

## INFORMATION AND REPORTS

# THE NATIONAL SUNFLOWER IMPROVEMENT PROGRAM IN THE UNITED STATES

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The current sunflower improvement program of the Agricultural Research, Scientific and Education Administration, U.S. Department of Agriculture is conducted at the four locations of Fargo, North Dakota; Bushland, Texas; Davis, California; and Beltsville, MD.

*Fargo, North Dakota:* Oilseeds research on sunflower and flax at this location is led by Dr. Don Zimmerman. The research team consists of two Geneticists-Breeders (Drs. Miller and Roath), two chemists (Drs. Cick and Zimmerman), a Pathologist (Dr. Gulya) and an Entomologist (Dr. Charlet). We estimate that about 70 percent of the total effort on oilseeds here is devoted to sunflowers.

The mission of the Oilseeds Research Unit at Fargo is: 1 — to develop new genetic populations, breeding lines and varieties of oilseed crops, particularly sunflower and flax, with improved yield potential; 2 — development of sunflower and flax genotypes with improved resistance or tolerance to diseases; 3 — determination of the role of fatty acid hydroperoxide metabolism during early plant growth; 4 — evaluation of quality characters, both desirable and undesirable, in sunflower and flax; and 5 — determination of the bionomics of the sunflower seed weevil and sunflower beetle in the North Central growing area.

*Bushland, Texas:* Our sunflower research within the Southern Region is conducted at Bushland, Texas under the leadership of Dr. Rogers, Entomologist. Sunflower breeder Dr. Thompson recently transferred to pecan breeding and we plan to fill this position as soon as possible. Dr. Yang is the Pathologist in this unit, recently reorganized as Sunflower and Guar Research Unit.

The overall mission on sunflowers at Bushland is to develop improved hybrids, insect and disease resistance and control, and improved management practices. Dr. Rogers has studied insect pest biology and control, cooperated in native species collecting, and evaluated *Helianthus* species for resistance to major insect pest complexes. He has also cooperated in studies on biochemical characteristics of *Helianthus* species. Dr. Thompson has placed emphasis on the development of improved parental lines for sunflower hybrids. He also has cooperated in collecting and maintaining native species of *Helianthus*. Dr. Yang is working on *Rhizopus* resistance and is evaluating hybrid lines and native species for resistance. Future work will also include resistance to rust and charcoal rot.

*Davis, California:* Sunflower research is conducted in the Western Region at Davis, California within a newly organized research unit, Rice and Oilseeds, Genetics and Breeding Research, led by Dr. Rutger.

Long range goals for sunflower improvement here include: (1) The use of variability in both domestic and wild *Helianthus* species to develop germplasm with needed characteristics that have not been available in useful forms (Examples include sunflower moth resistance, stability to fatty acid components of the oil in different environments, resistance to *Sclerotinia* and *Macrophomina*, and elimination of chlorogenic acid); (2) Maintain, increase and characterize the wild *Helianthus* collection; and (3) Continue to develop and refine the embryo culture technique for use in wild × domestic crosses.

Dr. Beard, Geneticist-Breeder, is developing germplasm pools and isogenic lines in sunflower as well as leading the program on inter-specific hybridization.

Pathologist Dr. Klisiewicz concentrates on charcoal rot, chalk rot, root and stem rot, and root knot nematode resistances. Other aspects

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of disease study are the current composition of strains and races of pathogens, their virulence and potential damaging capabilities on currently used breeding lines and cultivars, host-parasite-environment relationship, disease development and survival of pathogens.

Mr. Urie, Breeder, determines performance of early hybrids in double cropping systems, and evaluates sunflower lines for resistance to the cotton defoliating strain of verticillium wilt and to charcoal rot.

About 75 percent of the effort on oilseeds at Davis will be on sunflower, with the remaining effort on safflower and soybean.

*Beltsville, Maryland*: The research on sunflowers at Beltsville, Maryland, conducted by Pathologist Dr. Thomas, is concerned with disease resistance. Inheritance of resistance, and the development of new germplasm with resistance to two or more diseases combined with desirable agronomic characteristics, are emphasized.

Verticillium wilt, particularly induced by strains pathogenic to cotton and other warm-season crops, Sclerotinia stalk and head rot, Rhizopus head rot, and charcoal rot are the diseases being studied. The resistance of present cultivars, inbred lines and hybrids, and *H. tuberosus*, the F<sub>1</sub> hybrid of *H. tuberosus* X cultivated sunflower and backcross progenies are being investigated.

I appreciate the opportunity to learn of the objectives, progress, and future plans of the F.A.O. Research Network on Sunflower. Problem areas in sunflower improvement and production in which cooperative efforts will greatly benefit the World Community include further collection, study, and utilization of wild species of sunflower. This germplasm offers resistances to pests not currently available in domestic sunflowers. The required work in taxonomy, cytogenetics, and genetics of sunflower is so immense that it can only be achieved by joint efforts on an international basis, and we look forward to cooperate in these and related areas.

# THE THIRD CONSULTATION OF THE F. A. O. RESEARCH NETWORK ON SUNFLOWER

(Versailles, France,  
23–26 October 1979)

The third Consultation of the F.A.O. Research Network on Sunflower, sponsored by the F.A.O. Regional Office for Europe, was held at INRA Versailles, France, from 23 through 26 October 1979. The Consultation was attended by 51 delegates representing 15 countries (Argentina, Canada, Czechoslovakia, A. R. Egypt, France, F. Rep. of Germany, Iraq, Italy, the Netherlands, Portugal, Romania, Spain, Tunisia, U.S.A., Yugoslavia) and two international organizations (OCDE and the International Sunflower Association).

On behalf of the European Commission for Agriculture of F.A.O., Mr. P. Halimi (France), the chairman of this Commission, opened the Consultation delivering a speech in which Sunflower Network has been appreciated as one of the best functioning research networks, due to the good organization of the scientific co-operation within the existing five subnetworks and to the judicious selection of the common research topics.

The Consultation was greeted by Dr. A. Bozzini, chief of the F.A.O. Crop and Grassland Production Service, who expressed unanimous thanks to the French authorities, especially to the Ministry of Agriculture, INRA and CETIOM, for the excellent conditions created to the Consultation's works.

The Consultation was chaired by dr. A. Caudeyron, general inspector of INRA and by two vice-chairmen, Prof. A. Benvenuti (Italy) and Dr. D. Skorić (Yugoslavia).

On behalf of the Co-ordination centre, dr. A. V. Vrânceanu, co-ordinator of the Network, presented a general report on past activities (1978–1979) and proposals for the next biennium (1980–1981).

The results of the joint investigations carried out in 1978 and 1979 were presented separately by the subnetwork leaders who also made proposals for further improvement of the scientific

co-operation between the participating institutions. The activity of the following subnetworks was examined :

1. Experimentation of sunflower cultivars in international trials( dr. A. V. Vrânceanu, Romania) ;
2. Sunflower applied genetics (Prof. dr. A. Kováčik, Czechoslovakia) ;
3. Sunflower disease survey in Europe and disease mapping (dr. M. Achimović, Yugoslavia) ;
4. Chemical weed control (Mr. Y. Regnault, France) ;
5. Sunflower response to irrigation (dr. J. L. Muriel Fernandez, Spain).

The main results obtained in the second biennium 1978–1979 will be published in the second number of the Network's Information Bulletin "Helia".

The Consultation adopted the following recommendations for the next biennial research cycle.

**1. The experimentation of sunflower cultivars** will be reorganized and will be based on the existence of four different types of trials including both hybrids and open-pollinated varieties, corresponding to different geographical zones, taking into account the great variations of sunflower phenotypes in accordance with soil and climatic conditions. Thus, the following trials will be set up during the third biennium 1980–1981 :

— Zone I (West and Central Europe), Trial No. 1 with 15 early and medium-early hybrids ;

— Zone II (South and South-East Europe), Trial no. 2 with 20 medium-late and medium-early hybrids ;

— Zone III (Near and Middle-East, North and North-East Africa), Trial no. 3 with 10 open-pollinated varieties and 10 hybrids of a medium-late maturity ;

— Zone IV (Central and South-America), Trial no. 4 with 8 open-pollinated varieties and 12 hybrids of a medium-late maturity.

Sunflower cultivars included in trials will represent the most recent achievements of breeders from various Network member-countries, which had not been tested in the previous cycles. By countries, the structure of entries will be the following: Romania 14 hybrids, Yugoslavia 6 hybrids and 1 open-pollinated variety, Spain 6 hybrids and 1 open-pollinated variety, U.S.A. 3 hybrids, Argentina 2 hybrids and 2 open-pollinated varieties, F. Rep. Germany 3 hybrids, Hungary 2 hybrids, Bulgaria 1 hybrid, Italy 5 open-pollinated varieties.

The seed samples will be prepared and shipped to all participating institutions by the F.A.O. Seed Exchange Laboratory. The instructions concerning the experimental technique will be prepared and distributed by de Liaison centre of Fundulea, Romania. The participants discussed the main morpho-physiological and economic characteristics of sunflower cultivars which have to be used in field books and for direct transfer of data to cards by computer personnel at the F.A.O. Headquarters in Rome. The importance of collecting and sending accurate and complete data was stressed, as well as the necessity of carrying out the field trials according to the recommended methodology.

Oil analyses will be performed by each participating institution. Protein quantity and quality will be determined for all trials by the Research Institute for Fodder Crops of Iregszemcse, Hungary, and oil quality, expressed by fatty acid composition, will be investigated by the Research Institute for Cereals and Industrial Crops of Fundulea, Romania, instead of the Institute for the Application of the Nuclear Energy in Agriculture from Zemun-Belgrade, Yugoslavia. Consequently, the existence of the subnetwork on sunflower oil quality ended in 1979, due to the inactivity of its Liaison centre.

It was decided to compile a comprehensive and up-to-date list of sunflower cultivars registered, licensed, authorized or admitted in cultivation in all sunflower growing countries, indicating their main morpho-physiological and economic characteristics. Such a list will be published in the Information Bulletin "Helia" and will help all the interested people to identify the best cultivars to be tested and introduced in local commercial production.

**2. The applied genetic investigations** will be centered in the next two years on the determination of morpho-physiological components of sunflower ideotypes for different ecological regions, aiming primarily at achieving a new architecture of the plant which would improve radically its yielding ability. In a first stage, the genetic study of the model characters will be initiated, and then their integration into the general ideotype will be performed, on the basis of the study of correlations and genetic inter-

actions between these characters as well as of their interactions with the environment. Each of the participating institutions from Czechoslovakia, France, Italy, Spain, U.S.A., Romania and Yugoslavia will study the heredity of certain model characters, using genetic lines purposely selected by the respective institutions or supplied by the Liaison centre of Prague on the basis of mutual exchange of biological material.

Due to the fact that the designing of new sunflower ideotypes could be done only by using the  $F_1$  hybrid method, the applied genetic investigations of this subnetwork will take also into account and the theoretical and practical aspects of the phenomenon of male sterility and pollen fertility restoration, the selection and study of genetic markers and the identification of genes for disease resistance and their incorporation into the general ideotype.

**3. Collection, evaluation and conservation of wild species and their use in sunflower breeding programmes** constitutes one of the recent preoccupations of Sunflower Network, adopted at the Consultation of Versailles as topic of a separate new subnetwork with its Liaison centre at the Research Institute for Field and Vegetable Crops of Novi Sad, Yugoslavia (Subnetwork leader: dr. D. Skorić).

The necessity of this co-operation has been unanimously acknowledged and supported, due to the following considerations:

— wild species represent the main disease resistance gene pool and a valuable germplasm for breeding a xerophyte type of sunflowers;

— wild species, all native to the Americas, are in a process of disappearing, due to the impact of modern agriculture and civilization on the environment;

— the present collections are not representative with regard to the gene pool existing within the natural populations, being quite poor in genetic factors for resistance to diseases, due to their obsolescence and biological limitations caused by the small number of individuals collected at random within each species.

The collection of wild species will be carried out mainly by the help of the co-operating institutions from U.S.A., Canada, Mexico and Argentina, as well as of those participants which possess different strains of a recent date. Taxonomic study and genetic evaluation will be performed in Yugoslavia, France, Romania and U.S.A. and their multiplication and conservation in Yugoslavia and France. Such germplasm collections will be put at the disposal of all participating institutions for utilization in breeding programmes.

**4. The mapping of sunflower diseases** will be extended and to other sunflower growing countries from outside Europe, employing the same methodology during the next years. In addition, information about the sunflower genotypes on which observations were made, will

be provided, and this will enable any changes in disease patterns resulting from changes in the sunflower genotypes cultivated to be taken into consideration.

The subnetwork on sunflower disease mapping, whose Liaison centre has been changed from Cordoba — Spain to the Institute of Field and Vegetable Crops at Novi Sad, Yugoslavia, will prepare an exhaustive list of publications on sunflower diseases and will produce a booklet giving a detailed description of the symptomatology of the different diseases. If funds were available, this booklet could be published and so be available as reference particularly for people working in areas where sunflowers are a new crop. Some of the participants of the sub-network will undertake studies and exchange of information concerning the methodologies of testing for resistance to different diseases, with reference to both cultivated and wild sunflowers.

5. **The chemical weed control** in sunflower crops will continue to be an important topic for co-operation, taking into consideration the new products released on the international market. During the next two years, the emphasis will be placed on herbicides less susceptible to rainfalls, which can be applied before sowing and also on herbicides which can be used after sunflower emergence. The Liaison centre of this subnetwork, CETIOM Paris, will establish a "data bank" which will stock and distribute all information connected with herbicide behaviour and chemical weed control in sunflower crops.

6. **The subnetwork studying the response of sunflowers to irrigation** will develop its activity with the purpose of establishing the ecological zones where this relatively new oil crop could give profitable results under irrigation as compared to other irrigated or dry land crops.

In the final part of the Consultation, the participants expressed their agreement in connection with the election of the Liaison centres for the next biennial cycle, as follows :

— The Research Institute for Cereals and Industrial Crops, Fundulea, Romania, for the subnetwork on the experimentation of sunflower cultivars ;

— The Research Institutes for Crop Production, Prague, Czechoslovakia, for the subnetwork on sunflower applied genetics ;

— The Institute of Field and Vegetable Crops, Novi Sad, Yugoslavia, for the subnetworks on sunflower disease mapping and collection, evaluation and conservation of wild species ;

— The Interprofessional Technical Centre of the Metropolitan Oil Crops (CETIOM), Paris, France, for the subnetwork on chemical weed control ;

— The National Research Centre for Oil Crops, Córdoba, Spain, for the subnetwork on sunflower response to irrigation.

The Research Institute for Cereals and Industrial Crops of Fundulea, Romania, was re-elected, according to the provisions of the Network's statute, as Co-ordination centre of the whole Network, for the next period of four years (1980—1983).

The next Consultation of the Network will take place after two years, in the autumn of 1981, at a date which will be established subsequently. The following countries have offered themselves to house the fourth Consultation : A. R. Egypt (Giza, Cairo), Italy (University of Pisa) and Yugoslavia (Novi Sad). These proposals are being examined by the F.A.O. Regional Office for Europe, which will decide about the place of the next Consultation of Sunflower Network.

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