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PHYTOTRONIC NEWSLETTERS N°4_5_6

Contents

I- EDITORIAL

The first three numbers of the "Phytotronic Newsletter" have been received with pleasure, judging by the letters which we have received. However, we have been obliged to reduce temporarily publication for the following reasons.

In issue Number 3, October 1972, on the suggestion of Prof. R.O. Slatyer. which was adopted unanimously during the symposium at Duke University (May 1972), we asked for financial contributions from Phytotrons and Scientific and Technical Centers.

Since it is necessary to give a receipt to each contributor, it seemed to be convenient to make them out in the name of "Manager of Advance Receipts, CNRS Gif-Sur-Yvette" because we paid the main part of the expenses for the Phytotronic Newsletter thanks to the Administrator of Gif-sur-Yvette. The Administrative and financial structure of the CNRS was incompatible with this procedure, and therefore it was necessary to find another formula and reconsider the forecast use of the first amounts received. We immediately informed the contributors who wrote to us and just now we are able to say that we can solve this problem, but this new organization will still take several months to put into effect and will be announced as soon as possible. That is the reason why we have delayed the next issue of the Phytotronic Newsletter.

Instead of three numbers which have been foreseen for 1973: January, May, and September, we are sending today, for economy sake, jus t one bulletin which contains numbers 4, 5, and 6 dated November 1973. As in the past time, the financing of this issue will be paid out of the budget of the Phytotron of Gif-Sur-Yvette, as their participation to phytotronic activities. We heartily thank here, again the first contributors* and we thank in advance, future contributors

*Received contributors:

1972	Percival Manufacturing Co. USA	100 $
1973	Hokkaido National Agricul. Station Japan	50 $
	Station Amelioration des P1antes Gembloux (Belgium)	25 $
	Commonwealth of Australia	100 australiens
	Ets Rutner (Vienne, Autriche)	100 $
	Agricultural Research Council (London)	2 £
	Westinghouse Electrical Corp. USA	50 $
	CNIH Paris	100 FF
	Comitc des Plastiques, Paris	250
	L'Humidifcre, Vasles	20
	Heraeus, France	300
	Ets Tizier Freres, Valence	75
	Sapratin Seavom, Paris	500
	M. Scialom, Fouju (Yvelines)	100
	Association Sportive Culturelle do Chateaulin	50

and, finally a proposition of exchange with Revue "Agronomic Tropical" of IRAT.

and hope that with your participation, according to Duke University resolution May *1972*, the next issues of 1974 will be payed for as expected, the Phytotron of Gif--sur-Yvette thus will only complete necessary expenses, and an annual report of expenses and contributions will be given.

As indicated in the contents, he have analysed several meetings of which

a) 3 scientific and technical: ISHS symposium of Hannover and Geisenheim and colloquium of Martonvaser on winter hardiness of cereals.

b) 2 on horticultural practice: HORTIMATof France; and HortiProgress 72 at the Hague.

Finally, the Director or the most recent Phytotron, that of Martanvasar (Hungary) very kindly sent his paper for our readers on the Research strategy of the Martonvasar Phytotron. It would be very Interesting if Directors of other Phytotrons sent us remarks or notes on the sane subject, because it is such comparable subjects which have an enormous interest for all Pbytotronists.

As for the meetings analysed, it seems that it is opportune and indispensable to underline the utility of meeti.ngs like Hortimat or HortiProgress which unify around the same subject, horticulture, researchers, scientists, technicians, horticulturists and also engineers or fitters. Their utility is evident for all, especially if enough time is reserved for friendly and open discussions. The main interest is the rapid application in horticulture; but researcher's, scientists and fitters as well must have better idea of' the needs and actual practical problems which must be urgently solved.

Thus, we hope to receive papers on "horticultural practices", such as reports of meetings, or papers about pertinent problems in the same area, from which studies could be proposed to Laboratories or Research stations having Phytotrons or controlled environment installations.

With your cooperation, in furnishing papers which will be reprinted for general interest, our next issues of Phytotronic Newsletter will cover entirely the subject, Phytotronics in its double meaning as a new method of scientific research but also as a modern technique for research needs

II – BASIC PROBLEMS OF PROTECTED VEGETABLE CULTIVATION

ISHS Symposium - Hannover (P.R. Germany) September 13-16, 1972

It was Prof. LECRENIER, Chairman of the Commission on Protected Cultivation from ISHS who proposed to organize this symposium, Mr. van KOOT who took the practical initiative of organization, and Prof KRUG who agreed to undertake the preliminaries in Hannover. Due to the opportunity of holding this symposium at the same time as the joint meeting of the Executive Committee and the Council of the ISHS, several members of this organization were able to take part in it and to note the excellent organization and the perfect evolution of this symposium. About 75 participants from 21 countries attended the meetings which took place at the Institut fur Gemusebau der Technical Universitat Hannover.

At this meeting participants found an important concentration of horticultural research, historical gardens, and modern production of ornamental plants and vegetables, but particularly a friend1y atmosphere and cordial welcome. The lectures as well as the institutes visited during the session remindcd us of the fact that research work needs more and more technical equipment and, therefore, becomes more and more expensive. Due to these reasons, too, good and close international collaboration and careful mutual agreement are the basis of future successful research work. The main work of ISHS concerns applied research whose aim is to serve horticultural production and the welfare of men.

During the session all participants observed that all need better mutual contacts between specialists involved in plant physiology, applied boLany, horticultural science, *and* test and control technique. ISHS on the other hand, needs closes contact with the "Commission on Growth Chamber environments" of the ASHS (USA).

The symposium was made up of 5 sections:

Section 1, Growth chambers, means for analysing plant growth and development. Chairman : N. de Bildcrling (France), 7 conferences

Section 2: Transferability of results obtained in growth chambers, Chairman : L. OTTUSSON (Sweden), 4 conferences.

Section 3. Control of plant growth and development by the root environment., Chairman : R. BROUWER (Netherlands) , 3 conferences.

Section 4. Control of plant growth and development by climatic growth factors. Chairman: P. GAASTRA (Netherlands) and A.E. CANHAM (United Kingdom), 10 conferences.

Section 5. Growth simulating models as a tool for plant growth analyses and control. Chairman: E.G. NIEMANN (F. R. Germany), 1. conference.

All conferences of this symposium will be published in Acta Horticulturae n° 36 of Technical Communications of ISHS.

SECTION 1. Growth Chambers, means for analysing plant growth and development

1) The design and use of growth chambers for investigating the effects of environmental factors on plant growth and development.
B. ACOCK (United Kingdom)

In choosing or designing a growth chamber an experimenter decides what environmental factors are to be controlled, over what range, and with what accuracy. Attention is drawn to the difficulties of obtaining adequate duplicated of environments in space or in time and hence the difficulties of making a statistical analysis of cabinet data.

2) Experiences with the BBC York air conditioner EVX, System.
Dr. REICHART. H. SOCHTIG (F.R. Germany)

Short description of the construction and regulation of a unit of this system. Precisions temperature ± 0.2 without light and ± 0.3° with light; humidity ± 3 % RH. Electric energy consumed varying between 107 and 159 KW for 24 hours.

3) Apparatus for plant gas exchange measurements with micro-chambers and its suitability for physiological studies. A. PAPENHAGEN _ _ Germany)

Description of construction and function C02 exchange is measured by the reference method and transpiration by the compensation method. This apparatus is used for moderate short time experiments. Description of results.

4) Cells for automatic cultivation in artificial atmospheres.
M. ANDRE et al (France).

Discussion of the method and equipment developed for agronomical research and the need to combine automation and data processing techniques with growth cells. Illustration from corn cultivations carried out up to maturity in an artificial atmosphere. Typical curves of hourly and daily CO_2 consumption are given

5) Growth chambers with dewpoint controlling system construction, function and experiences. H. KRUG and H.J. WIEBE (F.R. Germany).

Description of construction and function of 9 Weiss growth chambers used for polyfactorial experiments with tall plants in the Phytotron. In each chamber (2 x 2 m) there are 33 fluorescent lamps; air speed varies from 0,2 for small plants to 0,6 m/sec for tall plants. Temperature constancy ± 0,2°C and controllable from + 3° to + 40°C. CO_2 is be provided by adding fresh air.

6) Phytotronics and horticulture. N. de BILDERLING (France),

Discussion of the complexity of the reactions of plants to environmental factors, especially : temperature, light, atmospheric water and humidity, carbon dioxide, wind-velocity (air flow) and direction of wind displacement. The use of Phytotrons and Phytotronics can provide useful information horticulture. Some ideas are given on the ways by which phytotronics can tackle horticultural problems.

7) Controlled environments for vegetable production : Physiological and engineering aspects D.T. KRIZEK et al. (USA)

The greatest acceleration in seedling growth and development (lettuce, tomato and cucumber) was obtained by combining high intensity fluorescent lamps with 20 % incandescent light (in watts), giving a total of 43 Klx for 16 hours under a fairly high temperature (30° day-24° night), CO_2 enriched atmosphere (1000-2000 ppm), air flow (10-15 m/min) 65-70 % RH, and high nutrient levels (0,5-1,0 g/liter : 20-20-20) with frequent additions of fertilizer (4 to 6 times daily). The acceleration in growth produced in the controlled environment persisted after the plants were moved to the greenhouse or transplanted outdoors.

SECTION 2. Transferability of results obtained in growth chambers.

1) Transferability of results obtained in growth chambers to greenhouses or field conditions. P. GAASTRA (Netherlands .

Plant performance is a function of various primary reactions of plants to the environment and of succeeding chains of complicated biochemical and biophysical processes, In most cases it is impossible to establish the effect of a factor on the plant, because frequently several parameters exercise an influence but with various relative importance. Growth chambers offer great possibilities for horticultural research when control of environmental factors is used to induce in. the plant primary reactions which are found in greenhouses or in the field. Various methods for the measurement of environmental parameters are possible ; there are methods which permit daily measurement of plant growth, without destroying the plants.

2) Physiological problems of experiments in growth chambers. H.J. WIEBE and H. KRUG (F.R. Germany).

With cauliflowers plants when the humidity is too high, the veins of the young leaves turn brown. When temperature and humidity are kept constant, glassiness and later decay of the cauliflower curds set in. Both symptoms are caused by a lack of calcium in the damaged tissues. The lack of calcium in the leaves can be eliminated by a high rate of transpiration.

3) Responses of Phaseolus vulgaris to temperature in growth enclosures and in the field. R.C. HARDWICK (United Kingdom).

In the field, Phaseolus vulgaris from early sowings were smaller, at emergence, than were plants from late sowings. In controlled environments it was shown that this effect is due to low temperature during germination and early growth. It is possible to choose Phaseolus vulgaris seedlings in climatized growth enclosures for their ability to grow at low temperature.

4) Effect of some simple temperature programs on Spring-wheat.
B. BRETSCNEIDER-HERRMAN F.R. Germany

Structure of yields and some physiological data show differences between varieties and the temperature programs : number of grains per ear, weight of 1000 grains and number of ears per pot. For Spring wheat a program with 5 phases and 2 daily temperatures give a yield structure, yields and physiological data very similar to what is obtained from a "nature like" program. With oats however, experiments give other results and therefore the results from wheat can not be transferred to other crops.

SECTION 3. Control of plant growth and development by the root environment.

1) Control of plan growth and development by the root cnvironment (excluding nutrition factors). J.F. BIERHUlZEN (Netherlands)

Short survey of: methods for root growth studies; root growths, shoot-root ratio and the effect of soil factors on the root growth.

2) Influence of soil water content and soil temperature on leaf elongation and - photosynthesis of maize. R. BROUWER (Netherlands)

The rate of leaf elongation. is much more sensitive to drought and low root temperatures than the rate of photosynthesis. Hence, the reduction in dry matter production is quantitatively ;.lore important in freely growing plants than in closed crops.

3) Influence of. root temperature on growth of young cucumber- plants.
E. FOLSTER (F.R. Germany) .

The development of plants are markedly influenced by different soil and air temperatures as well as by an increase in light intensity. A root temperature of 25° C in greenhouse conditions is in most cases the best. The higher the soil and air temperature the more unfavorable because the Mg content of the cumber plants

SECTION 4. Control of plant growth and development by climatic growth factors.

1) Control of plant growth and development by climatic factors.
H.J. DAUJNICHT (F.R. Germany)

The CO_2 requirements of plants is not sufficiently known. For cucumber and tomato C02 supplied at a young stage is beneficial. Night optimum of CO2 is unknown. It is useful to apply CO2 at early stage of vegetation during short periods. At the end of vegetation a supply of CO2 delays shoot abscission.

2) Some_effects of C02 air temperature and supplementary artificial light on the growth of young tomato plants. A.E. CANHAM (United Kingdom).

After three winter seasons' experiments, supplementary light was the most effective single factor for improving the rate of plant growth, the time to first flower and the early crop. Effects of other factors vary with seasonal conditions.

3) Effect of environmental factors upon transpiration. Y. HANAMI (Japan).

Transpiration and the resulting energy exchange in the biosphere is remarkably affected by surrounding factors such as air temperature, relative humidity and wind velocity.

4) Ana1ysis of the subsequent growth and development of wintcr-glasshouses lettuce in response to short periods in growth chambers During propagation W.M. DULLFORCE and J.D. DENNIS (United Kingdom)

Raising plants in artificial conditions not only produced an increase in dry weight at planting time, but influenced the type of head produced, in spite of the intervening weeks of low light conditions in the glasshouse. The gain in time to heading amounted to about 20 days as a result of 10 days in the growth cabinets at 17 Klux (warm white fluorescent lamps) provided in 16 hours days.

5) Phytotron cultivation of Pinus sylvestris L. provenances. J. DORMLING (Sweden).

Optimal temperature conditions include a relatively high day temperature and a night temperature 10°C lower than the day temperature. The best light period was 18 h for northern provenances and 16 h for southern ones.

6) Determination of treatments to be used in growth rooms. P. NEWTON United Kingdom

Growing rooms and bench lighting units with fluorescent tubes use in most cases 12 hours photoperiods._ It is possible now to predict the size of tomato and lettuce seedlings grown at temperatures between 15°C and 25°C and in up to 9 times normal CO_2 concentrations.

7) Production of tomatoes in plastic covered greenhouses in Manitoba. J.D. CAMPBELL Canada

Production of tomatoes in plastic greenhouses is economically feasible, The yield of marketable fruits was 4,5 to 5,5 Kgs per plants for the Spring crop.

8) Fresh weight and flowering of tomato plants as influenced by types_of containers and watering conditions. D. KLAPWIJK (Netherlands)

Fresh weights increased with the wetter conditions. Wetter grown plants had lower dry matter percentages. Initiation of flower buds was enhanced in the larger plants under wetter conditions.

9) Correlation between plant weight characteristics of young tomato plants. P.J.A.L. de LINT (Netherlands).

In propagation experiments, growth is the all important reaction; plant quality is only a minor aspect. Dry matter production. can be satisfactorily determined by weighing the fresh shoots. The amount of leaf material can be determined in relation to the total fresh shoot weight.

10) Experiences in the use of an IL 150 plant growth photometer in horticultural applications. E. KAUKOVIRTA (Finland).

Comparisons of data obtained by simultaneous measurements with a solarimeter and IL 150 photometer and analysis of plant growth responses in measured light conditions. Special emphasis is laid on the question of whether any additional information can be obtained about plant growth responses to light using an IL 150 photometer compared with the use of solarimetric data.

SECTION 5. Growth simulating models as a tool for plant growth analyses and control.

Simulation of crop yield processes. B. SCHNEIDER (F.R. Germany).

The different mathematical approaches to the simulation of crop yield processes, their limitations and interpretations are discussed and demonstrated by examples. These approaches are divided in 4 points: 1) simulation by differential equations and systems of differential equations (ex. Mitschlerlich equation), 2) simulation by stochastic models especially theoretical occupancy models (ex. Linser extended by Herrmann), 3) simulation with dynamic systems (ex. De Witt), 4) simulation by optimization procedures (ex. Linear programming methods.

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D. FRITZ (F.R. Germany), Chairman of the Section for Vegetables of the ISHS, gave the closing speech of this Symposium. He sent especially for our readers 4 pages from which are drawn the following main selections :

"The papers which were presented during the last few days proved again that we still need further technical progress with function and automatic control of growth chambers. The two most important goals or guidelines are :

1 to develop the basis for fully automatic plant production in greenhouses. In this case we must be able to transfer the results gained in growth chambers to greenhouses. Much will still have to be done in this matter.

2. to produce plants under artificial conditions only, as has already been done in experiments in several places (among others, I remind you of Prof. Moskow's studies . I conclude from several of the papers that by now we are still unable to find an ecological and economical optimum or even maximum at the same time for all of the different growth factors. Among others, further studies on the optimum size and on the conformity of plant nutrition. with environmental conditions of the growth chambers seem to be necessary. Such experiments including a great number of different factors account for the high amount of costs for personnel and material. We will have to try reducing these costs by co-operation among different research stations".

"Many details were dealt with in the lectures presented. Thereby contradictory statements have also become evident. Our increasing individual knowledge has to be concentrated, in order to be integrated. In most cases the different growth chambers demonstrated in the lectures have to be used during the next 10 years without any possibility of essential technical change (for standardization). Consequently, we will have to try standardizing the methods of measuring the climatic factors in order to r.-take the results comparable. The conditions under which experiments are being carried out have to be described very exactly. Dr. BOTTLANDER suggested using a check list for scientific research and for papers presented at symposia. This check list should include the essential factors to be compared. Auditors and speakers will then be enabled to more easily compare the results of different experiments or to comparably demonstrate their own results. As we were informed today, this idea has already been realized in a similar way by the A.S.H.S., Committee on Growth Chamber Environments. They have been published as "guidelines" in the A.S.H.S. journal "Horticultural Science" vol. 7(3), June 1972. It should be seen whether these guidelines will meet the purpose proposed by Dr. Bottlander".

"I am sure that there exist still a lot of proposals on future work. Please submit suggestions to Prof. KRUG or to the Commission on Protected Cultivation_."

"I close my speech with my hearty thanks to the organisers and participants. I wish you all successful scientific collaboration beyond all borders. See you again in Warsaw in 1974".

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Editor's note. As we received from D.T. KRIZEK (USA) the guidelines of ASHS we are very happy to reproduce them, partially, as follows. Phytotronic Newsletter welcomes your comments or other suggestions for publication. Please send them to us. Thank you.

P. CHOUARD and N. de B] LDERLING

Guidelines for Reporting Studies Conducted in Controlled Environment Chambers

ASHS Committee on Growth Chamber Environments (Reproduced from : Hortscience, Vol. 7 (3) June 1972.)

The following guidelines are proposed for reporting research conducted in plant growth chambers, especially for physiological studies. Greater detail concerning environmental conditions is being requested because similar studies conducted in different laboratories often result in different rates of plant growth and development. Investigation has demonstrated that these differences can be attributed to variations in certain factors of the environment, including soil temp., humidity, carbon dioxide and air movement that often are unreported. Only when all factors in the environment are adequately described can studies be compared or the experiment be repeated in another laboratory. Hopefully, use of the following guidelines will enable investigators to achieve these objectives. The model paragraph outlined below can be filled in and utilized for detailing the environmental information in research articles.

Guidelines

Light (Klx)

a) Minimum requirements

1 Lamp types and percent input wattage for each type.
2. Light meter readings at beginning and end of each experiment, indicating type, manufacturer, and model of meter used (preferably cosine corrected).
3. Location of reading in relation to plant height.
4. Photoperiod. Indicate if lights are turned on gradually or abruptly ; if gradual, indicate program.
5. Indicate whether a barrier is used between lamps and growing area, and type of material.

h) Desired additional information

1 Manufacturer and designation of lamp. a) for incandescent lamps, indicate lamp voltage and line voltage, b) for fluorescent lamps, indicate loading, 800 MA 01 1500 MA.
2. Fluctuations in light readings during the experiment.
3. Gradient in light intensity over the growing area.
4. Frequency of light measurements.
5. Spectral energy distribution : total radiant energy per given wavelength band (µwatts/cm2/nm) ; or ratio of visible to infrared radiation, indicating instrument used.

Temperature (°C)

a) Minimum requirements :

1 Air temp in plant area with a shielded sensor. Indicate type and location of sensor in relation to the plants.
2. Soil temp and indicate type and location of probe.
3. If day-night temp change is gradual, indicate program.

b) Desired additional information :

1. Leaf temp reading, indicating method of measurement.
2. Total radiant energy, indicating instrument used, and range of measurement.
3. Gradient of air temp over the growing area.
4. Record of soil temp in relation to light and dark cycles

Humidity (% relative humidity)

a) Minimum requirements :

Day/night level and indicate whether a separate monitoring instrument is used.

b) Desired additional information

1. Fluctuations from established level, including fluctuations with temperature and humidity cycling
2. Indicate type of sensor.

Carbon dioxide (ppm)

a) Minimum requirement

Indicate whether fresh make-up air is added.

b) Desired additional information :

1. Level and fluctuations during both light and dark periods.
2. Indicate instrument used to monitor and/or control C02 levels.
3. Indicate frequency of calibration of CO2 analyzer.
4. Indicate quantity of fresh make-up air.

Air movement m min

a) Minimum requirements

1. Air flow rates at top of plant canopy and direction of movement (up, down, or horizontal)
2. Instrument used.

b) Desired additional information :

Variations in air flow rates over the growing area of the chamber, at beginning and end of experiment.

Nutrient and media

a) Minimum requirements

1. Type and size of container
2. Type and source of media
3. Water utilized in preparation of nutrient solution (distilled, demineralized, or otherwise)
4. Water used in watering plants and frequency of addition
5. Nutrient solution utilized, conc. of each element and frequency of addition. Specify iron source used.
6. With liquid culture, indicate whether nutrient solution is added to existing vol or completely renewed.
7. Indicate charges in nutrient schedule or conc. during course of experiment.

b) Desired additional information:

1 With liquid culture, indicate conc. of nutrients at time of replacement and at conclusion of experiment.
2. Culture solution pH.
3. Tissue analysis.

III- HORTIMAT

Orleans (France), September 15-17 1972

From September 15 to 17, 1972, Orleans, important horticultural Center in France, was the center of important demonstrations which we hope will take on an international character.

Anyone who visited this important exhibition called "Hortimat" in the "Pare des Exhibitions" could see that Orleans was a Horticultural Center of world reknown and that Horticulture and nurseries have great economic importance for this region as well as for France.

Mr. TURBAT, President of "Orleans Horticultural Union" characterized this manifestation in these words :

"We would remind you that this meeting has become biennial and that this year it includes 122 exhibiters, of which ten are foreigners, as compared with 84 two years ago, which attests to its rapid evolution.

"In addition its organizers wanted it to become an Exhibition of Innovation and for this reason a professional jury had the difficult task of awarding prizes for the most advanced equipment in use and the most efficient."

Mr. TURBAT concluded "Thus Orleans found itself for three days a center of assembly for all French Horticulture, and even European, and in this way endeavored to enlarge its reputation as a Horticultural metropole of international reknown."

If we look back on these three days one must concluded that all aspects of Horticulture were touched upon :

1° Exhibition.

There are 9 000 square meters of Hall and two hectares of land around the Orleans "Palais des Expositions" where about 10 000 visitors from all French regions and abroad were able to examine, in detail all necessary equipment for horticultural farming. It should be to stressed that constant effort was required on. the part of the organizers to find new manufacturers working in horticulture who presented a large collection of diverse machines.

26 Demonstration

Hortimat did not forget its primary objective : direct demonstration in the field, and in nurseries.

The organizers did a good job in this area, however unfortunately some of the exhibitors did not understand that a horticulturist likes to see the equipment working before deciding to buy it.

Let us hope that there will be many more demonstrations in the coming years.

3°) Innovations

For the first time Hortimat organized an innovation competition

ti ti on More than 25 machines were presented and a national jury made up of professionels had the difficult task of choosing the equipment which was most advanced and most efficient. All innovations were of great interest and rating them was very difficult.

4°) Materials specially adapted to Orleans professionals.

Within the framework of Hortimat, and for the first time, there was a special presentation of materials and machineries adapted by professionals from Orleans. If this presentation was considered dull by some, one must remember that this first attempt can be developed further given the interest shown in it.

5° Plants

On 430 square meters, and under the auspices of the Orleans Horticultural Union professionals, whether nurserymen, horticulturists or vegetable growers, added a colorful and above an professional note to the exhibition.

6° Daylong working session

Hortimat would not have been complete without a day long working session for professionals, which brought together 250 participants from various countries and with different specializations scientists, technicians, manufacturers and professionals,

The Objective of this working session was to survey: the rational use of greenhouses and means of greenhouse regulation.

We shall give here only a brief summary of the lectures. Full texts *will* be published in a special issue of the French revue "Pepinieristes, Horticulteurs, Maraichers".

1 - Some reflections concerning thermic aspects of greenhouses and shelters. A. GAC (C.T.G.R.E.F. - Antony, France).

The internal temperature of greenhouses brings about an equilibrium, which can be temporary, between gains and losses of energy with the external environment, and which includes the space above the greenhouse as well as the soil. However if regulation of internal temperature is a necessary condition it is not enough; on one hand, if one must furnish a certain amount of energy in the form of light to plants and on the other hand, the greenhouse climate is defined by its temperature and also by its relative humidity and CO_2 level.

In greenhouses energy exchanges are complex and bound up with each other. They are complex because they bring into play all kinds of transmission, by light radiation and infra red conduction as well as by convexion on the surface and through greenhouse walls when the sides are not completely tight. In addition each transfer is dependant upon other types of transmission.

After having elaborated on various forms of energy transfers in a greenhouse as well as the means of modifying the energetic balance of a greenhouse, Mr. GAC concluded, stating that :

"Problem of heat in greenhouses is not so simple, but just because it is complex does not mean it should be ignored ; on the contrary, because by choosing carefully greenhouse properties, one can increase their profit earning capacity. Moreover, and this is essential, the producer must define exactly what he expects from a climatic modification and not afterwards claim or hope for better performances than those he foresaw

2 - Some ideas on light and greenhouses. Dr. A. NISEN (Gembloux, Belgique)

The needs of plants for light cannot be considered separately but in relation to a temperature conditions at the moment, water balance, etc.

The greenhouse plays, above and before all, the role of "wind break" and must allow for improving the water balance of the plants.

There is rarely too much light ; there is often too much heat, and the "shade" must then eliminate the heat (solar infrared) without reducing the intensity of the visible sunlight.

It is above all visible light which has an effect on photosynthesis, but this action is still not well known, because the amount varies from one plant to another. The ideal is to capture the maximum light without modifying its quality.

Consequently, a greenhouse does not always constitute an improvement on the natural climate ; on the contrary, generally, it produces very high losses of light in relation to that which is outside.

The choice, then, of form, orientation, and material for the sides and roof must be very carefully adapted to the plants being cultivated.

3 - Reflections on. greenhouse regulations. J.M. LEMOYNE DE FORGES (ENSH (Versailles, France).

The objective of regulation is to maintain the desired value to regulate, as near as possible, to the amount required independent of the external climate (temperature, wind, rain, etc.). The problem is to maintain the smallest difference in spite of disturbances, such as, variations in energetic exchange between cells and the outside air. It is necessary to discover the difference, as soon as possible, to evaluate it. and act by sending an order to an apparatus which determines the amount of regulation necessary.

There is, then, successively, detection, comparison, elaboration and transmission of an order, which have as a final effect, the displacement of something in an apparatus.

4 - <u>Typs of greenhouses-State of. Normalisation</u>, P. BORDES (ENSHS, Versailles, France).

For greenhouses the need to establish official norms appears as a consequence of the actual market and capital involved.

For the time being this normalization only is concerned with the:

-Improvement of relations between interested parties by increasing the precision of estimates and other contacts.

-Increase of security and quality of construction, particularly, regarding climatic dangers.

This Hortimat demonstration organized by the Technical Services of "Federation Nationale des Producteurs de l'Horticulture et de la Pepiniere" and by the "Comite de Developement Horticole de la Region Orleanaise" needs encouragement. As Mr. DEBROISE, President of the "Association Internationale des Producteurs de l'Horticulture," stated in his address : "It is necessary that Hortimat become a Center where all French horticulturists can find profitable materials learning".

For our part, as we have said elsewhere, about Hortiprogress, we hope that the next Hortimat exhibition, which will take place in 1974, will find a larger audience, especially for its daylong working session is a which certain sign of progress and evolution of Horticulture and its methods on a national level, first, and an International one afterwards.

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IV- SYMPOSIUM ON "WATER SUPPLY UNDERGLASS AND PLASTICS"

Geisenheim F.R. Germany, 18-20 September 1972

This symposium was organized by Professor H.D. HARTMAN at the Institut fur Gemusebau and the Institut fur Zierpflanzenbau at Geisenheim with about sixty participants from 18 countries. Texts of lectures will be published in no 37 of "Acta Horticulturae" Technical communications of ISHS. But one can read a fairly complete summary of this meeting by A. NISEN in the French revue *Pepinieristes, Horticulteurs, Maraichers" (P.H.M., 1972 no 131, p. 62-72. Au Symposium "Eau sous verre et plastique a Geisenheim").

During the introductory lectures, HARTMAN and FRITZ underlined the importance of water in the greenhouses and shelters which constitute one of the most important problems at the present time. In spite of the current interest in problems of water in greenhouses There are very few specialists of directly interested by this subject, especially for popularizing the subject and for contacts with horticultural practice.

The meeting was divided into 6 different topics :

Topic I - Basic problems of water balance. Chairman : J.G.V. ONSEM, Belgium : 4 lectures.

Topic II - Water and nutrition supply in relation to plant. Chairman : P.D. FRITZ, Germany : 3 lectures.

Topic III - Water application system with respect to plants, Chairman A. KLOUGART, Denmark, 6 lectures,

Topic IV - Sources and quality of the irrigation water. Chairman B. ACOCK, United Kingdom, 2 lectures.

Topic V - The quantities of irrigation water. Chairman : L. OTTOSON, Sweden, 2 lectures.

Topic VI - Water control and measurement. Chairman : J. APELAND, Norway, 3 lectures.

We will give a brief analysis below of the lectures on the basis of summaries distributed to participants as well as the article by NISEN in PHM publication. Some summaries are not given.

Topic I - Basic problems of water relationship.

1) Water supply to glasshouse crops in the western part of Netherlands. C.I. van der POST Netherlands

The author estimates at approximately 500 mm the average water needs for plants in Holland in cold greenhouses and at about 700 mm, in heated greenhouses, especially for tomatoes, cucumbers, roses and carnations. The relationship between solar radiation and water supply is formulated.

2) Integration of watering , s rink1ing and C02 into the greenhouse program. A. KLOUGART Denmark

There is a relation between insolation, C02 absorption and transpiration of plants. The order in which one intervenes (by shading, ventilation or spraying of water) when the temperature becomes too high in the greenhouse, is not without importance, because these three techniques, seem to influence differently the water loss of the plant and to act differently on its "stress". Therefore, it is preferable for cucumber, tomatoes and poinsettias to shade them at 21°, then to ventilate at 24° rather than to ventilate at 21° and then shade at 24°. The inverse situation is observed with chrysanthemums. It is better to spray, then shade, them, and only to ventilate when temperature rises under the glass instead of attempting other combinations of these operations.

3) The development of water deficit in sweet pepper (Capsicum annuum L.) in interaction with different water doses in a medium of polyethylene tunnels. V. SCHMELA (Czecoslovaki).

An apparent gradient for a deficit of water saturation VSD) in the plant was found. Pepper plants grown at a low level of soil moisture obtained a xeromorphic character and there was a distinct preference for water by the youngest plant organs. A relatively high VSD as well as a net gradient between the upper and middle levels caused various changes in metabolism. Plants grown at higher irrigation rates showed lower VSD values and the minor variations in its gradient proved that a steady water balance is linked to larger plant production.

4) Watering problems under glass and plastic on the Canary Islands. D. AHLERS (Germany)

No summary.

Topic II. Water and nutrition to plant.

1) Moisture supply and fertilization of pot plants. R.A. BIK (Netherlands).

Pot experiment with Gloxinia (Sinningia speciosa). Average yield of dry matter was best at 40 % of the water holding capacity, decreasing markedly with increasing water stress. Increasing soil moisture stress also depressed yield increment per unit nitrogen. The same absorption of nitrogen by the plant can give quite different yields, depending on the humidity of soil (that is to say, the possibility for plants to find water) as well as on the salinity of the substratum. To promote the effectiveness of nitrogen in pot plants the substrate should be kept as moist as possible without endangering the air supply to the roots.

2) Some aspects of water and fertilizing relationships in peat culture of tomato. B. NILSSON (Sweden).

In a glasshouse experiment with tomato (Minerva) grown in peat, different watering regimes and N : K ratios on two depths of peat, were studied. The yield and number of fruits increased significantly with the depth of the peat layer. The increase was highest on peat with low potassium supply. The higher water regime caused a small but not significant increase of the yield. The weight of the fruits was not affected by the factors studied.

3) Determination and study of the water availability of substrates for ornamental plant growing. 0. VERDONCK et al. Belgium).

In the Experiments with ficus in pots a marked difference in growth was observed with different water levels and hence the range of water tension for optimal plant growth could be determined. Once the proper limits for the amount of water to be used was fixed, a special device, a filter plate tunnel system, was constructed to determine in the laboratory the water availability of the substratum. With this technique different organic as well as inert substrates were examined. So, a practical way is now available to calculate one of the very important aspects of the substratum, the optimum amount of water to be used for ornamental plant growing.

Topic III. Water application systems with respect to plants.

1) Studies on the water regime of the carnation Sim. V.G. ANGELIEV. (Bulgaria)

No summary.

2) The effect of soil moisture regime on rose Production under protected conditions. E. SHMUELI et al. (Israel).

Maximal flower production of Baccara roses of 150 flowers per 1 m2 in 69/70 and of 185 in 70/71 was obtained in sandy loam which was placed on top of the local soil and irrigated so that the soil moisture potential did not drop below -5 centibars. There was a decrease in yield seasons when the water potential was lower. The distribution of flower grades was unaffected by irrigation regimes in this growth medium.

3) Comparison of methods of water supply in hothouse tomatoes. I.v. d. ENDE (Netherlands).

Methods analysised : 1) normal sprinkling, 2 strip sprinkling, 3) trickle irrigation, 4) lay flat tubes and, 5) perforated pipes. The normal sprinkling method is less satisfying than the new methods of water application. It is likely that with the new methods there was a more regular supply of water to the crop. The water was applied more frequently and brought more closely to the roots.

4) Experiments with an automated watering technique on the principle of capacitive moisture measurement. F.W. FRENZ (Germany).-

Automated watering and fertilizing equipment for vegetables in 10 liter pots is described. Automatically a tensiometer is connected to a control apparatus, a relay and a magnet valve, to regulate the moisture of the substrate. Watering is carried out by trickle irrigation. By this method in summer within 110 days, 6,2 kgs of tomatoes per plant were collected. Drawbacks were : calibration, determination of reference values and homogenity of soil in pots.

5) Hydroponic culture techniques in industrial horticulture. J. RUTHNER (Austria).

No summary.

6) Economic Evaluation of a greenhouse irrigation system.
D. KARMELI (Israel).

No summary.

Topic IV : Sources and quality of the irrigation water.

1) The influence of saline irrigation water on some vegetables grown in greenhouses. C. SONNEVELD Netherlands

For vegetables grown in greenhouses it is necessary to have available irrigation water with a low salt content. The results for lettuce, tomatoes, cucumbers, and spinach are discussed. If the electrical conductivity of the irrigation water is increased with 1 mmho/cm (25°C) the yields of lettuce, tomatoes and cucumbers decreased 4,7 and 14 per cent respectively. The spinach yields did not show any difference. Sometimes crop quality was affected adversely. In case of lettuce, for instance, addition of sodium chloride to the irrigation water greatly increased the occurrence of tipburn. The uptake of several nutrients was influenced by the salt content of the irrigation water and varied with climate conditions.

2) Contribution to the study of the problem of evaluating the quality of irrigation water. N. VUCIC Yugoslavia

Comparative evaluation of water quality for irrigation by different methods shows that there are certain disagreements about the methods, which may be misleading in making decisions about the utilization of water. In certain cases the results obtained differ diametrically. Though there are numerous evaluation methods (about 40), it is not sufficient to rely on the criteria of only one of them. This is especially so when the quality determined by one method is of a borderline nature.

Topic V : Quantities of irrigation water.

1) Water relationships of lettuce crops under glass.
W.M. DULLFORCE (United Kingdom).

The situation concerning irrigation of lettuce crops in glasshouses is reviewed. Experiment was developed with the aim of studying the effects of various water regimes at three stages of growth : a) during germination, b) during the seedling stage and c) after planting in the greenhouse. A further experiment has analysed growth to maturity following different degrees of stress up to 15 bars applied in the seedling stage, in conjunction with the provision of supplementary lighting during the winter.

2) The influence of irrigation on the yield and nutritive values of sweet pepper Capsicum annuum L, grown in polyethylene tunnels. F. VICEK Czechoslovakia

The irrigation rates applied in polyethylene houses exercised an influence on the formation of pepper fruits. At the irrigation rate of. 8,5 mm the studied varieties gave the highest yields. Greater growth intensity is influenced by more intensive metabolic processes in the whole plant. Dry matter content was decreased by the highest irrigation rate. Formation of L-ascorbic acid was greater at the lowest irrigation rate.

Topic VI - Water control and measurement.

1) Measurement of plant water status in the glasshouse with pressure bomb, P.A.M. HOPMANS (Netherlands

Description of theory and techniques. Experimental data is presented on the relation between soil water potential and plant water potential measured with the pressure bomb and on the relation between leaf diffusion resistance and plant water potential.

2) Evaluation of water requirements from solar radiation measurements. DE VILLELE (France

A relatively simple method has been studied at the Bioclimatological Station at Avignon and at neighboring glasshouse crop growing areas. As previously reported by Morris, it was found that water requirements were closely correlated with incoming solar radiation, passing through glass or plastic covering. The influence of heating or air renewal seems negligible. For practical purposes, the amounts of water required depending on incoming solar radiation transmitted by the glasshouse covering, have been calculated for various crops. This method of predicting weekly water requirements based on incoming solar radiation or sunshine duration measurements is already being practiced in the South of France, at INVULFLEC at Balandran. This method separates the problem of air humidity, which it considers secondary, the water requirements of the soil and plants which is bound up directly with insolation accumulated under shelters. When the latter reaches a certain level (depending upon the plant) it is necessary to supply a certain amount of water which has been calculated beforehand for each crop.

3) An integrating light meter as a tool for the determination of water application to roots and leaves. P. KARLSEN Denmark

This method allows frequencies and durations of water spray to be automatized depending on outside insolation measured by the Light meter described. This Danish apparatus does not seems to be adapted to measure duration and importance of irrigation in relation to soil moisture and to the plants' water needs ; these characteristics are pre-fixed at debatable theoretical means levels.

Use of this light meter according to the method proposed by De Villele should make possible automatized watering which depends on the actual needs of plants at precise circumstances of cultivation and growth level.

Below are some pertinent remarks by Nisen of the PHM Journal.

In concluding this symposium one can consider it hopeful that, on the one hand, we understand far better the importance of the role of water in greenhouses and, on the other hand, that scientists are delving into necessary theoretical research without forgetting about the practical applications of their work. A long and frank discussion and exchange of ideas, such as took place in this symposium, can, only be beneficial to horticulturists. Our only regret was that very few speakers brought up the problem of the relation between hygrometry of air and plant behavior; in what way hygrometry influences the quality of cultivated plants and by what means it influences the yields obtained by the absorption of mineral elements (which is connected to the importance of the root system, in turn determined by greenhouse climatic factors).

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V- HORTIPROGRESS 72

The Hague (The Netherlands), 25-26 September 1972

This meeting was organized by five commercial companies of which 4 produce horticultural plants :

- Riviera Plant Company (RPC) selection and production of chrysanthemums cuttings.
- Klemm and Sohn, carnation and Poinsettia cuttings.
- W. Moolenaar and Zonen B.V. Iris and Freesia Flower Bulbs.
- De Jong Lelies Holland B.V. Lily bulbs.
- J.M. Van der Hoeven N.V.-Greenhouse ccnstruction, heating and regulation.

In the large Congress Hall of The Hague 600 to 800 people from different Countries (experts, scientists, technicians, fitters and businessmen participated in a serious discussion about various horticultural problems, which arose during the "Amsterdam Floriad".

Below you will find a report on this meeting, but it seems very important to draw your attention to the need for more such meetings and the regrettable lack of them particularly in France.

Indeed, similar meetings are the best forum for interesting discussions, exchanges-of information and knowledge, and more direct contact between research and practice it is precisely in this way, that horticulture can profit more rapidly scientific discoveries, and, in return, scientists will find new ideas for reflection and possible discoveries, with the immediate result of increasing production, diminishing production costs, or enlarging horticultural possibilities towards new horizons.

The only regret we have is that too little time was reserved for important discussions which prevented scientists or technicians to satisfy their curiosity about the work of the experts. This certainly limited the information which scientists could acquire in order to orient their research work in all areas: fundamental, applied or technical.

Opening this meeting, A.J. VERHAGE, General Commissioner of. Floriade stated his satisfaction about the meeting because : "it is the first time in the Netherlands that a Congress was organized directly by commercial companies". This attests to a change in the notion of marketing and "selling" becomes instead one of complete cooperation with customers.

Two working days were devoted to four topics :

1) Glasshouses and Glasshouse Climate. Chairman Dr. G.H. GEPMING, 5 papers.

2) Plant and Plant Environment, Chairman : Prof, A. KLOUGART 4 papers.

3) Flowering and Flowering regulation. Chairman Prof. Dr. P.K. SCHENK, 5 papers.

4) Marketing. Chairman : Prof. Dr. C.M. STORM, 4 papers.

From the various papers presented we have tried to give the main or original ideas, based on the collection of speeches distributed to participants, and also on the report published by A. Angiboust in PHM Journal (Hortiprogress 72, un congres d'avenir, PHM, n° 131, November 1972, p. 61-74.)

Topic I : Glasshouse and Glasshouse Climate.

1) Plant and Climate control. Dr. O. BOKHORST (Netherlands)

Plants are grown in glasshouses to protect them against adverse weather conditions. It is necessary to have good and healthy plants. Sometimes, it is useful to give preference to growing processes and, therefore, activate photosynthesis and reduce respiration and sometimes development for flower initiation. Air humidity must control plant transpiration by their stomatas. Greenhouse climate was regulated by heating and ventilation (opening the windows). A switch clock is needed to switch the temperature setting to a higher level before sunrise. This avoids the undesirable situation of too rapid transpiration of plants and maintains a good equilibrium with their environment.

In addition a greenhouse has a great inertia, instead of the rapid variation of sunlight. Carbonic acid gas control is rare. For the author, the most important point is that engineers and horticulturists continue to work as a team. The horticulturist must formulate the requirements of the controls and the engineer must develop controls for these requirements.

2) The glasshouse in the sun. Ir. P.A. SPOELSTRA (The Netherlands).

One rarely hears of light saturation in plants and therefore it is unnecessary to shade greenhouses. Indeed, in an unshaded glasshouse only 60 % of the outside radiation is absorbed by the crop. To avoid overheat and suppress shading mat equipment the author proposes the use of techniques of lowering temperature by means of water pulverisation in the greenhouse. This avoids plant transpiration and lowers temperature by evaporation of pulverized water. Economizing on the expense of shading equipment, this technique is interesting for those in horticultural practice.

3) Carnation cultivation and glasshouse climate. Dr. C. Vonk NOORDEGRAAF (The Netherlands)

Carnation cultivation takes two years of production and the grower who wants to realize a profit, must keep in mind price fluctuations and market the best quality of flowers. For this, one can play with greenhouses climatic conditions and adapt temperature to lighting and to the development of the crop. Carnation flowering is optimum with good light and moderate temperature of 18°C by day and by night in Holland. In this case flowers are big and stems firm. Day temperature must be high (2R°). Low temperatures particularly at night (3°) give rise to "bulheads" because extra growth centers appear.

Carnation plants need light, and its is unreasonable to shade them, but during summer, it is necessary to looser the temperature in the greenhouse by ventilation or cooling. In the Spring an increase of C02 can increase production. Atmospheric humidity is very difficult to regulate, but a rapid rise in temperature of the tubes just before sunrise, by closing the ventilators, is helpful. By controlling these factors, it is possible to obtain a good production of cutting carnations at a time when prices are high and to better utilize maintenance time.

Best financial results are obtained, in a Dutch climate, by suppressing young shoots in April-May, which delays harvesting until September, production during July and August, thereby being greatly reduced. By suppressing young shoots at the end of June, beginning of July, production is delayed until November-December.

4) Climate control for year-round production of chrysanthemums. G.P.A. von HOLSTEYN (The Netherlands).

The growth of chrysanthemums depends as much on its environment, above the ground, as well as under it. Their quality is determined by the number of plants that planted per square meter. If cultivation is too dense the quality of the flowers is diminished.

Chrysanthemums cultivation requires control of at least three factors : light (well known, of course) but also temperature and humidity. To economically lower the temperature in a greenhouse, one generally uses mattress cooling (pad system or aspiration of air through a wet coating) or water spray in the greenhouse. The quality of chrysanthemums is judged by the length and firmness of the stem, the colour of the leaves, the number of flowers per stem, the colour and size of the flower. In chrysanthemum growing we can make a distinction between a vegetative and a generative period with different climate requirements. In most cases, plants in the generative stage and plants in the vegetative stages are housed in the same glasshouse space. In addition, the same glasshouse often houses different varieties, each requiring a special climate. All this, presents serious problems for climate control. The problem of varying the length of day has been adequately solved practice (curtains or incandescent lamps). Control of temperature and air humidity is still meeting with insurmountable obstacles. The most difficult period is the winter months.

As a rule the quality of the chrysanthemum crop in January and February is very poor : stems are too thin, frequently they are hollow and as a result very weak. The number of flowers that keep growing is too small and the flowers frequently have brown hearts. The cause of the difficulties lies in first instance in insufficient light, as a result of which the plants do not assimilate properly. It is necessary to utilize better sunlight and not a rise temperature. It is necessary to note that the most popular varieties need a high night time temperature for flower formation in the generative stage, but this is particularly harmful in a period with little light. Choosing the best varieties, using complementary light, during growing period it is possible to correct part of the difficulty.

In autumn light intensity decreases and outside air is Relatively hot and wet and there is no need for much heating. Air humidity is often high and it necessary to lower it. Growth is very slow and it is necessary to extend the growing period. With planting in mid-September the longitudinal growth remained constant throughout the Autumn. The diminishing light was compensated for by an increase in leaf surface which intercepted a higher percentage of light used for growth.

An important aspect of the quality of chrysanthemums is the firmness of their stems.

In conclusion, chrysanthemum cultivation can only be done in glasshouses with a maximum light transmission. In addition, every effort should be made to make maximum use of the available light, helping to increase leaf surface. It is also necessary to encourage the plant to evaporate in a period of damp and overcast weather. This can be done by traditional heating with open ventilators or by boosting the temperature as it is done to carnations. It means that the temperature of the glasshouse space is raised by 4 to 5°C for about 90 minutes in order to reduce the relative air humidity and to raise the temperature of the plant after turning off heating ; ventilators are gradually opened to let the produced moisture out. This temperature boost must be given as early as possible in the morning. During the day the temperature must be adjusted properly to the available light in order to achieve maximum growth. Automatic control equipment for heating and ventilators responds more quickly to changes in the weather, without necessitating hand intervention.

To obtain maximum light in the greenhouses many speakers suggested using metallic greenhouses with clean glass and keeping away all shading equipment. It is necessary to supervise air humidity because plants increase their evaporation with growth

A German participant has confirmed this fact, adding that chrysanthemum variety "Luyona" breaks down its stems at 35-40 cm height in greenhouses that are too wet. It seems that there is a desequilibrium between soil and air humidity, and insufficient evaporation produces in this variety broken stems in the Spring.

\ 5) Cultural conditions when forcing (early, very early, and Late) glasshouse lilies. J. BAKKER (The Netherlands).

For a grower to provide cut lilies all year, it is necessary to advance or retard flowering by choosing the right variety, by temperature treatment, by storing bulbs and varying the time of planting. The starting bulb material must be of the highest standard young, well grown and ripened bulbs without diseases. The greenhouse soil should be porous and nourishing with a sub soil water level at least 40 cm below the surface. Planting depth of 8 cm in summer and only 6 cm in winter and when forcing L. longiflorum very early in September, 3-4 cm:. It is important to have a good upper layer of soil and one which does not dry out, since most forced varieties are stem rooting. Container planting did not give results.

Early forcing gives flowering from February to April, very early forcing in December-January and late and very late forcing, from August to November, It is recommended to use germinated bulbs to regulize greenhouse production,

Early forcing. Storage temperature for bulbs must be around + 2°C. Planting time is mid-December. Temperature in the greenhouse should not be too high. High temperatures shorten the forcing period but they also increase the chance of bud dropping with the amount of light available at this time. Preference should be given to well lighted glasshouses which are not too low. Low forcing temperatures (maximum night temperature 13°C) in particular are required for. L. pumilum (time of planting January to March), Fire King and L. hollandicum hybride (time of planting early December to March). Such varieties as Mid. Cont. hybrid "Harmony", "Brandwine" and "Fire King" should no longer be planted after March. Immediately after lifting give temperature treatment of at least six weeks at + 2°C with a high relative humidity in the cell (90 %).

The following table gives treatment method for bulbs :

Time of lifting	Av. Length of stem	Av. number of calyxes p.br.	Av. flowering date
Normal, 1 November Planting date 6 Dec.	129 cm	12	July 3
Too early , 14 October Planting date 18 Nov.	110 cm	9	July 13

After lifting both batches were given five weeks at 3°C.

Very early forcing . Time of planting from the end of August until the second week of September, with imported L. longiflorum varieties. With the trumpet lily temperature is the most important environmental factor. Time of planting depends on the time of lifting and on the pre-cooling treatment given in the country of origin and in transit. Forcing period 90-100 days. Do not expose bulbs to storage temperatures of less than 2°C since this would lead to resetting and retardation of flowering. The soil should not be allowed to dry out when planting depth is 2-3 ca:. Planting temperature 17-18°C, optimal glasshouse temperature at night should be 15°C. Sufficient glasshouses with clear glass are necessary. Supplementary fluorescent illumination with 100-110 watts HPL per square meter of planted area for 12 to 14 hours per day does not advance the time of flowering, but reduces the dropping of buds.

Late to very late forcing . Bulbs must be stored at a low temperature TO-0,5°C . For very late flowering it is desirable to wrap the bulbs in dry wood shaving and to wrap this again in polyethylene foil in boxes at a high relative humidity. Start with a bigger size of bulb. As a result of greater light intensity and high temperature, stems grow shorter. This process can be countered in part by planting the shorter varieties closer together and by shading the glasshouses and keeping the soil well moistened in advance. Before planting the bulbs should be dipped into water for about two hours. L. speciosum varieties (Uchida, Brabander, Favourite, Kuipers) must be planted until mid July. With too low temperature in September-October the leaves become yellow and drop. Minimum night temperature 18°C Trumpet lilies must be planted until the third week of July, like Fiesta hybrids, Citronella and L. tigrinum Enchantment until early August. Several. varieties are very sensitive to humidity and ventilation.

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It is useful to note that during discussions many speakers warned, particularly the horticulturist, against frequent mistakes in temperature measurements. One must take a temperature at the plant level and avoid exposing the thermometer bulb to the sun's radiations.

During the discussions the utility of refreshing greenhouses in Summer time was questioned because it increases production costs. It seems that especially for lilies greenhouses with forced ventilation are the best. For those greenhouses already built, forced ventilation costs in Hollande 15 florins are (about $ 6) per square meter for installation and the estimation of annual costs (amortization and running costs) is about 3 florins ($ 1.20) per square meter. Studies given on this question showed that the better quality of plant and flower, specially for lilies, pay all expenses.

Topic II. Plant and Plant Environment.

1) Root growth of year round Chrysanthemums C.V. White Spider. Ir. C.J. van der POST, M.G. van der MEIJS and J.W.J. LOETERS (Netherlands).

The Authors measured during a year root development in length and number of roots per plant. Root observation was completed by measuring the crop height. Special attention was paid to the transition from the vegetative to the generative phase. After planting root growth starts quickly and a rooting level of 60 cm and more is attained in a couple of months. The greater part of the roots is found in the upper part of the soil. Until the beginning of the generative development the number of roots increases regularly. Root development is stopped at the moment that the buds become clearly visible, At that moment stern elongation progresses more slowly and the total mass of leaves increases at a slower rate. Root growing stagnates in this period without formation of new radicals. After blossoming of all buds, roots appear to increase distinctly again in number and length according to autumn and winter temperature. The competition for orientation of assimilates to the roots or to the flowers buds was attributed to hormonal regulation.

The generative stage in chrysanthemum plants falls about one month after the beginning of the short day treatment. It would be interesting to examine the action of interrupting the long winter night by artificial light on the roots growth. During the winter it is interesting to enlarge insolation time for plants ; this may stimulate root growth and entails also more vigorous development of the flower stalks and better flower quality.

2) Growth conditions affecting flower bud abortion in Dutch Iris. Dr. E.J. FORTANIER.

Climatic conditions after planting especially during bud initiation and development are particularly important. There are interactions between factors : duration and intensity of light, temperature during day and night and air and soil temperatures. The variety "Dominator" have the lowest requirements in light and temperature and it flowers much earlier than other varieties. Elongation of photoperiods increased abortion but only slightly with Dominator and Professor Blaauw. Energetically as well as photoperiodically light has little influence on the percentage and time of flowering. An increase of temperature during the day as well as the night increases the change of bud abortion. Soil temperature seems to favor water stress in the plant which produce bud abortion. The influence of environmental conditions on dry weight distribution is insufficiently known. Buds may abort sooner at higher temperatures or lower energies of light. Susceptibility for bud abortion exists in all stages of development from initiation until flowering. The knowledge of how flowers abort means that abortion of the buds during a plant's development can be prevented economically by a slight lowering of temperature or a moderate increase of light intensity during a short period-at the right time.

3) Physical and chemical control of vascular diseases in carnations. Ir. H. RATTINK (Netherlands).

The control of Phialophore and Fusarium during crop raising is still very difficult. Several methods must be proposed to protect crop. It is of the utmost importance to take cuttings from healthy mother plants. Steaming the soil has proved to be the best method for disinfection ; it is necessary to steam at the highest possible temperature, soil fungi are killed at a high temperature: 60-70°C. During cultivation maintain perfect hygiene for avoid re-infection. New possibilities emerged with the advent of the systemic fungicides (benomyl and thiophomattemethyl) which slow down but do not Kill fungi.

4) The control of dry rot, pythium and penicillium when forcing lilies and Irises. M. de ROOY (Netherlands).

Dry rot produced by Fusarium oxysporum is particularly dangerous in soil with a high temperature, such as found in glasshouses. Under certain storage conditions, such as prolonged cooling or inadequate ventilation penicillium can be most injurious. Pythium ultimum causes extensive damage particularly in warm and moist soil. For control development of these fungi. good results are obtained by disinfecting bulbs with 0,2-0,4 % benomyl before storage ; if necessary bulbs can be disinfected in 2 % thiram (TMTD) just before planting for supplementary control of Pythium.

Topic III. Flowering and Flowering regulation.

1) Development of illumination and darkening methods for year round chrysanthemums. J.W.H. van VEEN (The Netherlands).

There are several methods to produce year round chrysanthemums all based on a succession of vegetative and generative phases which are the basis of healthy and vigorous plants.

One can use the Riviera Plant Company method, but growers frequently encounter difficulties with various climatic conditions. It is also possible to base production on a succession of 12 hour periods of day and night all year round with 18°C for night temperature and variable day temperature from 19 to 27°C.

On this completely different basis, what happens to all the physiological processes of the plant ? It is necessary to study all these problems for aiding growers into all year round production of plants corresponding to market demands,

2) Illumination and shading of carnations. Prof. J.J. MUNCH (Germany FR).

It is possible to have better flower formation all year round by combining illumination and shading according to seasons. Stems must be have same height and a 18-20 cm, length is good for the start of illumination. The stem must be firm. Use incandescent lamps for illuminating 20 W per square meter : 4 weeks in winter, 14 days in Summer and three weeks in Spring and Autumn. Spraying with a 0,25 % cycocel solution at the start of illumination gives a high percentage of first duality carnations. Addition of C02 and soil heating advance flowering. This method gives a flower production between October and April with a monthly percentage of 10 % during October-December and April, and 15-20 % during other months with EE carnation variety.

3) Influence of light and temperature on flowering of Lilies (l. cv. "Enchantment") with special attention to flowering in winter.
Dr. G.A. KAMERBEEK and A.D.J. DURIEUX (The Netherlands).

To obtain rapid flowering it is necessary to give the bulbs a cold treatment for eliminate dormancy and induce flower initiation. For Lilium "Enchantment" a cold treatment of minimally 6 weeks at 2° to 9°C is required. For flowering in the Autumn and early Winter it is necessary to use bulbs lifted in a previous season and stored in cases lined with polyethylene bags filled with dry wood shavings at 0-2°C. After storage period the bulbs can be planted in a glasshouse at 15-18°C. For better flowering high light intensity during 16 hours is necessary. During flower bud development there is a critical phase when their length is about 1,5 to 3 cm. At this length under a high temperature the buds are very susceptible to abscission. However under normal temperature abscission did not occur if the plants were irradiated with a sufficient amount of light. In winter time supplementary lighting is most effective when applied in the critical period of bud development. The cost of extra lighting is considerable in terms of investment and electrical energy used. According to the calculations of the author the extra expenditure for three consecutive crops of lilies in the winter would amount to about 20 to 22 Dutch cents per stem (about a 0.08-4 0.09).

This preliminary study must be pursued on a large scale.

4) Practical experiences in Iris forcing in the Scandinavian Countries. T. HENRIKSSON Sweden

In Sweden there are long and cold winters and short precarious summers. For this reason Henrikssons Nursery, situated at Ulriceham has close contacts with Dutch Suppliers and Flowerbulbs Research Laboratory in Lisse. Iris cultivation is confined in greenhouses with two meridional varieties, Ideal and Prof. Blaauw. Bulbs arrive on the market having received a special "shock treatment" for the cold. If for some reason Iris bulbs cannot be planted straight away, they are stored at 13-17°C with an absolute maximum of a one week's period. Immediately after planting Iris Idea]. must stay during a two week period at 13°C temperature. When the plant has developed a few centimeters, raise temperature to 15-16°C. For Prof. Blaauw the temperature is 11_12°C and after two weeks 13°C. During winter when natural light is very limited in Sweden it needs artificial light but the cost may be prohibitive and results incertains. During cultivation Penicillium and Fusarium are pests that nursuryman should combat in every way. A suitable marketing plan gives a successive planting time the whole year round with a peak at New Year, Easter and Mother's Day. After harvesting the flowers are stored in cool storage at a temperature of. 2-3°C. A combination of Iris, Chrysanthemum, Freesia, Lilies and Tulips cultivated on a year round basis provides for a lucrative business in Sweden. An important point for Nurserymen is the need to maintain good contacts with his supplier and a laboratory or Research station for eventual advice.

5) Experience with supplementary lighting, including Growing Rooms in the control and improvement of Chrysanthemums. F.G. HARRIS (United Kingdom).

In the 10 week growing varieties the most succesful for year round chrysanthemum production have been found to be “Polaris” and its mutation "Fandago" "Heyday" and "Pollyanne". During the summer plants receive one week of long days followed by short days treatment for 5 nights a week. From late October to late February supplementary lighting is applied the first two weeks of short day treatment. Supplementary lighting consists of 400 W Mercury Vapour lamps, type MBFR/V spaced 2,12 x 2,12 m at a height of 1,82 above the plants. 3000 lux of lighting are obtained for 3500 plants in one unit of 84 square meter with 16 lamps. In the Southern part of the United Kingdom, at Fernhurst this artificial light plus natural light gives plant requirements of 120,000 lux hours per day (30 g cal per square centimeter). Price for two weeks illumination works out at about 1/2 p. per plant. Capital cost of the equipment works out at £ 25 per light including its starter equipment. At AYR Spray Chrysanthemums on uses the variety "Elegance" for a 14 week response, using mist propagation for cuttings during 7 days under long day conditions ; after rooting the trays of paper pots are transferred to a period of high light long days for 18 hours/day with supplementary artificial light during 14 days ; stage III consists of giving short day treatment for the last week before finally planting out, but under high light conditions. From planting using 10 week varieties, it is 9 weeks to flowering. The growing Room technique presents the opportunity to grow plants during the first two weeks of short days at high light intensity, 8000 lux.
In the United Kingdom growing room is interesting during winter months when overcast days are frequent. It offers also opportunities for better controlled conditions including use of supplementary C02 automatic watering. The size of growing room must be adapted for weekly treatment for the success of good quality plants produced throughout the year.

Topic IV. Marketing.

1) The sale of flowers at the supermarket. E. ZING (Switzerland).

Supermarkets are good flower sellers ; quantitatively 'Migros" sells more than one third of all the flowers sold in Switzerland. Chains of supermarkets are very interesting clients, taking substantial quantities daily but they want irreproachable quality, favourable prices a large assortment of flowers in large quanties without middlemen. Supermarket customers choose articles themselves, in one store, within their means, and do not have to enter separate stores when shopping. The flower department can be lucrative if the quality is good, and since flowers can not be stored, prices are interesting and quality is guaranteed to the client. The flower department Faust be impressive with at least 30 square meters of space near the exit, with simple but efficient equipment, and with green plants and flower pleasing to look at.

Saleswomen must be enthusiastic and well qualified, knowing how to create a display of at least ten varieties with various colours and sizes of plants. A self service corner is usually appreciated. A catering service is useful but also advertizing campaigns promotional sales, demonstrations and exhibitions.

2) The market for flowers and plants in France. Mlle LORIEUX TAUPIN (France)

There are in France about 7000 hectares of greenhouses, bed stock, carnations, roses, chrysanthemums, azaleas, hydrangeas, tulips etc... A big import and export market. The annual budget per inhabitant per year for buying flowers is 30 FF, and 70 % of the sales are for presents. Purchases are represented by 69 % for cut flowers and 31 % for pot plants. Pot plants included azaleas, cyclamens, hydrangeas and St Paulia. Cut flowers include roses, field flowers, carnations, gladioli, chrysanthemums and tulips,

3) The plant environment, Prof. A. KLOUGART (The Netherlands).

A plant's environment plays an. important role and to best control it one must foresee the need to : raise salaries by displacing horticultural areas and changing family businesses into ones which employ intensive cultivation under glasshouse or plastics, and also, on other hand, raising profits for capital invested. Modern horticultural production is based on intensive growing methods and the greenhouse is a kind of factory where light becomes the machinery, the energy source. Daily solar energy varies from 300 calories in December to 7000 in June in our region. Artificial lights are used only for propagation due to high costs. Very few glasshouse areas are placed in the sunniest regions. Single span 12-20 m glasshouse gives the crop a better environment than the ridge and furrow house "Venloo types", because there is more light, better ventilation and are easier to adapt to automation. Unfortunately the cost is higher per square meter but is soon repaid by higher production. Also, the extra area needed for spacing the houses does not need to be a drawback as long as agricultural land is available.

Production methods change but come up against two difficult barriers : shortage of capital and conservatism of growers. Some examples of new developments are : suppressing shade by reducing temperature without reducing light, the plants adapting their leaf areas to different light intensities. A better way of reducing temperature is by ventilation and leaf cooling by a water-film. More emphasis on the collection and storage of rainwater is needed, but new methods of purifying water are showing up, however, this system is expensive. Time and frequencies of watering and pulverizing water can be controlled by an evaporometer or by a solar integrator. Watering can also serve to fertilize in very diluted dose. Roots like a humid milieu but a well aerated one, like peat. Glasshouse heating systems must also be rethought using modern heating techniques, with little shading. The future seems call for increasing yields per square meter, on smaller areas with a very good infrastructure. Chrysanthemums, Iris, Fressia and Tulips are already produced all year round. Other crops should be so programmed as well and their daily needs of water, heating, lighting and fertilizing, established. The important idea is that we should look upon modern horticulture as an industry for which the law and rules of economics must be applied. We have to attract labor and capital by the best possible environment for both plants and men.

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It was M. J. HYLKEMA, President of Floriad 72 of Netherlands, who pronounced the closing speech. He underlined once more the importance of similar international meetings to renew the bonds which connect the horticulturist and floriculturist and the plant producer,

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For our part we are in complete accords with the ideas of M. Verhage, Hylkema and Angiboust and we hope and wish that similar congresses, expositions, colloquiums, meetings and discussions will be regularly organized in all countries and regions by major commercial companies, specialized in plant production or by national officials of Agriculture or Horticulture. This corresponds perfectly to such ideas as recycling, permanent formation of specialists and other methods which permit techniques and knowledge to evolve and advance.

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VI-. COLLOQUIUM ON THE WINTER HARDINESS OF CEREALS
Martonvasar October 31-November 9 1972

The following report about this colloquium was based on the note send by S. RAJKI, especially for Phytotronic Newsletter's readers, and based also on the summaries of lectures given to participants.

The first international. colloquium on the winter hardiness of cereals took place at Martonvasar from October 31-November 2, 1972 with the participation of researchers from 16 European, North American and Asian countries. This was followed by the official opening of the Martonvasar Phytotron on November 3, 1972.

The idea of colloquium on winter hardiness was put forward by Dr. Jenkins/ Cambridge and Dr. Fischbeck/Weihenstephan in June 1971 at the VI. Congress of Eucarpia at Cambridge, and. they immediately asked if a colloquium could be held at Martonvasar in 1972, Dr. Lukyanerko/Krasnodar who was also present at the conversation, strongly approved the suggestion.

During the following months questions concerning the colloquium, proposed at Cambridge, were clarified. The physiological and genetic aspects of the winter hardiness of cereals was chosen as the subject of the Martonvasar colloquium, the date of which was fixed for October j1-'November 2, 1972, with the participation of European researchers directly concerned with this subject., Thus the colloquium was planned as a closed meeting at which only invited researchers could take part. The ceremonial opening of the Martonvasar Phytotron, which at that time had been under construction for several months, was planned for the day following the colloquium, November 3, 1972.

The colloquium was arranged at the Martonvasar Institute's clubhouse at Miklos-puszta. .altogether 16 papers were presented in 4 sessions. Emphasis was placed on the discussion of the papers, and the interest aroused were beyond all expectations. According to the unanimous and frequently expressed opinion of the participants, the colloquium achieved its purpose "of studying and bringing up to date problems related to the winter hardiness of cereals, in the form of a dialogue which will help to establish the closest possible ties between scientists engaged in the subject".

Below, a short report of this colloquium. Those interested in the proceedings published in the middle of 1973 are kindly requested to contact Dr. S. RAJKI (POB 2462, Martonvasar, Hungary).

SESSION I. Physiological and biochemical aspects of frost resistance and winter hardiness of cereals. Chairman P. CHOUARD, Gif-sur-Yvette, France, 41 lectures.

1) Physiological and biochemical aspects of frost damages and winter hardiness in higher plants. K. SARTORIUS and U. HEBER (F.R. Germany).

During freezing of higher plants under natural conditions, ice crystals appear in the intercellular spaces. This extracellular ice formation is accompanied by dehydration of the cells. Dehydration, on the other hand, causes an increase of the concentration of soluble compounds within the cells. Various soluble compounds present in the plant cells *in vivo* are toxic at higher concentrations to protoplasmic membranes *in vitro*. An increase in the concentration of these membrane-toxic compounds is responsible for membrane damage. A primary effect of freezing consists in the irreversible uncoupling of phospho-rylation from electron transport. Inactivation reactions are dependent on the concentration of the membrane-toxic compounds, their nature, the freezing temperature, the rate of cooling and the initial salt concentration before freezing. The loss of the semipermeability of biological membranes due to dehydration which accompanies freezing is a basic cause of frost injury. If non-toxic compounds are present in suitable amounts in the cells during freezing membranes will be protected against inactivation brought on by freezing. Under suitable conditions even membrane toxic compounds are able to prevent, in combination with non toxic or with other toxic solutes, the inactivation of the membranes during freezing. Many compounds protect colligatively, but they also affect the membranes individually by specific interactions. The unspecificity of protection and protection by combination of solutes which individually are membrane-toxic can be explained by the colligative concept.

2) Relationships between vernalization, hardening and phytochrome. A. VINCENT, (France.)

Vernalization of wheat corresponds to an accumulation of total phytochrome in the vegetative apex (medullar meristem) correlatively, the pigment accumulates in leaves. The model presented of phytochrome can explain their properties and effects. Hardening corresponds to a shift of the total phytochrome towards forms less susceptible to frost induced dehydration, of cells.

3) Duration of hardening of different winter wheat varieties under constant temperature and light conditions. A. TSENOV (Bulgarie)

Under natural conditions (until Nov. 15) varieties studied (Bezostaya 1, no 301, San Pastore and Hebros) formed very different cold resistances. Under standard conditions (at 2°C with luminescence light up to 5000 lux during 9 hours daily) the varieties studied accumulated a maximum quantity of sugars and formed the highest cold resistance after 30 days hardening. After 45 days hardening the varieties studied gradually lost their cold resistance, while the stored sugars slightly decreased. At the end of the experimental period (Feb. 1) the cold resistance of the plants was weaker than their resistance at the beginning of the experiment. With the increase in cold resistance in the hardening plants the quantity of saccharose, glucose, raffinose and oligosaccharides also increased. The decrease in cold resistance took place more quickly than the reduction in the quantity of sugars in the plants.

4) Influence of pre-sowing hardening on growth, some metabolic-processes and frost resistance of cereal seedlings and young plants. R. RAAII'IELT (D.R. Germany)

The opinion of the author differs with Henckel’s theory. No considerable differences in metabolism and development, which might point out a hardening were observed in test plants and control. Furthermore, no increase in germination, growth, water content, transpiration, respiration or enzyme activity was found to follow the pre-sowing treatment. Often. the investigated processes were affected negatively. Therefore the yield increase under field conditions must be due to other factors but to a pre-sowing hardening.

SESSION II. Genetic aspects of and breeding for frost resistance and winter hardiness in cereals. Chairman : G. JENKINS (Cambridge, U.K.) 4 lectures.

1) The inheritance of frost hardening ability in crosses between Spring and Winter barley . E. SCHWARZBACH R.F. Germany .

In two crosses between Spring and Winter barley varieties the early generations exhibit a pronounced negative heterosis in hardening ability. In segregating populations only a low association can be found between Winter habit and hardening ability. In both crosses progenies of F2 plants can be found with a higher hardening ability than hardy parent and with a lower hardening ability them the Spring habit parent. Since the mean hardening ability of F2 progenies is similar to the non winter hardy parent in both crosses, the genes responsible are assumed to be recessive. The hardening ability showed a significant positive correlation with rachilla hairiness in the cross, where the hardy parent had a haired rachilla and a significant negative correlation when the hardy parent had a nonhaired rachilla. The extent of this correlation was similar to that with winter habit, whereas the correlation between winter habit and rachilla hairiness was much lower. Some of the genes responsible for hardening ability are therefore assumed to be located between the genes sh2 and s on chromosome 7.

2) Some aspects-of increasing the winter hardiness of winter wheat. V.N. REI,ESLO USSR .

In severe years winter wheat variety Mironovskaya 808 can bear a temperature of -19.5°C at the tillering node, but at a lower temperature the plants are killed. In certain regions. the crops were not covered with snow, the minimum temperature at the tillering node reached -22°C, and the wheat plants died. For breeding more resistant wheat varieties a method for converting Spring into Winter wheat, or as Dr. Rajki calls it, a method of autumnization, was used. This method produced basic material from which the varieties Mironovskaya 264, able to bear -16.5°C, Kievskaya 893, able to bear -17° and Mironovskaya 808, able to bear -19.5°C. were developed. In developing the Mironovka-bred varieties mentioned much experimental work was performed, which made it possible to draw the conclusion that the fundamental factor in the development of more Winter hardy forms from Spring wheat is Autumn light for the plants of the second autumnization generation. But unfortunately we cannot regulate this factor and neither the necessary quantity of radiation nor super Winter hardy forms can be obtained without Phytotron facilities.

3) Hardy Winter wheat from the non-hard Mexican Spring wheat Penjamo 62. E. RAJKI and S. RAJKI (Hungary).

Autumnization experiments have been carried on for the third year at Martonvasar on several Mexican Spring wheats bred by Dr. Borlaug, resulting in the hardy Winter Penjamo 62. A method of timing the sowings was employed for autumnization. In the earliest autumn sowing time series of the third year of experiments, autumnization. took place in all test plants of the Mexican Spring wheat Penjano 62. In some early Autumn sowing time combinations autumnization was observable in approximately one half or one third of the plants. At the same time practically no autumnization' occurred in late autumn and not more in those autumn sowing time treatments which were further combined with Spring sowing

4) Some aspects of winter hardiness from the view-point of the metabolism-biochemical concept of heredity. M. DEVAY and S. RAJHI Hungary .

The Winter hardiness of Winter wheat shows a relationship to the intensity of the photosynthesis occurring at low temperatures the material transport system and the growth reactions of the cultivar concerned. The hardiest cultivars proved to be those where a) the minimum temperature for photosynthesis was around 0°C or lower, b) a considerable part of the assimilates flowed into the roots, and c) the intensity of cell-division and the growth of the plants declined sharply as a function of the decreasing temperature and practically ceased at temperatures near the freezing point.

In Spring wheats in the course of autumnization all the metabolic processes characteristic to Winter wheat may be observed totally or partially, thus enabling the plants to survive under Winter climatic conditions. Detailed biochemical examinations were carried out on the physiological character of the photosynthesis taking place at low temperatures, the enzymology of the material transport towards the roots and the biochemical basis for the growth reactions.

SESSION III. Variability of adaptations to frost and Winter hardiness in cereals. Chairman : H. HANSEL (Austria), 4 lectures.

1) Utilization of physiological responses in breeding Winter barley for Britain. G. JENKINS United Kingdom

Primitive British Winter barley cultivars are alternative in type, having no vernalisation requirement. However, the established modern cultivars have a fairly strong vernalisation requirement, which, in association with their sensitivity to short days, renders them late developers in the Spring. It is concluded from experiments that adequate over-wintering ability is attainable in cultivars lacking a vernalisation requirement. By using exotic, particularly Japanese, genotypes in the breeding program, it may also be possible to reduce the short day sensitivity of existing Winter barley cultivars, to some extent, without seriously impairing Winter hardiness. Apart from modifying the vernalisation and photoperiod responses of existing Winter barley genotypes, considerable scope is presented for improving the basic level of frost hardiness in British cultivars. A renewed interest in Winter six row feeding barleys further enlarges the genetic pool which can be used in breeding.

2) Genetic variability of frost hardiness in Winter barley and some remarks on ecological aspects. H.D. KOCH (D.R. Germany)

Over several years, the genetic variability of frost resistance of Winter barley was almost completely investigated with the help of the artificial freezing test method.The classification of the assortment samples was done according to defined resistance classes, each represented by an indicator or standard variety. Market relationships were found to exist between the geographico-ecological conditions of the area of growing or occurrence and the genetically conditioned frost resistance. The most resistant barley varieties and local strains are to be found in the plains with a predominant influence of continental climate. Winter barleys growing at upper altitudes and those more strongly subjected to maritime climate, proved to be less frost resistant. The results obtained support the view that the genetically conditioned frost resistance is decisively involved in the development of the character complex "winter hardiness".

3) Winter hardiness of Springer x Winter wheat crosses. N.C. STOSKOPF (Canada).

Unadapted Spring wheat lines in the Winter wheat growing area has meant that Spring x Winter crosses have not been used for the improvement of Winter wheat. Recent new advances by CIM YI in Spring wheat breeding have opened up a whole new dimension to international research as well as new possibilities to advantageously broaden the genetic variation of the wheat gene pool through Spring x Winter crosses. Spring x Winter wheat crosses can only be useful for the improvement of Winter wheat if satisfactory Winter hardiness can be readily recovered. This concern formed the basis of this study beginning in 1969.

4) Variability of Winter hardiness of Ujszegedi Winter oat and M_2 lines. J. SZIRTES, M. NAGY and K. OBERMAYER (Hungary).

Selection in small plot experiments was assured by the completely snowless Winter conditions of 1971/72. As a result of a radiation minimum temperature of from -10 to -15°C for about 10 days in January, only 25.6 % of the lines of the variety survived. The frost resistance of the variety can be improved by selection of the lines with 39-56 % survival on the basis of the least significant difference. We wish to select transgressive recombinants from Winter x Winter hybridization, and also to increase the genetic variance by means of mutation. In this respect the survival range for the M2 lines of 0-76 % is encouraging. The selection of the lines with 50-76 % survival on the basis of the variance analysis, and their further mutagen treatment appears promising.

SESSION IV. Methods for determination of characters connected with frost-resistance and Winter hardiness in cereals. Chairman A. BALINT Godollo-Hungary ; 3 lectures.

1) On a method to determine the influence of the grain (endosperme) on hardening and recovery after fressing of the seedlings of Winter wheat. H. HANSEL Austria

The attached grain might under certain conditions exert a decisive influence on the degree of frost resistance and on. seedling survival. The results suggest furthermore :

a) that in young seedlings light dependent processes as well as the translocation of mobilized endosperm reserves are of importance for optimal hardening, and

b) that light can compensate for the grain effect more effectively with regard to hardening, than with regard to dry matter production.

These results should be considered in research work concerned with the frost resistance of wheat seedlings, especially when the effect of light processes during hardening is studied. In intact seedlings it does not seem possible to separate the hardening due to light dependent processes within the leaf from endosperm effects on hardening.

2) Determination of hardening ability in barley by measuring the electrical resistance of seedlings after freezing.

E. SCHWARZBACH (F.R. Germany).

A quick quantitative assessment of frosthardening ability of barley genotypes is possible by the following procedure : Barley seedlings are grown in complete darkness in a water culture, to a stage at which the first leaf starts to penetrate the coleoptile. Nearly at this stage the frosthardering ability of seedlings grown in the dark shows a maximum. After hardening in darkness at + 1 °C for about 5 days the temperature is lowered by 1 °C/hr to -12°C, maintained so for 10 hrs and raised again slowly. Then the coleoptiles are clipped 1 cm above the kernel. After a short recovery the longitudinal electrical resistance is measured by a simple direct current ohmmeter. Totally killed seedlings show a resistance of about 10 kOhms, undamaged ones up to 1,000 kOhms. Clipping the roots and/or coleoptiles before hardening results in lower resistance values without changing the ranking of varieties. Sugar feeding or use of distilled water instead of mineral nutrition leads to higher resistance values, without changing the ranking of varieties. Hardening ability measured by electrical resistance corresponds fairly well with the known winterhardiness of the varieties.

3) Determination of the frost resistance of wheat plants By the estimation of their growth rate after freezing. R. RAMMELT (D.R. Germany)

Providing the freezing temperature was sufficient, the growth rate proved to be a sensitive indicator of the state of resistance that the plants had had before freezing. Therefore, there is the possibility of recognizing varietal differences in plants after various hardening conditions. This method is suitable for the estimation of frost resistance in physiological investigations. No varietal differences can be observed when the survival rate is very high or very low. Furthermore, it seems to be possible to classify varieties according to their degree of frost hardiness, even if an order on the basis of equal survival rates is no longer possible. A freezing treatment could generally be defined as a product of freezing time and freezing temperature. In other words The longer a damaging' temperature is maintained, and the lower it is, the smaller is the growth rate, or rather the frost resistance.

SESSION V. Improving current arrangements for exchanging information and the possibility of organising cooperative projects in the topics discussed. Chairman : E. Schwarzback (F.R. Germany)

During the closing Session V, it was decided that the proceedings of the colloquium should be published as soon as possible. Mention was made of the necessity of establishing a set of key barley varieties having different combinations of frost resistance, vernalization. and photoperiodi.c reaction, for the examination of frost resistance in barley as standard for varietal comparisons. It was also decided that the next, second colloquium on "the Winter Hardiness of Cereals" should be held in Prague in 1975. The preparations for this were undetertaken -subject to the consent of the authorities -by Dr. Segeta, who will be assisted by Dr. Jenkins, Dr. Fischbeck and Dr. Rajki.

Finally Dr. Jenkins expressed the genera]. feeling of all participants in thanking the Hungarian colleagues for the outstanding hospitality, the excellent organisation of the colloquium and the stimulating atmosphere, and for the hard work they had done in preparing the Colloquium.

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The 32 foreign and 19 Hungarian participants of the colloquium were introduced to the Martonvasar phytotron in the afternoon of October 31 and were taken on a tour of the Institute laboratories and the farm's seed processing plant in the afternoon of November 2.

On the final evening of the Colloquium, a reception was given in honor of the participants at the Martonvasar institution's clubhouse at Miklos-puszta. As a finale to the scientific events at Martonvasar, the participants of the colloquium and the organisers of the colloquium and the opening celebrations of the phytotron attended a concert of folklore presented by the Hungarian Youth Art Ensemble on the evening of November 3.

Martonvasar Phytotron, Inauguration Ceremony

The opening ceremony of the Martonvasar phytotron took place on. November 3 in the presence of the participants, of the Colloquium, the representatives of the specialists and workers concerned in the establishment of the Phytotron, of the Hungarian Academy of Sciences, the Ministry of Agriculture and Food Industry and the press.

The president of the Hungarian Academy of Sciences, Professor T. ERDEYGRUZ welcomed the audience and opened the Inauguration Ceremony.

In his address, I. LANG, Deputy Secretary General of the Hungarian Academy of Sciences said particularly :

"Time is approaching when men will be able to control not only the fundamental physical and chemical processes, but also the biological processes. The Szeged Biological Center of the Hungarian Academy of Sciences, where up to date conditions were created for molecular and cell-lever research on bioregulation, was opened one and a half years ago. And today we inaugurate a new establishment the first phytotron in Hungary. This scientific investment provides controllable and reproducible environmental conditions for exact studies performed at the level of the whole plant too. All this offers a new range of possibilities for both basic biological research and applied breeding research. To build a phytotron is an expensive undertaking (120 million forints are concentrated on this investment) and it is a highly important and responsible task to determine the priority of research subjects to be dealt with here. It is my desire that in this establishment : 1) basic research should be carried out at such a high level as to promote the realization of concrete practical objectives, 2) that in its own peculiar way this phytotron should serve the main purpose of maize and wheat breeding in Hungary, and 3) that the opportunity should be created of training a wide circle of experts in phytotron techniques so as to lay the foundation of intellectual resources necessary for the preparation of further similar investments

Thanks were also attributed to: first, A. KUTI, Manager of the Experimental Farm of the Agricultural Research Institute of the Hungarian Academy of Sciences at Martonvasar, to all workers who constructed the edifice since April 1971; second, to R. TAYLOR, President of controlled Environments Ltd, from Winnipeg at Manitoba, Canada which has supplied the equipment(growth chambers) for the Phytotron.

Finally, S. RAJKI, Director of the Agricultural Research Institute of the Hungarian Academy of Sciences at Martonvasar gave a brief historical revue and said : "The idea of establishing a phytotron at Martonvasar first came under discussion at the end of 1959 at a Scientific Conference held on the occasion of the Institute's 10th Anniversary. Analyzing then the causes of autumnization genetic conversion of Sping into Winter wheat we arrived at the conclusion that a parallel analysis of complex and individual causes and the exact reproduction of experimental. conditions, necessitated research carried out in a Phytotron. As a result of cooperation between the scientists and workshop technicians of our Institute, growth chambers were built from 1960 to 1967. Three of four home-made air conditioned chambers, those build in 1964 and 1967, are still functioning to day. At the end of 1969, according to the decision of Academy, a start could be made on the concrete preparation for the establishment of the Martonvasar phytotron. A building entreprise commenced work in April 1971 and completed it in October 1972 after eighteen months of work. Equipment was ordered in Canada. It might perhaps be mentioned that while we paid over half a million dollars worth of hybrid maize seed produced at Martonvasar was exported to the United States of America. Phytotron is, by nature, mainly a workshop for theoretical and methodological research, and it is for such work, for studies on relationship between metabolism and heredity that an Phytotron is destined. Nature never repeats itself exactly, therefore biological experiments carried out in the field and under glasshouse conditions, which cannot be precisely controlled, cannot be reproduced under the same conditions. It is thus understandable that the precise study of the effect of environmental. factors on the growth and develops lent of plants could only be commenced with the establishment of the Phytotrons. The possibility of producing phenomena or repeating experiments under the same conditions, i.e, reproducibility, is a criterion without which biology cannot become an exact science, similar to physics or chemistry. The significance of the Martonvasar phytotron for fundamental biological research in Hungary lies in the exact reproduction of life conditions in plant research performed at various organizational levels'.

After the addresses of welcome, Professor B. Kopeczi, Secretary-General of the Hungarian Academy of Sciences, cut the Tricoloured band closing the main entrance and declared the Martonvasar Phytotron open.

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For Phytotronic Newsletter's readers S. Rajki sent us in June 1973 the following paper which we are very happy to reproduce :

VII- RESEARCH STRATEGY OF THE MARTONVASAR PHYTOTRON

S. RAJKI, Agricultural Research Institute of the Hungarian Academy of Sciences, Martonvasar.

1. Last year, 1972, on several occasions, particularly in May in the United States of America and in June in the Soviet Union, I gave a lecture on the Martonvasar phytotron (S. RAJKI, E. RAJKI, M. DEVAY, 1973) which consisted of a report on the initial stages of our research on autumnization genetics, which gave rise to the idea of a phytotron at Martonvasar. It went on to describe the homemade air conditioned chambers, which were established from the beginning of the sixties onward, and the construction and research orientation of the phytotron, which was then being built.

Now, in June 1973, it is already 9 months since experimentation was begun in the Martonvasar phytotron. The fundamental aim of these experiments, and simultaneously the purpose of the Martonvasar phytotron, is the exact scientific exploration of the relationship between metabolism and heredity, and the achievement of an objective answer to this cardinal question of biology, genetics and phylogenetics. At the same time a thoroughly scientific basis is being sought for the elaboration of exact methods for the systematic production of certain major agronomic properties (Winter or Spring character, frost and Winter hardiness, growth period, quality, resistance, etc.)in the interests of practical plant breeding and production.

Nine months is a relatively short time even in phytotron research, so it obviously does not suffice for the attaining of "sensational" new scientific results, much less for a report on the like. Nor is this the object of this short article. We wish rather to outline the research problems which we have begun to study in the phytotron, and to make known in one or two cases our fundamental standpoint or phytotron research. In other words, to summarise the research strategy of the Martonvasar phytotron,

2. The first experiments set up in the Martonvasar phytotron are concerned with wheat and maize.

The wheat experiments cover the following topics : a) Biochemical processes taking place in the green plant stage : photosynthesis, enzyme induction. b) The examination of plant preparation for wintering, or hardening, in the course of the individual development of the plant ; testing for frost resistance. c) The inheritance of Winter/Spring character and frost resistance or Winter hardiness. d) The examination of the individual effects of certain environmental factors to which Spring wheat repeatedly sown in the Autumn is exposed ; the elaboration of an autumnization "recipe book" for varieties, and also for the planned Winter character and for. Winter and frost hardiness. e) The study of the heterogeneity supposed to exist in shoots developing under different, Autumn and Spring environmental conditions in one and the same Spring wheat plant, and of the variation. in the growth period found in the autumnizing population, f) The aneuploid analysis of Winter and alternate character and frost hardiness in order to clarify their relationship. g) The production of monosomic and substitution series. h) The flowering biology of male sterile and restorer forms : the improvement of restorers.

The first experimental topics on maize are as follows : i) The study of photoperiodic sensitivity in the course of individual development, j) Cold resistance during the initial developmental period ; "cold test". k) The conditioning of certain environmental factors of Fusarium resistance ; the study of the level of nitrogen nutrition and of low temperature effective at the beginning of the developmental period. l) The study of the nutrient reaction of inbred lines and their hybrids, the relationship between the nutrient reaction at an early stage and in the course of development.

Experiments are also planned on the Martonvasar Institute's third plant. barley. but in recent morths short lived examinations on vines have also been carried out.

3- Our fundamental standpoint on phytotron research may be briefly summed up as follows : as a first step we must learn to simulate nature in order that, as a second step, we may try to improve on nature. This will certainly prove possible. After all, nearly four decades ago TUMANOV *(1935)* wrote that, in places, under partially artificial conditions, in pots, plants achieved better hardening and developed stronger frost resistance than plants grown and hardened in the open field under natural conditions. Tumanov's conclusions have been strengthened and further developed by our first experiments on the hardening and frost resistance of wheat plants, carried out collaterally in the field and in the phytotron.

In the Martonvasar phytotron the experimental programmes, or weather models, which are compiled from adjustable environmental factors, temperature, light and humidity, are an attempt to simulate nature. The weather models are guided by the technical abilities of the phytotron equipment and are constructed from the meteorological data available (PLESTER 1973). The primary aim of one experiment was to raise in the phytotron a Winter wheat similar to that which, under optimum field conditions at the end of Autumn, is strongly tillering and of prostrate habit. However, under model weather conditions based on normal Autumn temperature, illumination and humidity averages, this aim was not realised. In the first of these experiments the leaves became elongated and the plants developed unusually quickly, but they did not tiller and instead of being prostrate, were of erect habit, or at best semi erect. From the following experiments it became clear that the reaction of plants to these average meteorological values differs considerably from their reaction to the natural meteorological values on which the models are based, since, for example, in the phytotron the stress conditions which occur in nature (temporary drought, extreme fluctuations of temperature, etc, were, understandably, not included in the programme.

The modifications to the weather models necessary for the achievement of the required aim are similarly simulations of nature, using weather averages taken from cooler years which occur less frequently in nature. The realisation of the most recent weather models results in stocky, strongly tillering Winter wheat plants of prostrate habit. These experiments also demonstrate that the relationship between temperature and illumination, and the systematic, harmonious programming of these factors is of a basic importance in phytotron research.

4. It is known that the necessity of establishing a phytotron at Martonvasar was first put forward in December 1959 (s. RAJKI, E. RAJKI, M. DEVAY, 1973). This conclusion was based on our autumnization genetics research being conducted in order to study the exact effects of environmental factors on plant growth and development, in other words, to clarify scientifically the relationship between metabolism and heredity. The fact that spring wheat can be transformed to the Winter form, that is, that autumnization can take place, is a fundamental factor in determining our answer to the question of the relationship between metabolism and heredity ; namely, that Autumn character, as hereditary property absent in the initial Spring wheat and developing as a result of the modified environment and of the changed metabolism consequent on this environmental alteration, is a case of the inheritance of acquired characters (S. RAJKI, M, DEVAY, E. RAJKI, 1972). Our own phytotron research is thus based on the assumption that the environmental factors acting on plants can influence heredity in an adequate manner.

Judging by the results so far achieved in the current phytotron experiments, a positive answer may be expected to the question raised in December 1959 of the precise reproducibility of our autumnizatior results, despite the fact that only a few of the variable factors for Autumn effect can be simulated in the phytotron. Nevertheless, it is to be hoped that the gradually decreasing temperature and light. intensity, the shortening daylength and the increasing preponderance of red rays in the spectrum, i.e., those Autumn conditions reproducible in the phytotron which are diametrically opposed to the corresponding tendencies prevailing in the Spring, will prove to be among the most important factors for the autumnization process.

From the above it is obvious that the Martonvasar phytotron research is fundamentally of genetic orientation, and moreover that our own research is built essentially on our metabolism-biochemical concept of heredity, being developed on the basis of the Lamarckian-Darwinian-Michurinian. theory. Nor do we deny that we have attempted to construct a research programme for the phytotron consisting of the most possible experiments to throw light on the relationship between metabolism and heredity, even in those cases where the researcher responsible for the experiment holds genetic views opposed to ours. For only thus, through the unprejudiced evaluations of a large number of experiments suitable for the exact determination of the relationship between metabolism and heredity, can the objective low of the development of genetics as a science become manifest.

5. Although our phytotron was primarily established for the use of plant researchers attached to the Martonvasar Institute, it may be used by any qualified plant researcher, be he Hungarian or foreign, from a socialist or non-socialist country. The fundamental criterion for the adjudication of external research applications is to what degree the experiments planned for the solution of problems, which can only be examined effectively under exactly reproducible conditions, serve to realise the task formulated in the 2nd paragraph of the lst section of this article.

With a minimum of effort and expense the Martonvasar phytotron offers a unique opportunity for the examination of the relationship existing between the plant and its environment. The Phytotron experimentation takes up very little of the external researcher’s time since the routine care of the plants during the course of the experiment is taken over by the phytotron Management. The presence of the researcher is generally only required, if at all, to supervise the setting up of the experiment, to carry out certain special treatments or measurements, and to supervise the harvesting. Even certain special treatments and measurements can, however, be carried out, provided the necessary instructions are presented.

The operation of the phytotron is financed out of the Martonvasar Institute's budget. Non-Martonvasar researchers are thus required to pay for the use of growth and/or testing space, according to the unit price calculated on the basis of the 1973 operational costs. The minimum area for calculation is 1 square meter of growth and/or testing space. Payment, at a rate of sq.m, x months, must be made in Forints, for researchers from Hungary and socialists countries, or in the US dollar equivalent for scientists from nonsocialist countries.

Any scientist, Hungarian or foreign, from a socialist or non-socialist country, may join in the research program of the phytotron itself free of cost. According to general institute practice, non-Martonvasar researchers who join in the research programme of the phytotron itself may, if considered worthy, receive a salary proportionate to that of a similarly qualified Martonvasar researcher. In justified cases accommodation may be made available to the researcher in the Institute at a moderate price.

References

PLETSER J., 1973, Climatic model for phytotron studies. Acta Agronomica Acad. Sci., Hung., 22, 67-80.

RAJKI S., DEVAY M., RAJKI E., 1972. Metabolism and heredity, or Autumnization as a microevolution. Agricultural Research Institute of the Hungarian Academy of Sciences, Martonvasar, 112.

RAJKI S., RAJKI E., DEVAY M., 1973. Phytotron at Martonvasar for elucidating relationship between metabolism and heredity. Acta Agronomica Acad. Sci. Hung., 22, 293-299.

TUMANOV 1.1., 1935. Uskorennye metody otsenki zimostoikosti rastenii. Teoreticheskie osnovy selektsii rastenii, State Agricultural Publishing House, Moscow, Leningrad, 1, 753-782.

Editors note.

Having read this very interesting paper, may we suggest to other Phytotron directors to send us also their research strategy or comments which we will reproduce with pleasure for a better knowledge of the future evolution of Science and Researche.

Thank you,

P.C. and N. de B.

VIII- COMMUNICATIONS AND INFORMATION OF INTEREST TO PHYTOTRONISTS.

a) New books.

1) Tuinbouwtechnik 1. International Dictionary of Horticv.ltural Technique with 4,380 words in 6 languages. German, English, French, Spanish, Italian and Dutch). Library Kniphorst, Hoogstraat 49, Wageningen, The Netherlands.

2) Crop Processes in Controlled Environments. Applied Botany Series. Volume 2. Edited by A.R.REES et al. 1972 Academic Press.

3) Plant Response to Climatic Factors. Proceedings of the Uppsala Symposium, Sweden. UNESCO 1973, Edited by R.O. Slatyer.

4) Industriellen Pflanzenbau Vortragoreihe des 4 Sumposiums fur Industriellen Pflanzenbau, Wien 1971. Band IV.

5) Symposium on Greenhouse Climate : Evaluation of Research Methods, Technical Communication, ISHS no 32, July 1973.

6) Controlled Environment Agriculture : A Global Review of Greenhouse Food Production by Dana G. DALRYMPL}:. Economic Research Service, USDA, Foreign Agricultural Economic Report no 89, October 1973.

7) KUREC V.K., Irkutszk Phytotron. Project, Realization and Use. Novoszibirzkj Ed. Nauka 1973 (In russian).

TAVEIRINE W. Temperatuurregelingbij Kasverwarming 1973 (in Dutch) Rijksstation voor Landbouw technick B 9220 Merelbeke, Belgium.

b) New Zealand Review.

Plant Physiology Division of Palmerston North (NZ) announce diffusion of the Newsletter : "Climate Laboratory News",

Purpose of this Newsletter is to :

1) outline work being carried out in the climate rooms.
2) give brief reports on completed work.
3) report on aspects of policy relating to controlled environment studies that may be of interest to those reading the Newsletter.

It will appear three times per year: March, August and November.

In Issue No 1, the following items are included : Room Allocation Committee, Room Climate service, Projects currently being handled in the laboratory, Department of Scientific and Industrial Research (3 projects), Ministry of Agriculture and Fisheries (4 projects), Forest Service (4 projects), Universities (7 projects), and Room Climate service Section (2 projects). Current Overseas Visitors, Climate Laboratory Publications, Supplementary Assistance.

Those who would like to have more details can write to:
Dr. I.J. WARRINGTON, Plant Physiology Division DSIR, Palmerston, North New Zealand.

c) Meetings and Conferences.

1974 March 25-27. London (United Kingdom), International Conference on Plastics in Agriculture and Horticulture. New developments.

Inquiries : Plastics Institute, 11 Hobart Places London SW I, United Kingdom.

1974 Spring. Athens (Greece) Fifteenth International Symposium of Agricultural and Food Industries in the Mediterranean region.

Inquiries : M.R. FORESTIER, CIPA, 24 rue de Teheran, 75008 Paris, France

April 1-5. Littlehampton (United Kingdom). Second International Symposium on Flower Bulbs.

Topics of discussion : Virus Diseases and production of Virus Free Plants-Fungal and Bacterial Diseases, Bulb Pests and their Control-Growth of Bulbs in the Field including Mechanisation and Weed Control, Bulb Storage and Forcing, Morphology and

Development, Post-harvest Physiology, Breeding, Propagation.

Inquiries : A.R. REES, Glasshouse Crops Research Institute, Worthing Road, Rustingtcn, Littlehampton BN 16 3 PU. Sussex. England-

1974 14 April-18 October. WIG 74. International Horticultural Exhibition in Vienna (Austria),

Inquiries : Touragri, 8 rue d'Athenes, Paris 9e, France.

1-974 June. Moscow (USSR) Twelfth International Grassland Congress.

Inquiries : Secretariat of the Organizing Committee of the International. Grassland Congress, 107139 Moscow, 1-139, Orlikov per., 1/11, Room 832, Moscow, USSR.

1974 June 14-22. Seventh International Congress of Seed Testing Association (ISTA), Warsaw (Poland). Seed Symposium and Exhibition.

Inquiries : ISTA, Secretariat, Box 68 N-1432 As-NL H, Norway.

1974 July 7-14. San Diego, California (USA). 2nd Intern. Drip Irrigation Congress.

Inquiries Program Comm, POB 2326, Riverside, Cal. 92506, USA.

1974 August 8-12. Kumasi (Ghana). First West African Horticultural Symposium (Tropical and Subtropical Horticulture) Theme of Symposium : Current Research on Horticultural Crops in West Africa.

Inquiries : J.C, NORMAN, Dept, of Horticulture, University of Science and Technology, Kumasi, Ghana.

1974 September 8-14. First International Congress of Ecology on Structure, Function and Management of Ecosystems.

Inquiries : International Congress of Ecology, c/o Royal Netherlands Academy of Sciences and Letters, Kloveniersburgwal 29, Amsterdam, the Netherlands.

1974 September 100=18. Warsaw (Poland). Nineteenth International Congress, 87 sessions.

Inquiries Secretariat Nineteenth International Horticultural Congress, 00930 Warszawa 71, Poland.

1974 September 12-15. HORTINAT, Orleans (France). International Exhibition of Horticultural Machinery.

Inquiries : HORTIMAT, Domaine de Cornay, 45590 Saint Cyr en Val, France.

1974 September 22-26. Vienna (Austria). V Symposium fur industriellen Pflanzenbaii.

Inquiries Dr. E. BANCHER, Institut fur Botanik der THWien, Getreidemarkt 9, 1060 Wien, Austria.

1574 September 23-29. Biddinghuizen (The Netherlands) Congres International de Genie Rural (CIGR).

Inquiries Intern. Agric. Centre, POB 88, Wageningen, The Netherlands

1974 November 4-14. (Japan) and November 1_5_19 (Formosa). Ninth International Congress on Mushrcom Science.

Inquiries • Joint Commission on Rural Reconstruction, 37 Nan Hai Road, Taipei 107, Republic of China.

1975. Prague (Czechoslovakia). Colloquium on the Winter Hardiness of Cereals.

Inquiries Dr. S. Rajki, 2462 Martonvasar, Hungary.

1975. Aalsmeer Naaldwijk (The Netherlands). New Developments in the Control of Glasshouse. Environment for : a) different flower crops (Aalsmeer) ; b) different vegetable crops (Naaldwijk) on the occasion of the 75 th anniversary of the Research Stations at Aalsmeer and Naaldwijk.

L9_D. (The Netherlands). ISHS Commission for Plant Substrates : Peat in Horticulture.

1975 April. Melle (Belgium). Azalea Symposium,

Inquiries J. van Onsem, Inst. of Ornam. Plant Growing, Caritasstraat 21, 9230 Melle, Belgium.

Su:.mier 1S7'. Twelfth International Botanical Congress, Leningrad SSR). Sections :
1U Nomenclature 2) Systematic and Evolutionary Botany
3 Lower Plants 4 Floristics and Phytogeography
5) Ecological Botany 6) Structural Botany (cytology, embryology, anatomy, morphology) 7) Ontogenesis 8) metabolism and its Regulation 9) Photosynthesis 10) Mineral Nutrition
11 Resistance to extreme environmental conditions
12) Immunity 13) Cultivated Plants and Natural Plant Resources 14) History of Botany and Botanical Bibliography
15) Plant Conservation in the World.

Inquiries Organizing Committee of the XII International Botanical Congress, 2 Prof. Popov Street, Leningrad 1970 22, €SSR.

Spring 19;6. Lausanne (Switzerland). Cucumbercae under Protection.

Inquiries : Dr. G. Perraudin, Station Federale de Recherches Agronomigves, 1962 Pont de la Morge, Switzerland.

Summer 1976. Tokyo, Kuyushu, Kyoto (Japan). International Symposium on Biotrons and Biotronics

Inquiries Dr. M. Knnishi, Laboratory of Applied Botany, Faculty of Agriculture, Kyoto University, Kyoto, Japan.

d) Future Issues of Phytotronic Newsletters.

Our most urgent needs in terms of articles, which we would appreciate receiving from you so that others can read them, were stated in Issue no 3, page 25 (May 1972). The 4 main subjects which we suggested are as follows, with comments :

1) Reference list for home made controlled environment rooms cabinets.
We received only three reports from our readers whom we gratefully thank.

2) Information from installators and builders of air conditioning in greenhouses. No answers have been received. We have obtained lists of builders from the Netherlands and Belgium and would be very glad to receive lists from other countries.

3) Research strategy of existing Phytotrons. We have reproduced the strategy of Martonvasar and we have still two papers which will be reprinted soon : Prof. I. HORVATH from Szeged (Hungary) and Prof. J.W. O'Leary from Tucson (USA).

4) Programs and results of research in the main agricultural horticultural or university centers. No answers have been received. It should be noted that for our Phytotron at Gif-sur-Yvette we have drawn up a list of our publications. We can send it to those interested.

We would like also to include a summary of "Committee for the standardization of measurement of environmental factors in Phltotrons'1 (N° 3 1972, page 23), of which Dr. P. GAASTRA is President and Moderator. We are waiting for it with great interest. It is, in fact, in view of helping this committee that we have reprinted in the present issue the guidelines for the summaries of experiments of the American Committee (Hort. Science, Vol. 7 (3) June 1972).

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Our bulletin of information and liaison can only be effective if it is a collective undertaking. Our role at the Phytotron of Gif is to receive, to classify, and to publish what any of our readers thinks would be useful for others to know: conferences, symposiums (announced or described) new technical inventions, books (published or in preparation with address of publisher), personal meditations, etc..-

With the evolution of recent research trends, it is clear that interest will greatly develop for phytotronic equipment and for Phytotrons. We remind you that this evolution is evident by the subjects which will be discussed at the next three international meetings on Plant Science. In each one, and for the first time, either a part of or the entire program, will be devoted to Phytotronics and its current aspects :

19 th International Horticultura]. Congress September 10-18 1974 at Warsaw (Poland) where of 87 sessions, one is titled : Phytotrons and Horticultural Research (Session n° 25 on September 12, afternoon).

12 th International Botanical Congress, Summer 1975 at Leningrad (USSR) where a special Symposium on-Phytotronics will be organised.

- International Symposium on Biotrons and Biotronics : Summer, 1976 (Japan).

Many of you will be soon be engaged in preparing to animate or participate in this meetings.

One of the main turning points, and one of the most significant to foresee due to the demand for it, will be the development

Of production of growth chambers and phytotronics cabinets in great quantity and with good viability b) industrial fitters and societies combined for this purposes. It will result in a great reduction of prices which is absolutely indispensable phytotronic strategy to come into general use. Phytotronic technology provides man with one of the strongest levers for innovation in various plant sciences, above all for fundamental or applied research or its applications, but very soon also for horticultural industrialization and the production of standard plants all the year round.

We thank you again for your cooperation and for your notes and papers which we await to reproduce in future issues.

P. CHOUARD et N. de BILDERLING