

# TEN YEARS OF SCIENTIFIC INTERNATIONAL CO-OPERATION

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The existence of the F.A.O. Research Network on Sunflower is the successful fruit of the admirable initiative of the F.A.O. Regional Office for Europe to stimulate and implement the international co-operation in agricultural research based on the voluntary contribution of each participating country. This network is the second one after the European Research Network on Olives, within the frame of a system of ten research networks, known under the generic denomination of ESCORENA.

The F.A.O. Research Network on Sunflower was established at the consultation meeting held in Bucharest between 2—4 October 1975, attended by 24 scientists representing 8 countries (France, Hungary, Israel, Italy, Romania, Spain, Sweden, Yugoslavia). The foundation meeting was assisted by two distinguished and enthusiastic delegates from F.A.O., Mr. G. E. Bildesheim, regional representative for Europe at that time and Dr. Al. Bozzini, former chief of Crop and Grassland Production Service and presently regional representative for Europe. The first programme of scientific co-operation was outlined on the basis of the general report prepared by dr. A. V. Vrânceanu after a consultation mission undertaken in several European countries. The co-ordination of sunflower network was entrusted to the Research Institute for Cereals and Industrial Crops, Fundulea, Romania, which continues to fulfill voluntarily its duties, after four re-elections. A limited number of subnetworks were defined, corresponding to the research topics envisaged, each of them being conducted by a liaison centre.

From the beginning of its activity, the main purpose of sunflower network has been to undertake joint applied research on sunflower, according to an accepted methodology and agreed division of tasks and to exchange experience and information among to participating institutions. The scientific co-operation among the network members has been based on the principle that in a period of rapid technological and scientific changes, it is difficult if not impossible for one institute or coun-

try to do all the necessary research in any subject matter. A well defined division of tasks among interested institutions would multiply the efforts of each of them. Thus each co-operating institution will do only one part of the overall research and will benefit from the results achieved by all of them. Each participating institution agreed to support its own expenses enabling it to implement its own scientific contribution to the joint research programme and to undertake the agreed co-operation in the field of documentation. However, it should be underlined that F.A.O. has played not only a promotional and catalytic role, but also has assisted more substantially in the organization of the activities of the network and in the functioning of its liaison centres, by ensuring partially the funds for working meetings and network consultations, co-ordination and review visits and for the publication of the research results in the Information Bulletin HELIA.

The remarkable development and consolidation of sunflower network in the last ten years as well as its valuable scientific results obtained so far, clearly indicate that the co-operating institutions have chosen the right path, that their joint efforts and voluntary contributions have been based on viable principles and mutual confidence. Within a decade, the network has gradually extended its activities to the majority of sunflower cultivating countries all over the world, with the number of its co-operating countries amounting to 36.

Although initially intended to the European countries, the network has extended its activity to the other countries outside Europe, so that they could take advantage of the experience acquired, receive scientific information regularly and even participate to the joint research programmes. In this way, institutions from developed and developing countries have started co-operating together harmoniously and on an equal footing, which is important not only from the point of view of the transfer of technology but also because it facilitates the strengthening of the scientific

capabilities of the co-operating institutions from the developing countries.

The participants have concentrated on a few carefully selected problems whose solution could benefit from international co-operation and have tackled them from an applied research angle, giving the scientific community a means of stepping up its efforts and obtaining concrete results within a relatively short period of time.

The scientific co-operation among the network members has been also guided by the principle of flexibility and gradual development, according to the existing scientific staff and facilities and the advances in the joint research activity. Due to the experience gained in the first years, the ways and the means of the international co-operation, as well as the research methods and experimental technique have been improved, a better unity of ideas and interpretation of scientific results being achieved. The periodical analysis and review of the overall network activity, performed on the occasion of the biennial or triennial consultations, has permitted the re-orientation of certain research topics and so the re-organization of the respective subnetworks with the view of maintaining permanently alive the interest and the enthusiasm for joint scientific co-operation.

The results of ten years of scientific international co-operation are worthy of mention, although briefly.

A large network of trials with sunflower hybrids and open pollinated varieties, extended to 46 locations from 36 countries, was organized during the period of 1976—1985 in five biennial cycles, for the identification of the most yielding and well adapted cultivars.

The number of entries in these trials amounted to 138 hybrids and 25 open pollinated varieties, all of them representing the most recent achievements of sunflower breeders from all over the world. Beside seed and oil yielding performances, sunflower cultivars were also studied in respect of their morphophysiological traits, disease resistance, oil and protein content and fatty acid composition. The evaluation of varietal adaptability was also performed. The results obtained revealed the large diversity of sunflower cultivars and their different response to the environmental variations, and permitted the identification of the adapted hybrids or varieties for each country or region.

Co-operation in the field of sunflower applied genetics has been developed by five countries with a tradition in genetic research. So far, a range of experimental hybrids has been produced and studied during the period of 1981—1985 in respect of the genetic control of the main quantitative traits involved in sunflower productivity. Preliminary information was obtained concerning head position and

stem bending under head, head size and shape, fertility of the central zone of the head.

With respect to the traits determined by a limited number of genes, a comprehensive conception on heritability of branching was reached and linkage studies were performed with some marker characters. New sources of genes for resistance to the attack of *Plasmopara helianthi*, *Phomopsis helianthi* and *Orobancha cumana* were identified, some of them being already used in breeding works.

A large number of genotypes was evaluated for pollen self-compatibility and genetic correlations between this character and the main plant and seed traits have been studied, including the negative correlation between pollen self-compatibility and the melliferous index.

The joint study on new sources for cytoplasmic male sterility resulted in the identification of certain promising new sterility types coming from the interspecific crosses of the wild species to the cultivated sunflower.

The co-operative activity related to the use of wild species in sunflower genetics and breeding have rendered encouraging results, especially as far as the collection and conservation of wild species are concerned. This part of the programme has been successfully accomplished thanks to the generous assistance of USDA researchers who helped the Liaison Centre at Novi Sad to collect over 600 populations of wild sunflowers on the territory of the United States. This material has completed and renewed the already existing collections, from which seed samples are distributed to all network participants.

This large collection is being screened in five countries for resistance to diseases and pests and for tolerance to the ecological stress. Studies are also underway to determine the degree of self-compatibility and to identify new sources of cytoplasmic male sterility and restorer genes. A large number of interspecific crosses has already been performed in order to transfer the positive character of wild species into the cultivated sunflower.

A general survey of sunflower diseases in Europe was achieved and mapped in the last 10 years, with positive results regarding the prevention of the spreading of some very destructive diseases such as downy mildew, white and gray rot, leaf spots a.s.o. Although the pathogenic picture in Europe has not undergone essential changes in this period of time, a new and intense epiphytotic caused by the fungus *Phomopsis* sp. which has broken out in the neighbouring regions of Yugoslavia, Romania and Hungary in 1981 and 1982 determined the subnetwork and the Coordination Centre to initiate a joint regional programme to study the biology of the pathogen and to establish the measures of prevention and control of this new disease.

Apart from the mapping of diseases and the survey of the main sunflower pathological pro-

blems in different countries, a new research topic on fungicide control of parasitic fungi by seed treatment has recently been added.

The list of the authorized or promising herbicides in use in the participating countries as well as the list of the main weed species in each country, in terms of their importance in the competition with sunflowers were compiled in a first stage. At a subsequent stage, most efficient methods of herbicide application were studied, the emphasis being placed on herbicides which are less susceptible to rainfall and could thus be applied after sunflower emergence. The study of varietal susceptibility to herbicides has also been developed, as well as the residues of herbicides as regards the following crop.

The study on sunflower response to irrigation resulted in some preliminary information concerning the effects of different water regimes on plant development and production as well as the methods to obtain maximum water efficiency when water is scarce, i.e. maximum yield per unit of water.

The first three programmes based on topics related to sunflower genetics and breeding have experienced a gradual development, improving and permanently adapting their joint research and methodology. For this reason, they will be continued without essential changes for the next years, according to the already adopted subject-matter and division of tasks, but with certain qualitative improvements.

Thus, the experimentation of sunflower hybrids will be enlarged and directed towards a better interpretation of yield stability, environmental adaptation and genotypic similarity and diversity.

The applied genetic programme will focus its joint scientific efforts on the determination of the main genetic components of sunflower ideotypes for different ecological regions, aiming primarily at achieving a new morphophysiological structure of the plant which would radically improve its yielding ability.

The subnetwork on sunflower wild species will continue to collect populations of pure species and natural interspecific hybrids especially from Mexico and the Southern regions of the U.S.A. The evaluation of the large collection already existing will be intensified, in order to identify new sources of genes for resistance to diseases and for cytoplasmic male sterility and pollen fertility restoration.

The joint research on certain aspects of sunflower crop management such as chemical weed control and sunflower response to irrigation have started to lose actuality with the passing of years, either because in some cases the expected results have already been obtained or, in other cases, the adopted topics have a definite local character and do not present difficulties of experimentation and interpretation.

On the other hand, in the past years, there has been a tendency towards the exaggerated

and unilateral use of pesticides, with the well-known consequences on environmental pollution and the disturbance of the ecological equilibrium as well as with the important economic implications in the context of the actual world energy crisis. The present trend in agricultural research is the establishment and the utilization of a more efficient strategy based on the integrated control of weeds, diseases and insect pests, which supposes the association of pesticide use with agrotechnical preventive and limiting measures and with the use, on a larger scale, of biological control and the genetic resistance to diseases and insect pests. The majority of these factors move in the same direction of integrated control and even if some of them have opposite actions, their utilization should be correlated correspondingly. Thus, for instance, the low plant populations favour a satisfactory sanitary state of the crop, but, at the same time, they are favourable to weed infestations; an equilibrium should be found in this case between integration of disease and weed control measures.

For this reason, the last consultation of sunflower network held in Novi Sad in July, 1984 decided to unify the programmes on sunflower disease mapping and chemical weed control into one joint programme based on the general topic on sunflower protection against weeds, diseases and insect pests, with two or three projects reformulated according to the integrated control strategies.

The research programme on sunflower response to irrigation is enlarging its sphere of activities in order to give primarily biological solutions to sunflower cultural practices. The scientific co-operation has been directed toward a better mastering of the physiological phenomena of sunflowers in terms of yield formation through both physiological and agronomical experimentation. The existing topic on sunflower response to irrigation has become a joint research project on sunflower hydric behaviour and other projects will be associated gradually such as sunflower nutrition, peculiarities of photosynthetic functions, the physiological aspects of seed filling, sunflower reaction and adaptation to certain environmental factors etc.

This scientific multi-project co-operation is expected to make a significant contribution to the progress of sunflower ecophysiology, with practical applications to sunflower breeding and cultivation.

The results already obtained and the encouraging prospect for future success are due to the enthusiasm of the scientists who have worked together efficiently and with dedication for the excellent functioning of the whole network. They deserve great praise for their successful scientific co-operation developed during the last ten years and for their willingness to make firm steps further.