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DEVELOPMENT OF THE JOINT RESEARCH ACTIVITY WITHIN THE F.A.O. COOPERATIVE NETWORK ON SUNFLOWER

By

A.V. Vranceanu (ROMANIA)
Coordinator of the Network

The European Cooperative Network on Sunflower, organized and sponsored by the F.A.O. Regional Office for Euorpe, was officially established at the consultation meeting held in Bucharest, Romania between 2-4 October 1975. The rules for the operation of the Network were adopted on that occasion as well as its organizational structure, centered on the existence of a Coordination center and of a limited number of subnetworks corresponding to the research topics envisaged, each of them being conducted by a Liaison center.

The Research Institute for Cereals and Technical Crops (I.C.C.P.T.) of Fundulea, Romania, was designated as Coordination center for an initial period of four years.

Four research topics were investigated in the first biennial cycle of activity (1976-1977):

1. Experimentation of sunflower cultivars in competitive trials (Liaison center: Research Institute for Cereal and Technical Crops, Fundulea, Romania);

2. Sunflower disease mapping in Europe (Liaison center: National Research Center for Oil Crops, INIA, Cordoba, Spain);

3. Chemical weed control in sunflower crops (Liaison center: Interprofessional Technical Center of the Metropolitan Oil Crops, CETIOM, Paris, France);

4. Study on variability of fatty acids and tocopherols in sunflower oil (Liaison center: Institute for the Application of Nuclear Energy in Agriculture, Veterinary Medicine and Forrestry, INEP, Zemun-Belgrad, Yugoslavia).

Two new research topics have been added in the next biennial cycle (1978-1979):

1. Genetics of the main agronomic characteristics in sunflower (Liaison center: Research Institutes for Crop Production, Ruzyne-Prague, Czechoslovakia);

2. Sunflower response to irrigation under different environmental conditions (Liaison center: National Research Center for Oil Crops, INIA, Cordoba, Spain).

The number of the Network member countries has attained 29 in 1978 and that of the participating institutions 42. Depending on the existing trained staff and facilities, each participating country has contributed to one or more research topics.

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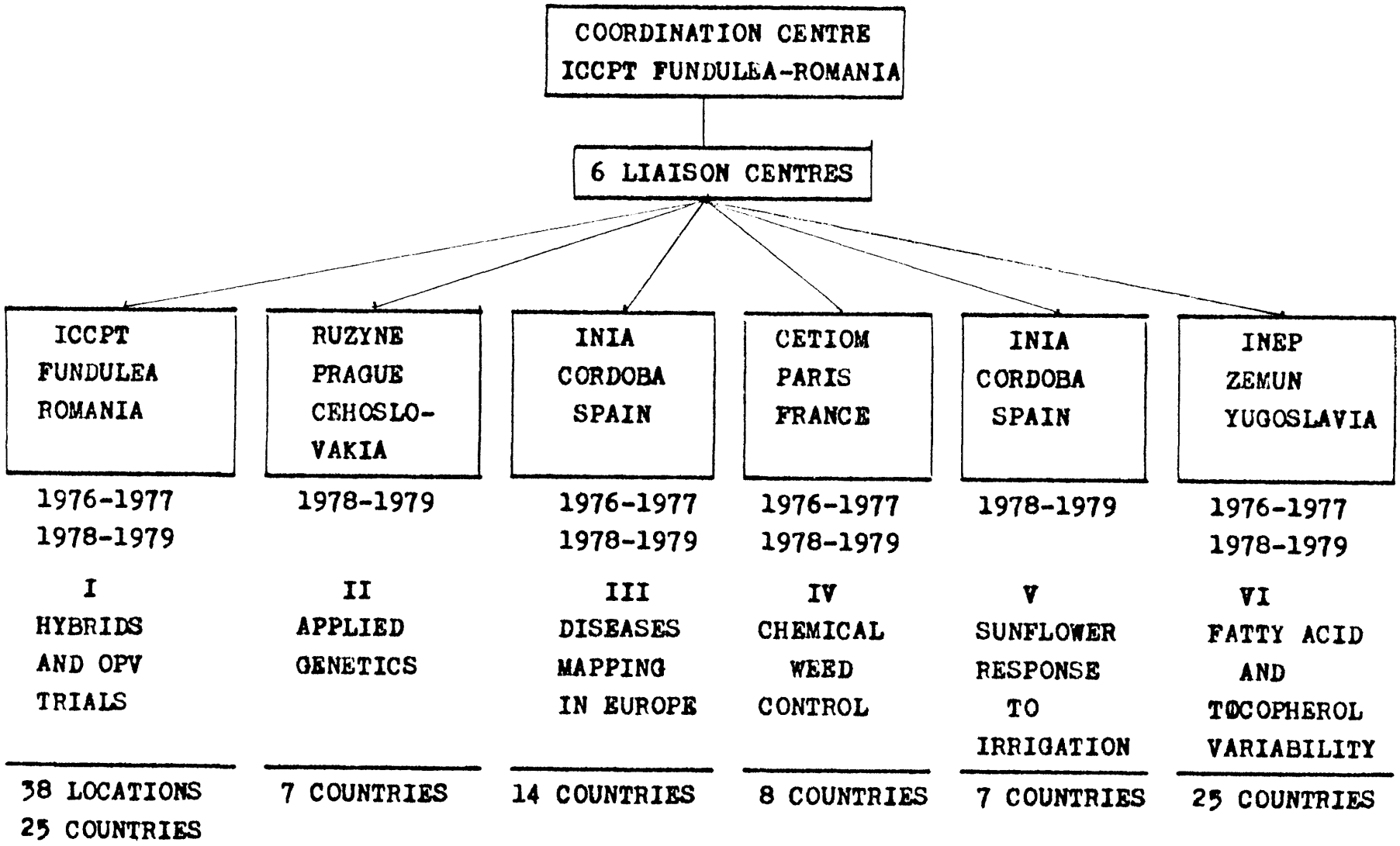

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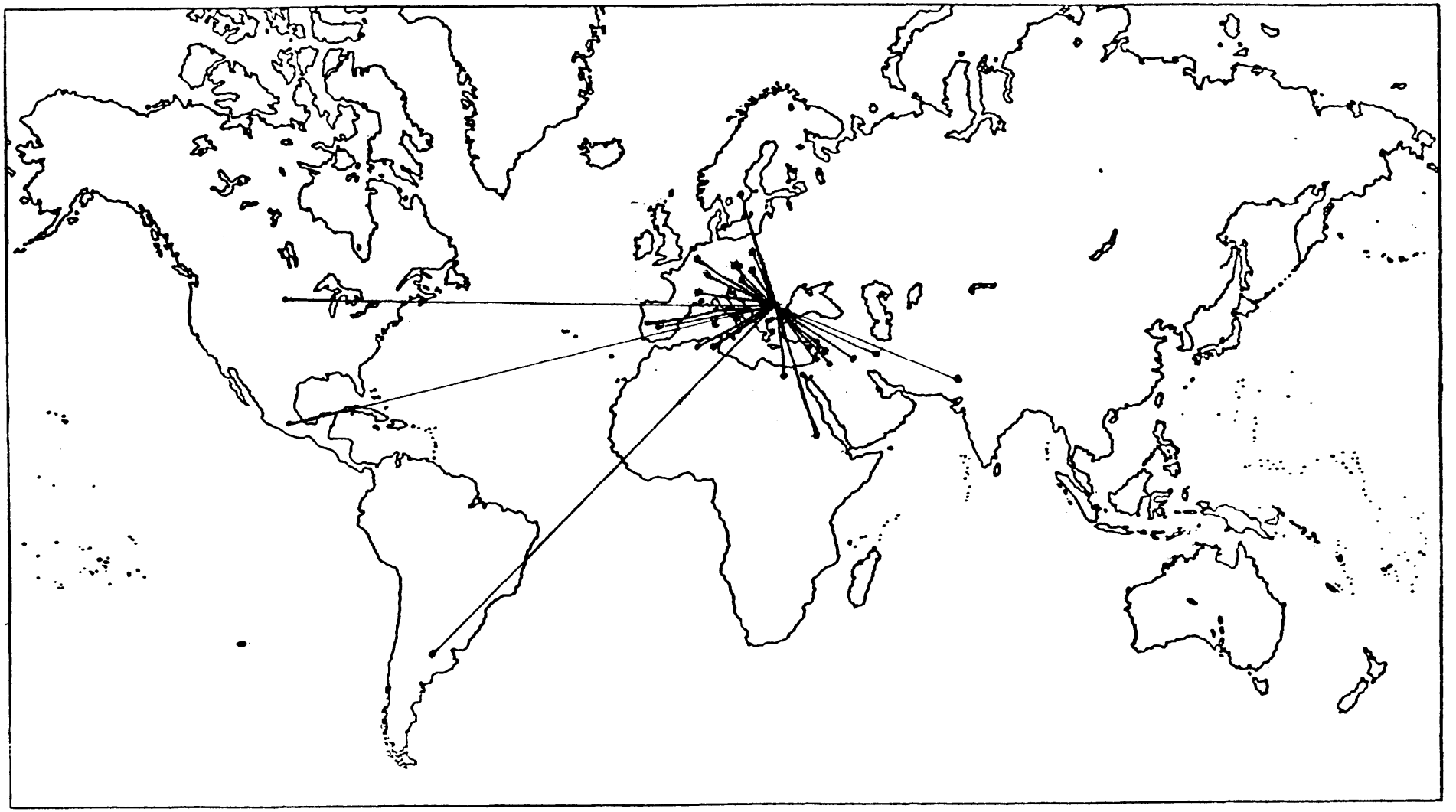

Nº. OF PARTICIPATING COUNTRIES:

EUROPE: 15.
NORTH AFRICA, & NEAR EAST: 11.
NORTH AMERICA: 1.
CENTRAL AMERICA: 1.
SOUTH AMERICA: 1.

The research programs for each topic, including objectives, methodology and experimental technique, were made up by the Liaison centers with the consultation of the participating institutions. On the basis of the experience gained in the first biennial cycle, the research methods and experimental techniques have been improved, a better unity of ideas and interpretation of scientific results being achieved. To this accomplishment has largely contributed the coordination and consultation visits performed by the coordinator of the Network and the leaders of the Liaison centers, as well as the second Network consultation organized at Cordoba, Spain between 23-26 September 1977 and attended by 51 delegates representing different institutions from 15 countries.

The scientific cooperation among the Network members is based on their voluntary contribution and has a flexible and experimental character and a gradual development, according to the advances in the joint research activity. Although initially intended to the European countries, the Network proposed itself from the very beginning to extend its activity and to other national institutions from the non-European countries interested in this type of cooperation, so that they could take advantage of the experience acquired, receive scientific information regularly and even participate to the common research programs. In this way, institutions in developing countries can collaborate with those in countries of a higher technological level, in view of expanding their investigations and thus obtaining more rapidly the results which are so important for the agriculture development of their countries.

In the second biennial cycle, certain countries from Central or South America as Mexico or Argentina or from North Africa and Near East as Egypt, Ethiopia, Sudan, Jordan, Syria, Iraq, Iran, Pakistan, have been accepted in Sunflower Network, most of them being interested in testing and identification of the best adapted sunflower cultivars.

The most active participation has been registered in the first subnetwork concerned with the experimentation of sunflower cultivars, showing the large interest manifested by the European sunflower growing countries for the identification and extension of high yielding hybrids, as an important factor for increasing seed and oil yield.

A number of 22 hybrids and 2 open-pollinated varieties were tested in 20 locations from 16 countries in the first experimental cycle. In the second biennial cycle, 20 single and three way hybrids and 11 open-pollinated varieties are being experimented in 38 locations from 25 countries. Sunflower hybrids included in trials are the most recent achievements of breeders from Romania, France, U.S.A., Yugoslavia, Spain and Bulgaria, and most of them are obtained on cytoplasmic male sterility basis and contain genes for resistance to downy mildew.

The average results of 1976 and 1977 revealed a different behavior of sunflower cultivars, in accordance with the geographical zones and localities, the seed yield of the medium-late hybrids varying from 20.0 q/ha at Pisa, Italy to 37.4 q/ha at Novi Sad, Yugoslavia. The oil yield varied from 7.3 q/ha to 18.6 q/ha depending on genotypes and environmental conditions (Tables 1, 2 and 3).

TABLE 1. F.A.O. Sunflower Test With Medium-Late Cultivars.
Seed Yield, q/ha at 0% Moisture (1976-1977)*

Cultivars	Origin	Romania Fundulea	Bulgaria Toshevo	Hungary Iregszemcse	Yugoslavia Novi Sad	Italy Pisa	France Aude (CETIOM)	Mean q/ha	Rank
Peredovik	U.S.S.R.	30.4	29.0	27.6	30.0	25.7	23.4	27.7	(9)
HB-322	Bulgaria	30.3	28.3	26.4	23.9	26.5	20.1	25.9	(11)
UY NS-65	Yugoslavia	31.6	27.2	22.3	37.4	27.5	26.1	28.7	(7)
Airelle	France	28.5	28.8	22.7	20.6	20.0	20.8	23.6	(12)
Relax	France	30.1	29.1	21.3	35.6	25.3	26.9	28.1	(8)
Remil	France	27.7	27.8	23.5	33.6	21.1	27.4	26.9	(10)
Romsun 52	Romania	33.1	32.4	27.2	33.9	26.2	33.2	31.0	(1)
Romsun 53	Romania	32.5	29.8	22.2	31.8	26.8	30.3	28.9	(6)
Romsun 59	Romania	36.0	30.2	25.9	27.9	28.9	26.5	29.2	(4)
Sorem 80	Romania	33.6	26.1	24.5	35.3	24.0	30.6	29.0	(5)
Sorem 82	Romania	34.4	26.8	32.6	32.9	27.0	31.8	30.9	(2)
Sorem HT-64	Romania	32.3	27.5	22.7	35.7	29.6	31.8	29.9	(3)
LSD 0.05		1.9	1.9	3.0	4.9	8.4	4.7	3.0	

* Only complete two year data were computed.

TABLE 2. F.A.O. Sunflower Test With Medium-Late Cultivars.
Oil Yield, q/ha (1976-1977)*

Cultivars	Origin	Romania Fundulea	Bulgaria Toshevo	Hungary Iregszemcse	Yugoslavia Novi Sad	Italy Pisa	France Aude (CETIOM)	Mean q/ha	Mean Rank
Peredovik	U.S.S.R.	15.6	14.0	13.3	15.5	10.4	12.3	13.5	(7)
HB-322	Bulgaria	16.0	14.0	13.1	13.0	10.2	10.8	12.9	(9)
UY NS-65	Yugoslavia	14.9	12.4	10.2	18.3	10.2	13.5	13.3	(8)
Airelle	France	13.6	13.3	9.9	12.8	7.3	10.7	11.3	(12)
Relax	France	13.5	12.6	8.7	16.3	8.2	13.7	12.2	(10)
Remil	France	12.6	12.5	10.2	16.1	7.5	14.3	12.2	(11)
Romsun 52	Romania	17.5	15.1	12.4	17.0	9.7	17.7	14.9	(1)
Romsun 53	Romania	16.8	14.1	9.9	16.4	10.2	16.2	13.9	(6)
Romsun 59	Romania	18.6	15.1	12.0	14.4	10.7	13.9	14.1	(4)
Sorem 80	Romania	16.6	12.7	10.8	18.1	10.0	15.7	14.0	(5)
Sorem 82	Romania	16.2	13.9	10.3	18.2	11.0	16.7	14.4	(3)
LSD 0.05		1.4	1.3	1.8	2.6	4.1	2.5	1.8	

*Only complete two year data were computed.

TABLE 3. Variance Analyses for Seed and Oil Yields of F.A.O. Sunflower Test with Medium-Late Cultivars in Six Locations and Two Years (1976-1977)

Source	DF	Mean Squares	
		Seed Yield	Oil Yield
Cultivars (C)	11	52.66**	15.72**
Locations (L)	5	462.67**	153.99**
Years (Y)	1	10.07	71.68
C x L	55	116.20**	23.95**
C x Y	11	24.98*	8.68*
L x Y	5	239.67**	96.76**
Pooled error	55	7.07	2.55
Total	143		

*, ** Significant at the 0.05 and 0.01 of probability, respectively.

The half-late hybrids have given the highest seed and oil yields in the countries from South and South-eastern Eruope, having a higher oil content in dry seed. The early and half-early hybrids are recommended in the Central and Northern European countries with short and cool summers. So in Austria, the early hybrid Romsun 20 gave an average seed yield of 32.5 q/ha, and an oil yield of 16.0 q/ha (Tables 4, 5 and 6).

The experimental data obtained by the European Sunflower Network reveal the fact that single hybrids have a more limited ecological plasticity than open-pollinated varieties, none of single hybrids being situated on the first places in all locations. The best hybrids, classified according to their average performances, are Romsun 52, Sorem 82 and Sorem HT-64.

The narrower plasticity of single sunflower hybrids which results in an important variation of heterosis intensity not only in accordance with geographical zones, but also with climatic annual variation within the same zone, requires first of all the necessity of carrying out selection works with inbreds and hybrids for certain soil-climatic conditions typical for sunflower growing zones, with the purpose of achieving a better adaptability to the local environmental conditions. It appears also necessary to develop sunflower hybrids with a broader genetic basis, as for instance three-way hybrids, which in addition offer the advantage of an increased economic efficiency of hybrid seed production. Finally, a greater number of hybrids should be tested in a larger number of locations and years, in order to find out, by studying the interaction of the three factors, the most valuable and constant hybrids, both for seed and oil yield.

The cooperation for mapping sunflower diseases in Europe has included 14 institutions from 12 countries. The National Research Center for Oil Crops in Cordoba, Spain, has initiated the collection of information data on disease survey methods in use in the various countries and the diseases already recognized as a basis for a generally acceptable methodology to be used by all participants in the mapping project.

In a first phase, all the diseases which have been recorded or observed on sunflower in Bulgaria, France, Hungary, Poland, Romania, Spain, Turkey, and Yugoslavia have been listed, indicating the frequency and the intensity of the attack, as well as the economic consequences. Among the major diseases, downy mildew incited by the fungus Plasmopara helianthi (P. halstedii) ranks the first place in most of the European countries, followed by white rot (Sclerotinia sclerotiorum) and gray rot (Botrytis cinerea).

One of the major diseases in Spain, France, Yugoslavia, and Hungary is charcoal rot incited by the fungus Macrophomina phaseoli (sclerotial form Sclerotium bataticola). Certain diseases were identified in 1976, as for instance leaf spot (Alternaria) in Bulgaria, leaf mottle (Verticillium dahliae) in Romania, and broomrape (Orobanche) in Spain.

The occurrence and the severity of sunflower diseases vary from year to year, depending on the climatic conditions and the susceptibility of the host cultivars, so that disease mapping must be the result of a dynamic study of the frequency and intensity of the attack of various pathogens, during a larger period of years.

Table 4. F.A.O. Sunflower Test With Early and Medium-Early Cultivars.
Seed Yield, q/ha at 0% Moisture (1976-1977)*

Cultivars	Origin	Romania Fundulea	Bulgaria Toshevo	Hungary Ireg-szemcse	Yugoslavia Novi Sad	Italy Pisa	Austria Vianna	Poland Poznan	France Aude (CETIOM)	Mean q/ha	Mean Rank
Issanka	France	22.5	18.5	18.9	18.3	15.7	21.1	12.0	8.4	16.9	(7)
Wielkopolski	Poland	27.2	25.9	22.3	26.7	26.2	29.5	23.0	15.4	24.5	(6)
UY NS-1	Yugoslavia	31.0	28.2	25.5	35.7	18.8	30.6	25.9	22.7	27.3	(2)
H - 23	Spain	28.3	28.3	21.8	33.5	22.4	29.0	24.9	22.4	26.3	(3)
Romsun 18	Romania	32.0	30.3	24.6	34.6	22.0	24.7	20.7	17.1	25.8	(4)
Romsun 20	Romania	33.6	27.5	23.7	33.9	25.0	32.5	24.8	18.1	27.4	(1)
Romsun 301	Romania	32.0	26.5	23.3	30.2	20.5	29.5	20.4	16.0	24.8	(5)
LSD 0.05		2.2	1.2	2.6	4.4	4.3	4.9	5.1	3.4	3.1	

*Only complete two year data were computed.

TABLE 5. F.A.O. Sunflower Test With Early and Medium-Early Cultivars
Oil Yield, q/ha (1976-1977)*

Cultivars	Origin	Romania Fundulea	Bulgaria Toshevo	Hungary Ireg-szemcse	Yugoslavia Novi Sad	Italy Pisa	Austria Vienna	Poland Poznan	France Aude (CETIOM)	Mean q/ha	Mean Rank
Issanka	France	10.5	8.2	8.1	9.6	6.1	10.0	5.9	4.2	7.8	(7)
Wielkopolski	Poland	13.1	11.7	10.0	13.3	10.2	14.2	11.8	7.8	11.5	(6)
UY NS-1	Yugoslavia	14.9	13.3	11.8	16.9	7.5	14.7	13.4	11.4	13.0	(2)
H-23	Spain	13.3	12.7	10.0	14.4	8.2	14.3	12.9	11.5	12.2	(3)
Romsun 18	Romania	15.2	14.1	10.9	15.7	8.4	11.7	10.1	8.2	11.8	(5)
Romsun 20	Romania	16.8	13.1	11.0	16.3	9.8	16.0	12.9	9.1	13.1	(1)
Romsun 301	Romania	15.7	12.6	10.7	16.0	8.3	13.8	10.2	8.2	11.9	(4)
LSD 0.05		1.4	1.0	1.7	1.9	1.9	2.8	2.8	1.8	1.7	

* Only complete two year data were computed.

TABLE 6. Variance Analyses for Seed and Oil Yields of F.A.O. Sunflower Test With Early and Medium-Early Cultivars in Eight Locations and Two Years (1976-1977)

SOURCE	DF	Mean Squares	
		Seed Yield	Oil Yield
Cultivars (C)	6	128.28**	30.37**
Locations (L)	7	375.82**	82.83**
Years (Y)	1	44.52	2.26
C x L	42	111.52**	12.70**
C x Y	6	6.10	1.23
L x Y	7	186.64**	66.09**
Pooled error	42	9.67	2.84
Total	111		

*, ** Significant at the 0.05 and 0.01 of probability, respectively.

In a subsequent phase, the mapping of each disease separately, by countries, was initiated, indicating the main sunflower areas and the distribution of each disease, so that a separate comprehensive map showing all the countries can be prepared later for each disease. Detailed maps of the main sunflower diseases have been prepared by the participating institutions from Bulgaria, France, Romania, Spain, and Yugoslavia.

A number of 16 experiments were conducted by 9 institutions from eight European countries within the frame of the subnetwork concerned with chemical weed control in sunflower. The liaison center, CETIOM Paris, compiled a list of the chemicals utilized or under testing in France, Italy, Poland, Spain, Sweden, Romania and Yugoslavia, as well as a preliminary list of the main weeds of sunflower crops, indicating the order of importance in which they are situated. Forty-one simple or combined herbicides have been utilized in pre-plant incorporation, pre-emergence, post-emergence or in double treatment, in production fields or on experimental plots.

The diversity of situations -- flora, soil, climate, and of results obtained in each country, is evident. The list of the authorized herbicides is being completed, indicating their main characteristics as concerns doses, stage of utilization, efficacy and selectivity, so that it could serve as a guide to all investigators for solving the local, specific problems.

The fourth subnetwork, based on oil quality investigation, has used seed samples taken from sunflower trials conducted cooperatively by the member countries. All sunflower cultivars experimented in these trials do not differ significantly with respect to total content of saturated and unsaturated fatty acids, the high proportion of the two unsaturated fatty acids, oleic and linoleic, being remarkable. On the other hand, an important variation of the ratio oleic/linoleic is noticed, in close correlation with the length of vegetation period and climatic conditions. A significant influence on the composition of unsaturated fatty acids exert the climatic conditions during the phase of seed filling and oil accumulation, the high temperature favoring the increase of oleic to the detriment of linoleic acid proportion.

The new research topic "Genetics of the Main Agronomic Characteristics in Sunflower" is suitable for a cooperative study program, each participating institution having to investigate a certain aspect of the subject. The final aim is to work out a morphological and physiological ideotype of a high yielding sunflower cultivar, with high oil content and goqd resistance to diseases, adapted to a specific environment.

The recent investigations concerning sunflower response to irrigation under different environmental conditions aim at making clear to what extent sunflower plants use the irrigation water efficiently and which are the geographic zones where irrigation is profitable.

The promising results obtained in the first biennial cycle of the Network activity as well as the great interest aroused by this type of international scientific cooperation constitute a premise of future remarkable successes in the development of scientific research in sunflower and thus contributing to fulfillment of the present desideratum of the mankind to increase the agricultural production and enhance the food resources.