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SYMPOSIUM ON THE CONTINUOUS INDUSTRIAL HYDROPONIC CROP
PRODUCTION SYSTEM IN ARTIFICIAL CLIMATE,
MOSCOW, USSR, 17-19 May 1988

XP/INT/88/MO4
XP/INT/88/901

Terminal report

Prepared for the Governments of the countries participating
in the interregional project
by the United Nations Industrial Development Organization

Backstopping officer: B. Galat, Agro-based Industries Branch

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INTRODUCTION

A. Project background

The continuous hydroponic crop production system for the cultivation of vegetables and other crops in an artificial climate has been developed in Austria by Professor Dr. O. Ruthner (Ruthner Phytotechnik). The first industrial-size production plant based on that system was manufactured by the Austrian company Vogelbusch GmbH, supplied to the Union of Soviet Socialist Republics and installed at an agricultural estate, the "Zarechye" State Farm near Moscow, where it is in full operation.

The Soviet Scientific Industrial Association of Agricultural Engineering (VISKHOM) is currently controlling all production parameters with the result that the production efficiency could be considerably improved and the continuous hydroponic production of vegetables such as cucumbers, tomatoes, lettuce, flowers and medicinal plants can by now be effectively carried out on an industrial scale.

As a result of Soviet-Austrian co-operation (Scientific-Industrial Association of Agricultural Engineers (VISKHOM), USSR - Ruthner Phytotechnik and Maschinenfabrik Andritz, Austria), a hydroponic module was designed that requires only electric energy and a minimum of water and nutrients to produce the desired crops in an artificial climate. The production plant is characterized by a slowly moving vertical conveyor system, housed in a building requiring only a minimum of ground space, which can be installed on any terrain - tundras, mountains, desert areas and other places where due to unfavourable soil and climatic conditions agricultural production would be impossible.

Being a modular system, the production plant can take any size, ranging from small-scale to large-scale. The new technology can further be combined with a continuous production of animal feed, thereby creating the basis for the establishment of animal husbandries (meat, eggs etc.) in addition to the production of fresh sprouts and vegetables for direct human consumption and medicinal herbs for the production of pharmaceuticals.

Depending on the particular situation of the country concerned, the hydroponic plant-production modules may be tailored to meet market demands for particular products and to achieve well-balanced production economies.

The continuous hydroponic-plant production system with its large development potential was, therefore, considered to be of great interest to many developing countries.

The Agro-based Industries Branch delegated two officials to attend the Symposium. Their function was to moderate the discussions which followed the lectures and the visit to the pilot plant, and to assist participants by answering any organizational, financial and other questions during the Symposium.

B. Official arrangements

On the invitation of the Ministry of Agricultural and Tractor Machine-Building of the Union of Soviet Socialist Republics, two officials of the United Nations Industrial Development Organization (UNIDO) visited the hydroponic production plant installed and operating near Moscow in May 1987 and discussed with representatives of VISKHOM the possibility of launching a

UNIDO project, in co-operation with the USSR/Austrian Consortium (VISKHOM, Ruthner, Andritz), with a view to sponsoring the new hydroponic plant-production technology and introducing it to appropriate developing countries.

On the basis of that visit a memorandum was signed by the two parties in November 1987, and in March 1988, Soviet experts from the Ministry and VISKHOM visited UNIDO for further discussions. The Agro-based Industries Branch formulated and submitted a project proposal which was approved by the Project Review Committee in October 1987. The project entitled "Symposium on the Continuous Industrial Hydroponic Crop Production System in Artificial Climate, Moscow, 17-19 May 1988" was to be funded from two sources, XP/INT/88/MO4 in United States dollars, and XP/INT/88/901 in roubles. Finally both parts of the project were financed by the USSR Government from a special-purpose contribution to the Industrial Development Fund and the Symposium was successfully held on the scheduled date.

THE SYMPOSIUM

A. Objective

The objective of the Symposium was the introduction of the hydroponic crop-production system in artificial climate to the representatives of selected developing countries with favourable conditions for the setting-up and operation of such plants. The vertical hydroponic crop-production system, which was invented by Professor Dr. Othmar Ruthner of Austria, has been further developed by the Soviet Institute VISKHOM in co-operation with Maschinenfabrik Andritz of Austria.

The hydroponic crop-production unit, an experimental prototype of which is in full-time operation at the "Zarechye" Farm near Moscow, is suitable for the continuous cultivation of a great variety of vegetables for daily harvesting throughout the year and may be particularly useful for the production of high-value crops such as medicinal plants, special herbs etc. As the hydroponic crop-production system operates independently from the environment, it permits the industrial cultivation of crops of highest quality because adverse environmental influences are avoided.

B. Participants

UNIDO sent invitations to 25 developing countries, six developed countries, six international organizations and six international and regional associations and banks (see annex I). Twenty-one developing countries and some organizations responded to the invitations, four countries did not respond at all and four countries were interested but unable to attend the Symposium. Finally, 15 countries nominated 26 candidates, and from these 15 countries (see annexes II and III) 20 participants were selected (13 participants from Africa and the Middle East, four from Asia and the Far East and three from Latin America). From the selected 20 participants only 18 (from 13 developing countries) attended the Symposium; the participants from Bhutan and Kuwait did not attend.

C. The programme - summary of meetings and visits

Some 40 international participants attended the opening session on Tuesday, 17 May 1988 at the premises of the VISKHOM Institute, Moscow. A welcoming address and an introductory statement were read out on behalf of the Director-General of UNIDO.

A. M. Skrebtzov, Deputy Minister, addressed the participants on behalf of the Minister of Agricultural and Tractor Machine-Building of the USSR and officially opened the Symposium. He said that the Symposium was dedicated to an issue of utmost importance to mankind - the creation of reliable systems for the continuous production of food and medicinal plants. Pointing out the existing paradox situation, namely that the developed countries had achieved a steep rise in their agricultural output whilst in the developing countries millions of people were starving, as well as the fact that in the past the agricultural production had been intensified without due consideration to ecological consequences, he stressed that the block modular complex developed over the last five years by the specialists of NPO VISKHOM, in co-operation with several Austrian companies, represented an entirely new approach to agricultural production and could assist in overcoming the above-mentioned problems. He added that the modular plant production system which combined the most advanced trends in agricultural and industrial development - biotechnology, hydroponics, controlled microclimate, rotary conveyors and automation of technological processes - would lend itself for the cultivation of crops in areas where normally no agricultural production could exist. He hoped that the Symposium would create such interest in this new and highly profitable system that would permit the Soviet-Austrian venture to start the manufacture of the modules, particularly for use in the developing countries.

The Deputy Director-General of UNIDO stressed the importance of the Symposium for the developing countries and welcomed the spirit of co-operation which had led to successful hydroponic plant development work. He offered UNIDO's continuing co-operation to all concerned and interested.

After having been informed by L. P. Kim of the USSR Chamber of Commerce and Trade about the forthcoming event of the international fair and exhibition "Green House Technics 88", the participants were given the opportunity to visit the various departments of the VISKHOM Institute to get acquainted with the research and development work on agricultural equipment and machinery carried out in the USSR.

In the afternoon of 17 May 1988, Y. Lipov of VISKHOM presented the following two papers:

"New principles of cultivation of agricultural crops on the basis of the modular rotary conveyor hydroponic system";

"Block modular complex: layout, systems and controls".

Professor Dr. Othmar Ruthner of Austria presented the paper "Plant-growing technologies in the block modular complex".

Copies of all three papers were given to the participants for their review and study prior to the visit of the prototype experimental hydroponic production unit on the following morning.

On the morning of 18 May, the participants visited the "Zarechye" State Farm near Moscow and were received and welcomed by the State Farm Director who informed them about the structure of the farm and its operations. This was followed by a discussion during which the participants had the opportunity to ask questions which were answered by the management of the State Farm. After the general discussion the participants visited the prototype experimental hydroponic crop-production module and a VISKHOM scientist explained the system and demonstrated its technological design and function.

Following that demonstration, the participants re-assembled in the State Farm's conference room, where R. Wick of Maschinenfabrik Andritz of Austria presented the paper "Technical and economic feasibility of the block modular complex". The presentation was followed by a discussion on the economic aspects of the hydroponic crop-production system just visited. The visit of the "Zarechye" State Farm ended with a guided tour through the farm facilities.

On the morning of 19 May, the participants assembled in the conference room of hotel Molodyozhnaya for an exchange of views and final discussions in the presence of VISKHOM specialists.

According to the views expressed during the discussions, the majority of the participants considered the hydroponic plant-production module a practical and interesting new way of crop production in an artificial climate. One participant pointed out that the system would be particularly suitable for the production of fresh vegetables in big cities where agricultural supplies cannot meet the demand. Several participants entered into details of the economy of the hydroponic crop production, an important aspect apart from the many advantages offered by that system. Many participants expressed the view that the consumption of electric energy was a main factor in production economy, and the use of alternative sources of energy was recommended on a case-by-case basis.

Some participants considered that the system might need to be adapted to conditions prevailing in the countries interested in its application. Several participants inquired what kind of assistance their home countries could receive with regard to the necessary pre-investment studies, followed by appropriate investment proceedings, should they consider establishing hydroponic crop-production plants. A number of participants also voiced their interest in follow-up actions after the Symposium concerning technical, economic and commercial issues, which should be taken care of by UNIDO, VISKHOM and Maschinenfabrik Andritz. The VISKHOM representatives offered their assistance and declared themselves ready to provide the participants with any further information they may request. The FAO representative offered the co-operation of his organization, especially in the crop-cultivation sector, while leaving the technical and technological aspects of the hydroponic production unit to UNIDO and VISKHOM/Andritz respectively.

The representative of Maschinenfabrik Andritz said that his company would readily submit, on request, prices, economic data and any other additional information to all concerned and interested. The UNIDO representatives invited the participants to request the assistance of UNIDO on all aspects of the establishment and operation of the hydroponic production system, particularly with regard to pre-investment and feasibility studies.

The Symposium was closed by the UNIDO representative by paying tribute to Professor Dr. Othmar Ruthner, the inventor of the hydroponic crop-production system under discussion.

D. Programme evaluation and conclusions

The Symposium was organized in order to acquaint representatives of selected developing countries with the vertical hydroponic crop-production system in an artificial climate, thus enabling them to consider the usefulness of its industrial application in their respective home countries. The discussions revealed that the overall technology was fully understood as well as the purpose of the hydroponic production of various crops, i.e. to increase the supply of fresh vegetables for the benefit of the population concerned.

All developing countries were assured of the co-operation of VISKHOM, Maschinenfabrik Andritz and UNIDO in the preparation, installation and operation of hydroponic production units, and that the available know-how and expertise would be shared with all parties concerned in the interest of the establishment of hydroponic crop-production plants whenever and wherever required.

UNIDO may play a special role in the preparation of pre-investment and techno-economic feasibility studies to facilitate appropriate investment decisions. UNIDO will, therefore, initiate follow-up activities within its established framework of technical assistance and welcomes requests for UNIDO assistance, subject to funds available. In the execution of technical assistance projects, UNIDO will draw on the know-how and experience available with VISKHOM, and its Austrian partner companies.

In the opinion of UNIDO the Symposium has fulfilled its objectives. It can be considered a starting point for the establishment and operation of hydroponic crop-production units in developing countries, which not only would guarantee improved food supplies, but would also be in the interest of the further industrialization of those countries.

Annex I

**GOVERNMENTS, INTERNATIONAL ORGANIZATIONS, INDUSTRIAL COMPANIES
AND INSTITUTES INVITED TO THE SYMPOSIUM**

The Governments of the following developing countries were invited to nominate candidates:

Algeria	Libyan Arab Jamahiriya
Argentina	Morocco
Bhutan	Nepal
Brazil	Nigeria
China	Qatar
Cuba	Saudi Arabia
Egypt	Sudan
Guatemala	Syrian Arab Republic
India	Thailand
Iran (Islamic Republic of)	Tunisia
Iraq	United Arab Emirates
Jordan	Yemen
Kuwait	

The following international organizations were invited to participate at their own costs:

Food and Agricultural Organization of the United Nations (FAO)
Economic Commission for Africa (ECA)
Economic Commission for Asia and the Pacific (ESCAP)
Economic Commission for Latin America (ECLA)
Economic Commission for Europe (ECE)
United Nations Development Programme (UNDP)

Selected industrial companies, institutes etc. from the following countries were invited to participate at their own costs:

Canada
Denmark
Finland
Iceland
Norway
Sweden

The following international and regional institutions were invited to participate at their own costs:

African Development Bank
Asian Development Bank
European Investment Bank
International Development Association
International Investment Bank
Nordic Investment Bank

Annex II

SELECTION OF PARTICIPANTS

Countries invited	Results			Number of nominations	Number of participants accepted
	Interested	Not interested	No reply		
Algeria	x			2	2
Argentina	x			1	1
Bhutan	x			1	1
Brazil	x			2	1
China	x			2	2
Cuba	x			-	-
Egypt	x			2	2
Guatemala	x			1	1
India	x			-	-
Iran (Islamic Republic of)			x	-	-
Iraq	x			1	1
Jordan	x			1	1
Kuwait	x			1	1
Libyan Arab Jamahiriya	x			2	2
Morocco	x			5	2
Nigeria	x			2	1
Nepal			x	-	-
Qatar		x		-	-
Saudi Arabia		x		-	-
Sudan		x		-	-
Syrian Arab Republic			x	-	-
Thailand	x			2	1
Tunisia	x			1	1
United Arab Emirates		x		-	-
Yemen			x	-	-
Total	17	4	4	26	20

Annex III

LIST OF PARTICIPANTS

A. UNIDO project participants

Algeria

Sadok MATAALLAH
Ouarda BOUMAAZA

Deputy Director, Ministry of Agriculture
Engineer, Ministry of Agriculture

Argentina

Tomas Migue: SCHLICHTER

Senior Scientific Researcher

Brazil

Antonio Aparecido LONGHI

Director, Centre of Pesticides, Plant
Protection and Seed Trade

China

Dian Kui CHEN
Ya Ping SI

Associate Professor
Assistant Research Fellow, Co-op. Research

Egypt

Mohamed Taha El-Wasif ABDEL-BADIE
Osama Abd Elsamd SHALABY

General Manager, Spare Parts and Green-
houses Production Centre
Head, Agricultural Department

Guatemala

Amarillis Saravia GOMEZ

Co-ordinator, Centre of Medicinal Plant
Projects

Iraq

Qahtan Mohammed ALMITWALLY

Consultant to Ministry

Jordan

Hashem Mohammed SHBOUL

Director of Irrigation and Maintenance,
Ministry of Irrigation

Libyan Arab Jamahiriya

Ali Mohammed EL-KHARRAZ
Rafi Ibrahim AZABI

Head, Soil and Water Research Unit,
Agriculture and Research Centre
Director, Regional Research Centre of
Agriculture

Morocco

Mohammed BERRADA
Hamid EL-MAHMOUDI

Chief, Vegetable Production Centre
Engineer, Food Industry

Nigeria

C. C. ANOJULU

Assistant Director, Federal Department
of Agriculture

Thailand

Kriang-Krai MEKVANICH

Head, Farm Mechanization Centre,
Department of Agricultural Ext.

Tunisia

Naceur HAMZA

Director, Vegetable Crops Department,
National Crop Research Institute

B. Other participants

FAO

W. BAUDOIN

Horticultural Officer, Plant Production
and Protection Division

Austria

O. RUTHNER
R. WICK
L. DOMES

Professor, Ruthner Phytotechnik
Engineer, Maschinenfabrik Andritz
Head, Sales Department for the USSR,
Maschinenfabrik Andritz

Czechoslovakia

Mr. KHMELA
Mr. LUEDEK
Mr. VANCATA

German Democratic Republic

Mr. ZAIDEL
Mr. BAYER
Mr. PALMA

Poland

Jan RADNITZKY

Union of Soviet Socialist Republics

A. A. EZHEVSKY

Minister of Agricultural and Tractor
Machine-Building

A. I. SKREBTZOV

Deputy Minister of Agricultural and
Tractor Machine-Building

M. M. FIRSOV

Deputy General Director, VISKHOM

Yu. N. LIPOV

Head of Department, VISKHOM

V. N. ZAITSEV

Head of Department, VISKHOM

M. A. GALKIN

Head of Laboratory, VISKHOM

V. S. SYSOEV

Senior Scientific Worker, VISKHOM

G. N. KOZHEVNIKOV

Laboratory Chief, VISKHOM

T. N. YELTSOVA

Senior Engineer

Union of Soviet Socialist Republics (continued)

Ya. F. SVIRIDENKO	Head of Department, Crimean Agricultural Centre
N. S. EVDOKIMOV	Chief, State Special Designing Bureau (GSKB), Leningrad
L. S. KOLOMIJSKAYA	Researcher
B. V. KUROTCHENKO	USSR State Committee for Science and Technology
Yu. Ya. PROHOROV	USSR State Committee for Science and Technology
L. P. KIM	USSR Chamber of Trade and Commerce

Yugoslavia

Z. NEDELKOV