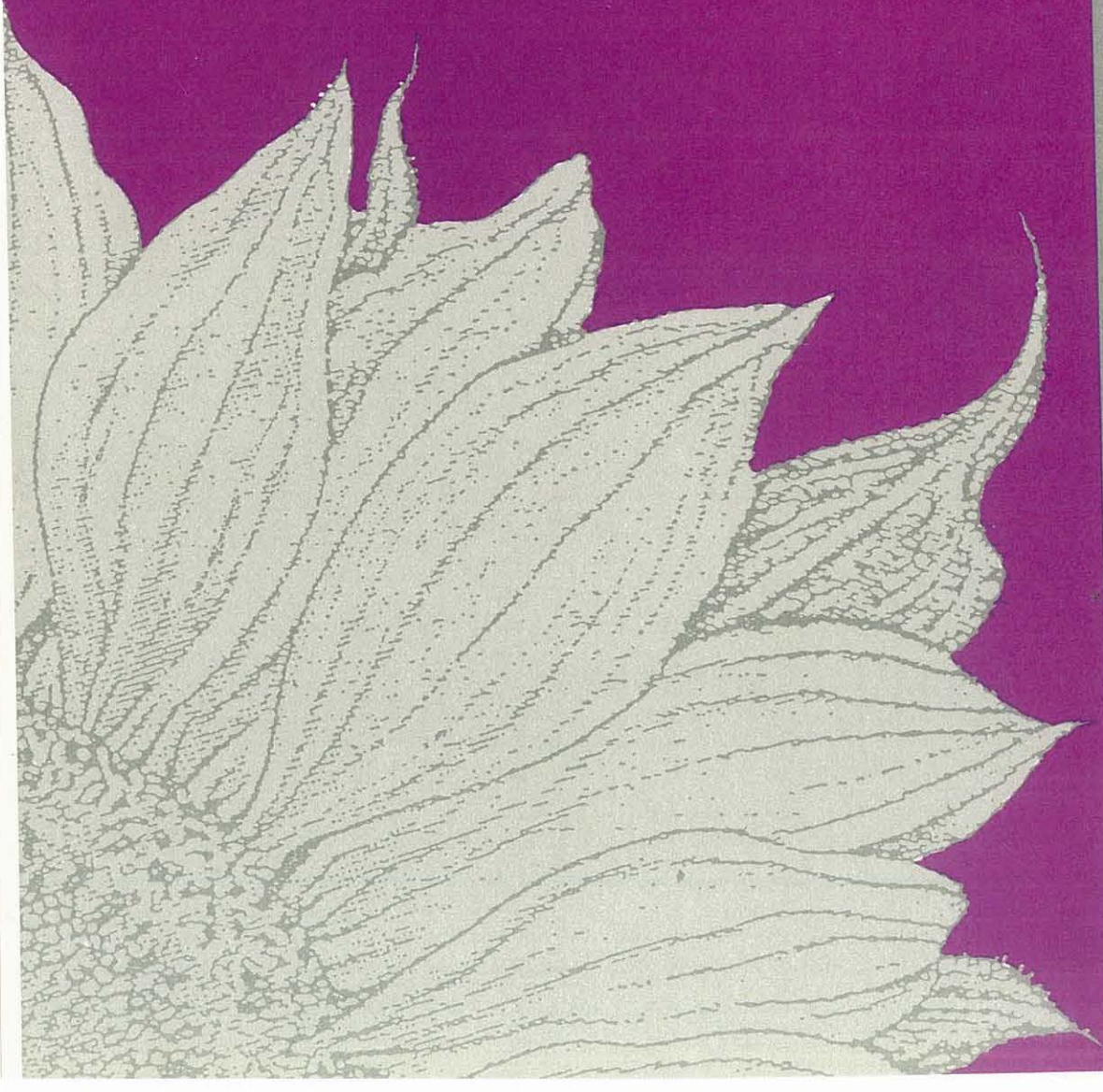
EUROPEAN COOPERATIVE PROGRAMME FOR CROP GENETIC RESOURCES NETWORKS

IBPGR

REPORT OF A WORKING GROUP ON SUNFLOWER

(fourth meeting) held at
Facoltà di Agraria, Università degli Studi di Pisa
Pisa, Italy
11-12 May 1991



INTERNATIONAL BOARD FOR PLANT GENETIC RESOURCES

The International Board for Plant Genetic Resources (IBPGR) is an autonomous international scientific organization under the aegis of the Consultative Group on International Agricultural Research (CGIAR). IBPGR was established by the CGIAR in 1974. The basic function of IBPGR is to promote and coordinate an international network of genetic resources centres to foster the collecting, conservation, documentation, evaluation and use of plant germplasm and thereby contribute to raising the standard of living and welfare of people throughout the world. Financial support for the core programme is provided by the Governments of Australia, Austria, Belgium, Canada, China, Denmark, France, Germany, India, Italy, Japan, the Netherlands, Norway, Spain, Sweden, Switzerland, the UK and the USA, the United Nations Development Programme and the World Bank

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ECP/GR/IBPGR
ROME 1992

CONTENTS

INTRODUCTION

The fourth meeting of the ECP/GR Sunflower Working Group was held at the Facolta' di Agraria, Universita' degli Studi di Pisa, Pisa, Italy, 11-12 May 1991, by kind invitation of the Dean of the Faculty, Prof. A. Benvenuti.

In order to continue to strengthen mutual collaboration between the FAO European Cooperative Research Network on Sunflower and the ECP/GR Sunflower Working Group, and also in order to allow joint sponsorship of some participants by the two respective umbrella organizations, FAO and IBPGR, the Working Group was convened just before the Seventh Consultation of the network mentioned above. Despite the Working Group meeting being convened on Saturday and Sunday, 28 participants from 8 European countries, plus USA, Argentina, Mexico and India joined. This was taken as a good sign of the growing interest outside Europe for sunflower genetic resources and of the extension of collaborative activities within the ECP/GR Sunflower Working Group. It also demonstrated the benefits of mutual collaboration between different networks.

Prof. Benvenuti welcomed the participants, and Mr. P.M. Perret, ECP/GR Coordinator, explained the objectives and *modus operandi* of Phase IV of the ECP/GR and summarized the previous history of the ECP/GR Sunflower Working Group, of which the first meeting was held in Novi Sad, Yugoslavia, in July 1984.

Prof. Vannozzi, responsible for the practical organization of the meeting, was warmly thanked by both speakers. Dr. J. Fernández Martínez expressed his wish to be released from the Chairmanship. Prof. Vranceanu was unanimously elected in his place. A list of participants is provided in Appendix I. The Agenda, as approved, is shown in Appendix II.

REPORT

REVIEW OF CURRENT ACTIVITIES

1. Dr. Mihaljcevic, from the Institute for Field & Vegetable Crops (IFVC), Novi Sad, Yugoslavia, summarized progress in the database for wild sunflower. He outlined gaps, necessary minor changes in the structure of the database and some bottlenecks due to inappropriate definitions of a few descriptors, i.e. days to flowering, days to maturity, when applied to wild species. His report is provided in Appendix III. Print-outs and diskettes of the current files of the database are available for distribution.

2. Dr. Nemeth, Cereal Research Institute (GKI), Szeged, Hungary, provided information on the development and current status of the database for cultivated sunflower (see Appendix IV). Print-outs of passport data collated until now were distributed.

3. Prof. Kovacik, Research Institute for Plant Production, Praha-Ruzyne, Czechoslovakia, reported on the progress of activities of the base collection for sunflower (see Appendix V). Participants expressed their approval for these extensive efforts and for the dynamism of this Institute in safekeeping sunflower genetic resources. Romania offered Praha-Ruzyne assistance in multiplying some open pollinated varieties, if necessary.

4. VIR, USSR, had joined Phase IV of the ECP/GR since the third meeting of the ECP/GR Sunflower Working Group (Novi Sad, Yugoslavia, July 1988). The report (see Appendix VI) on their activities, presented by Dr. Gavrilova, raised considerable interest among the members of the meeting, who were looking forward to receiving more information on the accessions at VIR through the two sunflower databases. Dr. Gavrilova informed them of VIR's good progress in systematically computerizing its data. Passport data for sunflower should be sent to both databases before the end of 1991.

5. Participants were also keen to learn more about activities on sunflower genetic resources outside Europe. Dr. Prabhakar, I.T.C. Agri-Business, India, explained the prospects for sunflower as a crop in India and about his breeding programme which started two years ago. Dr. Gómez Sánchez, INIFAP, Mexico, described sunflower activities in Mexico (see Appendix VII). Dr. Mancuso, INTA, Argentina, described work in Argentina as well as the Surcosol network, including Bolivia, Paraguay, Uruguay, Chile, Argentina, Brazil and Peru, whereas Dr. Seiler, USDA, provided information on the US genetic resources system.

6. Dr. Omram, IDRC Technical Advisor, Addis Ababa, Ethiopia, presented the activities of the IDRC Oilcrops Network for Eastern/Southern Africa and South/Southeast Asia (Appendix VIII) and called for further collaboration between this network and the ECP/GR Sunflower Working Group.

WORKPLAN

Entry of further data into databases

Wild sunflower

1. The Working Group fully endorsed the proposals from the documentation officer of the international database for wild sunflower (see Appendix III).

2. Members agreed to continue to provide the international database (IFVC) with references of articles/papers dealing with sunflower wild species (and when possible with photocopies). IFVC will thus update/expand the computerized bibliography which was presented for the first time at the third meeting of the Working Group (1988) and a new version will be presented at the forthcoming International Sunflower Conference (Pisa, Italy, September, 1992).

3. An exchange of views occurred on different strategies for strengthening the exchange of characterization/evaluation data through the international database for wild sunflower. Members recommended the continuation of efforts to observe in priority the 13 characters which were selected during the second meeting (Szeged, Hungary, April 1986).

   It was further proposed that a set of most interesting species and of most potentially interesting populations within these species be selected for joint in-depth evaluation in order to better understand the genetic diversity of those species and also to enhance the use of those populations for breeding (also see para. 13).

Cultivated sunflower

4. The person responsible of the database for cultivated sunflower agreed that diskettes, including also characterization and evaluation data received until now, should be sent as early as possible to all contributors in order to recreate the momentum for exchange of data.

5. Open-pollinated varieties are indeed an important reservoir of variability and they have to be conserved as a priority for future generations. It was however recognized that such material is actually not of primary importance for breeders and, therefore, a vivid discussion followed on the possibilities of collating information on breeding lines and other material of direct relevance to breeders into the database for cultivated sunflower.

   Members recommended the inclusion, and hence the free distribution, of three categories of material in the database:

a) open-pollinated varieties
b) genetic stocks, e.g. marker lines, inbred lines which are a well-known germplasm source for a specific character and which have become public
c) genepools/source populations, e.g. the source populations recently released in Spain (refer to Crop Science Volume 30 Number 4 pp 964 and 965)

6. Passport data, as well as, as far as possible, the eight priority characters selected at the second meeting of the Working Group, should be sent to the database for the three categories of the germplasm defined above. Specific additional information for genetic stocks and source populations, e.g. identified gene, main characters for which the source population was built up, is necessary.

7. Dr. Iliescu kindly accepted to proceed with systematic disease testing on plants of open-pollinated varieties which he will receive from the base collections (see para. 3). Members greatly appreciated this contribution which will enhance interest for those populations.

Revision of sunflower descriptors

8. The IBPGR list of sunflower descriptors (which was implemented by the ECP/GR group under the responsibility of Dr. D. Skoric) was unanimously considered as a very useful list and is now widely used. Through the increasing exchange of data, it appears now that there is a need to refine the definition of some descriptors, to slightly modify some descriptor states and in few cases to review descriptors, i.e. "50% flowering" for wild perennial sunflowers. Members agreed on the necessity to revise the published list.

Use of a reference line

9. Recognizing the need to substitute HA89 with another reference line, members recommended the use of HA821 (selected from Peredovick 300) which is neither photosensitive nor thermosensitive. Dr. Miller, from USDA, offered to distribute this line to all participating Institutes.

Collecting

10. Members recommended the continued participation of an ECP/GR scientist in the USDA-planned collecting missions (Canada, 1993; Mexico, 1995) and they also especially recommended IBPGR support for one of them to join the collecting mission to the US Great Plains, September 1991.

Rationalization of collections

11. Considering the difficulties and especially the costs involved with the

regeneration of wild species, considering the different ecoclimatic conditions which are required for their optimum regeneration, and considering that more than two thirds of the 1500 wild species accessions are held by IFVC, Yugoslavia, INRA, Montpellier, France and INIA, Córdoba, Spain, the Working Group recommended that the three Institutes above should collaborate on the regeneration of specific species in their collections.

Safety duplication/base collection

12. Members endorsed the proposals of the responsible for the sunflower base collection and agreed to send as many seeds as possible of the required open-pollinated varieties (see Appendix V). There was a general consensus that genetic stocks should also be duplicated in the base collection. It was noted that accessions of wild species should also be sent to Praha-Ruzyne (in this case a limited number of seeds is acceptable, with 100 seeds as an absolute minimum). Dr. Skoric informed the meeting that around 100 accessions from IFVC will be sent soon for duplication.

Future framework for sunflower genetic resources activities in Europe

13. The Working Group considered that the structures established for the coordination of its activities, nominally the two international databases, IFVC and GKI, supported by a Chairman on a rotational basis, provide total self-sustainability, so long modest additional cash contributions are available for the convening of the plenary meetings of the Working Group. However, the further expansion of collaborative activities, for example in-depth evaluation/research on a set of wild populations (see para. 3) is severely limited by the small budgets which are available for maintenance of genetic resources and studies of their diversity in each country. Exploring ways to overcome these constraints, members agreed that additional funding to stimulate the strengthening of the collaboration should be sought, primarily, but not exclusively, from programmes of the European Community such as TEMPRUS or EUREKA; these programmes include nearly all European countries and not only those of the European Community.

14. Being aware that Phase IV of the ECP/GR is ending in 1992, taking into account that no real indication is available on the future of the ECP/GR after this date, recognizing that the membership of the ECP/GR Sunflower Working Group is also represented in the FAO European Research Network on Sunflower, outlining that very close links between maintenance and studies on diversity of genetic resources (ECP/GR), and breeding and research (FAO) will be to the benefit of both networks, members agreed that the continuation of their activities under the umbrella of the FAO network could have some advantages, on the assumption that genetic resources activities would be considered as a full part of the activities of the latter network. Members

supported a proposal which had been prepared by Dr. Skoric, for some restructuring of the FAO network and which will be submitted to its members at the forthcoming meeting, to be held in Pisa, 13-15 May 1991.

An international sunflower genetic resources network

15. The Working Group always recognized the need to develop a collaboration with other regions of the world. Starting from its first meeting, a very effective collaboration has been established with the USA. In fact, this country has provided a very significant contribution to its activities without being formally recognized as a full participant, and this is certainly peculiar.

Since its second meeting, the Group has explored ways to further collaborate with remaining regions, but without obtaining tangible results. Members expressed strong concern about the disappearance of valuable sources of variability in developing countries due to the increase of hybrids and due to the difficulties of the relevant national programmes in maintaining their resources because of lack of funds; they emphasized again the necessity to link breeding and research with maintenance of genetic resources. If new sources of usable variability are not created through the enhancement of genetic resources, sunflower genetic progress will cease.

In due consideration of the above, all members called for the implementation of an international sunflower genetic resources network. The latter will have the responsibility to cover all aspects linked with genetic resources from exploration and maintenance of the existing variability to evaluation, pre-breeding and until creation of genotypes satisfying the eco-climatic and economic requirements of specific regions of the developing world.

In this framework, additional funds will be necessary for the development of this network, for real and fruitful collaboration between all regions of the world to the benefit of developing countries. Members outline that the creation of an international network is not to substitute already existing regional ones, e.g Surcosol in Latin America, the sunflower subnetwork in Africa and Asia coordinated by IDRC, the FAO European one, but to allow all those to agree on common objectives and to strengthen their effectiveness in operating collaborative projects.

16. Members drew the attention of private companies, national Governments and international organizations to the need to sponsor the development of such a network. In order to effectively publicize and advocate this international network, the Working Group agreed that one of its members, as main author, will have to present a key paper at the forthcoming International Sunflower Conference, developing the modus operandi and objectives of an international genetic resources network for the crop and calling for its sponsorship.

17. The Working Group called for the immediate support from the existing sunflower networks, i.e. IDRC oil crop network, Surcosol, Sunflower Crop Advisory Committee of the USDA, FAO European Network, etc. In a first step this collaboration could be most useful if those networks would agree to send their own views to the main author of the paper calling for an international network. Proposals on inputs which they could provide to the international network, as well as a clear formulation of their expectations from such an international network, would be most welcome.

Other matters

18. Members stated again that sending of data to one of the two international sunflower databases meant automatically a commitment from the contributor for the maintenance and free distribution of the related accession. It was further re-stated that an Institute which realizes that it will be unable to assume such commitment for the maintenance of its material (or a specific responsibility which it has accepted for the benefit of the Working Group, i.e. database) has the obligation to inform the Chairman in order that alternative solutions may be explored.

19. The Working Group was informed that some funds were still at its disposal due to the FAO-IBPGR collaboration in convening both meetings jointly. It recommended the use of these remaining funds as follows:

a) completion of the support already provided by FAO for Dr. Fernández Martínez to represent both FAO and ECP/GR networks at the IDRC oil crop meeting in China;

b) some support to Helia, the publication of the FAO network edited by IFVC;

c) support for participation in the next FAO International Conference to advocate the concept of an international network.

Vote of thanks

Members wished to warmly thank Profs. Benvenuti and Vannozzi for the very efficient organization of the meeting and for their very kind hospitality.

The Chairman, on behalf of the members, expressed his full satisfaction with services provided until now by IBPGR for the overall coordination and development of the Working Group activities.

APPENDIX I

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APPENDIX II

AGENDA

1. Opening Addresses

2. Election of Chairman

3. Adoption of Agenda

4. Review of activities

   4.1 Progress of European Sunflower databases since the third meeting of the ECP/GR Sunflower Working Group, July 1988, Novi Sad, Yugoslavia

   4.2 Review of progress on other recommendations issued at the third meeting of the ECP/GR Sunflower Working Group

5. Workplan

   5.1 Registration of further data into databases

   5.2 Collecting

   5.3 Rationalization of collections

   5.4 Safety duplication into the sunflower base collection (Ruzyne, Czechoslovakia)

6. Further strengthening of the collaboration with the European Cooperative Research Network on Sunflower

7. The implementation of an international sunflower genetic resources network

8. Other matters

APPENDIX III

EUROPEAN DATA BASE FOR WILD SUNFLOWER
1990 PROGRESS REPORT

M. Mihaljcevic, Documentation Officer
Novi Sad, European Wild Sunflower Data Base

The objective of this report is to present the progress achieved in the organization of the Data Base for Wild Sunflower since the thrid meeting of the ECP/GR Sunflower Working Group held in July 1988 in Novi Sad, Yugoslavia.

The data base includes information on 1,588 accessions which had been sent by the following institutions: Institute of Wheat and Sunflower, Toshevo, Bulgaria (BGRIWSGT) and Institute of Plant Introduction (BRGIGC) from Bulgaria, INIA, Cordola, Spain (ESPINIACOR), Station d'Amelioration des Plantes, INRA, Montpellier, France (FREAINRAMPG), Research Institute for Cereals and Industrial Crops (ROMICCPT) Romania, USDA-ARS, Fargo and Regional Plant Introduction Station, Ames from the USA, Institute of Genetics and Crop Plant Research, Gatersleben (DDRGAT) from Germany, Faculta Agraria, Pisa (ITACERPISA) from Italy and Institute of Field and Vegetable Crops, Novi Sad (YUGIFVC) from Yugoslavia.

Of the total of 1,588 accessions included in the data base, 605 or almost 40 percent of the accessions were gathered during the collection trips organized in 1980, 1985, 1987 and 1989. These accessions, no matter if they are still in the possession of the collector (descriptor 2.2) or if they were forwarded to other institutions, have the most complete descriptions.

Since the fall of 1990, the European Data Base for Wild Sunflower uses an IBMcompatible personal computer with CPU 80286, 20 MHz and two floppy disks: FDD 360 KB/1.2 MB, 5.25' and FDD 720 KB/1.44 MB, 3.25'. The users may communicate with the base by the two types of diskette or by printout.

The structure of the Data Base was organized acccording to the Descriptor for cultivated and wild sunflower (AGPG:IBPGR/85/54, June 1985). Starting from the hypothesis that most users have personal computers, all data gathered so far for the accessions were classified in three DB files: Passdat.dbf for Passport data, Colldat.dbf for Collection data and Plantdat.dbf for Characterization data (see description of individual files below). Each accession was classified following the taxonomic system presented in The North American Sunflower by Heiser et al., 1969; Memoirs of the Torrey Bot. Club; 22(3). For a faster access to the data base, the sorting was done alphabetically within the system Species+Subspecies. Sppasdat.ndx contains the sorted Passport data, Spcoldat.ndx the sorted Collection data and Spplndat.ndx the sorted Characterization data. The three

sorted files may be printed out by corresponding Report form files, i.e., Sppasdat.frm, Spcoldat.frm and Spplndat.frm for Passport data, Collection data and Characterization data, respectively.

Description of individual files.

Each file has a different number of characteristics which appear on the monitor and in the print-out. The first reason for it is that it is easier to manipulate a narrow paper format than a wide paper format. The second reason is that some columns (characteristics) are almost or completely empty. The third reason is that the same code applies for all accessions throughout the data base, for example, in the Collection data, the information about collection source and status of sample is always wild or 1.

Finally, the monitor presentation of the files Colldat.dbf and Plantdat.dbf includes, for clarity, the acronyms of the institutions and the scientific names of the species and subspecies although they should not be there according to the descriptor.

PASSPORT DATA - Passdat.dbf

The main improvement since July 1988 is the inclusion of the pi number for those accessions for which it has been determined. The necessary information were obtained from the Regional Plant Introduction Station (Ames, lowa, USA) to whom we express our sincere gratitude. In the column Othernum 1, the original designation for Bushland (e.g, Bush.Laet 653 - page 1, Cat.num. 21 in print-out) was kept merely for continuity since this station has discontinued its activity on the subject-matter. Question mark was retained for the unconfirmed species and subspecies and these accessions are thus sorted separately. After completing the taxonomy check, the sorting will be repeated. The major shortcomings in the Passport data file are the obsolete information for Date of last regeneration (1.8), Number of regenerations (1.10) and Availability of seed (1.9).

COLLECTION DATA - Colldat.dbf

This file received the largest number of additions. The information about State and Location of collection were conformed with those from Ames. The largest additions were made for the accessions gathered during the 1980, 1985, 1987 and 1989 collecting trips. The data for the 1989 collecting trip include precise information about the soil type, altitude and geographic location of the collection sites.

CHARACTERIZATION DATA-Plantdat.dbf

This file received the smallest number of additions. The problem of non-uniformity of the reported data was encountered. For example, in section 4.2 Inflorescence and fruit (Sunfl.Desc., refer to Descriptor for cultivated and wild Sunflower), there is the characteristic "Days to flowering" in point 4.2.1. Two kinds of information were received for this characteristic: days to flowering and date of flowering. Until this ambiguity is solved, we opened a temporary field for date of flowering. Furthermore, the descriptor did not standardize the procedure of determining days to flowering for the perennial species, especially if the plants overwinter in the open field. The procedure of determining the beginning of vegetation will also bear effect on the characteristic "Days to maturity" (4.2.3).

Expressing readiness to accept any suggestion which might improve the European Data Base for Wild Sunflower, I would like to make the following proposals.

Passport data:

- to complete the information for Donor name (1.2.1) and Donor country or institution(s) by the end of 1991;

- to renew the information for Number of times accession regenerated (1.10), Date of last regeneration (1.8) and Availability of seed (1.9);

- to run the taxonomic test on the species (subspecies) marked with the question mark;

- to add the Pl number for the accessions gathered during the 1989 collection trip.

Collection data:

- since the columns for Collection source (2.10) and Status of sample (2.11) give the same value (wild, i.e., 1) throughout the file, it would be an improvement for Status of sample (2.11) to introduce only two categories with alphanumerical designation, A (annual) and P (perennial). This would facilitate the use of the data base and the needless piece of information would be omitted since it is already implied by the name of the Data Base itself.

Characterization data:

- phenological observations for annual and perennial species should be standardized;

- the data for an accession should be sent only if accompanied with passport data. The lack of passport data makes all other information useless, no matter how precise they are.

General remark:

- in the 1988 Progress Report (Collection and Maintenance of Wild Sunflower), Dr. G.J. Seiler reviewed the part exploration of genus Helianthus in the United States. Most samples which had been collected before 1980 (M. Kinman & A. Luciano 1963; G.J. Seiler 1972; B. Beard 1970 - 'nucleus of the USDA's wild species sunflower collection at that time'; Thompson and Rogers 1976, 1977; USDA/USSR delegation 1979) miss the required data for Passdat.dbf and Colldat.dbf. Accession of such origin occur in practically all national data bases. It should be checked if the data from the Regional Plant Introduction Station in Ames or the other American data bases could be used to complete the above files.

APPENDIX IV

PROGRESS REPORT ON EUROPEAN SUNFLOWER DATABASE FOR CULTIVATED SUNFLOWER
from July 1988 to May 1991

Dr.Jozsef Frank
Responsible for Database of
Cultivated Sunflower,
General Director of CRI

Géza Mészáros
Junior research worker

Dr.Gyorgy Gal
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During the Sunflower Conference held at Novi Sad in 1984 (24-27 July) the Cereal Research Institute (Szeged, Hungary) was entrusted by IBPGR (ECP/GR) with establishing and handling the European database of cultivated sunflower. The database of cultivated sunflower has been created with the aim to provide an information - as complete as possible - for the breeding institutions interested in genetic resources.

During the 3rd meeting of ECP/GR held in Novi Sad on 30th July 1988, the representant of CRI, Dr. Gyorgy Gál, distributed among the participants the List of European cultivated sunflowers. This list contained the passport data of 1400 accessions from 9 countries as well as some characterization and evaluation data.

During that meeting the participants agreed that until September 1988 the complete database would be sent by CRI to all contributors. A proposal was accepted that the most important germplasm sources of Cereal Research Institute might be included into the database as well as the most important parental lines of hybrids which might be considered particularities in sunflower breeding history; their description data were also to be included in this database. According to this recommendation, the contributors had to revise and correct the data when necessary and add new characterization and evaluation data. These new data are to be computerized by CRI and sent again to contributors for revision and correction by the end of April 1989. In turn, after having done the definitive corrections the responsible contributors were supposed to return corrected data to CRI until the end of October 1989. Henceforward, the exchange of information should have been realized in a two-year period. Since the 3rd meeting, the diskettes containing mainly passport data and distributed to contributors during the 3rd meeting have not been sent back to CRI by sunflower curators, with the exception of Dr. Fernandez Martinez, who sent recently 122 accession data, thus the database for cultivated sunflower did not expand.

As mentioned above, the broadening of the database, beyond old varieties and landraces, to inbred lines which became public and have specific characters (as resistance to diseases, presence of restorer genes) as well as parental lines of hybrids which are not commercialized any more and might be considered as milestones in sunflower breeding, should also be included into the database. This task has not been accomplished because of the lack of data.

USSR became a full member of Phase IV of ECP/GR, and, thanks to the willingness of overseas sunflower-growing countries to fully collaborate with ECP/GR, the database of cultivated sunflower could considerably be increased in the future and in turn, genetic source material could be exchanged between the breeders. Therefore, the responsibles of the database for cultivated sunflower hope that diskettes will be sent back to allow further distribution of more comprehensive information.

APPENDIX V

ACTIVITIES IN SUNFLOWER GERMPLASM PRESERVATION

Prof. Ing. A. Kovacik, DrSc.
Research Institute for Plant Production
Praha - Ruzyne

In the Gene Bank of the Research Institute for Plant Production in Praha-Ruzyne we have initiated, as base collection for sunflower, a broad activity by requesting various institutions of many countries in the world to deposit their sunflower varietal populations into our gene bank. Replies were not always received and therefore the situation and progress in the amount of gathered collections cannot be taken for fully satisfactory.

At present following cultivars are stored in the gene bank in the amount of 1-2 kg :

France: ISSANKA, GRIS STRIE, NAIN NOIR
Hungary: GE-70, IREGI KORAI CSIKOS
Spain: SEPASOL
Romania: RECORD
Bulgaria: VIOLA, STADION, OBITEL
Poland : WIEIKOPOISEI, LECH
USSR: PEREDOVIC

In the year 1990 we have increased and cleaned the seed of the following cultivars obtained in small amounts:

CSFR: SLOVENSKA, BUCIANSKA OLEJNA
USSR: TRUDOVIK, SKOROSPELYJ, VORONEZSKIJ 436, UNIMK 1646

Two very old Czechoslovak cultivars **Slovenská sivá** and **Bucianská olejná** have been thus saved from irreversible loss. The third group is formed by the seed of cultivars that we obtained in the amount of several grams. In 1991 we shall try to increase them as much as possible and store them in the gene bank. The following cultivars are concerned:

USSR: VNIMK 8931, VNIMK 6540, VNIMK 8883, VNIMK 8031, SMENA, AVANGARD, VOSCHOD, CERNJANKA 66, START, ZARJA, ARMAVIRSKIJ, VORONEZSKIJ 272, VORONEZSKIJ 151, VORONEZSKIJ 154, PROGRES, ZELENKA 386, SALJUT, CAKINSKIJ, ARMAVIREC, JUBILEJNYJ, VOLGAR

Hungary: MEZOMEGESI, LOVASZPATONAI, MARTONI SZADORELLE NALLO, SZALBOCSI 4

APPENDIX VI

THE GENEPOOL OF SUNFLOWER

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One of the major tasks of the Institute is to collect and maintain in living condition the world diversity of all crops cultivated in the USSR, and of their wild relatives. The sunflower collection numbers around three thousand accessions. There are Soviet and foreign bred varieties, local populations, lines of Soviet and foreign production, and wild species.

The VIR networks incorporate the Institute in Leningrad and experimental stations in various climatic zones of the USSR. The sunflower collection is studied and maintained at three stations. Maintenance of the collection of varietal populations is carried out at the Maikop Experiment Station located in foothills of the North Caucasus. Sunflower varieties are multiplied here by natural pollination on isolated plots.

The Yekaterininsk Experiment Station is located at the northern border of sunflower cultivation. The collection is tested here for resistance to *Sclerotinia sclerotiorum* (Lib. de Bary) and to *Botrytis cinerea* (Pers. ex. Pers) against an artificial infectious background. This background is rather heavy, and therefore resistant forms have not been found so far. The N.S. hybrids from Yugoslavia showed 80 to 85 percent susceptibility against this background.

The major part of activities for the maintenance of self-pollinated lines and cross-pollinated accessions is carried out at the Kuban Experiment Station in the Krasnodar Territory, one of the major areas of sunflower production in the country.

Collection accessions and lines are evaluated for their ability to restore pollen fertility in CMS lines, for yielding ability, oil content, combining ability, and for a complex of morphological characters. The collection is also evaluated for resistance to the diseases caused by *Phoma oleracea* (Sacc.), *Plasmopara helianthi* (Novot.), *Puccinia helianthi* (Schw.), *Sclerotinia sclerotiorum* (Lib. de Bary), *Botrytis cinerea* (Pers. ex Pers) and by *Orobranche cumara* (Wallz).

Mostly the varieties for oil production are represented in the collection. They mark the history of sunflower breeding in the USSR. The collection contains old discarded varieties, such as Chernyanka, Louch, etc., as well as the latest home-bred varieties which are characterized by 50 to 52 percent oil content under production conditions, 20 to 24 percent of husk, average yield of 3.o to 3.9 tons per hectare, and a potential yield of

4.7 tons per hectare. Oil yield is from 1000 to 1500 kilograms per hectare.

The samples of local populations have been gathered thanks to the collecting missions by Dr. Anashchenko and other specialists from the Institute to Armenia, Georgia, Moldavia, the Far East, Altai Territory, Ukraine and other regions of the country. These are cross-pollinated populations, very difficult to maintain in the initial condition. They are represented mostly by large-seeded cultivars of folk breeding which serve as valuable initial material for breeding varieties for confectionary industry.

While breeding for large seed, it is reasonable to use forms with 1000 seeds weight amounting to 130 to 140 grams under usual conditions of cultivation, because that of modern oil-bearing varieties and hybrids makes around 70 grams with the standard plant's density. These large-seeded forms are the accessions with catalogue numbers K-1901 and K-1898 from the Krasnodar Territory, and K-1949 from eastern Georgia.

Of special interest for breeding are the forms of Armenian ecotype which have been grown in strict geographical isolation under the conditions of warm and damp high-mountainous climate. These large-seeded forms are characterized by long seeds, up to 28mm. The seed width to length ratio is 1:3, while that for an ordinary sunflower is 1:2. These forms have a comparatively thin husk, though the kernel occupies only about 3/4 of the caryopsis. However, in some biotypes the kernel lies closely to the cover. Besides, investigations by Dr. Ventslavovich, and later by Dr. Anashchenko have revealed some autofertile forms among the Armenian accessions.

The collection of lines includes those of foreign and home breeding, as well as the lines bred at the Cuban Experimental Station of VIR by Dr. Anashchenko and Dr. Rozhkova on the basis of varieties, local populations, hybrids and other lines by sister pollination crossings followed by strict inbreeding. Among those lines are CMS *petiolaris* lines, CMS lenticularis Anashchenko lines, sterility maintainers and fertility restorers, as well as those with marker and economically valuable characters. Major work is conducted with CMS lines on the basis of *H. petiolaris*. However, in 1985 we found out that the CMS lines obtained at VIR on the basis of CMS petiolaris received from Dr. Leclercq are not identical to the CMS *petiolaris* lines received from the USA (for example, HA 232). It can be illustrated by the fact that the fertility restorer line VIR 160 restores pollen fertility in VIR 151 CMS and has no such effect on HA 232. The results obtained imply a difference by one dominant gene in the restorers' genotypes. We are planning to identify the available CMS sources with the CMS of *Petiolaris* ssp. *fallax* received from Jan from the USA.

The collection of lines with marker characters contains various mutations on plant organs. The widest variability in seed colour and shape is represented.

Marking of lines using electrophoretic spectrum of the basic storage protein of sunflower seeds, 11 S globulin (Helianthinin) has been carried out by Dr. Irina Anisimova. Helianthinin spectra of the analyzed varieties and lines were compared to that of the standard variety Peredovik. The following Helianthinin characters were taken as marker ones: 1) presence in the spectrum of rare polypeptide variants, not characteristic of the standard; 2) absence of certain major components; 3) weakening or strengthening of intensity of components in comparison to the identical ones of the standard spectrum.

It has been shown that the varieties and lines with economically valuable characters often possess a type of spectrum close to that of the standard. At the same time, 83 percent of lines with marker characters contained unusual polypeptide variants. This method also makes it possible to determine homogeneity of a variety or line. 70 percent of the analyzed lines proved to be homogeneous.

The collection of wild sunflower numbers 700 accessions, of which 170 are perennials. Maintenance of the collection and all field experiments are carried out at the introduction quarantine nursery at the Kuban Experiment Station.

Primary attention has been paid to the study of wild annual forms. Morphological description and field evaluation for resistance to diseases have been made in the conditions of the Krasnodar Territory. In addition, the crossing ability with cultivated sunflower and the rate of autofertility have been studied. All wild annual forms have been crossed with cultivated ones. All in all, over two thousand crossings have been made. The CMS *petiolaris* lines VIR 104, VlR 129 and VlR 130 were used as maternal forms. Nearly all accessions of *H. annuus* ssp. *annuus* (Heiser) or ssp. *lenticularis* (Anashchenko) crossed well with cultivated sunflower. Crossing ability of *H. petiolaris* was lower, as only 30 crosses out of 400 proved to be successful.

As a result of this work, new sources of pollen fertility restorers (Rf) have been revealed. After 3 backcrosses with a CMS line, and 7 generations of inbreeding, fertility restorer lines with a different genetic basis have been obtained (A.V.Anashchenko, A.I.Popova. The collection of wild sunflower and ways of its use in breeding. In: Agricultural Biology, 1985, No 10).

The collection of wild annual sunflower has been evaluated for the ability to self-pollination. Among the accessions of *spp. lenticularis* 17 percent of accessions were setting seed with self-pollination. From the accessions of *ssp. lenticularis* with interesting manifestations of dwarfness, earliness and changes in the colour and shape of the leaf blade, the 8th generation of 10 autogamous wild forms has been obtained. These forms differ stably by the rate of autogamy. For example, seed setting

in AWF-8 (440671)	is 10 to 18%
in AWF-4,5,6,7,9	is 20 to 30%
in AWF-1,2	is 50 to 60%
in AWF-3,10	is 70 to 80%

Thus, the performed evaluation of wild annual forms of sunflower shows their potential value as initial material in practical breeding.

All sources of economically valuable characters revealed during the study of the sunflower genepool are handed over to breeding institutions of the country to be used in breeding programs.

APPENDIX VII

SUNFLOWER GENETIC RESOURCES IN MEXICO

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Introduction

Mexico is one center of origin for sunflower. During thousands of years, a wide variability of ecotypes has been developed, due to the wide diversity of climates, soil types and ecobiological conditions. Sunflower is present in approximately 1,187,200 square kilometers in Northern Mexico, at altitudes ranging from 0 to more than 2,300 m.a.s.l., from dry semitropics to temperate semideserts, temperate deserts and temperate mountains. There are two kinds of germplasm sources: wild and cultivated.

Germplasm sources

Wild species:

The distribution of the Helianthus genus is localized in Mexico between 22 00' to 82 30' of North latitude and from 97 30' to 117 00' of West longitude. The classification and distribution of this genus has been studied since 1870, founding to date 12 species. These are: Section Ciliares: series Ciliares: *Helianthus ciliaris* (D.C.), *H. laciniatus* (Gray); Series Pumili: *H. gracilenthus* (Gray); Section Divaricati: Series Divaricati: *H. tuberosus* (L.), *H. strumosus* (L.), *H. hirsutus* (Raf.); Series Gigantei: *H. californicus* (D.C.), *H. maximilianii* (Shrad.); Section Annui: *H. annuus* L., *H. niveus* (Benth Brandegee), *H. petiolaris* (Nutali), *H. similis* (Brandegee) Blake. There are possibly other species not yet reported to date.

Cultivated:

There are two types of cultivated germplasm: open pollinated varieties and hybrids. The first one includes landrances, old varieties (Russians and Menonites) and new varieties derived from old varieties. The hybrids were formed from lines derived from old varieties. In the breeding of these new cultivars has been involved some universities and some government research centers of INIFAP.

Evaluation

In many research stations throughout the country, cultivated and experimental genotypes have been evaluated for many phenological, morphological and physiological characters, diseases and pests reactions as well as grain and oil yield.

Interchange of materials

It is necessary to establish formal communication with the Mexican Ministry of Agriculture by means of INIFAP.

The fourth group is formed by the following cultivars - which are not yet available as our request to the various countries concerned has still not been satisfied - :

Portugal: PREFO
Canada: SATURN, SUNRISE, ADMIRAL, BEACON, JUPITER, MENNONITE, COMMANDER
Germany: HESA
USA: ARIKARA, HAVASUPAI, ARROWHEAD, MINGREN, SUMBO

Available documentation indicates that we have succeded in collecting about one third of all known sunflower varietal populations till now. Of more than fifty entries obtained until now, almost thirty have been definitely included into the collection. By an increase of smaller samples in 1990 we have obtained a satisfactory amount of seed of six other cultivars. Being aware of the responsibility which we have committed to the IBPGR for the development of a base collection of sunflower varietal populations useful for the future generations of specialists in genetics and plant breeding all over the world we have addressed various world institutions again in November 1990 asking them by letters for their varietal populations to be preserved into long-term storage conditions of our genebank.

Beyond varietal populations, all possible sunflower germplasm should also be deposited into Praha-Ruzyne. The latter institution does not have a sunflower-breeding programme, thus the considerable amount of work undertaken is done by enthusiasm and dedication to the safe preservation of the sunflower genepool.

APPENDIX VIII

SUNFLOWER IN THE IDRC OILCROPS NETWORKS FOR EASTERN/SOUTHERN AFRICA AND SOUTH/SOUTHEAST ASIA

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The Network

The Network Project and its constituent projects have an increasing role in enabling large numbers of small farm families to obtain their daily requirements of oils and fats. The project seeks to continue to link together researchers working in a number of IDRC-supported oilcrops improvement projects. These projects are providing increasingly effective in raising edible oil production in several countries of Eastern and Southern Asia and Africa which have severe deficiencies in edible oil.

The Network is coordinated by an IDRC Network Advisor, based in Ethiopia at present. The Advisor organizes and facilitates all the Network and Sub-Networks workshops, committees and other meetings, edtis and arranges publication of the workshop proceedings, Oilcrops newsletter, reviews, bibliographies and other publications. He visits and provides advice, assistance and encouragement to scientists in national programmes and especially the IDRC-assisted projects included in the Network, and also provides assistance to the Ethiopian national oilcrops programme which is supported by IDRC.

In Phase I (1981-84) initial steps were taken to link IDRC-supported national oilcrop research programmes in Eastern and Southern Africa and the Indian region. Phase II (1984-87) and III (1987-90) continued to strengthen and expand the Network to include additional countries such as China and the Philippines. The one-year continuation phase of the project (1991-92) will allow a thorough evaluation of previous phases of the project to be undertaken by the Network Steering Committee, so that future activities can be carefully planned.

Four Sub-Networks were created for "Brassicas", "Sunflower", "Sesame" and "other oilcrops". These Sub-Networks enabled scientists specializing in the various crops to interact more closely and economically in Sub-Network workshops, rather than in the larger Network meetngs, and to organize successful collaborative research programmes.

An effective oilcrops information system was developed to enable scientists to obtain the necessary specialized information on oilcrops, and an annual newsletter is published since 1984.

Collaboration

By encouraging collaborative research between scientists in stronger research programmes (including Canada) with those in weaker programmes, and arranging peer review of research results and programmes in regular workshops and in other ways, the Network helps to raise scientific standards in the member countries. The collaborative research projects which are being developed within the Network will have effect of speeding the solution of urgent common research problems, and strengthening the capacity of the weaker programmes to carry out research.

In order to make the most efficient use of limited resources, the Network Advisor is seeking to collaborate in any way possible with other Networks or Institutions involved in oilcrop research and development. In particular, collaboration is sought with IBPGR, the various FAO networks and activities on oilcrops, as well as with CGIRC and ICRISAT. In order to make the neeeds for oilcrop research more widely known, and to enhance the resources available to the network and its members, the Advisor and all concerned informs other appropriate donors of the needs of the Network and its members, and invites their representatives to attend workshops and meetings.

Germplasm

After a slow start due to bureaucratic problems and national reluctance to share germplasm, a useful germplasm exchange programme has been developed through the Network coordination office. At the request of the members, the Network Advisor coordinates the collection of germplasm both from member countries and from other sources, makes up nurseries and distributes them in a timely fashion to those members who request them, and who supply germplasm (Table 1). If sufficient seed is available, the Advisor may provide it to others on an exchange basis. The Advisor also encourages and assists members to exchange germplasm bilaterally, either as part of collaborative research programmes, or in other ways.

Training

The training needs of the Network members are many and varied, ranging from short course training for technicians and scientist at various levels to graduate training. These needs are supplied from many sources. IDRC's Fellowships and Awards Division assists the network to arrange appropriate short-course training within member countries, according to the resources available.

Table 1. Oilcrops Network Nursery (up to April 1990)

Country	Brassica	Linseed	Nigerseed	Safflower	Sesame	Sunflower	Groundnut
Bhutan	4	-	1	-	-	-	-
Canada	-	-	-	3	-	45	-
Cyprus	-	-	-	6	-	-	-
Egypt	-	-	-	10	10	-	-
Ethiopia	5	4	8	3	9	8	-
FAO		-	-	-	49	-	-
India	31	2	-	2	-	-	-
Israel	-	-	-	-	21	-	-
Kenya	1	1	-	-	2	2	-
Mexico	1	-	1	7	11	7	-
Nicaragua	-	-	-	-	9	-	-
Nepal	11	2	1	-	1	-	4
Pakistan	-	-	-	3	-	-	-
Philippines	-	-	-	-	16	-	-
P.R. China	8	1	-	2	-	-	-
Somalia	-	-	-	-	13	-	-
Sri Lanka	-	-	-	-	3	-	-
Sudan	-	-	-	-	20	-	-
Sweden	8	-	-	-	-	-	-
Tanzania	-	-	-	-	9	-	-
Yugoslavia	-	-	-	-	-	16	-
Total	64	10	11	36	173	78	4

Network development in chronological order

1981	*India	-	Mustard Project
	*India	-	Rapeseed Project
	*India	-	Sesame Project
	*India	-	Safflower Project
	*Malawi	-	Groundnut Project (ICRISAT)
	*Ethiopia	-	Highland Oilcrops Project (Nigerseed, Ethiopian mustard, Rapeseed, Linseed, Sunflower)
	*Ethiopia	-	Oilcrops Network Project with Dr. Ken Riley, IDRC Network Advisor
1982	*Ethiopia	-	Lowland Oilseeds Project (Sesame, Groundnut, Sallfower)
	*Sri Lanka	-	Oilseed Project (Sesame, Soybeans, Sunflower, Brassicas)
	*Egypt	-	Oilseed Project (Groundnut, Sesame, Rapeseed, Sunflower)
	*China/Canada	-	Project (Brassicas)
	*Mozambique	-	Project (Groundnut)
1983	*Sudan	-	Oilseed Project (Groundnuts ,Sesame, Soybeans, Sunflower)
	*Tanzania	-	Project (Pulses and Groundnut)
	Egypt	-	1st Network Workshop
1984	Dr. A. Omran replaced Dr. Riley as Network Advisor		
	Italy	-	FAO Sesame Consultation Meeting
	Malawi	-	ICRISAT 1st Groundnut Regional Workshop of Southern Africa
	*Network/Canada	-	Anther Culture Project (Sesame, Nigerseed)
1985	India	-	2nd Network Workshop (Sesame and Safflower)
	Argentina	-	11th Sunflower Conference
1986	Ethiopia	-	3rd Network Workshop (Niger and Brassicas). Decision was taken to form sub-networks
	USA	-	American Peasant Research Society
	Zimbabwe	-	ICRISAT 2nd Groundnut Regional Workshop of Southern Africa
	*Pakistan	-	Project on rapeseed/sunflower for reclaimed lands
	*Pakistan	-	Project on Soybean
1987	Sweden	-	Brassica Sub-Network formed
	Poland	-	7th Rapeseed Congress
	Austria	-	FAO Sesame Project Formulation
	India	-	Sesame and Safflower Training Course
	*India	-	Project on Sesame Scholars
	*India	-	Project on Sesame Onfarm Research
	*Ethiopia	-	Project on general Oilcrops
	*Nepal	-	Project on Oilseeds

1988	Kenya	-	4th Network Workshop (Sesame, Sunflower, Linseed). Sesame and Sunflower Sub-Networks formed
	*Kenya	-	Project (Vegetable Oil and Protein Systems)
	*India/Canada	-	Project (Brassicas)
	Malawi	-	ICRISAT 3rd Groundnut Regional Workshop of Southern Africa
	Yugoslavia	-	12th Sunflower Conference
	*Philippines	-	Project on Rice-based Sesame

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1989	India	-	2nd Brassica Sub-Network Workshop
	India	-	International Safflower Conference
	India	-	Other Oil Crops Sub-Network (Safflower, Nigerseed, Linseed) formed
	India	-	1st Network Steering Committee Meeting (Network constitution drafted)
	Turkey	-	FAO Sunflower Network meeting
	Egypt	-	2nd Sesame Sub-Network Workshop
	Egypt	-	2nd Sunflower Sub-Network Workshop
	India	-	Brassica Production Training Course
1990	Sudan	-	FAO/UNDP Project Formulation for Sudan, Somalia and Yemens
	China	-	International Rapeseed Symposium
	China	-	3rd Brassica Sub-Network Workshop
	Tanzania	-	ICRISAT 4th Groundnut Regional Workshop
	*Kenya	-	Sesame Project
1991	Italy	-	FAO Sunflower Research Network
	Italy	-	IBPGR Sunflower Meeting
	Czechoslovakia	-	IBPGR Brassica Meeting
	China	-	Sesame Sub-Network Workshop
	China	-	Sunflower Sub-Network Workshop
	China	-	Other Oilcrops Sub-Network Workshops
	China	-	Network Steering Committee Meeting
	Canada	-	Brassica Sub-Network Workshop
	Canada	-	8th Rapeseed Congress

Sunflower Sub-Network

China and India have about two million hectares of sunflower. Production of this crop is expanding rapidly in the Sudan, and more slowly in some other Eastern African countries, with Tanzania 81,000 ha. and Zambia 63,000 ha. Zimbabwe, Zambia and Kenya all produce both hybrid and synthetic seed, and a considerable amount of hybrid seed is also imported from other countries.

Sunflower is quite widely grown by smallholders in Eastern and Southern Africa, but most of them do not have local processing facilities, so they have to sell their crop, often for comparatively low prices, to large-scale processors far away in the cities. Therefore, a number of agencies, including IDRC, are supporting the investigation of low-cost processing methods which can be used in the villages. In this way, growers should be albe to satisfy their own and local needs for oil at lower prices than having to purchase cooking oil or fat from the cities. Also the residual cake will be available for livestock feed.

The Sub-Network is quite young. It had been established during the 4th Oilcrops Network Workshop held in Kenya, January 1988, with 75 participants from 23 countries. Sunflower papers were presented from Kenya, Sudan, Ethiopia, Tanzania, Zambia, India, Pakistan, Nepal, Bangladesh, Philippines, Thailand, China and a guest speaker from Canada. The proceedings of that Workshop had been published in IDRC Manuscript Report MR 205e. FAO, CIDA, EEC, IBPGR, ODA, SIDA, and USAID supported participants and contributed to the core budget of the Workshop. The recommendations called for collaborative research in the fields of diseases, drought resistance, bird resistance and earliness. Links with the Sunflower Associations wer highly recommended. COnsequently, three members of the Steeering Committee participated in the 12th Sunflower Conference in Yugoslavia in 1988, and the Network Advisor attended the previous and present meetings of the FAO and IBPGR Working Groups.

The 2nd Sunflower Sub-Network Workshop was held in Cairo in 1989 with 49 participants from 16 countries. Sunflower papers came from Egypt, Ethiopia, Morocco, Pakistan, India, Bangladesh and guest speakers from Spain, Italy and Yugoslavia. Again, FAO supported sunflower guest speakers from Yugoslavia, Spain and Italy, and contributed to the core budget of the Workshop. Also IBPGR supported a sesame guest speaker from Israel. The proceedings of the Workshop were published by IDRC (MR 271e). The presentations of Dr. Skoric and Dr. Fernández Martínez englightened all participants from Asia and Africa. Dr. Skoric kindly donated to the Network 19 copies of his book "Sunflower Breeding".

To diversify venues and to keep the Sub-Network members aware of developments in the far east, we decided to have the 3rd Sunflower Sub-Network Workshop in China. FAO has kindly agreed to participate and to partially support participants and guest speakers. IBPGR is about to decide in this meeting how to participate. We are also thinking of linking the 4th Workshop with the 12th International Sunflower Conference to be held here in 1992.

A one-month training course had been recommended by the Sub-Network Steering Committee in Yugoslavia with Dr. Skoric. We had budget difficulties to compe up with a reasonable number of trainees. Dr. Skoric kindly planned and reduced the number down to five. However, so far we are still looking for additional budget or additional donors.

The Sunflower Sub-Network has already contributed to sunflower research in participating countries by enabling researchers to obtain germplasm from these advanced breeding programmes (Table 2), and to attend international meetings such as the one in Yugoslavia.

Table 2. Sunflower germplasm lines/varieties received from and despatched to Network countries

CANADA		**ETHIOPIA**	
1.	Early Gene pool	1.	Comp-1
2.	1803-1	2.	Russian Black
3.	CMS CM-597	3.	Che x Gene Pool I
4.	Tambousby early	4.	Argentario
5.	1422	5.	NSH-2
6.	BRS-1	6.	INRA-7702
7.	2336	7.	NSH
8.	Chernianka 66	8.	NSH-25
9.	CM-590		
10.	BR-Composite	**KENYA**	
11.	BR-Restorer I		
12.	Saluit	1.	Fedha
13.	RHA-858	2.	Shaba
14.	HOPI		
15.	1497	**MEXICO**	
16.	1479		
17.	Late gene pool	1.	P-2
18.	1501	2.	P-4
19.	RHA-274	3.	P-5
20.	RHA-297	4.	P-6
21.	BRS-1	5.	P-9
22.	CM-592	6.	P-12
23.	1684	7.	P-13
24.	RHA-801		
25.	B-7422-1	**YUGOSLAVIA**	
26.	CM-597		
27.	RHA-296	1.	NS-Sarevi
28.	RB restorer III	2.	Skorospelyj
29.	BRS-2	3.	Progress
30.	MRS-564	4.	Trudovik
31.	BR restorer II	5.	Peredovik
32.	ND-BLPL 2	6.	Voronezskij 436
33.	RHA-859	7.	Cakinsky 269
34.	BRS-3-1484	8.	Nadioznyj
35.	RBA-272	9.	VNIIMK 8931
36.	RHA-271	10.	Jubilijnyj 60
37.	R-line gene pool	11.	Saluit
38.	1972 R-composite	12.	Avangord
39.	1806-2	13.	Novinsko
40.	RHA-276	14.	Zorio
41.	RHA-278	15.	1671
42.	RHA-857	16.	HS-2
43.	RHA-856		
44.	RHA-855		
45.	RHA-299		

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