence comprises a swelling of leaf cells which have become 'amoeba-like' in appearance, with projecting pseudopodia. It is not clear whether they originate from the epidermis or mesophyll of the leaf. The symptom did not occur at lower humidities. The addition of 2 uv-A emitting lamps below the perspex also removed the symptom.

Two additional observations of relevance are:
a) a tomato species originating from a high Andean environment developed intumescence in cabinets, whatever was done to it, though it grew without symptoms in a glasshouse. This was put down to a greater requirement for uv-A due to 'selection' at naturally higher intensities of uv.
b) tomato plants in cabinets with additional uv-A looked better, particularly they did not show 'incurling' of leaf margins. (The appearance is akin to a draw string having been inserted through the leaf margin and pulled taut. We sometimes see this at Wellesbourne on cabinet-grown brassicas - C Hole)
c)
Address requested by some users during guided tour

Suppliers of spectroradiometer:
Macam Photometrics
10 Kelvin Square
Livingston
Scotland EH54 5PF
Tel 0506 37391
Fax 0506 38543

Wick material for psychrometers (from R. Hunghes, IACR, Long Ashton). The superabsorbent sponge which is very effective as wick material for psychrometers is available from:

Wrightway Marketing Ltd
15, Warren Bridge
Stoke Doyle Road
Oundle
Peterborough
PE8 4DQ

The material is called "supersorb" and comes in 6" x 4" x 1.5" blocks at £6.95. This needs to be cut, when dry, into thin strips for forming into tubes. There was some correspondence with one of the directors, Miss V. Kay, on whether they could manufacture the material in tubular form. The company eventually said they were unable to do so.

Build your own PAR sensor (from R.M. Woodfin, Centre for Population Biology, Imperial College at Silwood Park) Instructions and circuit diagram are appended. The transmittance spectrum for "Calflex B" heat protection filter can be obtained from Balzers.

Ultrasonic humidification (from G. Taylor, Sanyo-Gallenkamp) Gary Taylor has reported that Sanyo-Gallenkamp will not be producing a package which could be purchased for fitting into one's own rooms/cabinets. He has supplied 28 pages of information to enable users to make their own and comprising a) a brochure on ES Electrosonic humidifiers from

Energy Technique Ltd
Brookwood Industrial Estate
Brookwood Avenue
Eastleigh SD5 4EY Tel: 0703-620252

and b) a guide to ultrasonic humidifier design appearing to originate from TDK (Japan). This is too much for me to copy to all members. Please contact me if you are interested in seeing a) & b).

L D Incoll
17 January 1992

LIST OF PARTICIPANTS
CE USERS GROUP MEETING 1991
AT THE DIVISION OF BIOLOGICAL SCIENCES
UNIVERSITY OF LANCASTER

1.	Z. Chalabi	Silsoe Research Institute
2.	S.H. Crothers	Dept. of Agriculture, Belfast
3.	G.E. Crowthurst	HRI, Wellesbourne
4.	P.Curtis	John Innes Institute
5.	D.Dickinson	University of Reading
6.	C.L. Dudley	Dow Elanco Europe
7.	C.F. Eagles	IGER-WPBS, Aberystwyth
8.	J. Evans	Royal Botanic Gardens
9.	C. Foster	Royal Botanic Gardens
10.	J. Franklin	Rothamsted Experimental Station
11.	V. Frodsham	Vindon Scientific Ltd
12.	D. Gray	SCRI, Invergowrie
13.	W.D.O. Hamilton	Agricultural Genetics Co.
14.	C.C. Hole	HRI, Wellesbourne
15.	R.F. Hughes	Long Ashton Research Station
16.	L.D. Incoll	Leeds University
17.	A.C. Kendall	Rothamsted Experimental Station
18.	S. King	Long Ashton Research Station
19.	M. Lappage	Leeds University
20.	H. Lee	Edinburgh University
21.	J. Lonsdale	Royal Botanic Gardens
22.	D. Mead	IGER-WPBS, Aberystwyth
23.	A. Morgan	HRI, Wellesbourne
24.	C.A. Newell	Agricultural Genetics Co.
25.	A. Nichols	John Innes Institute
26.	R.G. Parkinson	Long Ashton Research Institute
27.	H.K. Pentelow	Richings Scientific
28.	B. Roberts	HRI, East Mailing
29.	J. Roylance	Vindon Scientific Ltd
30.	I. Southworth	ICI Agrochemicals, Bracknell
31.	G. Taylor	Sanyo Gallenkamp Envir. Equipt.
32.	B. Thornton	MacAulay Land Use Institute
33.	J.K. Welling	University of Sussex
34.	R.M. Woodfin	Imperial College
35.	A.G. Worthington	University of Nottingham
36.	P.G. Ayres	Lancaster University
37.	P.W. Lucas	Lancaster University
38.	T.A. Mansfield	Lancaster University
39.	N.D. Paul	Lancaster University

Transcribed from duplicated copies by L.D. Incoll, 2/04/2009

Centre for Population Biology

Imperial College at Silwood Park

Ascot. Berks SL5 7PY

Prof J.H. Lawton FRS, Director
Telephone 0344 294354
Facsimile 0344 873173
E Mail UMRB001@VAXA.CC.IC.ACU

BUILD YOUR OWN PAR SENSOR R.M.WOODFIN 22/10/91

The principle is very simple: To produce a photo sensor which responds to the 400 - 700 nm region of the spectrum by combining a red sensitive photo-diode with a heat protection filter. The photo-diode should not respond significantly to light with a wavelength of less than 400 nm and the heat protection filter should cut off that part of the spectrum above 700 nm to which the selected photo-diode is sensitive.

By obtaining manufactures data on the spectral response of photo-diodes and the transmittance characteristics of filters you may select your own to meet these criteria. But we have had success with the following:

Photo-diode - Red sensitive "BPW 34" Manufactured by Siemens and supplied locally for 85p each by: Electrovalue ltd 28 St Judes Road, Englefield Green, Egham, Surrey TW20 0HB tel. 0784 433603 fax:. 0784 435216 or northern branch - 680 Burnage Lane, Manchester M19 1NA tel. 061 432 4945 fax. 061 432 4127

Heat protection filter - "Calflex B" Suppled in 50mm x 50mm squares of coated glass for approx £40 by Balzers High Vacuum Ltd, Northbridge Road, Berkhamstead, Hertfordshire HP4 1EN tel 0442 862181, fax 0442 871727.

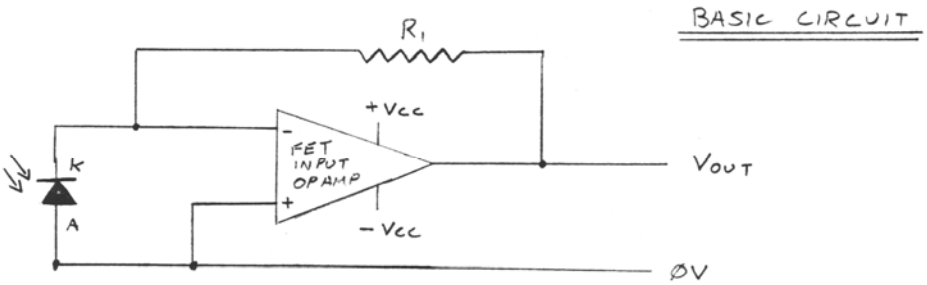
Cut the filter into 5mm squares sufficient to cover the photo-diode and stick the filter, coated sidetowards the Light, to the light receiving surface of the diode with a drop of "glass bond" (a LOCTITE product).
A basic photocell sensitive to the PAR region has now been formed and will generate a photo-current when illuminated that will be linearly related to the incident radiant energy.

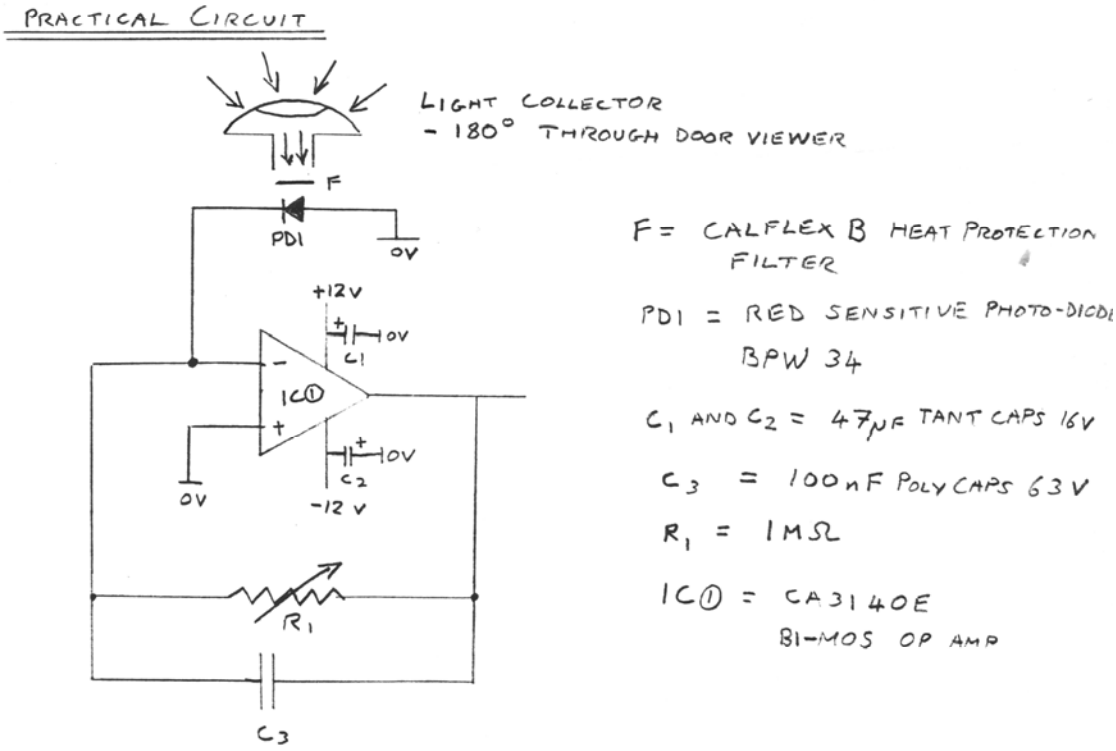
This current is tiny and methods of converting it to a measurable voltage are discussed in Pearcy et al 1989. The first person to build these sensors at Silwood Park was Dr Peter Mueller a plant physiologist in the department of plant biology and he used the photocell, driving its photocurrent through a shunt resistor. You may prefer to use an FET type op amp to amplify the photocurrent, or to amplify the leakage current with a reverse biased photo-diode (Parr 1982).

The practical circuit I have used successfully is given but I do not put it forward as the only or even the best solution.

The Centre for Population Biology is an Interdisciplinary Research Centre sponsored by the Natural Environment Research Council

Transcribed from duplicated copies by L.D. Incoll, 2/04/2009





References:

Pearcy, R.W. (1989) Radiation and Light Measurments. In *Plant Physiological Ecology - Field Methods and Instrumentation* (eds R.W. Pearcy, J.R. Ehleringer, H.A. Mooney and P.W. Rundel), Chapman and Hall, pp 97-116.

Parr, E.A. (1982) How to use op amps - (BP88). Bernard Babani (publishing) ltd, pp 113-114.

Transcribed and scanned from duplicated copies by L.D. Incoll, 2/04/2009