Secretariat Phytotronique
Phytotron C. N. R. S.
91190-Gif-sur-Yvette

Gif-sur-Yvette, April 1976

PHYTOTRONIC NEWSLETTER N°12 and 13

Contents

Reports

Information

I - EDITORIAL 1

Our last issue came out in October. We had hoped to publish the following issue at the beginning of the year, having had sufficient material, but unpredictable events, mainly of a financial order, prevented this. Therefore, we have carried over slightly the publication of this issue, including more material in it and giving it a double numbering (12 and 13) in order to adhere to our scheduled three issues per year and to economize on shipping costs. We hope that our readers will excuse the delay.

We again thank those readers who write to us and send us news and encouragement.

Equal thanks to all those who sent or will be sending us financial aid, whether personal, official or from private groups. As always, we ask you please to send donations to us at our address and enclosing a note saying that it is for : *Participation aux frais de parution du Bulletin "Phytotronic Newsletter"* . In the case of *bank cheques* make them payable to : *l'Agent comptable secondaire du CNRS-4e circonscription, 91190-Gif-sur-Yvette, France.*

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In the beginning of this issue we pay homage to Professor Pierre Chouard who retired at the end of the year 1975.

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The Table of Contents includes as always four main headings: Under the heading "Meetings" we glance rapidly at three international meetings which took place during 1975. The titles of the papers are given only for purposes of informing readers who want to obtain the reports. We analyze more completely three meetings which were held in France and which cover scientific and practical concerns in the area of energy savings.

As we have written many times before, we would like to receive information about scientific or technical meetings in other countries for purposes of exchanging information and establishing guidelines. News from laboratories or associations have also been received which we publish for all to read. Some of these papers also come under the heading "Research Strategy" , some may have useful information or addresses.

Scientific papers or articles are reproduced giving the names of the authors who sent them to us. Here one can find technical or practical information, mainly about energy savings or pollution, laboratory techniques, chiefly about CO, control in growth chambers or air-conditioned cabinets, about vegetable production in countries near the North Pole, or basic research on forestry photology.

The last chapter deals with a *variety of news* interesting journals, books, published articles or coming meetings.

We finish this editorial, as always, by inviting our correspondents to kindly send us scientific or technical papers or those dealing with horticultural practice which we will gladly publish. These information exchanges, inquiries and news coming from different countries, allows phytotronists to progress more rapidly in their work, while at the same time strengthening the bonds which exist between them.

We thank you in advance for your letters.

N. de Bilderling and R. Jacques

II - RETIREMENT OF PROFESSOR CHOUARD

No.11 of the "Phytotronic Newsletter" had scarcely appeared than a normal administrative decision awarded retirement to Professor Pierre Chouard. Initiator, Director and leader of the Gif-sur-Yvette Phytotron, he was succeeded in this post by Monsieur Pierre Champagnat, Professor of Plant Physiology at the University of Clermont-Ferrand, Doctor Roger Jacques having been maintained as Assistant Director.

We hope that our readers will permit us this time to render homage and friendly tribute to our "chief" for more than twenty years and the initiator of our Journal. The organizer, or rather, the reformer of plant physiology teaching in France, he was at the same time the teacher of multitudes of students of which certain are now themselves leader in new areas of research.

Under his direction the *Phytotronic Secretariat* was created which has grown into a center for communication between phytotronists throughout the world. Now retired, Mr. Chouard will certainly continue to give us his criticisms and judicious counsel and thus help our work progress thanks to free time which is now afforded to him.

A Jubilee Committee, created to honor Mr. Chouard work in diverse areas of plant physiology, which he studied, or, in which he participated , will render tribute in the form of a book which will be off the presses during the year?

The few words that we now present to our readers are heartfelt and are written by one of his oldest collaborators and editor under his supervision of this Journal. Without claiming to be able to explain, or in fact recall, the entire work of Mr. Chouard, it does seem fitting to emphasize one of the essential ideas that he transmitted and taught us. An open mind, without limits of restrictions, he always allowed us to cover a very large number of subjects in our Journal, all linked to Phytotronics and which include pure and basic theory as well as practice. It is this same liberal mindedness, practically without limit, which has been followed by a great number of his students and which serves them as a guideline in their work and research. Instead of working and limiting himself to a single plant, Mr. Chouard furthermore taught us to try to choose a plant in relation to the research object or the problems encountered or in the course of the study. Thanks to this main line one finds such a large number of different plants species at Gif, which incidentally is one of the particularities and features of this Phytotron.

The same idea and the same scope permitted us to publish this Journal in two languages, French and English, and to have produced such varied past issues, in spite of budgetary difficulties which have fortunately always been surmounted up till now and at all times with the complete cooperation and friendship of our Director to whom we here present our deep thanks.

Let us hope that his liberal outlook will remain alive and present in each one of the future issues of this Journal.

N. de Bilderling

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III-ENVIRONMENTAL EFFECTS ON CROP PHYSIOLOGY

Fifth Long Ashton Symposium (U. K)
13-16 April 1975

Here we reproduce titles of communications. A special book will be published during 1976; for information please write to : *Scientific Liaison Section-Long Ashton Research Station - BS l8 9 AF Bristol U. K.*

Inaugural Lecture - Professor J. P. HUDSON

Session I- Weather and Microclimate

a. Weather patterns and cropping	Dr. G. Stanhill
b. The microclimate of plant communities (grassland)	Dr. B. Saugier
c. The microclimate of plant communities (forest)	Dr. T. A. Black

Session II- Weather and Crop Productivity

a. Dry matter production in relation to weather	Dr.P. Biscoe
b. Growth and nutrition of apples in relation to temperature and humidity	Dr. J. Tromp

Session III- Physiological Processes: Assimilate Production

a. Factors limiting photosynthesis	Dr. Ph. Chartier
b. Field studies of photosynthesis: Monitoring with $^{14}CO_2$	Dr. L. D. Incoll Dr.
c. Physiological behaviour in relation to environment	F. E. Eckardt

d. Stomatal behaviour — Dr. W. R. Watts

Session IV Physiological Processes: Respiration and Translocation

a. Role of respiration in crop production — Professor K. J. McCree

b. Energy relations of respiration — Dr. F. W. T. Penning de Vries

c. Root functioning — Dr. R. Brouwer

d. Carbohydrate allocation — Dr. P. Hansen

e. Dynamic aspects of plant water status — Mr. D. B. B. Powell Dr. M. R. Thorpe

Session V Critical Stages of Plant Development

a. Morphogenesis and flowering — Dr. R. Jacques, Madame M. Mousseau

b. Phenological stages

c. Effect of weather on development — Dr. J. J. Landsberg

Session VI Modelling and Synthesis of Results

a. Modelling as a tool in plant physiological research — Dr. J. H. M. Thornley

b. Simulation modelling of plant physiological processes to predict crop yields — Dr. P. E. Waggoner

c. Evaluating crop responses to weather by statistical methods — Dr. W. Baier

Summary-Professor C. T. De Wit

IV- PROTECTED CULTIVATION OF FLOWERS AND VEGETABLES

ISHS Symposium- Scheveningen, The Netherlands
May 12-16, 1975

To commemorate the 75th anniversary of the Netherlands' Stations of Aalsmer (1899) and of Naaldwijk (1900), the International Society of Horticultural Science organized this meeting on protected cultivation.

As the French Interprofessional National Committee of Floral and Ornamental Horticulture and Nurseries (CNIH) in its issue of "Information", (75 C1.09 of June 6,1975) notes "This meeting takes place just in time because in the face of a constent accelerated increase in production costs, greenhouse growers in countries with temperate or cold climates, that is, the industrialized countries, are wondering whether they will be able to survive."

An analysis of this meeting made by the CNIH may interest our readers. We publish it in its entirety :

'Thirty six papers made it possible to summarize research done in Canada as well as in Germany., Hungary , as well as in Sweden, etc. in order to be better acquainted with the relations which exist between plant growth and features of an artificial environment created by the greenhouse, the substratum of the cultivation, the watering, the lighting, etc".

"It is worthwhile noticing that no matter what the political regime, whether socialist or capitalist, all researchers now pay increasing attention to the economic aspects of their work. The same concerns appear everywhere: how to reduce energy consumption, how to shorten cultivation cycles, how to economize water (in arid zones).. Another constant concern is the automation of cultivation and keeping manual labor to a strict minimum".

"Finally, the results presented tend to show that, thanks to progress in research greenhouse, growers, in developed countries, will be able to maintain a sufficient technological advance to make up for the handicap that exists in unfavorable climates or using up costly energy. This obviously supposes that professionals have properly equipped research and experimental centers, as well as, all kinds of necessary technical assistance: laboratories for analysis, advisors, formation sessions, etc. From this point of view, the visit to the Aalsmer and Naaldwijk Stations leave us in admiration and make it possible to understand how growers in the Netherlands can supply Southern Europe with eggplant and cactaceae, and make a profit too!".

5 sessions followed this symposium and the titles of the papers presented are as follows :

Session I Control of growing conditions in the greenhouses
President : J. Damagnez

Reducing the heat requirements of a glasshouse:
B. J. Bailey, K. W. Winspear
The influence of convective sensible heat transfer on the greenhouse and the curtain effect:
M. G. Amsen

Natural convection heat transfer in covered plant canopies: M. Iqbal and J. A. Stoffers

Controlled environmental agriculture in desert regions:
Miguel R. Fontes

Problems of desert greenhouses:
H. J. Daunicht

Leaf cooling of roses by low volume overhead sprinkler:
P. A. M. Hopmans,C. J. V. D. Post & P. A. Spoelstra

Climate regulation for *Anthurium andreanum :*
L. Leffring

Successive crops in plastic houses with light heating:
L. Korodi

Session 2 Control of growing conditions in the soil
President: E. Stromme

The influence of temperature regime, photoperiod and size of container on the growth rate and development of young tomato plants in growing rooms :
E. J. Clarke and J. V. Morgan

The use of calcareous sand in Abu Dhabi as a growing medium in the sand culture system:
Hamdy M. Eisa and Merle H. Jensen

The use of decomposed pine bark as a substrate for growing Gerbera
E. Jesiotr,M. Saniewski and Z. Strojny

Flower crops in peat substrates:
R. D. Polluck

Tomato growing in peat
R. E. Moorat

Soil cooling for fresia's
T. Dijkhuizen and G. P. A. van Holsteyn

Session 3 Climate requirements of vegetables crops
President: D. Rudd Jones

Stage of development for planting tomatoes:
E. J. Clarke and J. V. Morgan

Analysis of growth of young tomato plants
D. Klapwijk and P. J. A. L. De Lint

Light dependent control of day temperature for early tomato crops
A. Calvert

Effect of short term temperature reductions from blueprint temperature programs on the growth, yield and fruit quality of glasshouse tomatoes:
G. Halligan and R. A. J. White

Influence of the water status on growth and fruit setting of pepper and egg plant in protected cultivation:
E. Pochard

The response of the heat glasshouse lettuce crop to *in situ* supplements of low illuminance fluorescent light.
D. J. Dennis and W. M. Dullforce

Effects of CO2 nutrition on growth and yield of Muskmelon *("Cucumis melo L."),* Eggplant *("Solanum melongena" L.)* and Sweet Pepper *("Capscium annuam "C.)*
C. Costes and Y. Milhet

CO_2 nutrition of cucumbers:
N.
van Berkel and J. A. M. Van Uffelen

Session 4 Climate requirements of flower crops
President: W. V. Von Hentig
The effects of long days on the flowering of spray carnation A. Beisland

Carnation production times for flowering in November-December G. Kokas

The effects of CO2 concentration on the Canopy Photosyn-thesis and Winter Bloom Production on the Glasshouse Rose "Sonia" (syn. "Sweet Promise"):
K. E. Cockshull and D. W.
Hand

Discoloration of rose flowers as affected by light and temperature :
A. H. Halevy

Supplementary Lighting for Spray Chrysanthemums A.
E. Canham

Progress in the realization of flowering in lilies by supplementary lighting:
3. Boontjes,A. J. B. Durieux and G. A. Kamerbeek

Factors influencing growth and flowering of *Gerbera :* L.
Leffring

Temperature and day lenght requirements of Alstroemeria: C.
Vonk Noordegraaf

The influence of the time of propagation, pinching and shortday treatment on the growth and development of *Euphorbia pulcherrima*
O. Voigt Christensen

The influence of temperature,daylength and light intensity on flowering in *Hydrangea x macrophylla* (Thun) Ser.: B.
Litlere

Factors affecting flowering in regal pelargonium
(Pelargonium x domesticum Bail.):
J. Nilsen

Session 5 Other specific aspects of protected cultivation'
President: L. Korodi

The effect of steam sterilisation on the manganese uptake of glasshouse crops:
C. Sonneveld en S. Voogt

Ethylene disorders in bulbous crops during storage and glasshOuse cultivation:
W. J. De Munk

Influence of temperature regime on virus diseases in

December H. J. M. Van Dorst

Humidity conditions and the development of fungus diseases in glasshouses:
L. Bravenboer and Th. Strijbosch

Pectobacterium carotovorum in forced Dutch irises as influenced by temperature and soil moisture:
W. Kamerman

Industrial crop production:
G. H. Germing

Economical prospects of protected cultivation in North Western Europe:
J. M. Jacobs and D. Meijaard

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Editors'Note : All of these papers will be published by ISHS in "Acta Horticulturae"

To obtain any further information write to: *Secretariat, ISHS,l e. V. D. Boschstraat 4- The Hague, The Netherlands*

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V- ENERGY SAVINGS IN GREENHOUSES

Orleans(France)

June 10-11, 1975

The following summary was published in the Journal "Plasticulture", (No.27, September 1975, page 27) :

Some general discussion days on this subject of topical interest have been arranged by the technical department of the F. N. P. H. P. (Federation Nationale des Producteurs Horticulteurs et Pepinieristes) and the INVUFLEC (Institut National de Vulgarisation des Fruits,Legumes et Champignons).

About 200 delegates attended, and the presentations were grouped under the two major themes:

- Energy savings which are obtainable in the range of traditional cultivation techniques, that is, choice of a better system of heating, maintenance of the heating unit, use of additives in the fuel to improve the efficiency of combustion, reduction in heat losses, research on better materials for the construction of greenhouses, research on varieties better suited to withstand less critical climatic conditions, etc.

- New energy sources to replace oil based fuels which are presently available: research on the use of solar energy by a "sun-house" with double walls through which a fluid passes, thereby capturing the heat of the day and partially reducing the emission of long wave infra-red radiation during the night; studies on the recovery of heat from warm water produced at nuclear centres.

The texts of the papers presented during the meeting will appear in a special publication. Orders should be sent to: "Pepinieristes-Horticulteurs-Maraichers", 59, rue du Faubourg-Poissonniere, Paris 9e.

VI- MEETING OF COMMITTEES ON AGRONOMIC RESEARCH-PLASTIC INDUSTRY

Geneva, Switzerland, June 17-19,1975

The following summary is compiled from papers published in "Plasticulture" (No.27 of September 1975) and from a summary of the review edited by M. R. Brun (INRA- 66 Alenya-France).

These two Committees have met this year, as always, when representatives from the "Institut National de la Recherche Agronomique" (INRA) ,from agriculture and industry (manufacturers of raw materials and of finished and semi-finished products) came together to continue their work in the sphere of collaboration between agronomy and industry.

The meeting, this year, was arranged by Mr. DAMBRON (Technicien du Groupement des Maraichers Genevois) and was held in the fine surroundings of the Centre Horticole de Lullier near Geneva in Switzerland.

During the first two days, the Committee concerned with cultivation methods met under the chairmanship of Mr. BRUN, the Director of the Station Experimentale of INRA at Alenya near Perpignan and concentrated on drawing up a balance sheet of the position of plastics in agriculture in France and specifying what studies need to be done and what the perspectives are for the future.

During the final day, under the chairmanship of Mr. GAC, the Committee for "Greenhouses" has discussed the subject "modern greenhouses,their design and equipment" when the various French manufacturers have been able to present their latest designs.

During the period of the meetings, visits were made to a number of local vegetable growers to see the developments in the use of wide tunnels (7 m)for growing tomatoes, lettuce, courgettes, peppers, eggplant, etc...

A. Balance Sheet for 1974

Mr. Buclon, General Secretary of the French Committee of Plastics in Agriculture presented the results for the year 1974:

1) Total Plastic Production in France: 2,616,000 tons or an increase of about 3% over 1973.

2) Consumption in agriculture and horticulture for the whole of the cultivation methods:

1974: 57,500 to 60,000 t.
with the following distribution
Mulch .... 8,000 t........ (33-35,000 ha)
Low tunnels .... 7,000 t....... (11-12,000 ha)
Greenhouse structures including tobacco
driers .... 3,800-4,000 t .... (1,900 ha)
Silage .... 18,000-19,000 t
Protection of equipment and crops, water
storage .... 7,000 t
Shade nets,wind-breaks
and anti-hail nets 2,000 t

Pots and containers ..4,000 t
Irrigation and drainage 9,000-10,000 t

3) Break-down of the films used for mulching, low tunnels, greenhouse structures, silage and for the protection of equipment and crops:

-Normal, p. E. and long-life	42,500	t
-PVC	1,500	t
-Infra-red polyethylene	600-800	t
-E. V A	150	t
TOTAL ...	45,000	t

B. FUture prospects

Mulching: certain crops are already largely grown under plastics mulch: melons (100%) and strawberries (60-65%)
It is likely that there will be some use for the mulching of potatoes, artichokes, maize and also inside greenhouses (perhaps with the application of trickle irrigation) is widely practiced in Roussillon.

- Greenhouses: this generally involves the use of "long-life" polyethylene films made to the standard mark of quality
- Low tunnels: there is a fall-off in this application because growers prefer the larger structures 7 metres wide for reasons of ease of working, and better results than are obtained with the low tunnels
- Silage: this has shown an increase of about 15% per year which seems reasonable, taking into account the continuing increase in the areas devoted to maize .
- Covering materials: this year has seen a take-off in the usage of EVA films, and it should continue to develop in this next year. From the trials carried out at Alenya with the use of different covering materials for greenhouse structures, an increase in the average weight of lettuce and improved quality have been recorded when grown under EVA film.

C. Physics of greenhouses

The Committee on "Physics of greenhouses" concentrated above all on energy savings, as was done at the Orleans Meeting; An open discussion between agronomists and manufacturers gave this meeting a particular interest.

Some of the more outstanding points will be outlined below since the discussions covered a wide spectrum of subjects. It should be of interest to note the estimated average amount of fuel consumption in: Kassel (FRG) - 170 liters/m2
and France at: Lorraine 30 "
Aquitaine 10 "
Roussillon 2 "

so, the problem of energy savings is one which affects all of France.

Covering Materials and the comparison between glass and plastic material. It remains a question of cost: if several layers of plastic are necessary, then glass seems most economical (50 to 60 francs/m2). It would appear that the cost of plastic must be less than 30 francs/m2 to be competitive; unless the grower prefers the dependability of glass. If growers avoid letting the plastic flap against the steel poles it can last for four years.

The materials which exist on the marked are rigid polyester with standard frames also usable for glass. This polyester lasts ten years and the cost is 60 francs/m2, about the same cost as glass.

In regard to these materials it is of interest to note some information : first, a table taken from an article by M. Brun ("Plasticulture", no.26,June T975, p.11).

The average price for covering materials only, for a 2000-3000 m2 area:

Law Tunnels Light structure	2,60 to 3 F.
built by grower	F./m2 6-9
Open structure wooden frame	10-12
Open structure metal frame	32-36
Light greenhouses, built by local con-	15-18
tractor	30-34
Commercial tunnel	
Commercial multispan	32-38
greenhouse	60-75
Dutch glass house, wide span	

And next, the cost of making alteration in order to diminish heat loss which C. Wacquant worked out in December 1973 ("Plasticulture", No.27,September 1975, p.15) and which should be recalled:

Lining of walls with plastics film:

-Lining of Gable Ends:
Cost (with installation by the grower)= 10,00 F /m2 to 15.00 F/m2 (labour accounts for 60%)

-Lining of certain north-facing Gable Ends with opaque insulation :
Cost (with installation by the grower) polystyrene: 12,00 F to 15,00 F/m2

-Lining of Side-Walls with plastics film:
Cost with installation by the grower: 2,00 F/m2

. Lining or permanent screen in transparent plastics films:

Cost of screen of plastics film: 1.2 to 2.0 F/m2

. Movable screen system (shade type used for chrysanthemums):

Cost (with fitting of screen by the grower): 12.00 to 15.00 F/m2

Cost (with fitting by supplier): 40,0 to 60,0 F/m2.

. Lining of walls with infra-red opaque plastics for plastics greenhouses:

Cost: 1.0 to 2.0 F/m2

With *Heating-Aerating Materials* , several ideas have been suggested which we print in random order: The grower as well as the greenhouse manufacturer are interested in having a material with a mixed system of air conditioning with heat in the winter and cool aeration in the summertime.

In Roussillon the installation of anti-frost heating for security came to 6 francs/m2, with fuel, for a temperature difference of 8°C and 9 francs for 12°C difference.

For tunnels a simple sprinkling on the roof reduces the risks of frost.

With heating-aerating in certain cases drainage pipes can be used, eventually controlling in the same way the amount of carbon dioxide in the greenhouse.

The choice between static ventilation with opening spans and dynamic ventilation, depends on the cost of labor, because the latter is almost the same as the cost of natural aeration. Installed ventilation comes to 34-35 francs/m2.

Dynamic ventilation ensures between 16 and 30 times of air renewal per hour. Choose ventilators with low speed but large output.

The problem of height of the ventilation above the canopy is always a controversial subject.

A "heating mulch" for the cultivation might be a solution to the problem of greenhouse heating, mainly near thermal power stations or using geothermic springs and even solar energy.

Experiments have shown good results with:

1) Polyethylene sheaths covering 50% of the ground in a greenhouse with water at 30°C permitted greenhouse temperature to be maintained at f 9°C while the external temperature was -11°C.

2) Sheaths covering 75% of the total surface with water entering at 35° and an output of 40 liters per square meter and per hour gave temperatures of 18° to 24° for cucumber.

3) Sheaths covering 80% of the ground surface with water entering at 27° to 30° maintained ground temperature at 10 centimeters depth at 20°C with a greenhouse temperature 1U° higher than the minimal night temperature.

These experiments do not prevent considering the tightness of greenhouses by the use of sheaths blown up by a small ventilator or by installing an aluminized nocturnal reflector with easy manipulation for nocturnal protection.

In conclusion we can only hope that these meetings continue as they have, being absolutely vital. The presence of some physiologists at these meetings would often help work progress more rapidly, or perhaps contribute explanations or explain the latest scientific knowledge.

Editors' Note: Meetings of a similar nature on other subjects of interest to our readers must certainly be taking place in other countries and we would like to publish their summaries. Thank you in advance to those of you, who do send us, this material.

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VII- IIIrd MEETING OF THE MEDITERRANEAN GROUP FOR APPLIED PLANT PHYSIOLOGICAL RESEARCH (M. P. P.)

October 13-17 1975 - Izmir (Turkey)

We receive from Prof. Y. Vardar, ex-president of MPP, several documents concerning these group and its' meeting from which the following information is taken. For those who want more details please contact: Prof. Y. WALLY- Dept. Of Horticulture, Shubra El-Kheima, Cairo, A. R. E.-Egypt.

1) Organization and Objectives of MPP

The Mediterranean Group for Applied Plant Physiology is composed of members from several of the Mediterranean nations (i. E. Portugal, Italy, Greece, Egypt, Turkey) who are aware of the plant physiological problems facing their region, and of the need for cooperative programs of research.

The broad objectives of the Group are to stimulate a cooperative approach to those plant physiological problems common to the Mediterranean countries, and to stimulate interest amongst other disciplines to bear upon problems employing a multidisciplinary approach. This is bound to influence research workers to attack those problems most likely to influence the economies of their native countries. Also an interchange from one Mediterranean country to another will permit a much closer collaboration between Universities and Research Institutes in the Mediterranean area and North Africa. Another objective is to train young scientists for work on specific physiological problems (i. E. Water relation, etc.).

2) Scientific Matters

It was agreed that the major problems in the Mediterranean area can broadly be defined as:

1. The need to understand better the physiology of xerophytic plants-their photosynthetic processes,their ability to grow on saline soils, their resistance to drought, etc.
2. The need to consider solar energy and photosynthesis as an alternative, and potentially, as important a source of energy as the fossil fuels,

3. The need to understand the fundamental physiological problems in xerophytic species and to attempt to 'transfer" such knowledge to the development of eco nomic plants and efficient cropping systems,

4. A need to understand better the problems of Mediterranean soils, including not only salinity problems, but also those of structure, nitrogen fixation, etc.

3) *Facture activities of MPP*

1. Election of new Chairman :

Prof. Yusuf Wally of Egypt was elected as the Chairman of the Executive Committee of MPP for a period of two years in succession to Prof. Yusuf Vardar of Turkey.

2. Future MPP meeting:

It was agreed that in two years time the next meeting of MPP would be called by Prof. Wally.

3. Membership of Executive Committee:

The Executive Committee will be open to members from every Mediterranean country (i. E. Libya, Syria, etc)

4. Seeking new members:

It was agreed that all the present members of MPP would make an effort to recruit new members.

5. Exchange of students:

Exchange of students, especially post-graduates, was considered a vital function of the Group.

6. Fund raising:

Funds will have to be found to assist the Group in holding meetings, publishing reports, etc. A brochure should be produced describing the activities of the Group, its members etc.

]. Membership subscription:

Individuals: It was decided that the annual membership subscription for individuals shall be U. S. A 10.

Industrial organization: The annual membership subscription from industrial organizations shall be U. S. $ 75.

8. Research award:

The Tate and Lyle Group Research and Development laboratory has graciously announced an award of 100 Pounds Sterling to the best research paper (to be decided by the Executive Committee of the MPP) on the results of greatest economic value for the Mediterranean region presented at the MPP Group meeting in 1977.

g. Collaboration of Research Activities:

It was agreed that the MPP should continue to collaborate on problems of interest to the Mediterranean area with emphasis on :

i, The physiology of plants (including *Ceratonia);*
ii, The physiology of the major existing Mediterranean crops; and
iii, The physiology of crops capable of high conversion of solar to chemical energy, i. E.,sugar beet and other carbohydrate crops.

4. Summary of the proceedings of the MPP meeting held in Izmir, Turkey

This Meeting marked the first attempt of the Group to exchange scientific research information on a formal basis. In accordance with the decision reached at the Athens Meeting in 1973, cooperative research was initiated on specific Mediterranean flora, i. E. Maquis, and on Mediterranean crops. The results of such research were reported. In addition, a very interesting presentation by Dr. H. F. Linskens (Holland) stressed the fact that stigmatic responses affecting pollination are equally relevant to Mediterranean plants as they are to these of Northern Europe.

A. Maquis

Dr. Sheikh (Pakistan) presented valuable data on some maquis species. His studies on *Quercus coccifera* and *Arbutus andrachne* indicated some rather unusual plugging of the stomata of both the species by some unidentified compound, and in addition provided other useful information regarding xerophytism in these two species.

Prof. Vardar (Turkey) valuable studies on water relations,and Dr. Bozcuk (Turkey) studies on *Statice* sp. and *Pisum* sp.,and the studies on the germination of *Myrtus communis* seeds by Dr. Oztiirk (Turkey) have added new knowledge to a potentially important subject for future studies.

B. Ceratonia siliqua

Considerable progress has been made in understanding the eco-physiology of *Ceratonia siliqua* . Dr. Segmen (Turkey) showed that in Turkey there are three distinct varieties of *Ceratonia* i. E.,wild, fleshy and sisam, and that recognition of this fact will facilitate the economic utilization of the crop. That is, wild type will probably be best for tragasol production, fleshy type for syrups, and sisam type for sugar production.

The auxin content of *Ceratonia* seeds, as presented by Dr. Baltepe et al. (Turkey) , showed and increase with the maturity of the fruit. Similarly the sugar content increased from young to mature fruits.

Prof. Catarino and Benito Pereira (Portugal) in their detailed physiological studies, established that *Ceratonia* is a C_3 plant. However ,they pointed out that under certain conditions of temperature, light, water, etc., the species might possibly exhibit C4 tendencies.

The studies on *Ceratonia* ,both in Turkey and in Portugal, stress the fact that the species is ideally suited to xerophytic environments.

C. Mediterranean crops

Prof. Wally(Egypt) presented a comprehensive review of the problems facing Egyptian agriculture. He stressed the fact that high-value vegetable crops are likely to achieve greater importance in Egypt but that the common problems of trace element deficiency, water supply, etc., will have to be studied in greater detail.

Dr. Halevy (Israel) emphasized the role of high light intensity as a factor influencing the flowering of high value ornamental species, including *Static sp. gladioli,* roses and orchids. Interestingly the high intensity light required is not a photosynthetic requirement but rather it affects the distribution and mobilization of metabolites to the flower.

An interesting paper was presented by Dr. Dokuzoguz and GUlcan(Turkey) on the selection of almond varieties for the Aegean region. Varieties of almonds with late flowering characteristics *have* been selected and these may increase the potential for cultivating almonds in areas subject to late frosts.

The flowering behavior of the olive tree in Italy and its relation to water supply formed the subject of a short communication by Dr. Mazzolani (Italy). There is no doubt that this is a very important subject which needs detailed investigations.

Editors'Note : For more details please write to:

Prof. Y. WALLY. Dept. Of Horticulture. Shubra El Kheima, Cairo, ARE-Egypt.

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VIII. THIRD MEETING OF THE STUDY GROUP ON ROOTS

Grenoble,France, October 21-23, 1975

This meeting,the third since the Group was formed at the Centre d'Etudes Nucleaires de Grenoble, was organized by Mrs. J. Gagnaire-Michard and Mr. A. Fourcy of the Department of Basic Research of the C. E. N. Grenoble, and by Mr. A. Riedacker of the C. N. R. F. of Nancy, Champenoux (France).

More than 100 participants took part,having been only 40 the previous year. This attests to the growing success of these informal meetings.

While the program for the first two meetings treated more specifically the problems of methodology, this one, in addition, aimed at a dialogue between scientits and growers (nurserymen, horticulturists): to make known to growers the problems dealt with by scientists, the results already obtained, to be aware of the problems encountered by growers and capable of being studied by scientists.

This program was spread out over three days in the following manner:

-October 21. A)Methods of microlocalization
-October 22. B)Rates of growth and root regeneration
C)Study of root functions and behavior
-October 23. D)Examination of problems related to plant roots with growers.

A. I. *Methods of microlocalization of elements in biological structures*

The Department of Basic Research of the C. E. N. of Grenoble has devised a certain number of "nuclear" methods which permit particularly fine analyses on areas of some ten odd w and volumes in microncubes.

Essentially, two categories of methods can be distinguished:
Elementary microanalysis and cyto-chemical enzymatic localization.
Elementary microlocalization essentially allows for the localization of mineral elements. It is possible to carry out quantity determinations of mineral elements either on the surface by excitation of elements without destroying material or

more or less in depth, by destructive excitation-analysis in depth is obtained by erosion, or both by combining the conditions for use of the excitation elements or by combining the techniques.

Mr. Garrec: Protonic microanalysis of mineral elements on the surface of plant tissue (adaptation to the quantity determination of fluor and calcium in pine needles).

Mr.81anchard: Application of ionic analysis to a microanalysis of plant tissue (surface and depth).

Mr. Eloy: Application of mass spectrography with laser probes to biological materials (depth)

Messrs. Jourdan and Charnel: Application of some techniques for a study of the localization of copper supplied by foliary way. The combination of radioisotope marking with 0 Cu, of examination in electronic scanning microscopy,of quantitative analysis by Castaing microprobe- makes it possible to specify the morphology of the copper deposit and to determine simultaneously the quantity absorbed.

Mr. Fourcy: Some aspects of analysis by radioactivity in plant biology.

Mr. Aude: Application of analysis by activation to neutrons of 14 MeV and to thermic neutrons to problems of plant biology (simultaneous quantity determination of N,P, K and Ca at a rate allowing for 500 analyses per 8 hours). This methods give satisfactory results as to precision and only requires small neutron generators. It can therefore be used outside of a Nuclear Center.

Mr. M. Baquey: Study in *vivo* by paramagnetic electronic resonance of the reduction of chrome.

Messrs. Garin and Vastel: Description of an installation for cytochemical analysis (automatic coupling of electronic scanning microscopy and of quantity determination by Castaing microprobe).

Cytochemical enzymatic localization:

Mrs. A. M. Lhoste. Cytochemical localization with the aid of electronic microscopy: the activity of a dozen enzymes can be detected (among them, the cytochrome oxydase of mitochondries, polyphenoloenooxydase of thylakoides),prefixation and incubation (which must supply a specific compound of the enzyme opaque to electrons) are delicate.

As a general rule for quantitative microanalysis the critical point remains the preparation of samples. It is necessary to have flat conducting surfaces. It is also necessary to avoid the destruction of fine structures. There is no currently simple method. Cryoscopic techniques are promising.

A.2. *Techniques relating to the localization of mineral elements in an organ*

Mrs. J. Gagnaire-Michard and Mrs. C. Souidi:

Use of a double marking radioisotopic technique for a study of mineral exchanges at the level of tree roots (study of Epicea). Radioisotopes Cesium 134 Cs and 137 Cs were retained. Each one of these two radioisotopes is injected separately in two neighboring trees, they diffuse towards the roots from an injection in the trunk; in each of the trees studies their progression is followed in time and space (by probes placed at increasing distance from point of injection). Ground samples are periodically taken to extract root fragments. Their radioactivity is detected by autoradiography. The identification of the tracer thus detected is done by spectrometry y . Until now, the simultaneous presence of two tracers in the same root fragment had never been brought to light.

A.3. Growth chamber for root cultivation on nutritive fog (Mr. Lamond)

Improvements were made with respect to last year's device. One can now obtain roots of normal anatomic and histologic constitutions (particularly the presence of absorbant hair).

B. *Rates of growth and root regeneration*

Mr. Riedacker: Bibliographic report on rates of growth and root regeneration. Growth models with antagonism between aerial parts and roots or without antagonism, exogenous determinism or endogenous determinism of regeneration (case of nut tree reported on by Mr. Barnola).

Mr. Franclet: Methodology with respect to root growth: influence of form of the container.

Mr. Griffault :Role of leaves in cultivation of meristems of excised roots: synthesis of cytokinines and gibberellines at the level of these meristems.

Mrs. Vartanian: Morphology and morphogenesis of roots in terms of ground humidity and ambient humidity.

Mrs. Gagnaire-Michaud and Mrs. Souidi: Rooting of a poplar sutting: morphogenesis, root and foliar absorption of mineral elements (marking with 42K and 32P).

Mr. Monard: Daily periodicity of exsudats in tomatoes (in respect to transpiration).

Miss Desbiez: Correlations between root system and cotyledons (Flax and Bidens).

C. Study of Root Functions and behavior absorption , respiration, synthesis.

Mr. Maertens: Bibliographic Report: passive and active absorption of mineral elements, notion of free space, necessity for contact between root and absorbed element,problem of continuous replenishment...

Mr. Morizet: Water absorption by roots,influence of mineral nutrition and notably of nitrogenous nutrition (a nitrogenous lack acts as does dryness by provoking a decreas in the level of water in the tissues, in the rate of water absorption by the roots).

Mr. Frossard: Root respiration in terms of temperature and radiance received on the aerial part,influence of surrounding oxygenation.

Mr. Gadal: Some aspects of the carbon and nitrogen metabolism of roots: existance of a CO_2 fixation, equal to 1/60e of that of leaves, existence of 2 enzymes, RuDP carboxylase and PEP carboxylase in root plastids.

Mr. Boutin: Parietal phosphatases of roots. Mr.

Berlier: Absorption of ammonium ion by roots.

Messrs. Andre, Massimino, Daguenet: Presentation of an entirely automatic growth cabinet: light⁄ temperature and wind flow are controlled in the compartment for the aerial part, the compartment for roots is equally controlled in a manner independent from the upper compartment; this cabinet allows for sterile cultivation conditions for large plants (maize) , but the price of the growth chamber is high.

D. Examination of problems with growers

The accent is put on the problems of regrowth when transplanting perennial plants. The grower seeks 100% success. This successful transplant involves root regeneration, the regrowth of roots being keptintact. Regeneration calls for a certain number of conditions: climatic conditions (ground temperature in particular),physiological conditions (age of plant, dormancy or not of aerial parts, equilibrium of aerial parts/ roots, sufficient reserves, etc....) . Regrowth of root is better when we have great number of intact roots and more reserves.

All of this is expressed in restraints of which the most important is the limitation in the period of time of transplantation. The optimal period is difficult to determine: it varies as well with the region as it does with the plant species being considered. The most often used remedies are: "girdling", which "brings" back functional roots at proximity to the pivot, maintaining good mineral nutrition before transplantation, conservation in a cold state while waiting to put in place and the cultivation and transplantation of pot plants. This latter practice did not give the anticipated results: regrowth seems to work in good conditions in the beginning, but growth is slowed down on a long term basis in a definitive manner by the formation of a "chignon" (roots with too little space in the pot roll over on themselves and form a "chignon" whose growth is very rapidly limited in an irreversibly manner).

The crisis of transplantation is one of the most important problems which face growers. The action of ground temperature, air temperature at the time of this phase on regeneration on the one hand and on root growth on the other is a point to be kept in mind.

The report "in extenso" of this meeting and last year's meeting in Nancy-Champenoux are going to be published. All requests should be adiressed to :

Madame Janine Gagnaire-Michard
Laboratoire de Biologie vegetate
Departement de Recherche Fondamentale
Centre d'Etudes Nucleaires de Grenoble
BP 85 - 38041- Grenoble Cedex France

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IX- SOLAR ENERGY FOR GREENHOUSE-RESIDENCE TO BE STUDIED

Dr. D. Dalrymple (Economic Research Service-USDA-Washington DC 20250 USA) sent us the following information ("USDA News" 2091-75) which we reprint with pleasure :

Washington,July 15- Under cooperative research agreements awarded by the U. S. Department of Agriculture (USDA) and funded by the Energy Research and Development Administration, scientists will study methods to utilize solar energy for heating combined greenhouse- residences.

The one-year contracts, totaling $ 159,900, are between USDA's Agricultural Research Service (ARS) and four research centers: Clemson University, the University of Arizona, Cornell University and the Ohio Agricultural Research and Development Center.

The agreements include:

A $ 32,000 contract at Clemson, S. C., to study solar energy and waste heat utilization. Scientists at the university will develop design concepts of combination greenhouse residences to be located on one-acre mini-farms. A greenhouse-residence may be the means by which families could use solar heat to reduce fuel costs while growing their own food.

A $ 46,000 contract with the University of Arizona at Tucson to modify an existing greenhouse-office structure at the university Environmental Research Laboratory, and to operate a similar structure to serve as a control for experimental studies. Using an existing heat and mass transfer analysis computer program, scientists will study the potential of combining greenhouses and residences; the use of liquid foam between layers of plastic greenhouse covers for nighttime insulation; and environmental interaction between residential and plant growing conditions.

A $ 35,000 contract with Cornell University Agricultural Experiment Station, Ithaca , N. Y.,to design and test combinations of solar collectors and heat storage systems best suited for greenhouses and residences in the Northeast. Researchers will develop an atlas of solar radiation data; identify energy load patterns for greenhouses and residences; develop mathematical models; and evaluate various combinations of solar collection and storage systems.

A $ 46,900 contract with the Ohio Agricultural Research and Development Center, Wooster, Ohio, to develop economical methods utilizating solar energy in solar ponds for heating greenhouses and residences. Researchers will build two greenhouses for testing insulation, and a solar pond with a plastic cover, liner, and large area heat exchangers. The study will include methods of moving heat into or out of the solar pond directly or via a heat pump to the greenhouses.

Dr. Theodore E. Bond, Agricultural engineer at the USDA-ARS Rural Housing Unit, Clemson, S. C., is the ARS representative for the cooperative research.

Editors' Note : We would like to print news, in the order received, of similar research of topical interest being done in other countries and regions. Please send us news of projects, studies and practical applications immediately and in advance we thank those of you who do.

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X- TAIWAN AGRICULTURAL RESEARCH CENTRE

(Republic of China)

In October 1975 this Center published a Phytotron Journal (1969-1974) which contains in the Preface a brief summary, in English, of the Phytotron and its construction and a summaries in English of work done whose titles are given below. Those wanting to have this Journal should write to: Dr. Kwan Long LAI-Taiwan Agricultural Research Centre c/o National Taiwan University. College of Agriculture Taipei-Taiwan - Republic of China.

List of works:

1)A study on the chilling resistance of rice seedlings.
2)Physiological and ecological studies on the roots of rice plants- The effects of casein acid hydrolysate on the growth of excised roots *in vitro.*
3)Physiological and ecological studies on the roots of rice plants- The improved culture media for the *in vitro* culture of indica rice roots.
4)Morphogenetical studies on the callus originated from excised roots of rice plants. 1) The induction and anatomical observation of callus formation.
5)2)Organ induction and successful rising of green plants.
6)Growth and development of rice plants under controlled temperature conditions. I. Effects of different temperature conditions at reproductive stage on the grain yield and agronomic characteristics of Chia-nan 8 rice plant.
7)II. Effects of different temperature conditions on the grain yield and agronomic characteristics of Chia-nan 8 rice plant.
8)Chilling resistance among rice types and its enhancement by chemical treatments.
9)Effect of CCC on rice seed starch hydrolysis during germination and contents of young seedlings under chilling.
10)Studies on the effects of metabolites on the root growth of Taichung Native N°1 rice; seedlings. I. Effects of concentration of metabolites on the growth of rice seedlings.
11) II. Effects of ascorbic acid,IAA and their interaction on the root growth of rice seedlings.
12) III. Effects of metabolites,nursery periods and temperatures on rooting ability of rice seedlings.
13)Study on the relationship between rice blast disease resistance and enzymes by electrophoresis.
14)Physiological and ecological studies on the roots of rice plants .1)Further studies on the in vitro culture of excised rice roots.
16)2)On the effects of nitrate and organic acids to the respiratory and growth rate of excised roots.
17) Effect of CCC (2-Chloroethyltrimethylammonium Chloride) on the growth,development, lodging, and yield of rice plant.
18) The effect of temperature on phenoxy compounds to rice varieties.
19) On the nutrition of excised rice embryo.
20)A study on the chilling resistance of rice seedlings. I. On the chilling resistance among rice varieties.
21)Study on the effects of water and air temperatures to the tillering and the yield of paddy rice.
22)A study of the relationships among stomatal aperture leaf water content and CO_2 absorption rate of rice plants.
23) Comparison of physiological characteristics in different type rice during germinating stage.
24)Effects of alternating day-night temperatures on maturity of rice grains.
25)Physiological and ecological studies on the roots of rice plants. The significance of respiration rate of the different types of rice roots and its application.
26)Effects of light on the cultured rice roots.
27)Studies on the interaction of photoperiodic and temperature response and the effect on various yield components to different ecological types of soybean varieties.
28)Induction of callus from cotyledon and root-tip of *Glycine max,* Merrill (L.).
29)Effects of kinetin and auxins on the callus formation of soybean anther culture.
30)Effect of temperatures at pod filling stage on the yield, oil and protein contents of soybean seeds.
31) Growth and root formation of soybean calluses cultured *in vitro.*
32)Effect of temperatures of blooming stage on the yield,oil content and protein content of peanut.

33)The effects of GA3, and IAA on the activities of peroxidase and IAA oxidase during the germination period of bean.
34)The changes in hydrolytic enzyme activities and degradation of reserves during the germination period of soybean.
35)A study on the effects of temperature on fiber content in snap bean *(Phaseaus vulgaris* L.).
35)Studies on ethyl methanesulfonate induced mutations in grain sorghum.
37)The effect of low temperature on premature flowering in tobacco.
38)Studies on the morphogenesis of citronella grass *(Cymbopogon Nardus RendZe* var. *maha pengiri)* leaf.
39)A study on the effect of environmental factors on sex expression of cucumber *(Cucumis sativus L. J.*
40)Effects of gibberellic acid on growth and bolting of celery *(,opium graveolens var. dulce)* in northern Taiwan.
42)Preliminary study on the photoperiodic effects of strawberry.
43)Studies on the nuclear properties of *Agaricus bisporus*

XI- SMALL-VOLUME GROWTH CHAMBER AND ITS CONTROL

J. Krekule,W. Schon ,I. Krekule Ullmann

Institute of Experimental Botany
"Institute of Microbiology
=Institute of Physiology,Czechoslovak Academy of Sciences,Prague

Five small volume growth chambers have been in operation at the Institute of Experimental Botany of the Czechoslovak Academy of Sciences in Prague since 1965. They have been applied to the standard cultivation and/or ecological experiments with photoperiodically sensitive plants which have short life span- as *,e. G. Chenopodium rubrum L.* (i. E. SO plants) or *Brassica campestris L.* (i. E. LD-plant) . The chambers are manufactured by the mechanical shop of the above Institute.

Each of the chambers has two separated cultivation compartments (CC)with working volume 440 x 260 x 165 mm (L x W x H). Temperature inside the CCs is controlled to the fixed presettable value ranging from +10°C to 30°C 0.2°C. Duration of the illumination intervals can be preset by using electromechanical clock with 24 hour cycle. Both the temperature and illumination are recorded applying an ink line recorder.

CC is illuminated by sec of fluorescent lamps (eight pieces of 20 H TESLA day light) fixed on the removable ceiling. The effect of illumination on the temperature regime of the CC is suppressed by a neat isolation materialized by a transparent glass sheet placed between the CC and the lamps which are moreover cooled by air fan.

The CC fabricated from zinc sheet (W = 1.5 mm) represents a rectangular container with double walls. The space between the walls is filled with water in which an electrical heating element (400 W) and tubes of the cooling system, are immersed. The water mantel helps to stabilize the temperature inside the CC and to decrease the temperature gradient.

The original design of the temperature control was based on the application of a contact mercury thermometer as the sensor coupled via single stage transistor am - plifier with relays. The latter switches power between the electromagnetically actuated valve of the cooling system and heating element. The thermometer was found to be the less reliable element of the control system in the long term-experiments and thus the system was redesigned to avoid its application.

The new control loop employees a thermistor instead of the thermometer, an amplifier and a comparator both being based on the application of operational amplifiers (TESLA MAA 502,similar to Fairchild IA 709). Pair of the control circuits and indicating instruments of one growth chamber are housed in a separate and remote instrumentation box. The glass encapsulated miniature thermistor (R9roc 10kO) represents one part of the resistor divider. Amplified voltage across the th6rmistor which is inversly proportional to the temperature of the thermistor is displayed by a moving coil V-meter calibrated in °C. This voltage is processed by the comparator . The reference voltage of the comparator which corresponds to the demanded value of the temperature inside the CC can be preset manually by using knob of the single turn potentiometer situated at the front panel. The output state of the comparator which governs the power relays is indicated by using two bulbs.

The main advantages of the innovated system are its improved reliability and the remote temperature measuring and control. This system measures the temperature with an error less than 0.1°C,however, the temperature inside the CC varies in the range of + 0.2°C,partially because of (i) the temperature gradient inside the CC (ii) the two position regulation used (iii) the overrated power of the heating element.

The small-volume growth chambers which are under construction now are equipped with three CCs according to basic experimental set up, i. E. Comparing the long day regime with a short day one and short day with a light break during the dark period.

Further development of the control system which is just being installed resulted in: application of the three valued control and by replacement of the relays by power triac switch which moreover enables continuous setting of the power of the heating element from zero up to its full rating. It is assumed that in the future the latest control system will be applied also to the 24 hours programmed variations of the temperature.

XII- LABORATORY OF TROPICAL PHYTOTECHNICS AT LOUVAIN

Information given us *by* Dr. C. Renard,Chef de Travaux
New Address: Laboratoire de Phytotechnie Tropicale ,3 place Croix du Sud
Sc.15 0-8-1348 Louvain La Neuve-Belgique.

New installations consist of 6 greenhouses of + 100 m2 of surface each, of which 2 are divided into 10 ventilated small cells of + 8 m2 surface.

For controlled environments Controlled Environment was called in and delivered and put up 3 PGW 36 rooms of 3.5 m2 usable surface each.

In these rooms, research being done currently concerns gramineae and tropical leguminous plants and particularly *Rrachir'a ruziziensio* and *StyZosanthes guyanensis.*

In a first phase growth parameters for these two species, placed at 4 different light levels (180,130 ,80 *W/m2* respectively) are studied.

Parallel with this foliar morphological features and stomatic resistance are studied.

The second phase of the program undertaken aims at a comparison of varieties of these same species as to their drought resistance or to engorgement.

X11.1. NATIONAL EXPERIMENTATION CENTER OF MEDICINAL & AROMATICS PLANTS

Address: 4-6 Bd Marechal Joffre,91490-Milly la Foret,France.

Medicinal and aromatic plants production supposes many agronomics problems,such like largest productions. Because of their little economical importance,they are often careless.

So ,Syndicat National des Producteurs,ramasseurs et collecteurs de Plantes medicinales et aromatiques has made a technic section for its own agronomic problems. This section is named "National Experimentation center for medicinal and aromatic plants". It was born in 1952 ,but it is developped since 1969. It stands at Milly la Foret, near Fontainebleau.

Now, National Experimentation Center has 3 agronomic graduates, one at Milly , the others on most productive places (S. E. And W).

This Center has an experimental garden about 2 Ha area, for keeping the collection (200 species) of native and exotic plants,and for experimentation on 10 species.

First importance

Mentha spp.,Artemisia atrata,Anthemis nobilis,Colchicum automnaZe,Digitalis purpurea and lanata, Foeniculum officinale, Vinca minor.

Second importance

Aconitum napellus „Angelica archangelica,Tanacetum balsamita,Ocinum basilieum,AtropabelZadona„Carwn carvi,Eysopus officinalis,Levisticum officinale, Origanum majorana,Melissa officinalis,Hieracium pilosella,Satureia hortensis and S. Montana, Salvia officinalis,Thymus vulgaris.

Third importance

Often new plants: *Amsonia tabernaemontana,Inula helenium, Ballota foetida, Lespedeza capitata,Marrubium vulgare,Achillea millefolium, Nigella damascena, Origanum vulgare,Antennaria dioica, Spiraea utmaria,Rheum palmatum,Sanguisorba officinalis,Scopolia stramonifolia,Scutellaria galericulata.*

Some other species are also studied: for Pharmacy Universities (Paris University) and for private laboratories. Works are published in an yearly technic publication. With these technic information,National Center of Experimentation can make technic forms that are given to everybody who wished. These forms are published in information bulletins of Syndicat National with economic information.

Direct assistance is also given to people who cultivate medicinal plants.

Money arises from auto financement (45%) :provide agreement, sales,contribution,share; FNDA completes this budget (National Fund for agricultural development).

National Center has connections with similar Centers in other countries. It can supply seeds for beginning plantations.

Our aim is to promote french production,because France must buy 60% of its needs in medicinal plants (12 000 T/year for native plants, 8 000 T/year for exotic plants.

XIV- EUROPEAN SOCIETY OF NUCLEAR METHODS IN AGRICULTURE (ESNA) 1

We give below some information about this Society and the address of the chairman of the various existing working groups. For those who are interested further information can be obtained from the secretary, P H van Nierop, ITAL,P 0 Box 48, Wageningen, the Netherlands.

Scientific workers from many European institutions with a common goal and similar equipment have founded the "European Society of Nuclear methods in Agriculture" (ESNA),the twin aims of which are:

1 to exchange ideas and techniques aimed towards promoting the advancement of agricultural science

2 to co-ordinate nuclear agricultural research in joint projects

At the heart of ESNA are the working groups, which are listed here with their main interests.

1. Use of large radiation sources

1 a Food irradiation

Technology of food pasteurization by irradiation
Promotion of pilot plant scale research work
Introduction of legislation permitting the irradiation of food. Marketing.
Co-operation with industry

lb Sludge irradiation

Technology of waste water treatment by nuclear irradiation. Study of technological effects.

Chairman: D. De Zeeuw (acting chairman)
ITAL, P 0 Box 48,Wageningen
The Netherlands

2. Radiations induced stimulation effects in plants

Low dose irradiation of seeds to promote crop production: discussion of results. Joint experiments to obtain more statistically reliable data.

Fundamental research on stimulation phenomena.

Chairman: J. Simon
PHYLAXIA,Szallas u.5,Budapest,
Hungary

3. Tracer techniques in animal science

Tracer studies of mineral metabolism, protein metabolism, immunology and endocrinology.

Chairman; M . Jovanovic
I NEP,P0 Box 46,Belgrade-Zemun,
Yugoslavia

4. Radiation analysis

Interaction of radiation and matter. Activation and indicator activation analysis. Various methods to determine soil moisture and evapotranspiration. Evaluation of counting techniques and instrumentation. This working group often assists other theme orientated working groups.

Chairman:
Institut flit' Strahlenbotanik der GSF mbH Mlinchen,
Herrenhauser Strasse 2,3-Hannover,
Fed. Rep. Germany

5. Nuclear technique in the study of soil plant relationships

Availability of nutrients in soil,efficiency of fertilisers,iron and water uptake mechanisms in plants,development of rootsystems,leaching and accumulation phenomena in soil.

Chairman; M. J. Frissel
ITAL,P 0 Box 48,Wageningen,
The Netherlands

6. Applied mutagenesis

Incompatibility. Induction of disease resistance and improved protein content. Improving vegetatively propagated (ornamental)plants.

Chairman: W. Gottschalk
Institut filr Genetik der UniversitNt Bonn,
Kirschallee 1,53-Bonn,
Fed. Rep. Germany

7. Environmental pollution

Tracer techniques applied to the study of conventional and radioactive pollution of crop and soil. Special emphasis on heavy metals, pesticides and herbicides.

Chairman: C. Myttenaere
Comm. Of the European
Communities DG XII,Biology,
200 rue de la Loi,
1049-Brussels,Belgium

8. Nuclear methods in fast routine analysis of biological material

Methods orientated to the fast screening of protein, and specially of lysine content in crop products. This working group often assists other theme orientated working groups.

Chairman: E. G. Niemann
Institut fUr Strahlenbotanik der GSF mbH MUnchen,
Herrenhauser Strasse 2,3-Hannover,
Fed. Rep. Germany

9. Genetical methods of pest control

The introduction of unnaturally high levels of genetic death (load)into a population (sterile males,cytoplasmic incompatibility, induced transloca-ions). The employment of genetic manipulations to alter the nature of a population so as to render it harmless or susceptible to some other form of control (translocations,meiotic drive).

Chairman: R. J. Wood
University of Manchester
Dept. Of Zoology,
Manchester M 13 9PL,
United Kingdom

10. Radiositopes in insect ecology

Use of tracers to study the population dynamics of insects and their ecology. This working group can be seen as a service group for working group 9.

Chairman: L. Buscarlet
CEN Cadarach,DB/SRA,BP n°1
Saint Paul lez Durance
France

11. Nuclearmethods in plant physiology

Photosynthesis transport of growth regulators, isotope techniques.

Chairman: R. Antoszewski
Research Institute of Pomology
ul Pomologiczna 22,
96-100 Skierniewice
Poland

Working group meetings are informal with a maximum time allowed for dis - cussion . Above all, priority is given to those who wish to discuss technical difficulties or research proposals. Joint projects (i. E. Similar experiments carried out simultaenously by various laboratories) receive special attention.

ESNA was founded 1967 in Wageningen, the Netherlands. Annual meetings, where all working Groups have met in parallel sessions, have been organized since the in Dubrovnik (Yugoslavia), Hannover (Fed. Rep. Of Germany) ,Budapest (Hungary) ,Louvain (Belgium) ,Bucharest (Rumania) and Aix en Provence (France). The 1976 meeting will be held in Warsaw (Poland). ESNA has about 260 members, more or less evenly distributed over Eastern and Western Europe. The committee of the Society is composed of 17 members residing in: Belgium (1), Fed. Rep. Of Germany (2),France (1),Hungary (2),Italy (1), Netherlands (2),Poland (1), Rumania (1), Sweden (1), Switzerland (1), United Kingdom (1) and Yugoslavia (3).

Chairman: Dr. Ir D. De Zeeuw
Honorary Chairman: Prof. Dr. H. Glubrecht.

We received from the Secretariat of ESNA two reports of the activity of this Society whose summaries we give below:

Proceedings 1974

Meeting of working group 2. Radiation stimulation effects in plants(march 1974-Godollo-Hungary)

Joint Meeting of working groups: 4-Radiation analysis- 5-Nuclear Techniques in the study of Soil Plant Relationships and 7-Environmental pollution (february 1974 Hannover FRG)

Meeting of working group 7-Environmental pollution (april 1974-Grenoble France).

ESNA -Vth Annual Meeting (september 1974-Bucharest Rumania).

-Programme
-Opening address by Prof. T. Muresan
-Official address by Prof. N. Giosan
-Annual report 1973/74 of the Chairman of ESNA by Dr. De Zeeuw and of the Secretary by P. H. Van NIEROP
-Some aspects of research in plant breeding,conservation of genetic ressources in connection with irradiation processes by A. Jacques (FAO)
-Our responsibility of the Environment by D. De Zeeuw (Netherlands),

Pilot plant for the irradiation of sewage sludge by A Suh (FRG)
Nuclear agronomy in France by P. Guerin de Montgareuil
Report of working group 1 food irradiation by F. Munzel (Switzerland)
Report of working group 2 Radiation induced stimulation effects in plants by J. Simon (Hungary)
Report of working group 3 Tracer Techniques in animal Sciences by M. Jovanovic (Yugoslavia)
Report of working group 4 Radiation analysis by W. Kuhn (FRG)
Report of working group 5 Soil plant relations by M. J. Frissel (The Netherlands)
Report of working group 6 Applied mutagenesis by J. Sneep (The Netherlands)
Report of working group 7 Environmental pollution by C. Myttenaere (Belgium)
Report of working group 8 Nuclear Methods in fast routine analysis of biological material by E. G. Niemann(FRG)
Report of working. group 9 Genetical Methods of pest control by R. J. Wood (UK)
Report of working group 11 Nuclear Methods in plant physiology by R. Antoszewski (Poland)

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Report of the chairman M. J. Frissel
Smierzchalska,K:Tracers for K:^{42}K. ^{86}Rb or enriched stable ^{41}K?
Middelboe V.:Optical analysis of ^{15}N abundance
Filipovic R. and M. Momirovic: The effect of organic matter and nitrogen from labelled fertilizer on the total mheat growth and dynamics of nitrogen utilization. Ffdifferent stages of growth

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Hera Cr. And V. Mihaila:Studies on N-fertilizer efficiency in soil with ^{15}N to different crops.

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Kerpen W. and G. Schleser:Use of radioactive tracers and a computer program to study adsorption and desorption of MBT in soils

Hernando V. And J. R. Sanfuentes: Effect of Ca/K ratio on the uptake of Fe by bean plants, using 59Fe

Sinnaeve,J.:Present state and future perspectives of the ESNA joint project on double labeling

Dorp F. Van and J. Sinnaeve: Description of two mixtures of synthetic resins as a growth medium for the study of plant-soil interactions. Evaluation of experimental advantages.

XV. PHOTOLOGY- A NEW BRANCH IN FORESTRY SCIENCE

by L. Roussel, 48 rue Courtalon , 10000 Troyes-France

The influence of light has long been established: it has been the subject or precise study in strictly controlled environments in many laboratories and the phytotrons, at the present time, constitute one of the most effective ways of determining the innumerable aspects.

In the natural environment the factors are much more complex as they operate at the same time as light intensity, especially in the forest environment, where for example, the two factors of vigour and moisture seem often to be in opposition. In fact the amount of light has always been recognized as one of the most important factors in silviculture, and foresters refer, quite generally, to the idea of shade bearing and light demanding species, to clear felling or to partial felling in order to attain the required conditions in the forest environment. Forest photology, a discipline of recent recognition, can thus be defined as the systematic and precise study of the relationship between natural radiations, non ionising and the forest environment. These affinities can be divided into two separate branches of forest research :

I-The modifications in quantity and in quality, sometimes also in direction, of these radiations as they penetrate the forest entity (above all the physical aspect of the problem)

2-The global influence on the vegetation of the said radiations especially on the young trees (more especially the physiological aspect)

I-The physical study of the natural radiation in the open and its penetration through the many layers of tree strata is effected in diverse ways:

-thanks to the instruments registering or totaling the natural radiation coming from the sun and from the sky (using pyranometers), occasionally also assessing equally those of the terrestial atmosphere and of the earth (using pyrradiometers).

-thanks to those instruments registering or totaling only the visible radiations (various luxometer models)

-by theoretical procedure (special study of forest open gaps by methods based on or-thographical and stereographic projections, etc.

-by mixed procedures (hemispherical photographs the interpretation of which is corrected, taking into due consideration preceding methods) etc.

In France, in fact, one frequently finds that in coniferous stands with their persistent foliage, a relative consistency, in the course of the year, of the proportion of radiation transmitted to ground level (3,4 or 5 percent in forests of silver fir or spruce, to 15 or 20 percent in stands of various pines). In leaftree stands, losing their leaves in winter, the percentage of radiation transmitted to soil level frequently varies from 1 to 10 ,depending upon the full leaf season or the winter period.

The radiations are little modified in quality in coniferous stands, in contrast, during summer in the leaftree stands, they are strongly enriched in the infra-red, above all in periods of sunshine.

2. The study of the gl obal reactions of vegetation with definate variations in the microclimate can be made,first at soil level in the case of types of vegetation on identical soil of which the variations of humidity can be measured;then on the adjacent underwood species. The results obtained should be subjected to classic statistical tests; those only which have been tested in a satisfactory procedure are recorded here in after.

It appears, at first sight, that one can readily distinguish the effect of natural radiations on a vertical component which operates in a preferential manner on the photosynthesis and of the effect of radiations on a horizontal component which regulates, rather, the phenoma of growth in length. This distinction is, of course, a little arbitary, but thanks to this simplification one better understands certain reactions of the young forest trees.

Coniferous

Some of the conifers in France (genera *Abies,Picea,Pinus ,Larix* notably) germinate perfectly under shade producing stands (often less than 1 percent of relative light). At this stage in the case of species with lateral light only they are very pho - totrophic and in the forest environment if the natural rays are very reduced, the hypocotyl axes lengthen while the radicals are reduced. On the other hand, in forest gaps a more intense circumlateral radiation reduces the elongation of the stem while the root system is more strongly developed. These processes are reproduced in the greenhouse for example, thanks to small protective opaque panels or Imuffs", laterally sheltering certain species at germination, while others receive the full circumlateral light. The cultural consequences of this phenomenon are obviously important (from the development of the radicle processes depends the ultimate supply of the species with water and dissolved mineral substances).

In general, between the second and third years, the phototrophic ability of the conifers disappears, and, at the same time, the lateral shade does not promote any lengthening of the axes. It would appear that the two effects are vaguely connected. The development of the species at first loosely connected by the intensity of the vertical rays (action by photosynthesis), becomes more and more dependent upon this intensity. This influence has been especially studied on young species (less than 8 or 10 years); but it is very obvious that one consider the general development, the length of the annual growth, the weight etc. Certainly the connection between the radiation intensity to the vertical component and the general development of the species is only well marked with a relative radiation of the order of 30 and 50 percent in most cases (save, notably, for specimens of the genus Larix); with the intensity of stronger radiation, one approaches a kind of saturation point. It is noted that in the investigations destined to study the action of the photosynthesis of conifer needles (type URAS or IRGA) in the action of the light intensity, one again finds the same type of curve; growth at first rapid with pure photosynthesis, then reduced to the saturation point.

Fagaceae

Considerable precision is always given to Quercus species, common in France (natural or introduced). In the case of species established in the normal environment, the seeds germinate perfectly under the dense shade (less than 1 percent of relative radiation in summer). Later, the species which have receive during one year's growth , less than 4 percent of relative radiation in summer (say less than 16 cal/cm2/ day) disappear completely during their second year, whatever the treatment to which they are submitted. On the contrary the species which have received, in the first year of their growth, from 10 to 15 percent of relative radiation in summer (the equivalent of 40 to 60 Cal/cm2/day) subsist in perfect condition. With higher relative radiation the development is poorer overall in the open. There again one should remember the reduction of the horizontal component of the circumglobal radiation, for if one shades the young oak laterally(with tubes or opaque "muffs"),the leaves being in good light, one obtains taller plants and a larger volume. These trials have been carried out up to the age of four years in forest nurseries, but one has every reason to think that this effect continues over a number of years. The "cones of regeneration" seen in the young trees at 10 years and more, are explained perfectly by the conjugation of the two effects mentioned above : in the centre of the cones the intensity of the vertical rays (photosynthesis is greatest, even the reduction of the lateral radiation (growth) is perfectly assured by the density of the young stems in the thicket state.

It should be noted that as in the case of the Coniferae one sees a liaison between the phototrophic faculty of the young Fagales studied (in the case of the vegetation with only lateral light) and their ability to elongate when the circumlateral light is reduced. Then as this phototrophic faculty does not disappear with age (as happens in the conifers), one considers that the young oak remain sensitive to the action of lateral light.

An analagous effect of lateral shade on the lengthening of stems has just been obtained in the case of a species of Populus, thanks to the use of opaque plastic sheaths.

When the young trees have been grown in a dense stand their laters branches die and then often disappear, the lower part of the bole becomes clean and they acquire the forester's ideal form which assures in general, timber of good quality. Grown in isolation, the same trees maintain multiple lateral branches. The case is well known. If, following a slightly heavy silvicultural thinning, certain of the remaining stems of the closely grown stand are suddenly exposed to the light , one can often demonstrate the appearance of small lateral shoots which, little by little, develop into branches and which, incorporated within the forming wood, subsequently diminishes the quality of the tree products.

This reappearance of the lateral shoots on the boles exposed to light is apparent only in certain species (the genera Quercus, Carpinus and Tilia notably): but with careful observation one can again find the same phenomenon on certain young trees of Fagus, Acer and Betula for example. As for the oak, one notes the presence of epicormic shoots ("gourmands") well known to foresters. One can reconcile the presence of epicormic shoots to the general views of THIMANN: the lateral light penetrates the bark (of which the coefficient of optical transmission measured, is in "the order of 1/1 000 000 °) can come "photo inactiver " the ALA (according to the assessment proposed by GALSTON) , of which the value diminishes and which passes thus from the term "growth of the stems" to the term "growth of the buds". The resulting buds, abundant on the oaks, then develop and if the light intensity reaches the bole, produce true lateral branches which redirect, to their profit, the mineral substances and the water carried by the sap. Later comes the withering of the upper portion of the tree; this is the "lowering of the crown" , common on open grown trees.

There exists, on the other hand, a direct relation between the amount of radiation absorbed by a stand and its density. This experimental relation exhibits the same behaviour that relates the density of the stocking to the current annual growth; this concord is interesting for it underlines the importance of the energy absorbed by the crowns, which by photosynthesis, assures the eventual growth of the biomass of the forest ecosystems.

In another context,photoperiodism, of which the systematic study was begun in France by P. Chouard, affects the silviculturists in the choice of species to introduce in diverse forest regions. It assists the understanding of the wherefor of the successes and the checks which foresters have noted, when in rather hazardous fashion, they are formerly attempted to introduce, particularly in France, such and such coniferous or leaftree species.

Thus, from the germination to its decline, the tree depends on natural radiation for its distribution in time, in its intensity, in its composition, in its management and the results recorded hereunder constitutes only a small part of what will be, in some decades, true agreement on forest photology.

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XVI. POLLUTED WATER PROBLEMS IN HORTICULTURE I

Paper presented by J. Whermann to the Horticultural Congress at Warszaw sept.1975
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1. Introduction

Irrigation which means applications of water in addition to the natural rainfall is in many parts of the World necessary for economically successful horticultural production. Irrigation water is never chemically pure. It contains disolved or suspended materials. These can be of natural origin as e. G. The sodium chloride concentration of sea water or the result of human activities for instance, from the production of potassium fertilizers in the case of European rivers.

The impurities are often so concentrated, that the utilization of the water is limited or even impossible .

Therefore, it is important to have criteria for the evaluation of these water impurities in respect to plant production (a. G. U. S. Salinity Lab.1954).

The objective of this paper is to present :

1. A preliminary table of critical values for the evaluation of irrigation waters to be used in protected cultures in the Federal Republic of Germany

2. Using the Rhein river as an example to show

2.1. The degree of water pollution as a result of human activity

2.2. Limitations in applicability of polluted waters in horticulture

My report will be restricted to the use of waters for protected cultures only, because in central Europe these cultures require waters of a certain quality since they depend on irrigation exclusivly. In outdoor plant production in Germany irrigation is used for the supplementation of natural precipitation only. Rainfall amounts to about 600 mm in the important horticultural areas. In the humid climate of central Europe, this supplies the main portion of water demand of field crops and prevents permanent salt accumulation in soil as a result of dilution and leaching.

2. Criteria for the evaluation of irrigation waters for protected cultures

The data given in Table 1 are now being considered as critical values in the Fed. Rep. Of Germany. If irrigation waters exceed these values, yield depression are presumed to occur on plants of a certain salt tolerance.

Table 1

Suggested critical values of irrigation water for protected cultures				
	relative tolerance of plants to salt			
	very low	low	medium	high
	Orchid Fern	Araceae Gesneriaceae Cucumber	Begonia Cyclamen Lettuce	Carnation Tomato Cabbage
Salt, mg/l	250	500	750	1000
EC, mmhos/cm	0,4	0,8	1,0	1,5
Cl^- mg/l	50	100	200	300
SO_4^{--} mg/l	100	200	250	300
Na^+ mg/l	50	100	150	150
Hardness, me/l				
"total	2	4	7	11
"temporary	1	3	5	9
Boron, mg/l	0,5			
Iron, mg/l	1			

Some questions arising from table 1 will be discussed briefly:

2.1. Which substances are important for the evaluation of the quality of irrigation water ?

Total salt, expressed in mg salt/1 or in terms of electrical conductivity (EC, mmhos/cm) is the cause of osmotic pressure of the water. Besides other factors it determines the water uptake **by** the plant. If water is supplied in amounts that do not or only slightly exceed evapotranspiration they will result in salt accumulation in the soil so that osmotic pressure of the soil solution will exced osmotic pressure of the irrigation water. Fertilizer salts will further increase salt content. Therefore, salt crystals can often be observed at the soil surface of greenhouses.

Waters in Germany mainly contain chlorides and sulfates as dissolved salts. Hence, these two ions have been listed in the table. At iso-osmotic concentrations they do not differ very much in their effect. Their separate determination besides total salt content will probably be unnecessary as soon as we have empirical values enough.

The determination of sodium and calcium contents of the water is important in regard to soil structure and pH (Scofield a. Headly 1921).

The problems connected to salt, alkali and alkaline earth of irrigation waters are described in detail in Agricultural Handbook n' 60 (1954). The terms sodium hazard (SAR) and salinity hazard (EC) are just mentioned.

Waters of high temporary hardness (calcium bicarbonate) as well as of high iron content can produce undesirable precipitation of salt on the leaves of ornamental and vegetable plants. Therefore, these substances are mentioned in the table.

Specific effects can be expected of such substances which will be accumulated within plant tissues in toxic concentration. As may be seen from fig.1,this holds for boron. Contrary to this, yield depressions caused by excessive concentrations of iron, zinc, manganese, copper or aluminium in irrigation waters are rarely to be suspected.

According to our present knowledge, the list of substances of table 1 is assumed to be complete. In the future the list will possibly be extended by such substances which occur in waste waters that may impair the food quality of vegetable plants as for example cadmium.

2.2. What is the order of salt tolerance of different plant species?

This question is related to the critical values of the four ranges of salt tolerance given in the table 1 and to the economically possible yield depression by using polluted water for irrigation compared to rain water.

Some results on the salt tolerance of horticultural plant species are found in the literature (a. G. US Salinity Lab 1954, v. D. Berg 1967, Ploegman a. Bierhuizen 1970,Bernstein,Frangois, a. Clark 1972, Shalhevet a. Yaron 1973). There is agreement that orchids, carnations,cucumber and cabbage varieties significantly differ in their
salt tolerance and that they have to be classified in different ranges of salt tolerance; e. G. It is doubtful whether cucumbers belong to the group of low or medium tolerance of table 1. To decide this, growth experiments including yield determination on different soils as well as economic calculation are necessary.

The results of van den Berg (1967) in fig.2 show that the use of water of 200 mg chloride/1 resulted in yield depressions of 15% on the clay and of 20% on the sandy soil. The differences between the soils can be diminished by leaching of the soils using excession irrigation.

The yield depressions caused by irrigation water containing 200 mg C1/1 might be critical for the economic survival of a vegetable grower considering the strong competition on the vegetable market. Under different economic conditions the use of waters of more than 300 mg C1/1 may successfully be possible. This holds also for ornamental shrubs according to Bernstein et. al (1972).

3. The pollution of the Rhine river and its consequences for irrigation in horticulture

For irrigation in horticulture mainly groundwater and to a lesser extent surface waters are used. The salt content of groundwater depends on natural conditions and is normally relatively high. Pollution of surface waters originates mainly from waste water of human settlements and industries. Their extent in the Fed. Rep. Of Germany is indicated by the pollution occuring in the waste waters of the densly populated North-Rhine-Westfalia area and the Rhine river between Switzerland and the Netherlands.

The map of pollution of the river in North-Rhine-Westfalia in fig.3 shows that some rivers, e. G. Niers and Emscher,in their entire length, and others like Rhine and Ems in sections only are very heavily polluted so that fish and higher plants cannot live because of oxygen deficiency and of the occurence of hydrogen sulfide. In heavily polluted rivers like the Rhine, tolerant fishes only like carp, can still live. Microbial decay of waste material still proceeds when heavily polluted.

These criteria are unimportant for irrigation water but in general they are related to salt content. For instance, the Emscher river contains up to 1300 mg C1/1 which gives an EC of 5,2 mmhos/cm. Water of such high salt concentration can hardly be used for greenhouse irrigation.

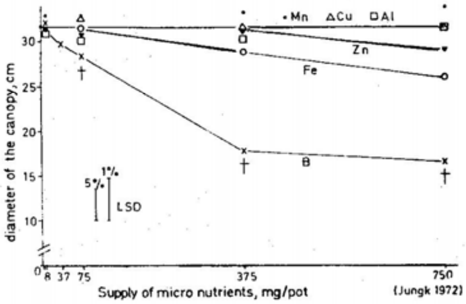

Fig. 1
Effect of micro nutrients on the size of Azaleas

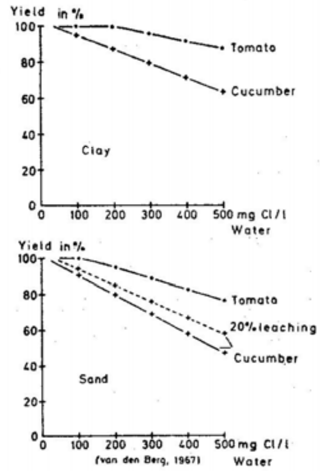

Fig. 2
Effect of Cl in irrigation water on yield of tomato and cucumber

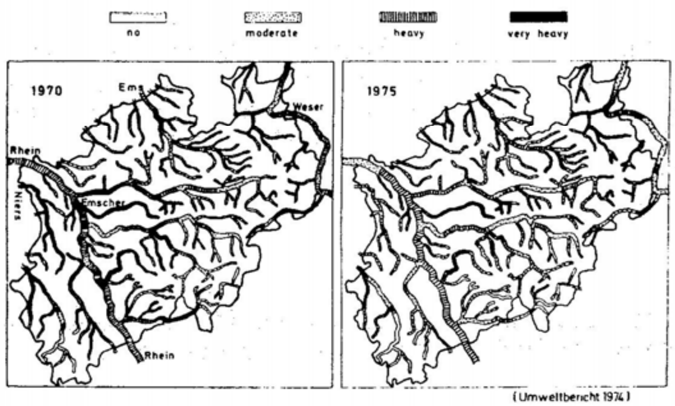

Fig. 3 Pollution of waters in Nordrhein - Westfalen (F.R. Germany)

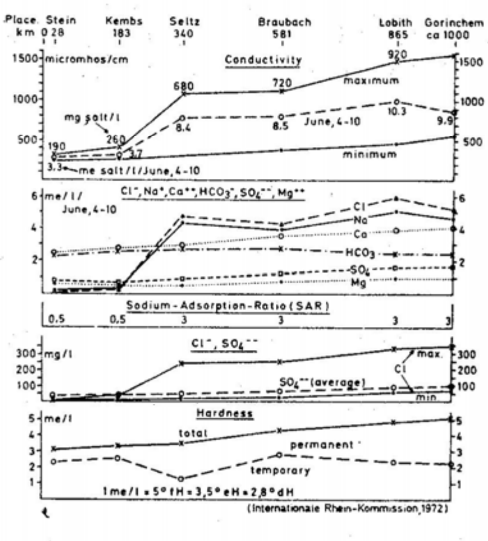

Fig. 4
Pollution of Rhein water between Stein a.Rh. (Switzerland) and Gorinchem (Netherlands), 1972

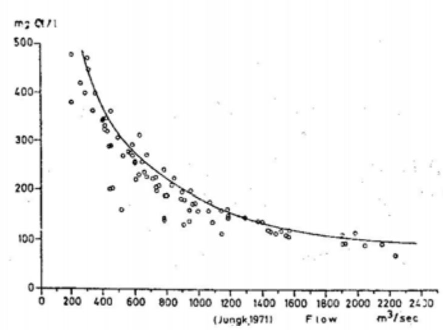

Fig. 5
Chloride content and flow of river Elbe near Hamburg

The water of the Rhine river is heavily polluted as can be seen from fig.4. In this fig. some results of chemical analyses are listed which are important for the evaluation of the water for irrigation purposes. Until Kembs, Rhine water is without any hazard for protected cultures. Between Kembs and Selts, salt content increases rapidly. In this river section NaC1 is introduced as a waste product of potash fertilizer, production.

A further increase of salt concentration is observed between Braubach and Lobith near the border between the Netherlands and the Fed. Rep. Of Germany. Salts of the water of North Rhine-Westfalia which has a population density of 503 inhabitants/ km2 (whereas the Fed. Rep. Of Germany has an average of 247) are introduced into the river.

Compared to the values of table 1 the Rhine water in its lower course does not fully meet the requirements for the irrigation of protected crops. If cucumbers in greenhouses are irrigated with such a water exclusively a yield depression of 30% compared to rain water must be expected.

On heavy soils the high Na content will probably be a disadvantage in longer periods of use.

In evaluating river waters there has to be taken into account the fact that periodic changes in the salt content occur. The relationship between the amount of water in the Elbe river and its chloride content is shown in fig.5 (Jungk 1971). The Cl content is highest in the summer. In this season also the demand for irrigation water is particularly high. Hence in order to evaluate the water quality analytical data of this season should be applied.

4. Summary

1. Intensive horticulture requires irrigation even in the humid central Europe. In this area pollution of the water affects especially protected cultures because they depend entirely on irrigation.

2. Critical values for the evaluation of irrigation waters are presented in table I.

3. Pollution of rivers as a result of waste water is indicated by their content in the densely populated North Rhine Westfalia industrial area and the Rhine river respectively. The water of the Rhine may be used for the irrigation of protected cultures with limitations only because of its high total salt and NaC1 concentrations.

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XVII. THE USE OF PLASTICS FOR HEAT INSULATION IN GREENHOUSES ⁻I

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Editors'fiote: Mr. P. Stieckler sent us this article asking us to publish it in our journal. This same text was published by Plasticulture (N°25,March 1975„p.41-53). Given the current interest of these problems we present a large number of extracts and remind those who would like to read the entire article to contact the Journal "Plasticulture" at the following address: Secretariat du Comite des Plastiques en Agriculture, BP 122, 92527-Neuilly sur Seine,France.

The fuel requirement per square meter (m^2)for Kassel is given in Table 1, with account having been taken of solar heat radiation. Before the energy crisis,light heating oil cost about 10 Pfennings/litre (Pfg/ltr) but by the end of 1973,the price had risen to 30-50 Pfg/litr and during this summer 1974,it was of the order of 25-30 Pfg/ltr.

Table 1:Mean average monthly litre oil consumption per square meter ground surface area for Kassel,in relation to the inside greenhouse temperature

	Greenhouse inside temperature (°C)			
Month	5	10	15	20
1	4,4	9,5	14,8	20,3
2	3,5	7,3	11,9	16,9
3	1,5	4,7	8,3	12,8
4	0,1	1,7	4,5	7,7
5	-	0,3	2,3	4,9
6	-		0,7	2,9
7	-	-	0,3	2,3
8	-	-	0,6	2,9
9	-	-	1,8	4,7
10	-	1,5	5,0	9,1
11	0,6	4,4	9,1	14,4
12	3,0	8,1	13,4	18,9
YEAR	13,1	37,5	72,7	117,8

Table 2 shows how heating costs have risen in accordance with oil prices and at 25-30 Pfg/ltr, these absorb many companies' profits. Proposals for conserving heat are therefore of particular importance to growers and it is possible to save about 30% of the oil consumption prior to 1973 by exploiting all the possibilities.

Table 2:Fuel costs at various greenhouse temperatures and differing oil prices in DM per square meter ground surface area.

Oil price (Pf9/')	Greenhouse inside temperature (°C)			
	5	10	15	20
10	1,31	3,75	7,27	11,78
20	2,62	7,50	14,54	23,56
25	3,28	9,38	18,17	29,45
30	3,93	11,25	21,81	35,34
35	4,59	13,13	25,44	41,23
40	5,24	15,00	29,08	47,12

Insulation schemes using plastics are considered in the light of the formula for calculation of heat loss (heat requirement):

$$Q \quad F \times K' \times (dt)$$

This establishes that F, in particular, can be modified in new buildings and the factor dt is more or less determined by the climate of the area and the plants under cultivation.

The biggest possibility for reducing loss of heat lies in efforts to minimize the factor K': the heat coefficient of the greenhouse. Savings of up to 30% can be attained.

Current methods of insulation with plastics in Western Germany are individually mentioned, together with information on the results obtained.

1. Use of flexible plastics films

A-Interior film lining

Polyethylene film is stretched along the inner sides of the roof surfaces, vertical side walls and gables.

A properly stretched lining can save as much as 25-30%. Since the film thickness does not affect the efficacy of the insulation ,0,05 mm (millimetres)thick sheeting is sufficient, although 0,1 mm sheeting is more generally used. An additional loss of light of 8-10% must be allowed with new films. With a heavy layer of condensation, the loss of light can rise by a further 10%. Since PE films allow infra-red radiation to pass through, there is no protection against heat radiation.

Particularly during winter months when light is reduced, the use of a polyethylene film lining can lead to loss of quality in the plants under cultivation.

The trend is towards the establishment of systems whereby the film lining is drawn over at nights, and open during the day.

BuSquare Thermalusystem

Inventor: Herr Leibfried,Heilbronn
Manufacturer: Wolf,Sachsenheim Industrial Estate

In this system, polyethylene tubing is installed and when the tubes are inflated, the growing area is hermetically sealed off from the roof surface area, insulation is effected by two thickness of polyethylene and the volume of still air included so as to give insulation of about 35%. This system provides for the tubes to be inflated at night and during the day, the air is let out again. When not in use, the polyethylene tubes remain hanging from their fitments. The system currently costs about 6-7 DM/m2 of ground space. According to various estimates this gives annual capital investment cost of 1.35-1.75 DM/m2 and this cost is more than made up by the cost of head saved.

"Square Thermal" is profitable above a 10°C greenhouse temperature with fuel prices at 20 Pfg/ltr.

C-Mechanically erected sheeting

Here, similar to the inner-shading and black-out systems, the covering is closed during the night and pulled up again during the day. Since these installations cost round 15 DM/m2 ,their profitability is questionable.

D-Foam sheeting (air-bubble film)

Foam sheeting has enclosed air bubbles, and is produced in widths of up to about 2 meters. Lt has to be stuck into the inside of the glass or plastic, butits application is particularly difficult into glass, as suitable adhesives have not yet been found. Until now, this material and its use remain so expensive that wide usage of this system is not to be expected.

E-Exterior sheet lining

The use of exterior sheet lining is problematic.

Great care must be taken in each case that the sheeting is correctly applied, which is not always easy. The use of 0.15 mm thick sheeting is possible, although a 0.2 mm thickness is advisable. In the normal way, UV unstablised PE sheeting is sufficient, unless tinted sheeting is to remain over the summer, when in this instance it ought to be UV stabilized . Insulation should be as much as 30% by good fitting and notably higher on very unsound houses.

F-Double sheeting

Double sheeting has been available for 4 years in two designs: for one type,(single sectioned), the sheeting remains fixed and with the other (multi-sectioned) the inner air space is inflated.

Inflated sheeting is liable to less movement and therefore lasts longer. Less condensation normally forms in the inner space. A heat saving of up to 30%, is calculated,which has been confirmed by American investigations. American experience that constructions with blown up double sheeting prove more stable against storm damage and snow weight can likewise be confirmed.

2. The use of rigid plastics sheet

A-Plastics double panes

Plexiglass Steg double panes from the firm of Rhom, Darmstadt, are the best known products here, and are used by various marked gardeners. Around 35,000 m2 of these houses have been produced by the end of 1973 . Its light permeability is given as circa 83%, and in practice, growth in these houses is observed to be as good as that in glass houses. In some cases, even, better growth has been recorded . These panes are UV-ray permeable. The Plexiglass Steg double pane currently costs 41 DM/m2,which proves more expensive for the total construction but deduction of the saving on heating installation of about 30-40 DM/m2, ground surface area in comparison with glass houses must also be taken into account. A capital investment cost of 20% gives an annual cost of 6-8 DM/m2 surface area. The use of this system becomes profitable above an inner temperature of 16°C. It must be emphasized here that round 40% heat is saved.

B-Supplementary fitting of plastics panes

Recently, efforts have been made, with glass houses as well as with plastics pane greenhouses,to line the roofing by fitting supplementary plastics panes. The question here is whether it is cheaper to fit a good quality pane on the outside,or a cheaper quality pane on the inside. Loss of light must be considerable, but the anticipated insulation should lie at about 30-35 %.

3. The use of insulating tiles

A-Styropor titles

Until now,styropor tiles (Polystyrol)of various thicknesses have been the only insulating tiles used. Insulating tiles must,however, be considered light impermeable and can therefore only be used in places where Toss of light is minimal (up to bench height,or for covering north-facing gable or vertical side walls, as well as for the insulation of foundations both above and below the ground). Light reflection partly compensates for the loss of light. Styropor tiles are a good insulating material, and the thickness of the material should be chosen in relation to the inner temperature desired.

Greenhouse inner temperature (°C)	Optimal insulating thickness (cm)	Percentage of insulation (%)
5	2	73,6
10	3	81,0
15	4	85,5
20	5	86,4
25	6	87,9

Insulation using styropor is a permanent solution, which one fitted lasts all the year. Styropor does not absorb moisture permanently and can be easily dried by heating. UV radiation causes disintegration but the tiles have a life of 5-10 years in greenhouses. Full insulation of the gable of a greenhouse (11 x 50 m) with vertical walls 2,4 m high will give an insulation of 3%. Insulation of the side vertical wall makes a difference of 9,4%. The insulation of one gable and one vertical wall therefore saves about 12,4%.

B-Styromat

With the Styromat system, produced by the firm Krahe & Wohr, Ludwigsburg, styropor strips are fitted under the roof in the form a "venetian blind", so that they can be closed at night and drawn up during the day. This system can only be used at night because when the strips are closed, there is a high loss of light, when open however this is minimal due to reflection off the strips. Heat insulation of 40% can be expected from Styromat .

The financial outlay at the present time amounts to about 14 0M/m2 ground surface area. A capital investment cost of 25% therefore gives an annual cost of 3.5 DM per m2 . In view of the fact that this system only insulates the roof, Styromat becomes economical above an inner temperature of 15°C (at 20 Pfg/ltr for oil).

C-Other insulating tiles

The use of other insulating tiles is widely considered and particularly in new buildings where efforts are being made to incorporate insulating tiles during construction.

4. Inner shading and black out

According to experiments, an inner shading installed above the heating unit saves about 10% warmth with air heating systems and about 15% with radiated heating systems. Savings of round 20% are calculated from black out installations, such as those necessary for chrysanthemums, amongst others.

III. The economics of insulation

The costs incurred by heat insulation must at least be redeemed during the time when it can be applied effectively, through saving on heating costs. Two examples are quoted here:

1. Styropor tiles

Calculation of the capital investment cost:

Written off 5 years	- 20%
Interest rate-actually: 10% mean average: 5%	= 5%
Maintenance	- 5%
	30%

Cost of material- 4 cm thickkness	3.2. DM/m2
Mouting	0.5 DM/m2
Total cost	3.7 DM/m2

Capital investment cost 0.3 x 3.7 = 1.11 DM/m2 year glass are. This is the minimum amount which has to be saved within 5 years through the fitting of Styropor tiles,and this is easily possible with the present cost of fuel.

2. Plexiglass steg double panes

The use of these double panes incurs actual expenses of about 35 DM/m2 ground surface area.

Calculation of the cost of investment :

Written off 10 years			= 10%
Interest rate-actually:	10%		
mean average:	5%		= 5%
Maintenance			= 5%
		Together	20% year

Capital investment cost : 0.2 x 35 = 7.0 DM/m2 ground surface annually.

At least 7.0 DM/m2 ground surface area must be saved annually for 10 years on heating costs through the use of double panes and this is possible with fuel prices of between 20-30 Pfg/ltr above an inside temperature of 16°.0

With higher temperatures of for example 20°C,their use is most emphatically recommended.

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XVIII. METHODS OF PRODUCTIVITY CONTRO1 OF GREENHOUSES CULTURES AT THE FAR NORTH

by G. S. BERSON,Department of Protected Ground of the Scientific Research Agricultural Institute of the North of West Sybiria (USSR)

The Far North of the USSR is a vast region from the Kola Peninsula at the West to Chukotsk and Kamchatka at the East which is situated higher latitude 65°North in the European part and higher latitude 60°North in the Asian part of the Soviet Union. The following climatic features are typical for the great or part of this territory:

1. Specific conditions of annual and 24-hour inflow of natural radiation, concentration of physiological active orange-red rays, in the sun spectrum, change of polar day and night.
2. Low average month temperatures, strong winds and snow moving, general severity and instability of weather conditions, especially in spring; short frostless period and in some parts even mid summer frosts.
3. Presence of permafrost, closing up with seasonal one.
4. Impoverishment of local tundra marsh soil with nutrients, their bad structure and even often absence or natural rich soils.

Process of intensive industrialization of the Far North sets a task of creation of local food base for growth of nontransportable agricultural products par-

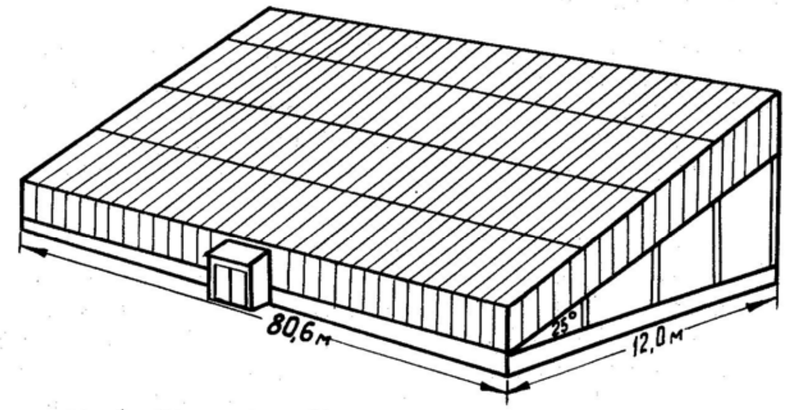

Fig. 1. Slope greenhouse.

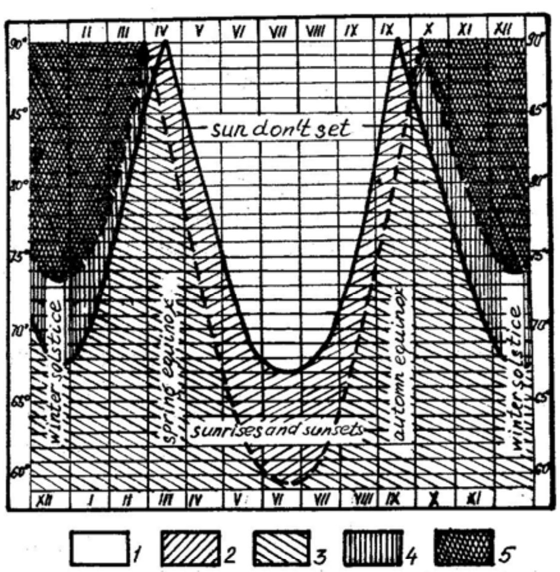

Fig. 2. Length of polar day and polar night
1-full polar day; 2-white nights; 3-dark nights;
4-midday twilight; 5-full polar night

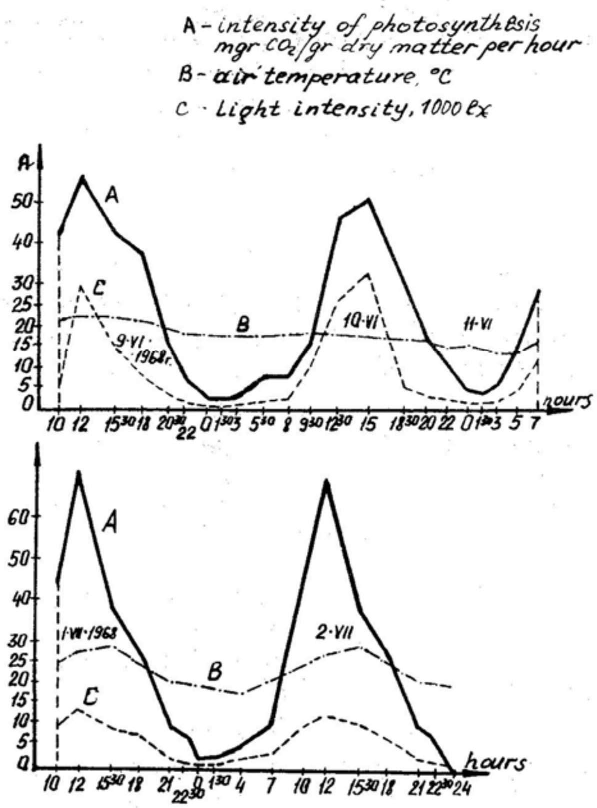

Fig. 3. Course of cucumber photosynthesis during polar day.

titularly fresh vegetables (Slavin,1973). Because of difficulties of growing vegetables in open ground at the Far North special importance has vegetable growing in the protected ground where at this time there are: greenhouses - 40 000 sq. M, plastic tunnels 30 000 sq. M, and frames- 15 000 sq. M.

For development of vegetable growing in protected ground at the Far North there are unlimited energetic resources in form of natural gas, commercial and lost heat of industrial enterprises, electric energy of hydro and atomic stations. At the North it is more than enough reserves of geotermal heat-carrying agent not only for own needs but for growing vegetables and fruits for taking out to other regions of the country (Janovsky, 1969).

Last two years (1972-1973) the yield of vegetables in the protected ground throughout the North was: 18 kg per sq. M under glass, 8 kg per sq. M - under plastic and 6.5 kg per frame. In the old farms of this zone the yield of vegetables is much higher: in winter greenhouses -20-33 kg sq. M (sovchoz "Industria","Severodvinsky",Teplichny", "Energetic"), in plastic tunnels- 12 kg per sq. M (sovchozes "Nefteugansky", "Surgutsky", "Lensky"), in hotbeds -9-10 kg per frame (sovchozes "Energetic,"Hasynsky", "Seimchan") .

These examples point out the available reserves of increasing the yield of greenhouse and hotbed vegetables at the Far North.

Operating experiences on several kinds of protected ground shows that the greatest output under its lowest production cost is provided in the winter glasshouses. This is most by one bay greenhouses of 1.000-1.800 sq. M warmed by hot water with the temperature of 84-110°C.

In zone of permafrost and especially in regions with great snow-moving it is likely to be promising to built slope greenhouses on pile platforms with the South slope (fig.1), as developed on order of our Institute. The slope greenhouses are characterized by the lowest heat losses, lower capital investments for building and good adaptability to unfavorable oecological conditions. Due to better illumination of plants and earlier terms of planting is expected an increase in vegetable yield up to 30%.

According to the light and climatic parting of the USSR (Gusev, Kireev 1968) the territory of the Far North is divided into two light zones relating to the natural light intensity. The high latitude regions situated tentatively higher latitude 65° North refer to the first polar zone, regions which are approximately between latitude 60-65° North refer to the second North light zone.

If in the North light zone the inflow of PAR (photosynthesic active radiation) amounts to 110-220 cal. per sq. cm per day in December-January, in the polar zone it falls up to 25 cal. per sq. Cm per day. During the spring summer period for the North zone it is typical the long term period of "white nights" changing into 24-hour polar day higher the parallel 65° (fig.2).

As far as estimated minimum of PAR amounts to 23 cal. Per sq. Cm for cucumbers and 38 cal. Per sq. Cm per day for tomatoes it is possible to plant the young plants in greenhouses only when the inflow of PAR in the greenhouses reaches the mentioned values (Vaschenko,1973).

In the North zone it is possible to plant early cucumbers from the first till 15th of February, tomatoes from the 5th till 15th of March, and in polar zone from the 25th February till the 10th of March and from the 15th till 20th of March respectively (Glikman and others).

Planting in later terms descents the yield.

According to the investigations of the Jamal Agricultural Research Station of our Institute which were carried out at the latitude of arctic circle in Salehard, each day of delay with planting results in drop of yield of cucumbers by 0.2 kg per sq. M (Chernih,1973).

Specific features of light condition at the Far North determine high productivity of photosynthesis of greenhouse cultures.

In the North zone during the "white nights" the pause in the photosynthesis activity of the cucumber leaf, compiles only 3-4 hours, in the polar zone during the arctic day photosynthesis is watched 24-hours under light intensity not less than 400 lx (fig.3) and photosynthesis of cucumber intensity reaches 3,5-5,2 gr CO,/sq. M per hour determining by the radiometer way that is 1,5 times as high as the maximum figures for the middle latitude.

Elongation of 24-hour working leaf period and high photosynthesis intensity results in high productivity of plant photosynthesis, reached 24-66 gr CO_2/sq. M per 24-hour (Afanasjeva,Berson,1969).

High level of photosynthesis activity of greenhouse plants at the Far North estimates their high potential productivity. Yields up to 45 kg per sq. M cucumbers or 15 kg tomatoes are often here.

Scientific and production aim is to approach the biological productivity of greenhouse plants to potential one. To solve this problem it is essential to use not only well founded by physiology time of planting in the ground but to not a small extent with the right selection of variety, by directed exposure to plant of the artificial irradiation ,by the optimization of root nutrition provided all recommended environmental agrotechnic conditions are fulfilled.

Right selection of crop variety based on knowledge of features of its morphophysiological development is the most effective way of yield increasing.

If not to take into account the extent of sexualization, possibility of plants self regulation, particularities of fruit formation, it is hardly possible to expect the high yield.

As a result at high latitudes the yield of pollinating varieties reduces considerably in consequence of changing the fertility of pollen because of environment troubles. Besides, yield reducing is often connected with bad work of bees.

Parthenocarpic hybrids of cucumber are deprived of these shortcomings therefore they offer the hight productivity.

Thus, on an average for 3 years of experiments that carried out in sovchoz "Energetik" on Kolyma the yield of parthenocarpic cucumbers of mixed flowering type "Din-zo-sn" and "Spotresistinn" was 47 kg per sq. M or 18 .4% higher than the standard pollinating by bees,heterosis hybrid "VIR-I". However mixed flowering type varieties are late ripe. 'This shortcoming can be eliminated by using the parthenocarpic forms of female flowering type,long fruit hybrids of type "Toska" ("Fortuna","Brilliant" ,"Fertila","Pervenets","Mbskovsky Teplichny") ,middle long fruit hybrids of type "Beata" ("Buratino","Kukaracha","Veterok") ,short fruit of type"Iva" ("Skernivitsky","TSHA-77" TSHA-98") relate to such forms.

During our experiments for variety testing that carried on in greenhouses of Surgutgasstroy the yield of parthenocarpic longfruit hybrids was up to 42 kg per sq. M, shortfruit up to 37 kg per sq. M whereas the yield of the best samples of cucumbers pollinated by bees,such as "Orugny 85" and "Surprise 66" was only 30 kg per sq. M.

Among learned parthenocarpic forms of cucumber we found a short fruit sample which was a source of genocism.

With the help of gibberelline was received an inbreeding line that was used for creation of new heterosis cucumber hybrids.

It is evident when growing tomatoes the most promising are indeterminant forms with multi-flower truss. Such a line which have about 240 flowers in the truss was developed in 1968. This line is improved for increasing the size of fruit and stability to leaf brown patch.

During last two years this line exceeded on the yield the more productive in the indigenous conditions, the variety "Uralsky Mnogoplodny' by 25% and "Revermun" by 38%.

It is known that the use of seeds of indigenous reproduction at the Far North increases the yield of vegetable crops by 20-25% (Ivanosky,1958) . At the same time seed farming at the polar latitudes is connected with considerable drop of yield in the seed growing greenhouses. Thus for obtaining 1 kg of cucumber seeds depending on variety it is necessary to set the following number of seed-bearings: "Mnogoplodny VSHV" 100 pieces,"Din-zo-sn"-176 pieces, "Fortuna"-167 pieces, "Spotresisting"-278 pieces. In that, as V. J. Volkov (1955) notes, one seed bearing develops at the expense of 15-17 cucumbers,the drop in yield on the seed plants have appreciable extents.

In the greenhouses of sovchoz "Norilsky" with the cucumber variety "Sprotresisting" a trial was carried out for studying the productivity of seed plants depending on number of set up seed-bearings. Three and five seed-bearings were leaved on the plants. Cucumber yield on the seed plants come up to :with 3 seed bearings -9,1 kg per sq. M;with seed-bearings- 5.2 kg per sq. M or respectively 51 and 29% relative to the common plant yield (17,7 kg per sq. M) . In the first instance it was received 11.4 gr of seeds,in the second -15,5 gr . Thus producing 1 kg seeds of Spotresisting variety depending on the set up seed-bearings decreases the yield in 710-780 kg.

Table 1: Yield of cucumbers and seed output of variety "Spotresisting" depending on quantity of vegetable seeds (Norilsk,l969)

Number of seed fruits on one plant	Total yield from 1 sq. M		Seed output from 1 plant			Weight of cucumbers for 1 kg of seeds	
	kg	1%	pcs	gr	1%	kg	%
3 pieces	9,1	51,4	288,5	11,4	100	755	100
5 pieces	5,2	29,4	418,4	15,5	136	810	107
without seed fruit	17,7	100,0					

To cut down the yield losses when producing seeds we suggest to produce following the procedure of VIR (the Research Institute of Plant Growing) (Bregnev 1964) a small value of superelite seeds of the best varieties and parental pairs of cucumbers and tomatoes in greenhouses at the North and then propagate them once-through (and also to obtain hybrid seeds) in the open ground at the South e. G., in Adler or Tashkent. Such a system was tested during three years (1964-1967) and allowed to prove that cucumbers and tomatoes which were grown of high quality and heterosis seeds of mixed reproduction (South-North) did not differ in development, yield and quality (Berson,1969).

During the polar night proper artificial lighting is the most important requirement for controlling the yield of greenhouse crops. The first promising experiments of using special sources of artificial lighting of greenhouse crops at the Far North refer to 1965-1966,when for the first time in the USSR we tested the experimental samples of lamps type 4.40 indicated AP -40,which were produced on order of our Institute (luminescent special 40 W lamps of low pressure) and Dp4top lamps (mercury 300 W lamps of high pressure) with spectrum of radiation which is approached to spectral intensity of photosynthesis (Berson,1970, fig.4).

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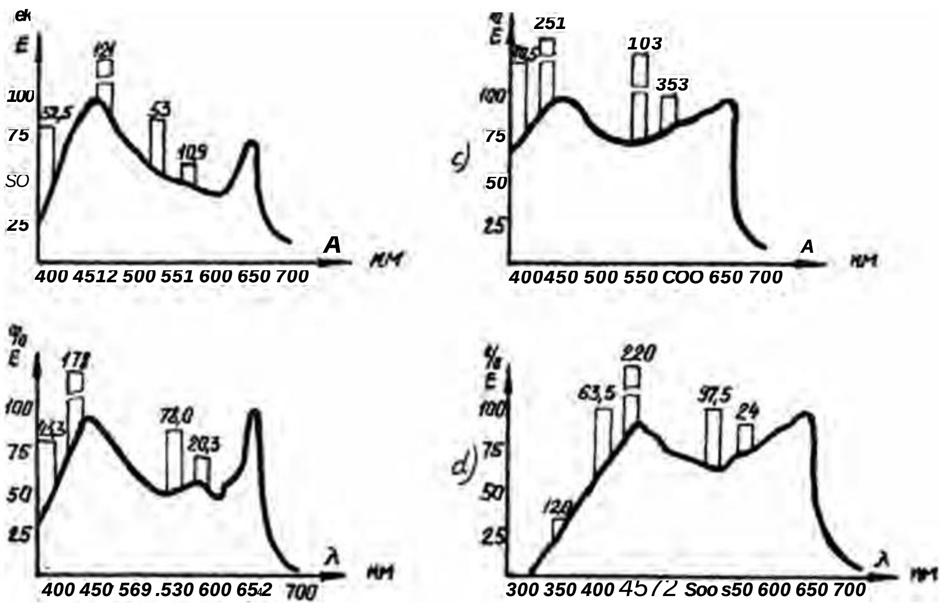

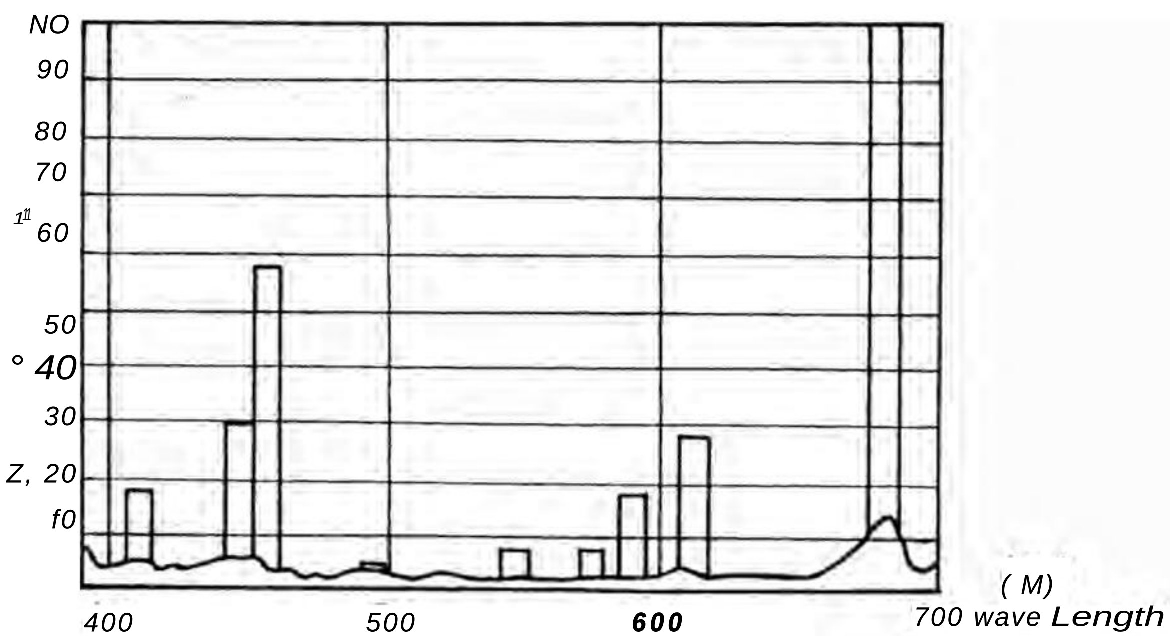

Figs. 5. Spectral energy distribution

Later (1972) in the greenhouses of sovchoz "Norilsky" there were attempted commercial growing of cucumbers during the polar night under the xenon. DKCTB -6000 lamps with specific power of the installation 1200 W/sq. M. In three rotations from growing seedlings (the first from October 20,1971 till January 22,1972, the second from September 23 till December 31,1972, the third from January 15 till April 15,1973) it was cropped 8.3 kg cucumbers per sq. M brutto. In spite of proved possibility to grow cucumbers under the artificial light, high operation cost (187.6 rouble per sq. M) and excessive price of production (9.87 rouble per kg) makes extremely unprofitable the light culture under the xenon lamps. This business gives losses up to 100 rubles of every sq. M of greenhouse.

Wide research work over the practical light culture of fruitificative plants during the polar night was carried out in the Far North sovchoz "Teplichy" in Vorcuta (Berson,Ignatova,1972).The cucumbers were grown under full artificial light using luminescent lamps type ЛФ -40 with five different luminophores and lampes type ДРЛФ -400 of three versions.Vegetation period from transplantation of seedlings was five months (November-March) in 1972,four months (November-February) in 1973 and four and a half months in 1974.

Seedlings were transplanted to the place of growing according to the light conditions chosen.Exposure of lighting was 16-hour a day. Lamps type ЛБ -40 served as a standard radiation source.Predetermined exposure rate under lamps type ЛФ-576 W sq.m, under lamps type ДРЛФ -876 W per sq.m.(Table 2).

Table 2: Efficiency of cucumber and tomato growing under artificial light (Vorkuta, 1972-1973).

Lamps types	Installation capacity, (w/sq.m)	Equipment cost,rouble/sq.m	Cucumbers		Tomatoes	
			Yield, kg/sq.m	Production cost,rouble sq.m	Yield /kg/sq.m	Production cost,rouble/ sq.m
ЛФ-40-2	576	82.85	11.58	5.72	2.96	34.37
ЛФ-40-3	576	82.85	13.57	5.22	4.70	14.77
ЛР-1+Л-42	576	82.85	14.71	4.81	6.72	10.33
$CaWO_4$	576	82.85	11.44	6.00	5.70	12.18
ЛР-1+Л-40	576	82.85	7.64	8.68	-	-
HLRG-400 "Philips"	876	143.09	10.60	12.37	-	-
HQLS "Narva" DDR	876	143.09	12.31	8.98	-	-
ДРЛФ-400	876	143.09	10.43	10.49	4.75	22.27
ЛДП-400	876	143.09	-	-	3.48	31.01
ЛД-40 (standard)	578	82.85	7.79	8.52	2.02	34.37

Fruiting under lamps eighther low or high pressure started by 57-58 day simultaneously after sowing. In the standard plots the yield of cucumbers was 3.5 kg per sq.m under lamps type ЛФ 11.5-14.5 and under lamps type ДРЛФ-10.6-12.0 kg per sq.m of bed.

When growing tomatoes under the artificial light fruiting began at the 95th day from the sowing. For 4 months of vegetation the yield of tomatoes in the standard plot was 2.0 kg per sq.m,under lamps type ЛФ 3 -6.7 and uner lamps type ДРЛФ from 3.5 to 5.7 kg per sq.m. Research results are given in table 2 and evidenced about low efficiency of light culture of tomatoes. However as investigations carried out in phytotrone shown, new lamps type ДРЛФ, ЛОР - 1000 (fig.5) for growing plants with specific power of installation 800 W per sq.m for 4 months of vegetation allow to rise the yield of tomatoes up to 7.63 kg per sq.m that twice as large as under lamps ЛР -1 +Л-42 and become 1.5 as great as under Dutch lamps HLRG-400.In this case expenditures of electrical energy per unit of production 1 kg were 189 kW-hour while in other variations the power consumption ranged within the limits 248-607 kW-hour (Ignatova,1974).

In the experiment on growing green onion in 8 rotations there were tested the influence of monochromatic and polychromatic sources of plant lighting at the formation of vegetable body during the polar night. The luminescent lamps used were 40 W,polychromatic radiationЛФ,ЛБ(white), ЛД (day) and monochromatic light ЛК (red), ЛГ (light-blue), Л3 (green). The value of yield increasing was equal.But under yelow-coloured lamps ЛЖ was fixed double intensity of photosyntheis (4 mgr CO_2 per gr of dry matter per hour) that contributed to 20% the increase of green onion then at the standard plots (10.8 kg per sq.m).

When growing radish under similar radiation sources the maximum rates of leaf apparatus formation and rootcrops were fixed when lighting with lamps ЛФ .Rootcrop formation more intensive went off during long 18-hour day in each variants.

The wave length of maximum radiation for lamps: ЛГ is 440 nm,Л3-530, ЛЖ-590 and for ЛК -660 nm.

The further investigations shown that the intensification of red spectrum part in the best variants due to lamps ЛК (2/3 ЛФ + 1/3ЛК) lighting shorts the vegetation period at 7 days, decreases up to 9% the steming and increases the yield up to 40% (4.5 kg per sq.m).

Contrast in quality of seedling grown under different artificial light sources is reflected later on after planting in the ground under natural lighting.

When estimating different spectrum rates of seedling lighting, the best quality tomato and cucumber seedling formed under lamps type ЛФ -40 (600 W per sq.m). Before planting in the ground mean intensity of cucumber photosynthesis (determining by calorimetric method) varied within 26-35 mgr CO_2 per sq.dm per hour, whereas under standard lamps ЛД and ЛБ -40,it was 1.5 times lower.

During after-induction period the increase of intensity of photosynthesis remained in this variant even 18 days long and ranged from 23 to 32 mgr CO_2/sq.dm per hour,after that is was equal to the standard variant (16-27 mgr CO_2/sq.dm per hour).

Visible difference between plants according to variants disappeared approximately to this time and established only when accounting of early yield of cucumbers and tomatoes which increases by 13-18% after lighting the seedlings with lamps ЛФ (Berson,1970). Difference was not discovered in total yield.

Similar results were obtained in experiments carried out by Ignatova in Vorkuta when comparing lamps type ЛФ (533 W per sq.m) and ДРЛФ (876 W per sq.m) . In this case the similar total yield was practically received from different on biometric characteristic of seedling during after-induction period.

Production checking of ЛФ lamps was carried out in 1973 in the greenhouse of "Surgutgasstroy" in Hanty-Mansyjsk autonomous region.Total yield of cucumbers in all the variants like in the laboratory investigations was statistically similar and came up to on an average 24.4 kg per sq.m.The highest early yield was received when growing seedling under lamps and totaled 15.7 kg per sq.m what was by 1.2 kg (8.2%) higher then in standard variant.

More representative results were got when growing tomatoes (table 3).Significance of received yield additions of tomatoes was proved statistically.

Table 3:Yield of tomatoes depending on type of lamps used for seedling illumination (Surgut,1973).

Type of lamp	Early yield (on July 1)		Total yield	
	kg/sq.m	%	kg/sq.m	%
ЛФ -40-1	5.30	109.2	11.29	104.7
ЛФ -40-3 (with reflecting layer)	5.56	114.6	12.41	115.1
ЛД +ЛТБ -40 (standard)	4.85	100.0	10.78	100.0

Moreover the seedling growing under artificial light allows plant seedling in ground earlier for a month and thereby to increase the total yield crop by 20%.

Method of agrochemical inspection is an important element of productivity plant control.

The highest yield of vegetables in greenhouses forms in the case when the determination of fertilization dozes (taking into account the factor of their use) is made in full accord with the difference between the value of macronutrient extraction by the crop and its contents into the soil. In our experiments (1968-1971) the application of estimated diagram of nutrition against the recipe method was contributed to increasing the cucumber yield by 12.5%,tomato 11.5% (Berson, Novogilova,1972).

Production estimation of existing ways of applying dozes calculation and proportion of nutrients,carried out by our Department in greenhouses of "Surgutgasstroy" in 1973-1974 shown the biological inequivalence connected with some difference in quality and quantity of additional nutrition.

Higher early yield and total cucumber and tomato yield was provided by applying nutrient dozes calculated according to the formula offered by our Institute:

$$X = \left(A - \frac{B\,K_1}{100}\right)\left(2 - \frac{K2}{100}\right)$$

where:

X - dose of nutrient gr per sq.m
A - extraction of nutrients from soil, gr per sq.m;
B - content of nutrients in soil, gr per sq. m;
K_1- factor of nutrient use from soil , %;
K_2- factor of nutrient use from fertilizer.

Factors of nutrient use from fertilizer and soil in calculations complied respectively : N- 60/50, P_2O_5- 25/10, K_2O - 80/30 per cent.

These investigations shown the possibility of root fertilize feeding for cucumbers 1 time a month and for tomatoes 2 times per season instead of recommended often feedings, every 7-10 days.

Experiments being carried out in 1958-1966 in Norilsk (70° North) and Uchta (64° North) confirmed that the greatest possibilities to control the greenhouse crop productivity by mineral nutrition make available when using hydroponics (Berson,l964).

Introduction of method of the gravel culture in greenhouse horticulture in Olenegorsk (Kola peninsula) allowed at an average for 3 years (1970-1972) to increase the cucumber yield by 2 kg per sq. M against the usual method of culture.

When growing by hydroponics the application of different solutions depending on growth phases gives the best results. During 3 years we studied the Rodnikov solution different in qualitative composition and total concentration when growing seedlings, intensified vegetative growth during fructification. Solution concentration is according to phases respectively 1.52-1.91-2.19 part per mil.

When using different solution the increase of yield amounts to 19%.

Thus the following is to concern to the most effective methods of productivity control of greenhouse culture at the Far North:

1. Application of slope greenhouses with South slope
2. Physiologically well founded term of planting in the ground.
3. Changing for high yield forms of parthenocarpic cucumber of female type flowering
4. Use of special plant growing lamps for lighting seedling and fructificative plants during dark year period
5. Seed reproduction in favorable soil-climate conditions of open ground og the South
6. Using of estimated method of root nutrition and hydroponic method for growing vegetables under glass.

SUMMARY

Increased intensity of ohotosyntnesis and 24-hour working period of leaf during polar day is a reason of high potential productivity of plants in North greenhouses. During 1958-1974 have been developed methods of intensity of leaf photosynthesis which approached the actual productivity of plants to potential one and based essentially on the integrated use of heterosis, direct radiation of plants by artificial light, optimization of root nutrition system.

Having observed the growing recommendations, the productivity of cucumber, tomato, radish, green onion reaches record values in the greenhouses of the Far North.

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XIX- THE EFFECTS OF CO2 CONCENTRATION AND TECHNIQUES OF ITS CONTROL,ON GROWTH PHOTORESPIRATION AND PHOTOSYNTHESIS IN CHAMBERS OR PHYTOTRONS

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Abstract.

A recalculation of the rate of photorespiration inside oat leaves shows a correlation to the uptake of C02. This fact, together with our observations of plants under different CO2 concentration serves to support the need for control of CO 9 concentrations. Such a CO2, control is needed in order to grow rather natural plants under fully controlled conditions.

Botanical and technical problems involved in the CO, control have been tested and considered in small as well as in walk in size chambers. Calculations taking into account the needs of larger Phytotrons led to the described compensating systems,each serving one or several chambers.

A CO2 scrubbing chamber was found to be practical e. G. For endogenic rhythm studies or under conditions of low CO_9 in polluted air such as present in densely populated cities. Compensating systems ga5e better results than either the closed CO_2 injection systems or the open fresh air supplying systems.

1. *The control of CO2 is needed for controlled growth*

Plants grown under higher CO_2 concentration ([$C0_9$]) have shown relatively smaller,thicker,green leaves, such as seen in plants grok under strong sunlight, as compared to plants grown in the shade or with low light intensity. Thus the higher [CO,] seems to contribute towards growing normal, healthy plants under the limited light which is available in most growth chambers. We observed that low [CO_2 enhances the aging of leaves in peanuts as well as in *Oryzopsis* plants.

The control of CO2 is another needed step towards fully control conditions under which so called "rather natural plants" are supposed to be grown. Conclusions of this nature have recently been published by P. J. Kramer (Phytotronic News Letter n°9 p.16,1975).

The effects of CO concentration on photosynthesis, photorespiration and transpiration are necessarily reflected in the growth of plants. The usefulness of CO_2 control in growth chambers has been generally recognized.

A relatively high CO_2 concentration C0,1 is required in order to obtain high rates of photosynthesis '(P) and photorespiration (L) under the conditions usually used. P and L are correlated with each other and with rapid plant growth. Previously, it had been thought that L is a wasteful process, against which one ought to select. Based on this assumption some crop breeders have been searching for plants with a low L and/or low CO_2 compensation concentration (r) among comparable plants of the same genus. Contrary to this, we have established with oats and soybeans (fig.1) that a high P or respectively the resistance to CO_2 uptake are associated with a high L and these again with rapid growth.

Such faster growing plants with rates of net CO, gain higher than those of genotypes of comparable plants,have a low mesophyll resistance to photosynthesis (R_m), high photorespiratory rates (L), and are likely to have a normal (or even high) CO'; compensation concentration (r). Thus, plants with a low R_m will show their higher phbtosynthetic potential and faster growth rates at high (CO_2'1. Therefore the breeders could select different genotypes in growth chambers, in which a higher [CO_2] is maintained.

We tested in Israel the effect of CO, enrichment of the atmosphere on the yield of cucumbers, sweet pepPer,lettuce,roses and grasses. A supply of CO, (causing an ambient [CO2] of approximately 0.1%) resulted in an increase in tht rate of vegetative growth and in a higher fruit setting as well as in increased resistance to disease in spite of the very warm microenvironment. Overheating of the enclosed crops at midday could be overcome by providing a higher [CO_2 1. The supply of CO2, produced higher and earlier yields. Plants under optimum [CO2] have higher net photosynthesis (P) and tend to have thick dark leaves and stems, and live longer. This is in agreement with results of Hesketh et al., (1972). While plants, grown in growth chambers, develop frequently the typical appearance of "shade plants" due to insufficient Illumination, the addition of CO, up to the optimum [$C0_9$] under prevailing light conditions will change them to look more like "sun growh plants". Thus, atmospheric [CO_2i control may be used to compensate partially for the low light intensities from artificial lighting; it is more economic to increase [CO_2 than to raise light intensity to those prevailing in nature.

The control techniques are classified as "open" systems, through which air is blown at the desired, predetermined composition and as "closed" systems in which the air is recirculated, excluding external air.

Diurnal changes of ambient [CO_2] are part of the natural, changing microclimatic environment of outdoor plants. Outdoor air is blown into non controlled chambers (so that they act as "open systems"), thus providing diurnal changes in [CO,] similar to those in nature, but with a magnified amplitude. We observed these magnified diurnal changes in a ventilated greenhouse and under plastic "tunnels" (Israel J. Agric. Res. 1970; and Hassadeh, 1970) and they are well known in leaf chambers. We also observed diurnal changes in rates of transpiration and photosynthesis, as well as the I' under those conditions. Pretreatments with different [CO_2] influenced interrelated factors of transpiration ,P_N, and r in more than one way. Therefore, in chambers with magnified diurnal changes in [CO,] , plants can hardly be expected to reproduce the response to natural diurnal changs in T and P in magnitudes comparable to those occuring under natural conditions. For physiological research, inexpensive chambers of different types have been designed by Koller and Samish in Jerusalem and by Pallas and Samish in Watkinsville, Georgia. In those chambers the [CO2] can be maintained at a constant level. This [CO2] control was found to affect growth considerably.

2. Different techniques for CO_2 measurement and *control*

Several systems far control of CO, exchange in closed spaces, such as chambers and greenhouses have been described in literature. In many cases the CO, control systems yield as a by-product an estimate of the net CO_2 exchange taking plate in a controlled chamber. Extensive research has been conducted for many years into techniques for the measurement and control of CO2, using assimilation chambers. These serve as models for the larger chamber.

"Injection" systems into which concentrated CO_2 is injected can be classified as closed systems or as special semi closed systems. Such injection systems represent a cheap common method of CO_2 control. Details of a "compensating system" which is a semi-closed technique have been discussed in the Plant Photosynthetic Production Manual of Methods, edited by Sestak et al. (1971) and developed recently by Samish & Pallas (1973).

3. The compensating system: *A semi closed technique*

We have developed a technique called "Null Point Compensating System" which combines some of the advantages of both the open and the closed systems. It was designed for the measurement of gases exchanged by plants, but could find wider applications. This compensating system provides a method to measure gas exchange accurately , while providing a strict control of air composition, regardless of whether natural or altered conditions are desired. It was developed as a tool to solve environmental problems, while monitoring CO_2 concentrations. This compensating semi-closed system is expected to show advantages in the solution of certain problems when compared with the popular open systems; for example :

A. In the study of airborne pollutants and natural gases, especially those which should be kept in hermetically closed systems, with minimal ventilation, this system should be particularly useful, because the gases leave the system at a slow, adjustable rate. Among airborne pollutants we may mention volatile pesticides, war gases, hydrocarbons, nitrous oxides, SO_2,CO,O^{18} , DHO, O_3 and dangerous or expensive radioisotopes.

B. Slow gas exchange is difficult to monitor and measure because of the limited sensitivity of gas detectors. This limitation can be overcome by the compensating system. This can mean that economic detectors may be considered. Examples of slow gas exchange could be excretion of ethylene and CO by plants which could represent important factors with dense, enclosed populations, as well as of CO_2, O_2 , and water vapor exchange by organisms under stress.

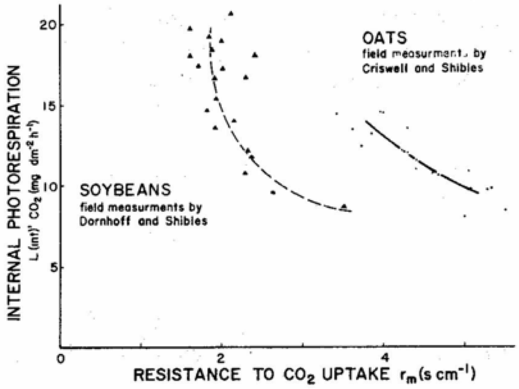

Fig.1.Photorespiration as function of CO_2 uptake. The photorespiratory CO_2 production recalculated by us as the rate inside leaves is shown as a function of the internal resistance to photosynthesis (r_m) of oats and soybeans.

This function may suggest that the photorespiration is influenced by CO_2 uptake rate and CO_2 concentration.

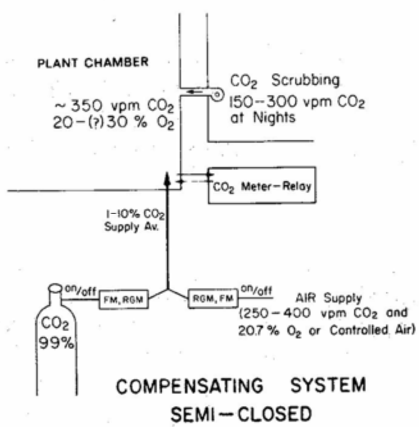

Fig.2.A compensating system used for CO_2 control in a growth chamber. A CO_2 Meter-relay (IRGA or other) controls the supply of air enriched with CO_2. During nights,when CO_2 is released in the chambers,the same CO_2 Meter-relay was used for the control of air partially scrubbed from its CO_2 content. This system provides ventilation as well as some control of the O_2 concentration.The CO_2 was supplied through a Recording Gas Meter (RGM) accurately.

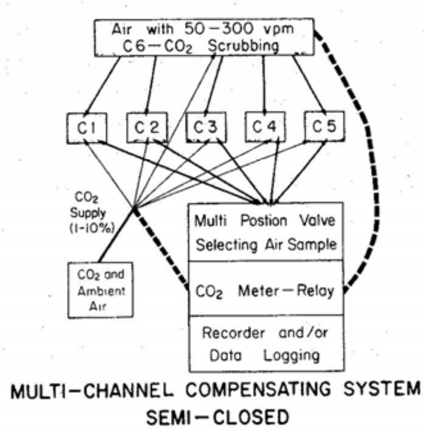

Fig.3.CO_2 control for five growth chambers. A central system which controls the CO_2 concentration of 5 chambers (No. C1 to C5).Air enriched with CO_2 is supplied in amounts proportional to the day time net CO_2 uptake. At night a CO_2 scrubbing chamber (C6) can provide air with low CO_2 content.

C. Rapid gas exchange, e. g., exchange of CO_2 and water vapor, as expected at large scale operations necessitates an open system to push through external air at exces - sively high velocities which require expensive regulation, filtration, drying etc. This would be considerably reduced in a semi-closed system.

D. Accuracy of measurements. The compensating system is more precise than either the "open" or the "closed" system (Koller and Samish, 1964; Bot. Gaz.125, Samish and Pallas, 1973,Photosyn.7) . This statement of accuracy assumes the use of comparable detection and control equipment in all systems.

E. Maintenance of defined conditions. In this system controlled air composition is maintained. With the other systems, the air composition is likely to change while measurements are being taken.

Controlled ventilation of this system is important in contrast to the injec- tion systems (i. E., closed system) since the compensating system has adjustable venti- lation. This reduces accumulation of pollutants,0_2,ethylene, etc.

For CO control during night hours the scrubbing of CO_2 from large chambers represents an economical problem. We use as scrubber as separate compensating system in which C - plants (e. G. Corn) get light when scrubbing is needed. Air with low [CO_2] from this scrubbing system is used to maintain normal·[CO_2]in another growth chamber. See Figs. N° 2 and 3.

The microenvironment surrounding active organs cannot be fully controlled by either open or closed systems, in spite of the controlled air which might be blown into those systems. The environment needs to be controlled by sampling the surrounding air after the activity of the organs has taken place at the steady state rate. This means that control should be done according to the [CO_2] in the air surrounding the or- gan or in the air outlet rather than according to the [CO_2] in the air inlet.

This relatively inexpensive compensating system is superior to the other two systems mentioned above and has many potential uses. Its special potential may hopefully be demonstrated in the solution of suitable problems of ecology, environ- mental, and general physiology. We have developed the compensating system so that it permits measurement and control at high transpiration rates. Water vapor from transpi- ration in excess of the predetermined humidity is condensed in a thermostatic bath (chemical desicants are not required nor desired because CD_9 may be adsorbed by them). On the other hand evaporation from the thermostatic bath cah compensate for the water vapor absorbed by the plant,where it will be recorded by a balance. Thus water vapor absorbed by plants under water stress can be measured. This improved compensating system uses accurate recording wet test gas meters for the measurement and control of CO_2 supply or displacement. An important consideration in the use of this advanced sy§tem is that it requires less supervision without need of expensive equipment and without loss in accuracy.

Acknowledgement: I wish to thank Drs. James E. Pallas, Jr., James E. Box, Jr., H. Enoch, and Dov Koller for their constructive remarks and support during the studies leading to this paper.

XX. USE OF CLASSIC CULTURE CELL AS A SO_2 CONTROLLED ATMOSPHERE AIR-CONDIT1ONNED ENCLOSURE. RESULTS OBTAINED

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Objective: To obtain culture in strictly controlled climatic conditions and in artificial light. Tests of long duration in the presence of amounts of sulphur dioxide (SO_2) in the range of 0 to 3 ppm in volume (regulation tolerance 2% of scale value).

A. *Culture Equipment*

The cell of a sealed construction forms a unit carried out in PVC including an altuglass ceiling slab to allow free passage of light, supplied by a set of 16 fluorescent tubes, 65-80 W, white industrial type and incandescence delivering 45 000 ergs/cm2/s^{-1} at 1 meter from the source. A ceiling darkening device relays extinction of the source following a program. Air-conditioned volume: 1 m3 approximately ; culture surface: 0,9 m2 .

1- Air-conditioning

The air-conditioning system is close to the cell and is separated from it by a partition on a vertical plane with blowing in the top part and intake in the bottom part after passage on the culture set out on perforated grating.

- heating circuit by sheeted 1500 W resistance on radiators
-refrigerating circuit, by hermetic unit 1/2 HP with water condenser-thermostatic pressure-reducer-refrigerating fluid R12 with direct expansion on evaporater with radiators
- steam humidifier by 1000 W thermoplunger

2-Automatic Regulation

A temperature sensor represented by a platinium resistance probe 100 ohms at 0' is connected in a WHEATSTONE bridge circuit formed by wired resistances.

The temperature set pains is manually fitted with a high definition potentiometer linked to a graduated drum. The unbalance is detected by a magneto-electric system comprising an index located at the upper part of the dial of the regulator enabling the evaluation of the instant temperature.

Regulation Principle

a- Dry temperature

On-Off regulation by:

turning on-off the 1500 W heating resistance
Stop/Start of the compressor

b-Humid bulb temperature On-

Off regulation by:

turning on-off the humidifier
Stop/Start of the compressor

Dry and humid temperature are controlled separately which leads any temperature correction to interfere on the situation of R. H.(relative humidity) and vice-versa.

Performance specifications: Temperature adjustable from 12° to +30° (+ 1°C)
Hygrometry adjustable from 60% to 90% (+ 10%)

B. Anal*ysis Equipment :*

-PICOFLUX "T HARTMANN and BRAUN analyser
-BITRIC M 1 . H. B regulator
-ARUCOMP 4902 - H. B point recorder

The analyser generates an output current 0-20 mA which is amplified and converted into numerical values on the recorder corresponding to graduations
0-100 of scale I (0⁻0,3 ppm)
0-100 " " 2 (0-3 ppm)

Coupled with the BITRIC regulator it assures a control function forinjecting the pollutant.

C. Equipment for Injecting Gas

Using in the principle a device perfected by the Laboratory for Atmospheric Pollution Studies (INRA 64-MONTARDON France) following our visit of Dec.12,1973 (Messrs. De CORMIS and BONTE) and taking into account. Information gathered in the Department of Mr. GAREIN Chief Engineer, Laboratoire Central de la Prefecture de Police de Paris, we worked out a simplified chain described in the appendix (fig.2).

FIRST RESULTS

The best recordings for a constant amount of pollutant are obtained in the absence of plant material and for climatic conditions close to those of the immediate environment of the cell (T°,20°, R H 50%) . The actuators of the automatic regulation being only slightly activated or not at all. In the range of amounts 0-0,3 ppm a sudden deviation in temperature (+ 2%) or in relative humidity (+ 10%) suffices to drive the recording off the reading scale. In a steady state condition of temperature corrections by too-humid or too-dry, which are the normal functions of regulators in culture cells under relative controlled humidity, here are accompanied by brutal drops in the amount when too-dry by fixation of the pollutant by the steam supplied by the humidifier, when too-humid by the condensation of excess atmospheric water loaded in pollutant on the only and unique cold battery which is included in the air-conditioning unit, which is fed by direct expansion of the cold-producing fluid for a pre set wall temperature of +2°. However, if we consider air at +20° -R. H. 70% its dew temperature is situated at +14°, i. E. the temperature from which and below which there is condensation on a wall that happens to be at this temperature.

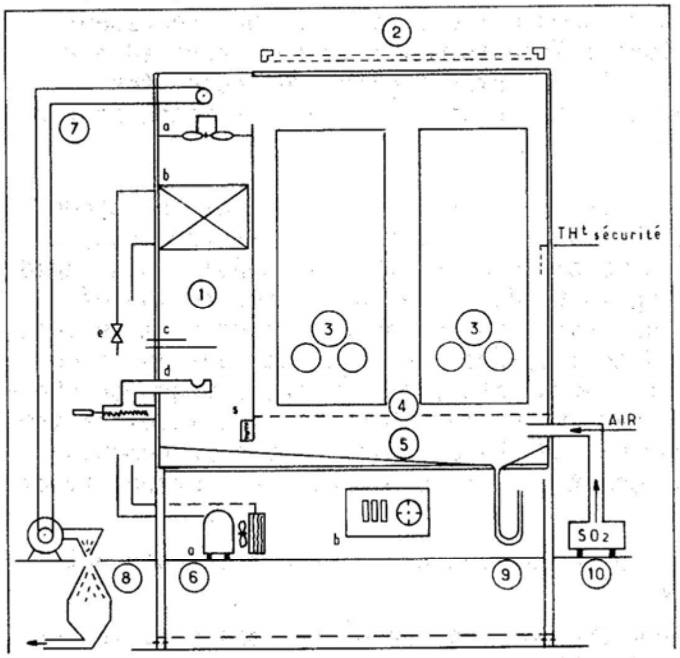

Figure 1

Lay-out Diagram

1-Air-conditioner

a-Blower
b-Evaporator
c-1500 W Heating Resistance
d-1000 W Humidifier
e-Constant Pressure Valve CPP

2-Lighting Unit and Darkening Device
3-Impervious Doors-Glove Box-Lock Chamber
4-Perforated Grating
5-Diamond shaped Bottom-Impervious Plug

a-refrigerating unit

6-Supporting Plate

b-control,regulation, programming

7-Permanent Extraction/Flap
8-Forced Extraction/Security-Mist Washer
9-Impervious Plug
10-Gas Device

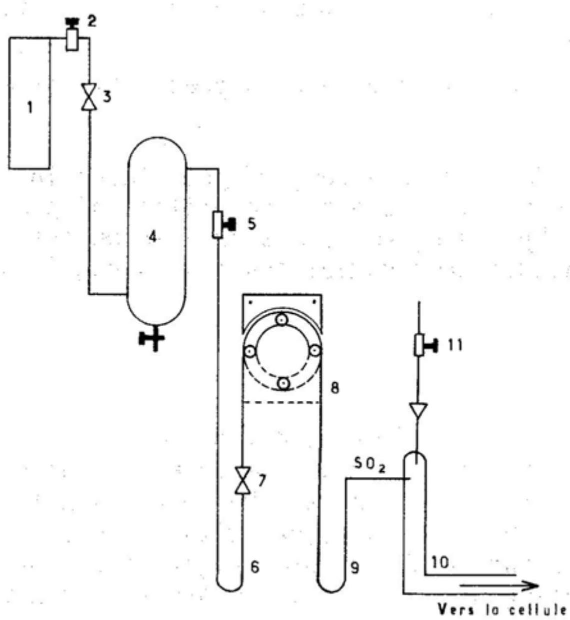

Figure 2

Gasing Device

1-Gas Reserve
2-5-Bellow Minivalve
3-Solenoid Valve 2
4-Buffer Vessel
6-9-Bubblers
7-Solenoid Valve 1
8-Peristaltic Pump
10-Spitter
11-Needle Minivalve

We were able to verify that in the present case in the steady state condition of recycled air this wall Vis sufficient to dampen the calorific load represented by the lighting source (1,5 kw/H approximately)and to maintain the recycled air at a constant temperature of 20°. This possibility of crossing the dew point for the humid regulation could be put to use for a better control of the set point of the amounts.

In alternate temperature conditions. The plant tests which should be conducted from the early stage of 3-4 true leaves and in alternation of temperature (Day 22°/Night 12°) and lighting, we note at the time of entering the Day condition a rapid rise in the amount- all injection of gas being suspended- due to the desorption of pollutant fixed on the condensates, culture substratum and other constitutive materials of the cell (PVC). We had thought of the need to insulate the sampling tube and even to place the Picoflux B analysis tank (itself thermostated) in the culture growth chamber in order to limit possibilities of condensation in the tubes, but the level of the recorded peaks (2 to 3 times the desired amount) and the duration of the phenomenon (between 3 and 5 hours according to working conditions) goes beyond the eventuality of the artifact.

Tests of temperature rises in steps of 2° spread out over 2 hours did not make possible the reduction of this tendency.

These observations lead us to review the mode of use of the basic equipment by introducing the following modifications (fig .1) :

a) at the level of dry and humid temperature regulation

- replacing the "on-off" regulators by APCF proportional regulator.

b) at the level of performances of the cooling unit and the humidifier device

- mounting of a discharge valve at constant pressure (and of a manometer) on the intake tube of the compressor, acting as a by-pass when the freon pressure exceeds the adjusted value. It is thus possible to pre-set the wall temperature of the evaporator according to the required dew temperatures.

(4e excluded the necessity of duplicating this device by a presetting of alternate temperature for the reason stated above).

- The fluant steam humidifier is of the 1000 W thermoplunger type placed in a small amount of water at a constant level. The experiment showed the utility of preheating permanently the water to evaporate,done by adding voltage step down on the power supply circuit of resistances which is shunted when humidification is required by direct full power control.

c) at the level of air circulation

- The air-conditioning unit included initially two helicoidal blowers side by side for a 800 m3/hour recycling. The air velocities measured at the level of the culture table showed an important horizontal gradient (0.70 m/sec. At the most distant point from ventilation pick-up ,to 1.20 m/sec. At the pick-up point) with turbulence at all levels and quiet zone in the median plane and on all usable height. These preferential movements determine an incorrect sweeping of cultures and provokes premature wilting not imputable to the effect of the pollutant.

The suppression of one of the blowers and the re-positioning of the one retained, mounting of deflectors suitably positioned (under perforated grating supporting the cultures) made it possible to homogenize the air distribution and to bring it down to the average speed to 0.50 m. Sec.,without notable consequence on the performances in air-conditioning ,but with a notable drop of the over-pressure (brought down to 15 m/m of water height at the level of the permanent extraction located at the upper point of the cell in the blowing area of the air-conditioned enclosure.

We thus benefit from :

1) a permanent extraction controlled by adjustable flap

2) a possibility to inject compressed air (negative dew T°) compensating this extraction and having as effect to control the rate of renewal of fresh air but also to facilitate the introduction of microdoses of pollutant supplied by the bubble by bubble gas device. The newly admitted fresh air passes through the tubes supplying the pollutant and draws in at a linear speed of 10 m/sec., sufficient to overcome the load losses and the over pressure existing in the air-conditioned growth chamber, thus improving the quality of sampling.

In this way the cell is exposed to a sweeping (of 1 to 2 m3/hour according to the required hydric condition) which does not affect the quality of the air-conditioning.

In a semi-opened circuit with recycling and fresh air intake, it constitutes a compromise between the sealed type cell often used for the measurement of the gaseous exchanges, in short-term tests, and the one recommended *by* Carl WEISS (Germany) for studies in polluted atmosphere; comprising a test chamber with thermo-regulated jacket equipped with a rotating tray on which the cultures are set out. This receives in one single crossing the air treated and charged with pollutant supplied by an air-conditioner and a regulated feeder under the control of output variations. The importance of the volumes of treated air calls for exchange surfaces of large dimensions, a large At between wall T° of the exchangers and the air to condition and above all a regulated mixture of dry and saturated air raised to operating temperature; humid regulation being carried out on the dew temperature of the mixture, thus eliminating the risks of aerosol formation responsible for brutal variations in the amount of pollutant in the humidifying devices equipped with steam injection. Conceived in this way, the air-conditioning permits to constantly maintain the concentration of pollutant at sub-necrotic doses much more easily than in a recycling system which introduces other causes of free SO_2 fixation and desorption than those due to the presence of the cultures.

Thus modified the cell that we have used can be charged in pollutant in all proportions, the concentration being adjustable to the desired level with a precision better than 3% of scale value and in the range of temperatures included between 10° and 30° and relative humidity 50 to 70%; however, the changes in Day-Night temperature conditions and vice-versa are not allowed, but the direct passage from the dark phase to the light phase has no effect on the constancy of the amount. The same goes for the drop by drop supply of watering fluid provided that they are supplied by programmed periods of short duration (5 to 10' for 20 1/h/m2) at the limit of retention refusal of the substratum.

Pilot bubble by bubble gasing device

a) Analyzer (principle of measurement)

A constant and continuous flow of analyzed gas and a constant flow of reagent react in a laboratory tube. The electric conductibility of the reagent (H_2O_2) varies according to the concentration of the measured constituent.

A "measurement cell" is found in the flow of the used reagent and a "compensation cell" in the flow of fresh reagent in order to determine the variation of conductibility. AC voltage is applied to each of the "cells, the difference of electric currents circulating in the 2 cells corresponds to the conductibility variation of the reagent and thus measures the concentration of the constituent measured in the gaseous mixture.

A transistorized amplifier converts this difference into a standard signal from 0 to 20 mA.

The electric circuitry is carried out in such a way as to indicate the absolute increase of conductibility AA and not the relative increase AX/A so as to eliminate the influence of conductibility variations of the reagent or tine lack of precision in its preparation. Response time with selective filter 180" approx./sensibility <1% of the calibre/reproducibility <3% of H B calibre.

b)Regulator

Of the one-level type, setting range 0-20 mA, equipped at output with a reversing contact relay, the switching taking place for a negative adjusted deviation (on or off) auxiliary power 220 V 2 VA.

A negative difference set point-measurement triggers the relay by means of a switching amplifier supplying the mains voltage to the controlled actuator.

c) Assembly elements (fig.2)

In order to reduce the high pressure gas (3,4 bars) supplied by the reserve to the operating pressure fixed at 0.2 bars, in the circuit between pressure-reducer 2 and solenoid valve 7, we have carried out a first assembly comprising (varient of the definitive version) in parallel with the buffer vessel 4 a mercury pressostat equipped with contacts supplying the power mains to the solenoid valve 3 (followed by a bellow minivalve) so as to re-establish the gas pressure as it is consumed.

This accessory allows for refining the adjustment of the reducer which was available to us.

In the definitive assembly solenoid valve 3 is conserved, the flow being laminated by minivalve 5.

The U-bent tubes (bubblers) with concentrated phosphoric acid constitute load losses upstream and downstream of pump 8 allowing with tube 6 for a complementary lamination of the flow and the visualization of the functioning of solenoid valve 7, with tube 9 the discharge of the quantity of gas strictly supplied by the pump ,the tubing connecting it to spitter 10 being as short as possible.

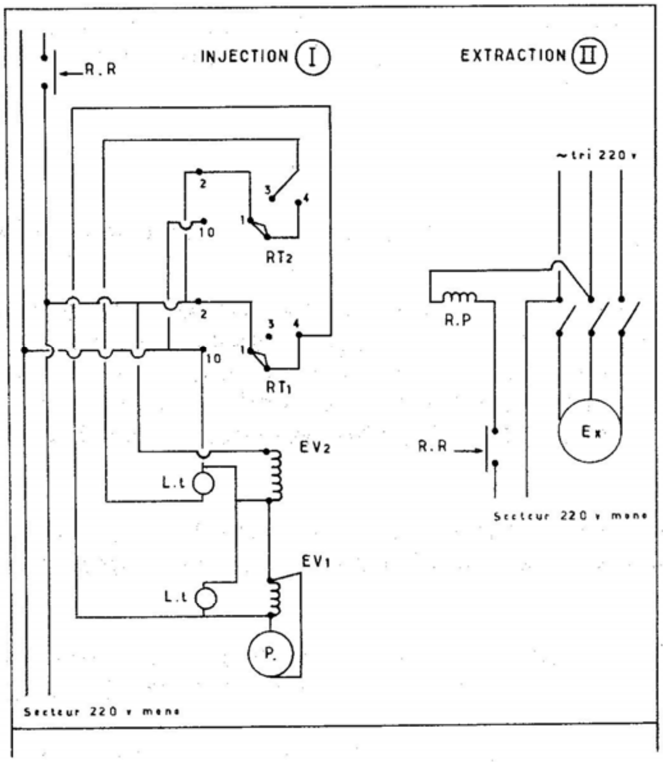

Figure 3

Regulation (wiring)

RR Regulating Relay

RT_1-RT_2 Time-delayed Relays

R P circuit breaker

L.t. indicator lamp

P pump

EV_1-EV_2 Solenoid Valves

Ex Blower Extractor

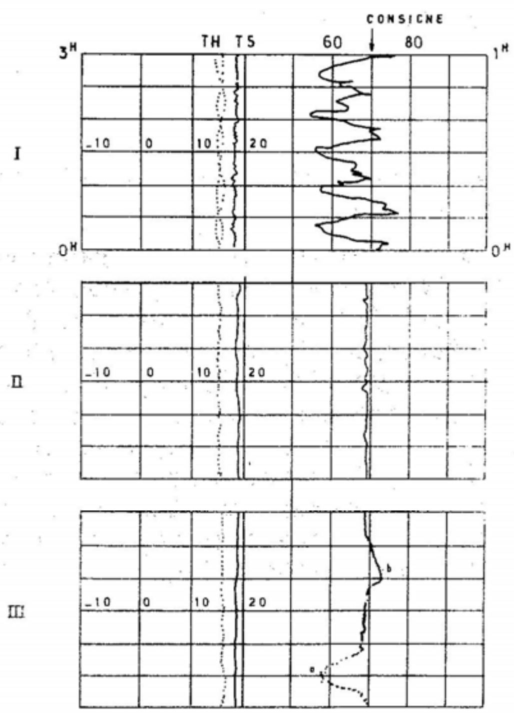

Figure 4

Climatic and Amounts Recordings

The climatic recordings (speed 20 m/m hour) and amounts recordings (speed 60 m/m hour) are shown in parallel.

diag.I. before modification of the humid regulation (5 crossings of the set point in 3 hours)

The minimums observed in amount corresponding to the condensations on evaporator during corrections by too-humid.

diag.II. after modification

diag.III. effect of a watering-disturbance of minimum amounts 0.23 maximum amounts 0.30 for set point at 0.25 ppm

The comparison in difference of levels observed in the two bubblers (the circuit being opened) enables to some extent the adjustment of valve 5 and the pump output.

d) Regulation (fig.2-3)

When gas injection is required the regulating relay supplies the power mains to:

1) a time delayed relay I (0-15") comprising 2 indexes making it possible to decide the duration of active times and shut-down times which can be added to form a 30" cycle (2 times 15") or be subtracted from each other within a 15" cycle of which 1" of active time for example. All intermediate adjustments are possible. Cycles are repetitive as long as the set point is not reached with automatic re-setting to 0 at equilibrium.

This relay controls in parallel solenoid valve 7 and the pump through pulses whose duration and frequency can be chosen at the moment when the amount curve reaches the desired level.

2) A time delayed relay 2 (0-150") linked to solenoid valve 3 which lets in a quantity of gas in buffer vessel 4 if necessary (re-setting to zero at equilibrium).

In practice the regulation only intervenes after permanent injection of gas near the set point; the output of the pump being thereby adjusted for a gain representing approximately 20% of the desired amount (through temporary setting). Experience shows that at least in the range of 0.17 -0.34 ppm (500- 1000 wgr/m3)this estimate of gain is sufficient to compensate the inertia of the measurement.

e) Security

Solenoid valves 3-7 are of the "open when energized" type which eliminates the risks of massive arrival of gas through power failure.

In the same manner the head of the pump is equipped with an impervious cover through which the compressed air needed for the spitter passes , thus any leak due to the wear of the flexible tube for gas transport (Isoversinic internal 0 i. 5 m/m) by the rollers of the pump rotor is trapped and intercepted by the analyser which by means of the regulator suspends any injection by the imperative closing of solenoid valve 7 linked to the pump. Furthermore, and to avoid the consequences of an accidental overdosage (e. G. Failure of air-conditioning with rise in temperature) a second regulator relay, of the same type as the injection regulator, is mounted at the analyser outlet and adjusted for a switching occuring at a level higher than the set point (10 to 20% of scale value according to tolerance). It controls the starting of the extraction blower and the flap-valve depressor towards the mist washer (fig.7 and 8 of the lay-out diagram).

XXI- NEWS FOR PHYTOTRONISTS

a-New Scientific Reviews

1. Agro-Ecosystems

4 issues per year. An international journal sponsered by the International Association for Ecology. The journal is concerned with fundamental studies on ecological interactions within and between the great variety of agricultural and managed forest systems .

Information: Associated Scientific Publishers. P 0 Box 211 Amsterdam- The Netherlands.

2. Ecological modelling

4 issues per year. An International journal on Ecological Modelling and Engineering and Systems Ecology. This journal deals with the use of mathematical models and systems analysis for the description of ecosystems and for the control of environmental pollution and resource development. It combines mathematical modelling, systems analysis and computer techniques with ecology and environmental management.

Information: Associated Scientific Publishers P O Box 211-AmsterdamThe Netherlands.

3. Environment energy contents monthly

Published by Environment Energy Institute. P 0 Box 1450 Portland, Oregon, 97207 USA.

4. *Jardin*

New French language monthly magazine concerned essentially with gardening for the amateur, do it yourself, decorating and cooking.

Information: Jardin-2 rue Edouard Colonne,75001-Paris ,France

Editions Vertes,93 rue Jeanne d'Arc ,75625,Paris Cedex 13 France.

b-Climate Laboratory Newsletter N°5 May 1975

Below find a summary of this New Zealand journal:

1) Dr. Jim Kerr is Director of the Plant Physiology Division and Chairman of the Allocation Committee.

2)Nutrient System. A dual system is installed and now offers either Hoagland's nutrient or a special nutrient which may be required for some experiments.

3)Climate Room use- 15% of space was reserved for maintenance and cleaning.

An average experiment of 10 weeks in two rooms costs betwen $ NZ 5 000-10 000 . These costs are borne by D. S. I. R.

The Climate Rooms should be regarded as an important and relatively cheap adjunct to field studies. There is an increasing need to integrate Climate Room research with field studies.

4)Technical systems

The second twin coil refrigerator has been built and is in service. The new refrigeration system and the CO_2 rooms are operating very satisfactorily.

The new chiller, installed in November 1974,was tested and is now producing a full capacity of 25.320 Kilojoules/hour and is working very satisfactorily.

5) Current projects

-Potassium efficiency in pastures
-Early vegetative growth of three barley grasses (hordeum sp.) and grosslands manawa ryegrass at different soil salinities and temperatures.
-The effect of temperature and relative humidity on *Cotulla pulcheaa.* -Partitioning patterns in perennial ryegrass response to the light environment
-Evaluation of differences in magnesium levels in plants grown on taranaki soils
-Pathogenicity trials with isolate of stemphylium
Effect of leaf wetness on sympton expression by *Dothistroma* pini

6) Completed projects

-Artificial frosting studies of radiata pine planting stock -Efficiency of utilization of nitrogen and phosphorus by yorkshire fog *(Holous lanatus)*
-Abscisic acid and water stress in maize and sorghum
-Adaptation of maize to drought

Those who want to receive more information ,please write to the Editor: A. K. HARDACRE- Plant Physiology Division D S I R -Private Bag. Palmerston North-New Zealand.

c - Review of New Books

1) Gartenbauliche Versuchsberichte 1975. 318 pages

Editor: Landwirstschaftskammer Rheinland Gruppe Gartenau Endenicher Allee 60 D53 BONN 1 -FRG.

The Reports of Horticultural Experiments are published annually by Section of Horticulture of the Rhineland Chamber of Agriculture. Their contents are the latest results of experiments on horticultural crops,achieved in the Experimental Stations at Auweiler, Essen, Friesdorf, and Straelen, and also in the model plants at Oilsseldorf, Krefeld-GroBhUttenhof, Krefeld-kOnigshof,and Bornheim-Roisdorf. Reports of Experience and Actual information on practical work are enclosed.

Work of Experimental Stations and of model plants particularly serves Rhineland commercial growers. All trials are planned and controlled by self-government organs of the Rhineland Chamber of Agriculture. We would appreciate a close cooperation with all institutes, organizations and similar institutions, being occupied with corresponding problems.

2- *New International Dictionary of Refrigeration*

The dictionary (containing 2400 expressions, all of them defined in French and in English) consists of two parts:

-the first part includes all the entries classified methodically, identified by reference numbers and presented correspondingly in seven languages: English, French, Russian,German ,Spanish,Italian and Norwegian.

-the second part includes a series of seven alphabetical indexes, one for each language, referring to the methodical arrangement of the first part.

Table of Contents: Methodical Classification

A. Basic Data and Instrumentation
B. Tnermodynamics and Transport of Heat
C. Production of Cold
D. Compressors
E. Heat Exchangers and Cooling Media
F. Valves-Control and Safety Devices
G. Refrigerating Installations:Assembly and Operation
H. Insulation-Gas and Vapour Seals-Sound Control
J. Cold Rooms-Cold Stores-Refrigerated Transport
K. Chilling and Freezing:Methods and Equipment
L. Food Industry
M. Freeze-drying and Biological Applications
N. Air Conditioning
P. Cryology
Q. Industrial Applications-Miscellaneous

Editor: International Institute of Refrigeration 177,BoulevArd Malesherbes, 75017-PARIS France, 600 pages,21 x 29 cm , hard bound cover. Price 300 FF.

3- *Die Technick im Gartenbau* R. BOHN
Band 3 Teil 1 (1971) and Band 3 Teil 2 (1974)

Ed. Verlag Eugen Ulmer-Postfack 1032-7000
STUTTGART 1- F. R. Germany

The two volumes contain, for the first time, a well-rounded presentation of all important fields of the techniques in horticulture (basic principles,greenhouse,heating systems, water management,machines,equipment,harvest and preparation for marketing, cooling systems, electricity,transportation,working techniques),each one prepared by experts in tne mentioned fields. The chapter on greenhouses contains details on the ways of construction in the Netherlands, Belgium, France, Switzerland, Austria, Denmark, England and the U. S. A.

The basis for independent further development is presented as well as the recommendation to the manager to apply profitably the technique in the horticultural enterprise.

Of interest to: All commercial growers of vegetables, flowers and ornamental plants, students and teachers all sections of horticulture, industry concerned .

c - List of New Books

-H. R. V. ARNSTEIN-Synthesis of Amino Acids and Protein. Ed. Butterworths Ltd. Borough Green Sevenoaks. Kent TN15-8 PH-UK -1975. 410 pp.

-Annual report 1974. Division of Plant Industry. CSIRO. Canberra Australia -A. BARY-LENGER,R. EVRARD et P. GATHY. La Foret-Ecologie-Gestion-Economie-Conservation-Editeur:Vaillant-Carmanne S. A. 4 place St Michel, 4000 Liege, 1975. 588 pages.
-Basic Principles in Nucleic Acid Chemistry Vol.' Editor P 0 P Ts'o. XII + 636 p. Academic Press,Inc. New Yrok 1974 $ 37,50.
-Bilayer Lipid Membranes (BLM):Theory and Practice par H. Ti TIEN, IX + 655 p. Marcel Dekker Inc. New York 1974 $ 39,50.
-R. BECKER. Theorie der Wrme. Unveranderter Nachdruck .1975. Ed. Springer Verlag Berlin, Heidelberger Platz 3,0-1 -Berlin 33- $ 8,10.
-V. J. B0FINGER and J. L. WHEELER-Developments in Field Experiment design and analysis. 1975. Ed. C. A. B. Farnham House,Farnham Royal Slough. SL 2-3 BN UK 200 pp. $ 15.00 -Clayton. The mecnanism of Photosynthesis.1975. Ed. Addison Wesley London.
-Crop Loss Assessment methods. FAO Manual on the evaluation and prevention of losses by pests,disease and weeds. Published by Commonwealth Agricultural Bureaux Farnham House,Farnham Royal, Slough SL 2-3 BN Grande Bretagne $ 16.80 -R. M. DMWOSKI. SysLems analysis and modelling approaches in environment systems.1974. 607 pages Editor : Institut de Cybernetique appliquee. Academie des Sciences de Pologne. Varsovie.
-DNA Synthesis, par A. KORNBERG 399 p. W. H. FREEMAN et Cy,San Francisco et Reading 1974 £ 9,40.
-R. J. DOWNS and H. HELLMERS. Environment and the Experimental Control of Plant Growth. Vol.6. Experimental Botany 1975. Academic Press.146 pp. $ 12.50.
-Eau en culture protegee. Note du cours post Universitaire d'Avril 1975. Gembloux Belgique, 250 pp. Publie par la Faculte des Sciences Agronomiques de l'Etat a Gembloux Belgique.
-EVANS . Daylangth and the flowering of plants.1975. Ed. Addison Wesley London -French-English Horticultural Dictionary. D. O. D. BOURKE. Commonwealth Agriculture Bureaux.
Farnham House. Farnham Royal Slough SL2 2-3 BN. UK $ 13.00 -D. H. GRIST-lice. Ed. Longman Inc. Sixth Floor 72 Fifth Avenue. New York NY 10011 USA.1975 608 pp.
-IX International Symposium on Fruit Tree Virus Diseases. East Malling,July 1973,Printed in february 1975 by ISHS. Acta Horticulturae n°44,pp.267.
-Mascarennas. The biology of pollen.1975. Ed. Addison Wesley London
-Micromethods in Molecular Biology, Vol.14 of Molecular Biology,Biochemistry and Biophysics, Editor : V. Neuhoof. XIV + 428 p. Chapman and Hall Lt,Londres 1973 E. 16.50.
-R. MARCELLE. Environmental and Biological Control of Photosynthesis. Ed. Dr. W. Junk. Publishers. The Hague. The Netherlands.1975. 408 pp.
-Yu S. NASYROV and Z. SESTAK. Genetic Aspects of Photosynthesis Ed. Dr. W. Junk. Publishers. The Hague . The Netherlands 1975. 384 pp.
-Neoplasia and Cell Differentiation by G. V. SHERBET XIV + 411 p. S. Karger AG, Bale, 1974 . E 20.30
-0. I. PATT and G. R. PATT. An introduction to modern Genetics 1975.375 pp. Ed. Addison Wesley London.

-A. J. PEEL. Transport of Nutrient in Piants. Ed. Butterworths Ltd. Borough GreenSevenoaks. Kent TA 15 8 PH-UK 1974. 320 pp.

-Yu K. ROSS. Regime radiatif et architectonique du couvert vegetal (en Russe) Edition Hydrometo. Leningrad 1975. 344 pp .

-M. R. SARIC. The use of Phytotrons and greenhouses in dealing with some problems in phytobiology and the most important technical requirements in Phytotronics Edit. Stamparija Univerziteta Novi Sad. Veljka Vlahovica br.3 . Novi Sad 1975. 35 pages.

-J. SEEMAHN. Climate under glai:s. Technical note n°134 1974. 40 pages. O. M. M. Ave Guiseppe Motta II. Geneva Switzerland.

-H. SMITH. Light and Plant Development . Ed. Butterworths Ltd Brough Green. Sevenoaks Kent TN 15.8 PH-UK 1975. 500 pp.

-N. SUNDERLAND. Perspectives in Experimental Biology Vol.2 Botany Ed. Pergamon Press Headington Hill Hall Oxford.0X3 OBW UK.1974. 542 pp.

-Symposium on Peat in Horticulture,Noordwijk April 1975. Printed in May 1975 by ISHS Acta Horticulturae N°50 pp.171.

-The Physical Biology of Plant Cell Walls by R. D. PRESTON XIV + 491 p. CHAPMAN and HALL,Ltd.,Londres 1974, 12.00

-L. J. WEBER and D. L. Mc LEAN-Electrical measurement systems for Biological and Physical Scientists 1975.448 pp. Ed. Addison Wesley London

-E. WESTPHAL. Agricultural systems in Ethiopia.278 pp. Ed. Pudoc Wageningen, The Netherlands.

-A. C. ZEVEN and P. I. ZHUKOVSKY. Dictionary of cultivated plants and their centres of diversity . Excluding ornamentals,forest trees and lower plants.224 pp. Ed. Pudoc Wageningen The Netherlands.

d-Articles in Print

-B. J. FORDE and all. Comparative Transpiration Rates of Three Grass Species. In Mechanisms of Regulation of Plant Growth Ed. Bulletin,12,The Royal Society of New Zealand Wellington 1974, pp.417-421.

-B. J. FORDE and all. Effect of Light Intensity and Temperature on Photosynthetic Rate, Leaf Starch content and ultrastructure of *Paspalum dilatatum. Austr. J. Plant Physia.* 1975.2, 185-95.

-J. GRACE. Wind damage to vegetation. Current *Advances in* plant *science* 1975 n°17 June, p.883-894.

-M. J. HURDZAN and R. M. KLEIN. Solar-Simulating radiation systems for Biological Research. *Photochemistry and Photobiology* 1975. Vol.21 pp.383-385.

-R. IMPENS. Pmblemes lies à la croissance des vegetaux en atmospheres polluees. *Annales de Gembloux* 1975 vol.81, n°1, p.15-24.

-0. L. LANGE Ind all. The Temperature related Photosynthetic Capacity of Plants under Desert Conditions. L. Seasonal changes of the Photosynthetic Response under to temperature. *Oecologia (Berl.)* 17, 97-110 (1974).

-0. L. LANGE and all. The Temperature related Photosynthetic Capacity of Plants under Desert Conditions. II. Possible Controlling Mechanisms for the Seasonal Changes of the Photosynthetic Response to temperature. *Oecologia (Berl.)* 18,45-53, 1975.

-P. MARTENS. Reflexions sur les problemes des residus de pesticides en Agriculture. *Annales de Gembloux* 1975 Vol.80 n°4, p.211-225.

-P. MATHY . Le Cadmium dans l'environnement. *Annales de Gembloux* 1975. Vol.80 n°4, p.227- 237.

-L. G. NICKELL and D. T. TAKAHASHI. The effects of antibiotics and other antimicrobial agents on the ripening of sugarcane. Hawaiian Planters Record. 1975 vol.59,n°2,p.15-20.

-E. D. SCHULZE and all. The Role of Air Humidity and Leaf temperature in Controlling Stomatal Resistance of *Prunus armeniaca* under Desert Conditions. II. The significance of Leaf Water Status and Internal Carbon Dioxide Concentration. *Oecologia (Berl.)* 13, 219-223 (1975).

-E. D. SCHULZE and all. The Role of Air Humidity and Temperature in Controlling Stomatal Resistance of *Prunus armeniaca* under Desert Conditions. III. The effect on water use efficiency. *Oecologia* (Berl.) 19, 303-314(1975)

-E. D. SCHULZE and all. The role of Air Humidity and leaf temperature in controlling Stomatal resistance of *Prunus armeniaca* under Desert conditions. I. A simulation of the Daily course of Stomatal Resistance. *Oecologia (Berl.)* 17,159-170 (1974)

-C. J. STIGTER and G. J. W. VISSCHER. Application of a new calibration method to an unventilated dynamic diffusion porometer. *Neth. J. Agric. Sci.* 23, 1975,303-307.

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e-Coming Events, Meetings and Exhibitions

1976. Switzerland

,Symposium on Labour and. Labour Management

Dr. A. WIRTH. Swiss Federal Res. Sta. For Arboriculture and Horticulture E;820-Waedenswill-Switzerland

1976. Alexandria (Egypt)

5th African Horticultural Symposium

Inquiries:H. D. TINDALL-Nat. College of Agr. Engineering Silsoe Bedford (UK)

1976. Moscow (USSR)

9th Congress on Irrigation and Drainage

Inquiries: Int. Comm. On Irrigation and Drainage,48 Nyaya Marg. Chanakyapuri New Dehli 21 India

1976. USA or Canada

Int. Ass. On Mechanisation of Field Experiments Congress on Mechanization of soil and plant research

Inquiries:IAMFE, 1432 As NLH Norway

1976. April 6-8 -Norwich UK

Eucarpia symposium on Genetics and Breeding of Peas

Inquiries: M. MESKEN-Eucarpia Secretariat PO B 138,Wageningen Netherlands

1976. April 7-8 -Wembley (UK)

Reinforced plastics in building and construction

Inquiries: Miss S. M. Keeble-Plastics and Rubber Institute
11 Hobard Place London WSIW OHL

1976. April 9-13 Munich (RFA)

European Conference on Biochemical Analysis

Inquiries: Dr. Rosemarie Vogel-Nussbaumstr.20
Box 220324 0-8000 Munchen 2 RFA

1976. April 20-23 Vienna (Austria)

3rd European meeting on cybernetics and systems research

Inquiries: Austrian Society for Cybernetic Studies
3 Schottengasse A-1010 Vienna Austria

1976. April 21-25 Verona (Italia)

Protagri-III rd International exhibition of horticulture

Inquiries: E. A. Fieri di Verona C P 525.37100 Verona Italia

1976. April 24 May 2-Genova (Italy)

Euroflora 76. *III rd International Exhibition of Horticulture*

Inquiries: Euroflora 76. Piazzole J.-F. Kennedy 16129,Genova (Italy)

1976.26-28 Avril Grignon France

Ecologie appliqude, remembrement et am4nagement de l'espace rural

Cycle Formation continue
Renseignemeit. Centre de Perfectionnement INA Paris-Grignon 16 rue Claude Bernard,75231-Paris Cedex 05

1976. Mai Toulouse (France)

Stage de Formation continue: *Nutrition minerale des plantes cultivees*
Renseignements: CFC Polytechnique Place des Hauts Murats
BP 364-31006-Toulouse Cedex (France)

1976. May-Corsica (France)

Symposium on Problems of Citriculture in Mediterranean Countries (ISO'.

Inquiries: Dr. L. BLONDEL-St Rech. Agr. San Giuliano par Mariani
Plage,Corsica (France)

1976. May-Bucharest (Rumania)

Symposium "Protected cultivation of tomato,pepper and eggplant"

Organisation:Prof. CEAUSESCU Project ISHS. Ministry of Agriculture-Bucharest-Romania

1976.1-16 Mai Paris (France)

Salon du jardin et de l'environnement et de la *maison*

Renseignements: PromOjardin,7 rue CoperniC 75782 Paris Cedex 16

1976. May 2-8 Noordwijkerhout (Netherlands)

4th Symposium ISHS on Virus Diseases of Ornamental Plants

Inquiries: Ir. F. A. Hakkaart Exp Stat. Of
Floriculture Linnaeuslaan 2 A. Aalsmeer
(Netherlands)

1975.3-7 Mai Paris France

Hydrothermique d'hiver dans le batiment cycle de Formation continue

Renseignements: C S T B,Secretariat de la Formation continue
41 ay. Du Recteur Poincare,75782-Paris Cedex 16

1976.10-14 May Brisbane (Australia)

Plant relations in pastures symposium

Inquiries: Secretariat of Symposium . Division of Tropical Agronomy CSIRO
Mill Road St Lucia Brisbane Qld 4067 Australia

1976.14 Mai Paris (France)

Table ronde sur la *chloration des eaux*

Renseignements:Cie Industrielle de filtration et d'equipement chimique S. A. 18 rue d'Armenonville 92200-Neuilly s/Seine (France)

1976. May 18-22 Bucarest (Romania)

International symposium SHS on greenhouse market gardening

Inquiries: Secretariat-Ministery of Agriculture 24 Bd of Republique
Bucuresti IV (Romania)

1976. May 30-June 2-Amsterdam (The Netherlands)

18th Congress Int. Seed Federation

Inquiries: Organisatiebureau Amsterdam N. V. Europaplein 14. Amsterdam (The Netherlands)

1976. May-June London (UK)

Weathering of plastics and rubbers International symposium

Inquiries: M. D. H. COHEN Plastics and Rubber Institute
11 Hobard Place,London WS 1W OHL

1976.1-4 Juin Toulouse France

Stage de Formation continue: *Protection des cultures cerdalieres*

Renseignaments:CFC Polytechnique-Place des Hauts Murats BP 354-31006 Toulouse Cedex (France)

1976.13-16 Juin Strasbourg France

Florexpo-Exposition de fleuristerie
Renseignements: FNFF,33 rue du Pont Neuf,75001 Paris

1976.21-25 Juin Paris France

Hydrothermique d'dt4 dans le batiment. Ventilation. Cycle de Formation continue

Renseignements: CSTB Secretariat de la Formation continue
4 avenue du Recteur Poincare,75782 Paris Cedex 16

1976. June 28-July 23. Wageningen Netherlands

24th Intern. Course on Rural Development

Inquiries: Intern. Agr. Centre PO B 88 Wageningen (Netherlands)

1976. July 5-8 Oxford (UK)

3 rd International Convention of World Federation of Rose Societies

Inquiries: Secretary-The Royal National Rose Society,Chiswell Green Lane,
St ALBANS Hertfordshire (UK)

1976. July 15-24 Strasbourg (France)

Nucleic acids and Protein Synthesis in Plants. Nato advanced study institutes

Inquiries: Prof. J. H. WEIL. Inst. De Biologie Moleculaire 15 rue Descartes, 67-Strasbourg France

1976. July 26-30 Dundee (UK) and East Mailing (UK)

Symposium on Breeding of Rubus and Ribes and its relation to the problems of mechanical harvesting (ISHS and Eucarpia)

Inquiries: Dr. D. L. JENNINGS-Scottish Horticultural Research Inst. Invergowrie-Dundee,Scotland (UK)

1976. July 22-26 Hannover (FRG)

Symposium on cultures of Vaccinium Species (ISHS)

Inquiries: Prof. LIEBSTER Inst. F. Obstbau. T. U. Munchen 8050-Freising Weihenstephan (FRG)

1976. August 5-6 East Lansing (USA)

ISHS Symposium on ornamental *and floriculture genetics and breeding*

Inquiries: Dr. Kenneth Sink Dept. Of Horticulture. Michigan State University East Lansing,Michigan 48823 USA

1976. August 1-8 Cali (Columbia)

IVth International Symposium on Tropical Root Crops

General topics: All Aspects of Tropical Root Crops. Organizer:international Society for Tropical Root Crops

Inquiries: Dr. Eduardo Alvarez-Luna ,Centro International de Agricultura Tropical Apartado Aereo 67-13,Cali Colombia (South America)

1976. August 3-5 Guelph (Canada)

Symposium ISHS Vegetable Production in Organic Soils

Inquiries: Dr. I. L. Nonnecke, Muck Research Station R. R. I. Kettleby Ontario LOG-IJO-Canada

1976. August 3-18 AAS-NLH (Norway) and Alnarp(Sweden)

Sympsium on growth and development of potplants (Norway) and roses (Sweden) (ISHS)

Inquiries: Prof. E. STROMME-Dept of Floriculture Box 13
Agric. College of Norway-N 1432-Aas-NLH (Norway)
and Prof. Kristoffersen. Dept. Of Ornamental Horticulture. Agric. College of Sweden S 230 53 Ainarp (Sweden)

1976. August-September USA or the Netherlands

3 rd Symposium on vegetable storage

Inquiries: Dr. J. Apeland. Dept of Vegetable Crops. Agric. Univ. Of Norway Box 22, 1432 Aas NLH-Norway

1976.15-19 Aout Cacak (Yougoslavie)

Symposium international sur la Ondtique des pruniers

Renseignements: R. Bernard-Station de Recherches d'Arboricultures. Pont de la Maye (France)

1976. August 22-September 3-Island of Spetsai (Greece)

Molecular interactions involved in the morphogenesis of cellular organelles and cellular recognition. Nato Advanced study institutes

Inquiries: Dr. Marianne Grunberg. Manago Service de Biochimie Inst. De Biologie Physico-Chioique,13 rue Pierre et Marie Curie,75005-Paris -France

1976.24-29 AoOt London (UK)

Inquiries: AFGC. *International Congress of Garden Centers (IGA)* 28 rue Bayard, 75008-Paris (France)

1976. August 29-September 3-Rome (Italy)

7th International Congress on Photobiology

There are 15th Symposia,among them :Photosynthesis,Mutagenic Effects of Radiation, Light and Development, Photomovement etc.

Inquiries:Dr. A. CASTELLANI-CNEN-CSN-Casaccia
Casella Postale 2400-00100 Rome A. D.(Italy)

1976. August 30-September 4-Lausanne (Switzerland)

IXth International meeting on growth substances

Inquiries:Prof. P. E. PILET. Institut de Biologie et Physiologie vegetales de l'Universite . Place de la Riponne,1105 Lausanne (Switzerland)

1976. September Heidelberg (FRG)

10th ISRS jymposium on Fruit Tree Virus Diseases

Inquiries:Cr. L. Kunze. Biol. Bundeshanbt. F. Land and Forstwissenschaft. Inst. Fur Obstkrankheiten ,6901 Dossenheim uber Heidelberg (FRG)

1975.3-8 Septembre Clermont-Ferrand (France)

Salon international du Dahlia

Renseignements: SNHF,84 rue de Grenelle,75007-Paris

1976. September 6-10 East Mailing (UK)

Symposium on High Density Plantings (ISHS)

Inquiries: Dr. J. E. JACKSON -Pomology Section EMRS East Mailing nr. Maidstone Kent (UK)

1976. September 7-11 Ithaca (USA)

3 rd Symposium on Vegetable Storage

Inquiries: Dr. F. M. Isenberg, 102 B. E. Robert Hall Cornell University,Ithaca NY (USA)

1976.10-12 Septembre Orleans (France)

Hortimat-De Salon de Materiel horticole

Renseignements:Hortimat-Domaine de Cornay
45590-St Cyr en Val (France)

1976. September 13-17 Warsaw (Poland)

VIIth Annual Meeting of European Society of Nuclear Methods in Agriculture
-Warsaw . Poland. Kryspina Smierzchalska ,Palace of Culture and Science 21 St floor

Inquiries: ESNA Secretariat PO Box 48,Wageningen, The Netherlands

1976.13 September-1 October Paris (France)

Microbiologie du sol et des eaux. Cycle de Formation continue

Renseignements: Centre de Perfectionnement INA-Paris -Grignon, 16 rue Claude Bernard,75231 Paris Cedex 05

1976. September 19-25 Poznan (Poland)

5th International Peat Congress

Topics:Peat and Peatlands in Protection of Natural Environment. In section 4: new ideas on the utilization of peat in agriculture and horticulture

Inquiries: Secretariat of Congress-ul Wspolna 30,00-930 Warzawa 71-Poland

1976.21-24 Septembre-Grignon (France)

Photosynthese at production veggtale. Cycle de Formation continue

Renseignements: Centre de Perfectionnement INA Paris-Grignon,16 rue Claude Bernard,75231 Paris Cedex 05

1976.21-23 Septembre Bischenberg (France)

Colloque sur 2 themes: *Qualitd des vegetaux- Relations commerciales entre pepinieristes at installateurs espaces verts*

Renseignements: CNIH Service economique BP 309 94152-Rungis Cedex

1976.22-25 Septembre Strasbourg (France)

14e Congres de l'Union Nationale des syndicate d'entrepreneurs paysagistes de France (UNSEPF)

Renseignements: P. Pekmer BP 2,67037-Strasbourg Cedex

1976. September 1.4-27 Karlsruhe-FRG

Exhibition and symposium on horticultural engineering

Inquiries:R. Bohn,Kuratorium f. Technik und Bauwesen in der Landwirtschaft Kolnerstrasse 42,53 Bonn-Bad Godesberg 1 FRG

1976.24-27 Sedcember Karlsruhe (FRG)

5 Fachausstellung und Vortragstagung Technik im Gartenbau

Inquiries: KTBL,Kolner Str.142,Bad Godesberg 1-53 Bonn-FRG

1976. Late September Florence (Italy)

ISHS Symposium on Spice Crops and Medicinal Plants

Inquiries: Dr. J. Van Kampen,Exp. Station for outdoor vegetable growing. Hoeverweg 106, Alkmaar Netherlands

1976. September 28-29 Pisa (Italy)

ISHS Symposium on flower formation in ornamentals

Topics:Flower formation and control of flowering in plants cultivated as cut flowers,potted plants or flowering shrubs.

Inquiries: Prof. A. Alpi-Instituto di Orticoltura e Floricultura. Viale delle Piagge 23-56100 Pisa (Italy)

1976.0ctober 1-10 Florence (Italy)

Symposium on Pear Culture (ISHS)

Inquiries: Prof. F. SCARAMUZZI Inst. Di Colt. Arboree Fac. Di Agraria. Via Donnizetti 6,Florence 50144 (Italy)

1976.4-6 Octobre Grignon (France)

Ecologie appliquee,remembrement et amenagement de *l'espace rural*
Cycle de Formation continue

Renseignements: Centre de Perfectionnement INA Paris-Grignon,16 rue Claude Bernard,75231 Paris Cedex 05

1976.0ctober 25-November 1. Las Palmas (Canary Island)

4th International Congress on soilless culture

Inquiries: IWOSC Secretariat PO Box 52. Wageningen The Netherlands

1976. Novembre-Toulouse (France)

Stage de Formation continue: *Multiplication de Za vigne*

Renseignements: CFC Polytechnique. Place des Hauts Murats BP 354, 31006-Toulouse Cedex (France)

1976. Novembre Toulouse (France)

Stage de Formation continue: *Problemes genera= de commercialisation des produits agricoles*

Renseignements: CFC Polytechnique Place des Hauts Murats,BP 354,31006-Toulouse Cedex (France)

1976.7-11 Novembre Bourges (France)

Congres des Chrysanthemistes

Renseignements: M. D. Lejeune. Jardins et Espaces verts de la ville de Bourges 18000 -Bourges

1976. November 14-20 Tokyo (Japan)

CORESTA 76. *VIth Tobacco International Scientific Congress*

Inquiries:Dr. E. TAMAKI-Japan Tobacco and Salt Corporation 2,Akasaka Aoi-Cho Minato-Ku Tokyo 107

1976.15-17 et 22-24 Novembre Paris (France)

Germination des semences ,Cycle de Formation continue

Renseignements: Centre de Perfectionnement INA Paris-Grignon,16 rue Claude Bernard 75231 Paris Cedex 05

1976. 22-24 Novembre Toulouse (France)

Stage de Formation continue: *Comportement des engrais dans les sac;*

Renseignements: CFC Polytechnique Place des Hauts Murats,BP 354,31006-Toulouse Cedex (France)

1976.22-24 Novembre et 13-15 Decembre Toulouse (France)

Stage de Formation continue: *La fertilisation et son contrele en Arboriculture fruitiere*

Renseignements: CFC Polytechnique,Place des Hauts Murats, BP 354,31006-Toulouse Cedex (France)

1976. Decembre Toulouse (France)

Stage de Formation continue: *Traitement de* Za *pollution industrielle*

Renseignements: CFC Polytechnique-Place des Hauts Murats,PB 354, 31006-Toulouse Cedex (France)

1976.6-9 Decembre Grignon(France)

La manutention en agriculture , cycle de Formation continue
Renseignements: Centre de Perfectionnement INA Paris-Grignon,l6 rue Claude Bernard, 75231 Paris Cedex 05

1976.13-15 Decembre Toulouse (France)

Stage de Formation continue: *Contrele de* la *fertilisation par l'analyse du v4ge-tal*

Renseignements; CFC Polytechnique,Place des Hauts Murats, BP 354, 31006 Toulouse Cedex (Francb)

1977. Quebec (Canada)

International Floralies of Quebec

Inquiries: Organizing Committee, 2527 Gregg. Str. Sainte Foy,Quebec,Canada 61 W1 J5

1977. Latin America

ISHS Symposium on Tropical Vegetables

Inquiries: Dr. M. Holle,Dep. De Hortic. UnivAac. Agraria Apartado 456 Lima
Peru 1977. USA/Roumania or USSR

VIth Symposium on Apricot Culture *and Decline*

Inquiries: Prof. S. A. Paunovic. Inst. Za vocarstvo Cacak
Yougoslavia 1977. Ghent (Belgium)

Symposium on Tissue Culture (ISHS)

Inquiries: Prof. Boesmans-Coupure Links 235.9000 Ghent (Belgium)

1977. Abidjan (Ivory Cost)

6th *African Horticultural Symposium on fruit crops of West Africa*

Inquiries: H. D. TINDALL-National College of Agric. Engineering Silsoe Bedford (UK)

1977. Wellesbourne (UK)

Symposium on Timing Field Production of vegetables
Inquiries: Dr. J. Van Kampen-Exp. Stat. For outdoor Vegetable growing-Hoeverweg 106 Alkmaar Netherlands

1977. Sweden or USSR

Symposium on More Profits of Energy in the greenhouse

Inquiries: A. E. Canham-Applied Research Section-Shinfield Green Reading (UK)

1977. Ireland

Symposium on Mushrooms

Inquiries: Dr. D. W. Robinson,Kinsealy Research Center an Foras Taluntais,Malahide Road,Dublin 5-Ireland

1977. VIth ISHS Symposium on Horticultural Economics
Inquiries:W. G. De Haan, Conradkade 175 The Hague (Netherlands)

1977. Twin symposia (North America and Europe/USSR) on *Winter injury and Rootscock Breeding*

Inquiries: Dr. F. R. Tubbs c/o John Innes Inst. Colney Lane Norwich NOR 70 F UK

1977. April 11-16 San Diego (USA)

7th International Colloquium on Plastics in Agriculture

Inquiries: Mr. B. Hall. University of California,Agricultural Extension Service, 5555 Overland Ave. San Diego Calif.92123 (USA)

1977. April Antibes (France)

Symposium on Carnations (ISM)

Inquiries: M. J. Garnaud, 14 ay. Ste Marie, 94 Creteil (France)

Debut Mai 1977. Sheraton Hotel Orlanda (Florida USA)

IInd International Citrus Congress

Inquiries: H. Reitz,President ISC. Agricultural Research and Education Centre **P 0 Box 1088 Lake Alfred 33850 Fla USA**

1977. May 9-14 Madrid (Spain)

18th International Seed Testing Congress

Inquiries: ISTA Secretariat Box 68, N-1432-Ails-NLM-Norway

1977. July 11-13 Munchen (RFA)

IiIrd International Meeting on Grass and lams

Inquiries: OeutscheRasengeseelschSt c/o Institut fur Planzenbau 5300 Bonn I **Katzenburgweg 5 (RFA)**

1977. September 4-10 Tokyo (Japan)

26th International Congress of pure* and *applied chemistry

Inquiries: 26th Congress of IUPAC-PO Box 56, Kanda Post Office,Tokyo 101-91 Japan

1977. September Nottingham (UK)

ISHS Symposium on seed problems in horticulture

General topics: 1)Seed production 2) Special germination problems, 3) Health and vigour, 4) Improvement of seed performance, 5) Special features (storage-testing techniques thermogradient and other devices)

Inquiries: Dr. W. Heydecker-University of Nottingham School of Agriculture and Horticulture. Sutton Bonington-Loughborough LEIZ -5RD England UK

1978. August 15-23 Sydney (Australia)

20th International Horticultural Congress

Inquiries: Secretary of Congress- G P 0 Box 475 Sydney N S W 2001 (Australia)

1982. Hambourg (FRG)

21st Internationa Horticultural *Congress*

Inquiries: Prof. D. Fritz,Institut fur Gemusebau 8050 Weihenstephan-Freising/088, Germany, Fed. Rep.

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We thank, in advance,all those who will be sending us reports or news to print in coming issues.

R. JACQUES and N. De 8ILDERLING