EUROPEAN CO-OPERATIVE TRIALS WITH SUNFLOWER HYBRIDS AND VARIETIES (1978–1979)

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INTRODUCTION

The F.A.O. subnetwork dealing with the experimentation of sunflower cultivars in international trials completed two biennial cycles (1976—1977 and 1978—1979), and tested a number of 14 open pollinated varieties and 40 hybrids in all sunflower growing countries of Europe, except U.S.S.R., as well as in some countries outside Europe, mainly in the Near and Middle East, Latin America and U.S.A. In 1979, the number of its members amounted to 28 countries and 35 research institutions.

The results of the first biennial cycle were published in the Information Bulletin "Helia", No. 1 of December 1978, edited by the Co-ordination Centre of the F.A.O. Research Network on Sunflower, the Research Institute for Cereals and Industrial Crops, Fundulea, Romania.

In the second biennial testing cycle, a greater number of sunflower open pollinated varieties was included, due to the still actual interest for this type of cultivar in certain countries, mostly in the developing ones from outside Europe, as well as a new set of single and three-way hybrids, including for the first time some of the best hybrids obtained in the U.S.A.

The experimentation has been extended to certain new countries of Europe (F. Rep. of Germany and the Netherlands), Near East and North Africa (Pakistan, Jordan, Syria, Sudan, Algeria, and Latin America (Mexico, Argentina, Bolivia, Chile), interested in cultivating new high seed and oil yielding sunflower varieties and hybrids. Unfortunately, not all these countries have secceeded in supplying scientific rigorous data which could be incorporated into a synthetic work, due to either the less favourable climatic conditions or to certain accidental causes as bird damages and the delay in receiving some experimental entries, or even as a consequence of using an inadequate experimental technique.

Nevertheles, in comparison with the first research cycle, the co-operation in this field has developed not only quantitatively but also qualitatively. The common entries have been examined more carefully and a more accurate interpretation of the experimental data has been achieved.

This paper presents a synthesis of the results obtained by the European countries in the second two-year experimental cycle. The other results of this cycle will be published in the next number of the Information Bulletin "Helia".

MATERIALS AND METHODS

The experimentation consisted of two competitive trials including the most recent creations of sunflower breeders from Bulgaria, France, Federal Republic of Germany, Hungary, Italy, Poland, Romania, Spain, U.S.A. and Yugoslavia.

Trial No. 1 was made up of 11 open-pollinated varieties and one single hybrid, as check (Annex 1). Besides the well known Russian varieties Peredovik and VNIIMK 8931 and

Annex 1

Trial No. 1 with open pollinated varieties
(SH = single hybrid ; OPV = open pollinated variety)

Entry Nr.	Cultivars	Genetic type	Origin
1	Peredovik	OPV	U.R.S.S., Produced in Bulgaria
2	Hemus	OPV	Bulgaria (General Toshevo)
3	IH — 10	OPV	Hungary
4	Iregi 816 B	OPV	Hungary
5	Iregi Csikós	OPV	Hungary
6	Argentario	OPV	Italy (Pisa)
7	Record	OPV	Romania (Fundulea)
8	Romsun 59	SH	Romania (Fundulea)
9	Sepasol	OPV	Spain (Sevilla)
10	Novi Sad 20	OPV	Yugoslavia
11	Novi Sad 61	OPV	Yugoslavia
12	Vniimk 8931	OPV	U.R.S.S., produced in Yugoslavia

the Romanian variety Record, a set of new varieties were studied : 3 from Hungary, 2 from Yugoslavia, 1 from Bulgaria, 1 from Italy and 1 from Spain.

Trial No. 2 comprised 16 single hybrids (4 from U.S.A., 3 from France, 3 from Yugoslavia, 2 from F. Rep. of Germay, 2 from Spain, 1 from Bulgaria and 1 from Romania), 3 three-way hybrids (from Romania) and the open pollinated variety Peredovik (produced in Bulgaria), as check (Annex 2).

All sunflower hybrids have been obtained on the basis of cytoplasmic male sterility and pollen fertility restoration, and in contrast to the open pollinated varieties which are completely susceptible to downy mildew *(Plasmopara helianthi)*, they possess a good or very good resistance to this pathogen. The three-way hybrids have been obtained by crossing a single male sterile hybrid to a restorer inbred line.

The locations where the two trials were performed as well as the participating institutions and researchers are mentioned in Annex 3. The investigations were carried out under dryland conditions, with the cultural practices adapted to the local technology.

The experimental design was the rectangular lattice with four replications and 12 and 20 entries, respectively. Plot size was of a minimum 80 plants, after discarding the borders (the marginal rows and 1—2 first and last plants on each row).

Annex 2

Trial No. 2 with single (SH) and three-way hybrids (TH)

Entry Nr.	Cultivars	Genetic type	Origin
1	HB-451	SH	Bulgaria (General Toshevo)
2	Remil	SH	France (Clermont-Ferrand)
3	Luciole	SH	Idem
4	INRA 7702	SH	Idem
5	Sorex	SH	F. Rep. of Germany (Giessen)
6	Olga II	SH	Idem
7	Sorem HT-111	TH	Romania (Fundulea)
8	Sorem HT-116	TH	Romania (Fundulea)
9	Sorem HT-117	TH	Romania (Fundulea)
10	Romsun 90	SH	Romania (Fundulea)
11	HS-1161	SH	Spain (Sevilla)
12	HS-72 M	SH	Spain (Sevilla)
13	P.O.I. 301 A	SH	U.S.A.
14	H-894	SH	U.S.A.
15	H-241	SH	U.S.A.
17	Sungro 380 A	SH	U.S.A.
16	NS-H-27	SH	Yugoslavia
18	NS-H-34	SH	Yugoslavia
19	NS-H-63 RM	SH	Yugoslavia
20	Peredovik	OPV	U.S.S.R., produced in Bulgaria

The statistic interpretation of the experimental results was performed using the analysis of variance.

Phenological observations and biometrical determinations were carried out on the basis of the common methodology established for the previous research cycle.

The resistance to diseases was mainly determined in the field, noting the natural infection frequency. The reaction of sunflower entries to *Plasmopara helianthi* attack was studied under artificial inoculation at Fundulea (Romania) and Novi Sad (Yugoslavia). Artificial inoculations with *Sclerotinia sclerotiorum* and *Orobanche cumana* were carried out only at Fundulea (Romania).

Annex 3

List of participants in F.A.O.
co-operative trials (1978—1979)

Country and location	Name and address	Trials conducted
1. Austria Vienna	Ing. D. Wolffhardt, Bundesanstalt f. Pflanzenbau und Samenprüfung, Alliertenstr. 1, Viena II	No. 2
2. Bulgaria G. Toshevo	Dr. Yordanka Stoyanova, Institute for Wheat and Sunflower, General Toshevo, Tolbuhin	No. 1 and 2
3. France Aude	Ing. M. Rollier, CETIOM, 174 Av. Victor Hugo, 75116 Paris	No. 2
4. France Clermont-Ferrand	Dr. P. Leclercq, Station d'amélioration des plantes INRA, Route du Pont-du-Chateau, 63100 Clermont-Ferrand	Idem
5. France Montpellier	Dr. G. Piquemal, Station d'amelioration des Plantes INRA, Place Viala, 34000 Montpellier	Idem
6. F. Rep. of Germany Giessen	Prof. W. Schuster, Institut f. Pflanzenbau u. Pflanzenzüchtung, Ludwigstr. 23, D-6300 Giessen	No. 1 and 2
7. Hungary Szeged	Dr. József Frank, Cereal Research Institute, P. O. Box 6726, H-6701 Szeged	No. 1 and 2
8. Hungary Iregszemcse	Dr. E. Kurnik, Research Institute for Forage Crops, 7095 Iregszemcse	Idem
9. Italy Pisa	Dr. G. P. Vannozzi, Istituto di Agronomia Generale e Coltivazioni Erbacee, Via S. Michele degli Scalzi 4, Pisa	Idem
10. Italy Bari	Dr. Elio Alba, Istituto di Miglioramento Genetico delle Piante Agrarie, Via Amendola 165, 70126 Bari	Idem
11. Poland Poznań	Dr. Z. Kloczowski, Plant Breeding and Acclimatization Institute, Dept. Oil Crops, Sieroca 1 a, 61-771 Poznań	No. 1 and 2
12. Portugal Elvas	Ing. Francisco Pinheiro Alves, Plant Breeding Station, Elvas	Idem
13. Romania Fundulea	Dr. A. V. Vrânceanu, Dr. Fl. M. Stoenescu, Research Institute for Cereals and Industrial Crops, 8264 Fundulea, Ilfov	No. 1 and 2
14. Romania Podu Iloaie	Dr. V. Ruasnovscki, Agricultural Experimental Station, Podu Iloaie, Iaşi	Idem
15. Spain Córdoba	Dr. Juan Dominguez-Giménez, Departamento Nacional de Plantas Oleaginosas, Apartado Correos 240, Córdoba	No. 1 and 2
16. Turkey Yeşilköy	Mr. T. Cirit, Agricultural Research Institute, P. O. Box 1, Yeşilköy — Istanbul	Idem
17. Turkey Ankara Luleburgaz.	Prof. Dr. K. Ilisulu, University of Ankara Faculty of Agriculture	Idem
18. Turkey Edirne	Mr. E. Indelen, Agricultural Research Institute, Edirne, P. O. Box 16	Idem
19. Yugoslavia Novi Sad	Dr. D. Skorić, Faculty of Agriculture, Institute of Field and Vegetable Crops, Maxim Gorki 30, Novi Sad 21000	Idem

RESULTS AND DISCUSSION

The common experimental procedures have been respected in most cases. Trial No. 1 was conducted adequately in 12 locations and Trial No. 2 in 15 locations, permitting a good mean yield evaluation for both years. In some instances however, certain institutions did not provide complete results for the two testing years, particularly with regard to the oil content (Bari and Pisa (Italy), Montpellier (France), Szeged (Hungary), Edirne and Yeşilköy (Turkey), Giessen (F. Rep. of Germany), Toshevo (Bulgaria).

1. Open pollinated variety trials

The results of Trial No. 1 with open pollinated varieties are presented in Tables 1—9. The seed and oil yield data show significant differences among varieties, as well as a great variation of yielding levels from location to location, in the two experimental years.

In 1978, the highest seed yields were obtained in the countries from South and South-East Europe : Italy (Pisa), Romania, Hungary (Szeged), Yugoslavia, Bulgaria (Table 1). In 1979, the highest levels were achieved in Romania, Poland and Turkey (Table 2). The two-year seed yield means (Table 3) exhibit high values in most cases, ranging from 5.0 q/ha at Elvas (Portugal) to 41.4 q/ha at Podu Iloaie (Romania). Most of the open-pollinated varieties tested proved to be significantly inferior to the single hybrid Romsun 59, used as check, especially in certain locations with more favourable soil and climatic conditions for sunflower from Bulgaria, Romania (Fun-

Table 1

Trial No. 1 with open pollinated varieties (1978). Seed yield test (q/ha, 0% moisture)

Cultivars	Bulgaria Toshevo	F. Rep. of Germany Giessen	Hungary Iregszemcse	Hungary Szeged	Italy Pisa	Poland Poznań	Portugal Elvas	Romania Fundulea	Romania Podu Iloaie	Spain Córdoba	Turkey Ankara	Turkey Luleburgaz	Turkey Edirne	Turkey Yeşilköy	Yugoslavia Novi Sad	Mean of 15 locations
Peredovik	31.6	29.0	23.9	30.1	35.4	14.2	10.6	36.8	40.1	18.9	17.4	20.4	16.7	29.1	26.8	25.4
Hemus	30.2	21.5	23.7	38.6	36.9	8.7	9.6	35.2	41.3	17.3	16.7	21.7	16.8	28.3	19.4	24.4
IH — 10	26.4	25.8	19.5	36.0	28.3	17.8	9.7	30.4	30.6	18.4	14.9	18.8	13.3	26.2	24.6	22.7
Iregi 816 B	25.5	24.7	21.7	19.0	28.1	9.7	5.7	28.0	27.6	16.3	12.9	18.5	12.0	15.2	31.8	19.8
Iregi Csikos	29.6	35.1	25.8	28.7	30.2	22.0	9.8	36.4	31.3	19.4	20.9	24.5	16.5	26.8	31.6	25.9
Argentario	28.0	28.0	24.9	33.3	34.5	10.0	9.8	34.5	35.6	18.5	13.7	20.2	14.8	26.6	31.1	24.2
Record	32.6	23.8	22.2	29.7	33.8	12.4	8.8	37.2	32.6	18.1	16.4	20.7	14.5	25.7	25.8	23.6
Romsun 59	33.5	26.0	23.8	32.5	37.2	15.7	9.4	38.9	37.1	17.7	19.2	23.6	15.4	23.2	39.0	26.1
Sepasol	30.8	18.5	26.2	33.9	30.1	7.8	9.3	36.5	35.5	17.2	14.8	20.3	16.6	24.5	23.5	23.0
Novi Sad 20	27.2	20.3	21.0	29.2	28.8	8.6	7.3	36.8	35.4	15.7	15.1	19.6	14.2	25.6	31.6	22.4
Novi Sad 61	27.1	10.3	25.9	40.0	29.2	6.5	8.7	32.1	39.1	16.0	17.1	20.5	13.5	26.0	24.1	22.4
VNIIMK 8931	31.7	20.7	21.5	39.0	28.9	6.9	7.9	34.2	29.4	17.6	17.3	20.7	13.6	25.2	25.6	22.7
L.S.D. 0.05	2.7	9.4	3.5	5.4	6.3	2.8	2.8	2.9	1.8	2.7	3.6	2.4	3.6	4.1	5.4	3.6

Table 2

Trial No. 2 with open pollinated varieties (1979). Seed yield test (q/ha, 0% moisture)

Cultivars	Bulgaria Toshevo	F. Rep. of Germany Giessen	Hungary Iregszemcse	Italy Bari	Poland Poznań	Portugal Elvas	Romania Fundulea	Romania Podu Iloaie	Spain Córdoba	Turkey Ankara	Turkey Edirne	Turkey Luleburgaz	Yugoslavia Novi Sad	Mean of 13 locations
Peredovik	27.8	28.9	25.4	11.9	35.3	21.0	34.1	42.6	17.0	24.4	37.4	31.7	23.4	27.8
Hemus	28.5	27.4	32.0	10.7	30.8	21.7	33.5	38.7	17.5	24.8	38.6	29.5	23.8	27.5
IH — 10	23.7	26.7	23.9	11.7	25.3	4.4	31.1	43.4	12.3	20.9	21.7	26.1	23.2	22.6
Iregi 816 B	23.7	20.7	11.6	14.5	25.3	4.2	25.2	42.6	12.3	18.0	24.3	24.0	12.4	19.9
Iregi Csikos	26.4	33.7	32.0	14.5	32.5	17.5	33.5	43.0	14.6	22.5	23.9	22.9	29.4	26.6
Argentario	27.6	28.8	25.2	12.1	32.7	17.4	30.1	40.0	16.7	27.9	34.3	31.9	28.5	27.2
Record	28.7	30.9	28.9	11.7	34.6	18.6	34.2	41.4	19.1	32.4	39.4	35.3	26.3	29.3
Romsun 59	30.2	28.2	26.1	11.8	37.7	24.4	36.8	38.5	18.9	29.3	38.5	36.6	26.0	29.5
Sepasol	26.6	28.9	26.4	11.1	31.6	19.5	31.8	35.4	17.4	27.9	35.2	33.4	25.7	27.0
Novi Sad 20	29.1	19.9	29.8	16.3	31.1	15.7	29.4	37.3	15.2	31.0	37.6	34.1	24.2	27.0
Novi Sad 61	31.3	25.3	35.9	12.6	32.9	20.5	31.5	30.7	18.4	31.4	34.4	35.2	29.0	27.5
VNIIMK 8931	29.1	26.9	35.8	12.2	38.1	20.3	31.5	39.8	18.3	30.4	39.0	36.1	30.8	29.9
L.S.D. 0.05	3.2	2.9	3.2	2.6	5.8	2.3	2.1	1.6	2.3	3.0	3.8	3.5	5.7	2.2

dulea), Turkey (Luleburgaz) and Yugoslavia. Mean seed yields over 25 q/ha have been supplied by Peredovik, Iregi Csikos, Record, VNIIMK 8931 and Hemus, while Iregi 816 B and IH-10 have given only 19.1 and 21.4 q/ha, respectively.

A similar variation can be noticed for oil yield (Tables 4, 5 and 6), which ranges from 2.0 q/ha in Portugal to 22.8 q/ha in Romania (Podu Iloaie), in 1979. The best oil yielding cultivars, Peredovik and Record, are closely situated to the check hybrid Romsun 59, while Iregi 816 B, Iregi Csikos and Hemus are significantly inferior to it.

The analysis of variance (Table 7) points out that environmental influences (locations and years) contributed much more then cultivars to the variability of both seed and oil yields. Small values of cultivar interactions with locations and years show that the reaction of cultivars was almost the same, especialy from location to location. The high significant loca-

Table 3

Trial No. 1 with open pollinated varieties. Two-year seed yield test (q/ha, 0% moisture)

Cultivars	Bulgaria Toshevo	F. Rep. of Germany Giessen	Hungary Iregszemcse	Poland Poznań	Portugal Elvas	Romania Fundulea	Romania Podu Iloaie	Spain Córdoba	Turkey Ankara	Turkey Edirne	Turkey Luleburgaz	Yugoslavia Novi Sad	Mean of 12 locations
Peredovik	29.7	29.0	24.7	17.6	15.8	35.5	41.4	18.0	20.9	27.1	26.1	25.1	25.9
Hemus	29.4	24.5	27.9	15.2	15.7	34.4	40.0	17.7	20.8	27,7	25.6	21.6	25.0
IH — 10	25.1	26.3	21.7	11.1	7.1	30.8	37.0	15.4	17.9	17,5	22.5	23.9	21.4
Iregi 816 B	24.7	22.7	16.7	7.0	5.0	26.6	35.1	14.3	15.5	18,2	21.3	22.1	19.1
Iregi Csikos	28.0	34.4	28.9	19.8	13.6	35.0	37.2	17.0	21.7	20.2	23.7	30.8	25.9
Argentario	27.8	28.4	25.1	13.7	13.6	32.3	37.8	17.6	20.8	24.6	26.1	29.8	24.8
Record	30.7	27.4	25.6	15.5	13.7	35.7	37.0	18.6	24.4	27.0	28.0	26.1	25.8
Romsun 59	31.9	27.1	25.0	20.1	16.9	37.9	37.8	18.3	24.3	27.0	30.2	32.5	27.4
Sepasol	28.7	23.7	26.3	13.7	14.4	34.2	35.5	17.3	21.4	25.9	26.9	24.6	24.4
Novi Sad 20	28.2	20.1	25.4	12.2	11.5	33.1	36.4	15.5	23.1	25.9	26.9	27.9	23.8
Novi Sad 61	29.2	17.8	30.9	13.5	14.6	31.8	34.9	16.7	24.3	24.0	27.9	26.6	24.4
VNIIMK 8931	30.4	23.8	28.7	13.6	14.1	32.9	34.6	18.0	23.9	26.3	28.5	28.2	25.2
L.S.D. 0.05	3.0	6.2	3.4	2.6	2.6	2.5	1.7	2.5	3.3	3.7	3.0	5.6	3.0

Table 4

Trial No. 1 with open pollinated varieties (1978). Oil yield test (q/ha)

Cultivars	Bulgaria Toshevo	F. Rep. of Germany Giessen	Hungary Iregszemcse	Hungary Szeged	Italy Pisa	Poland Poznań	Portugal Elvas	Romania Fundulea	Romania Podu Iloaie	Spain Córdoba	Turkey Ankara	Turkey Luleburgaz	Turkey Yeşilköy	Yugoslavia Novi Sad	Mean of 14 locations
Peredovik	15.8	14.7	12.5	15,8	14.5	6.5	5.1	19.1	21.3	9.0	7.3	7.9	14.3	13.5	12.7
Hemus	15.7	10.5	12.5	20.8	16.4	4.0	4.5	18.4	21.7	8.6	7.2	10.5	14.0	10.2	12.5
IH — 10	14.0	12.5	10.7	19.2	12.9	8.9	4.7	15.8	15.6	8.8	6.3	8.6	13.5	12.5	11.7
Iregi 816 B	13.4	10.3	11.9	10.4	12.7	4.7	2.6	14.7	15.0	7.6	4.7	8.2	7.4	16.7	10.0
Iregi Csikos	11.0	13.4	10.4	10.4	11.3	8.4	4.7	14.6	12.8	6.5	6.0	8.0	9.8	11.5	9.9
Argentario	14.1	12.7	12.8	17.0	14.5	4.3	4.8	17.7	18.0	8.3	5.8	8.9	12.7	15.6	11.9
Record	16.9	10.3	11.8	15.6	14.1	5.2	4.3	19.3	16.7	8.3	6.9	10.1	12.4	13.0	11.8
Romsun 59	16.2	11.6	12.5	16.4	14.1	6.6	4.8	19.7	18.9	7.6	7.3	10.3	11.4	19.2	12.6
Sepasol	16.1	8.8	13.3	17.7	12.5	3.2	4.6	19.1	18.2	8.4	6.8	10.1	12.3	12.1	11.7
Novi Sad 20	14.1	9.5	10.6	15.3	12.2	3.5	3.6	19.2	18,7	7.2	6.3	9.3	12.4	16.6	11.3
Novi Sad 61	13.9	4.6	12.6	20.5	12.0	2.7	4.3	16.6	20.0	7.3	7.2	10.2	12.6	12.1	11.2
VNIIMK 8931	16.1	9.1	10.6	20.1	12.3	2.8	3.9	17.5	15.0	3.3	7.3	9.1	12.4	12.8	11.2
L.S.D. 0.05	1.8		1.9	3.0	3.1	1.3	1.3	1.5	1.1	1.4	1.9	1.4	2.2	3.0	1.0

Table 5

Trial No. 1 with open pollinated varieties (1979). Oil yield test (q/ha)

Cultivars	Hungary	Italy	Poland	Portugal	Romania		Spain	Turkey		Yugoslavia	Mean of 10 locations
	Iregszemcse	Bari	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Novi Sad	
Peredovik	12.7	6.0	17.7	11.5	17.7	22.2	8.4	11.1	15.2	11.9	13.4
Hemus	15.6	5.0	15.4	12.1	16.7	20.0	8.4	11.2	14.2	11.6	13.0
IH — 10	12.1	5.9	12.8	2.3	16.1	22.4	6.0	9.5	12.7	11.3	11.1
Iregi 816 B	5.9	7.0	13.2	2.0	13.5	22.8	5.7	7.7	11.1	6.3	9.5
Iregi Csikos	11.4	7.0	12.2	7.5	13.4	17.4	5.1	7.7	8.0	10.6	10.0
Argentario	12.2	6.1	15.8	9.5	15.3	20.7	7.9	12.8	14.0	14.1	12.8
Record	14.2	5.9	17.3	10.2	17.5	21.3	9.0	15.3	17.0	13.4	14.1
Romsun 59	12.9	5.9	19.1	13.3	18.9	19.7	9.5	13.9	17.0	12.9	14.3
Sepasol	13.4	5.6	15.8	10.9	16.3	18.4	8.7	12.9	15.5	13.2	13.1
Novi Sad 20	15.0	8.4	15.9	8.9	15.5	19.4	7.2	13.9	16.0	12.3	13.3
Novi Sad 61	14.0	6.6	16.1	10.9	16.0	15.7	8.6	13.8	16.1	14.5	13.2
VNIIMK 8931	14.4	6.2	18.5	11.0	16.1	20.3	8.8	14.2	16.2	15.3	14.1
L.S.D. 0.05	1.9	1.4	2.9	1.2	1.3	1.2	1.1	1.9	2.0	2.6	1.3

Table 6

Trial No. 1 with open pollnated varieties. Two-year oil yeild test (q/ha)

Cultivars	Hungary	Poland	Portugal	Romania		Spain	Turkey		Yugoslavia	Mean of 9 locations
	Iregszemcse	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Novi Sad	
Peredovik	12.6	12.1	8.3	18.4	21.8	8.7	9.2	11.6	12.7	12.8
Hemus	14.1	9.7	8.3	17.6	20.9	8.5	9.2	12.4	10.9	12.4
IH — 10	11.4	10.9	3.5	16.0	19.0	7.4	7.9	10.7	11.9	11.0
Iregi 816 B	8.9	9.0	2.3	14.1	18.9	6.7	6.2	9.7	11.5	9.7
Iregi Csikos	10.9	10.3	6.1	14.0	15.1	5.8	6.9	8.0	11.1	9.8
Argentario	12.5	10.1	7.2	16.5	19.4	8.1	9.3	11.5	14.9	12.2
Record	13.0	11.3	7.3	18.4	19.0	8.7	11.1	13.6	13.2	12.8
Romsun 59	12.7	12.9	9.1	19.3	19.3	8.6	10.6	13.7	16.1	13.6
Sepasol	13.4	9.5	7.8	17.7	18.3	8.6	9.9	12.8	12.7	12.3
Novi Sad 20	12.8	9.7	6.3	17.4	19.1	7.2	10.1	12.7	14.5	12.2
Novi Sad 61	13.3	9.4	7.6	16.3	17.9	8.0	10.5	13.2	13.3	12.2
VNIIMK 8931	12.5	10.7	7.5	16.8	17.7	8.6	10.8	12.7	14.1	12.4
L.S.D. 0.05	1.9	2.1	1.7	1.4	1.2	1.3	1.9	1.7	2.8	1.3

Trial No. 1 — Analysis of variance for seed and oil yields in open pollinated variety test, evaluated for 12—9 locations and 2 years

Source	Seed yield			Oil yield		
	df	mean square	F	df	mean square	F
Cultivars (C)	11	99.75	4.0 **	11	25.40	7.7 **
Locations (L)	11	1 080.37	43.2 **	8	423.24	128.2 **
Years (Y)	1	1 495.78	59.8 **	1	178.64	54.1 **
C × L	121	10.53	1.0	88	2.07	1.0
C × Y	11	40.97	1.6 *	11	5.85	1.8 *
L × Y	11	418.42	16.7 **	8	52.11	15.8 **
Pooled error	123	25.03		89	3.3	

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

tion x year interactions indicate that the year influence was quite different from one location to the other.

The distribution of cultivars from Trial No. 1, in terms of yielding levels and coefficient of variation, is presented in figure 1. The highest and more constant seed and oil yields have been obtained with the cultivars Romsun 59, Record, VNIIMK 8931, Sepasol and Argentario. Here we deal with an interesting case when a single cross hybrid — Romsun 59 — with a narrower genetic background, manifests a large ecological plasticity. The cultivars Peredovik and Hemus have passed beyond the mean line only in certain favourable environments.

The main morpho-physiological characteristics (Table 8) exhibit also a great variation from one location to the other, and even in the same location from one year to the other, revealing the large plasticity of this species and its well known capacity of adaptation to very different environmental conditions. Thus, although the vegetation period of the experimental cultivars judjing by the average of all locations, corresponds to the half-late type of sunflowers, the large variation amplitude of this characteristic has situated them at the early type level in some countries and at the late level in others. When compared with the hybrid Romsun 59, the cultivars Iregi 816 B, IH-10 and Iregi Csikos are 5—7 days earlier and the other ones, 2—8 days later. Generally, plant height appears positively correlated with the vegetation period.

The highest oil content has been recorded in the South-Eastern European countries : Bulgaria, Romania, Hungary and Yugoslavia and the lowest — in Portugal, Spain, Italy and Turkey. Oil values vary greatly from 28.7 to 56.2%, depending on the genotype and, parti-

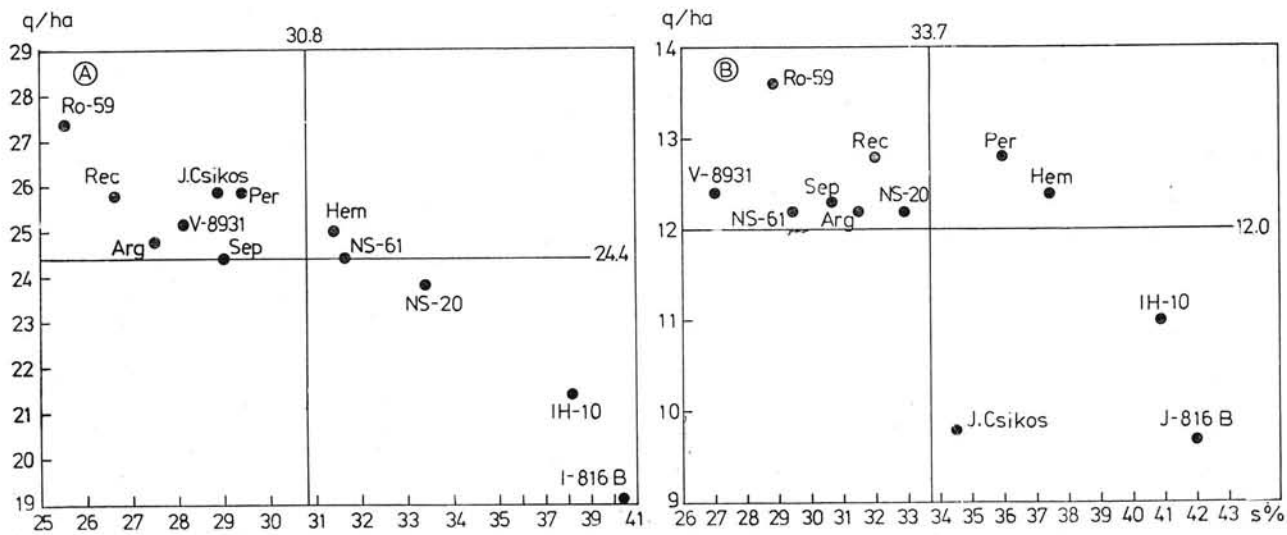

Fig. 1 — Distribution of sunflower open pollinated varieties in terms of yielding capacity and coefficient of variation (*A* = seed yield, *B* = oil yield)

Table 8

Trial No. 1 with open pollinated varieties (1978 and 1979). Morpho-physilogical characteristics (means for 12—17 locations)

Cultivars	Vegetation period (days)		Plant height (cm)		Head diameter (cm)		% oil in dry matter		Test weight (kg/ha)		1 000 seed weight (g)	
	limits	mean	limits	mean	limits	mean	limits	limits	limits	mean	limits	mean
Peredovik	99—154	128	113—232	191	11—29	21	40.9—55.1	48.6	33—42	38	49—79	69
Hemus	100—157	130	108—238	196	10—27	20	43.2—56.2	49.2	32—41	37	46—93	74
IH — 10	95—151	119	102—207	166	11—31	19	42.4—54.8	49.5	32—43	39	51—83	72
Iregi 816 B	94—149	118	86—165	147	10—27	18	36.7—54.9	49.0	32—44	39	45—70	57
Iregi Csikos	94—155	120	105—201	170	10—29	20	28.7—45.2	37.8	37—44	42	46—78	67
Argentario	101—151	127	110—228	190	10—27	20	41.9—54.8	48.2	30—41	37	48—73	68
Record	101—157	128	111—237	189	11—28	21	41.5—55.2	48.8	29—44	38	45—71	67
Romsun 59	100—153	125	100—217	167	11—30	22	37.9—55.3	48.3	31—42	39	43—73	64
Sepasol	94—163	132	118—259	203	11—31	21	40.7—55.8	49.0	25—42	36	47—77	65
Novi Sad 20	94—161	131	109—253	200	10—29	19	41.3—56.0	49.1	29—41	35	44—79	62
Novi Sad 61	98—163	133	114—243	194	11—31	21	42.2—53.2	47.9	31—42	36	49—80	64
VNIIMK 8931	103—164	131	114—256	199	11—30	20	40.9—54.1	48.2	28—42	38	41—73	62

Table 9

Trial No. 1 with open pollinated varieties (1978 and 1979). Percentage of diseased plants

Cultivars	*Plasmopara helianthi*				*Sclerotinia sclerotiorum*								*Botrytis cinerea*				*Orobanche cumana*		*Macro phomina*	
	Iregszemcse	Fundulea		Szeged	Iregszemcse			Fundulea				Novi Sad	Szeged	Iregszemcse		Poznań	Fundulea		Novi Sad	
	1978	1978	1979	1978	1978		1979	1978		1979		1979	1978	1978	1979	1979	1978		1979	1979
	nat.	art.	art.	nat.	head nat.	stem nat.	nat.	head art.	stem art.	base art.	nat.	nat.	nat.	nat.	nat.	nat.	F% *	I **	nat.	nat.
Peredovik	10	100	93	2	16	44	16	100	92	23	2	35	7	4	21	48	95	28	96	6
Hemus	8	100	98	4	27	63	10	100	100	40	2	30	10	3	17	45	—	—	—	2
IH—10	6	100	100	0	7	81	16	91	91	10	4	31	8	3	29	75	—	—	—	13
Iregi 816 B	4	100	98	2	7	78	11	90	100	14	4	62	2	3	68	78	100	29	100	24
Iregi Csikos	10	97	75	0	17	77	12	87	82	14	1	21	10	1	17	48	100	32	100	15
Argentario	10	98	100	0	19	68	11	87	94	11	4	27	12	2	38	40	100	29	100	6
Record	14	100	100	0	23	61	11	70	45	24	1	30	8	2	14	53	100	30	100	4
Romsun 59	9	100	83	3	19	76	29	86	100	9	1	40	10	1	19	48	100	80	100	3
Sepasol	13	100	100	0	21	70	8	91	100	29	1	23	5	3	16	37	100	72	100	5
Novi Sad 20	4	100	97	0	27	65	8	91	100	10	4	35	2	1	19	42	100	67	100	5
Novi Sad 61	6	100	100	0	20	53	10	100	100	30	5	17	5	1	10	42	—	—	100	13
VNIIMK 8931	18	100	98	0	19	69	10	100	76	19	2	14	9	3	12	25	98	64	100	15

* F% = frequency ; ** I = intensity.

cularly, on the environmental conditions. With respect to this characteristic, all cultivars display high mean values, over 48%, except Iregi Csikos (37.8%).

A better volumetric weight characterizes the cultivars Iregi Csikos, IH-10, Iregi 816 B and the single hybrid Romsun 59. Hemus and IH-10 have produced the largest seeds and Iregi 816 B — the smallest ones.

In respect of resistance to diseases (Table 9) the information supplied by the participating countries is rather scanty, due to the low frequency of disease incidence under natural conditions in most places, or due to a different reaction of each cultivar to the same pathogen in different locations. The severe artificial inoculations carried out at Fundulea, Romania, confirmed the susceptibility of all sunflower open pollinated varieties to the attack of the fungus *Plasmopara helianthi.* Superior resistance to *Sclerotinia sclerotiorum,* inoculated in the middle part of the stem, have manifested the cultivars Record, VNIIMK 8931 and Iregi Csikos, while the artificial infection with sclerotia in the soil has revealed a better resistance of Romsun 59, IH-10, Novi Sad 20 and Argentario. Artificial inoculations with broomrape *(Orobanche cumana),* performed at Fundulea, proved that all cultivars of Trial No. 1 are susceptible to the attack of this parasite, but a lower attack intensity has been observed to the open pollinated varieties Peredovik, Iregi 816 B, Argentario, Record and Iregi Csikos.

2. Single and three-way hybrid trials

The results of sunflower single and three-way hybrid trials (Trial No. 2) are presented in Tables 10—18. As in the case of the open pollinated varieties, one can observe a great variation of data from different locations and years. Seed yields obtained in 1978 ranged from 6.0 q/ha to 46.5 q/ha (Table 10), and those performed in 1979 (Table 11), from 9.3 to 42.8 q/ha.

The highest two-year seed yield means (Table 12) were registered in the South-Eastern

Tableau 10

Trial No. 2 with single and three-way hybrids (1978). Seed yield test (q/ha, 0% moisture)

Hybrids	Austria	Bulgaria	France			F. Rep. of Germany	Hungary		Italy	Poland	Portugal	Romania		Spain	Turkey				Yugoslavia	Mean of 19 locations
	Vienna	Toshevo	Aude (CETIOM)	Clermont Ferrand	Montpellier	Giessen	Iregszemcse	Szeged	Pisa	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Edirne	Yeşilköy	Novi Sad	
HB-451	18.0	32.9	32.0	27.0	**28.0**	33.3	20.1	33.4	31.7	15.0	6.8	33.9	41.8	15.4	21.3	22.9	12.1	25.7	35.4	24.7
Remil	17.9	28.3	35.4	23.4	28.2	30.3	24.6	21.5	34.8	15.7	7.8	30.1	29.1	16.0	18.8	22.3	14.0	27.9	33.7	24.2
Luciole	17.8	26.2	29.4	22.9	**26.3**	30.4	24.2	14.4	32.6	19.6	7.1	27.4	33.8	14.9	20.8	21.7	12.5	28.3	35.0	23.4
INRA 7702	15.9	30.4	35.5	30.3	**30.8**	28.1	22.2	28.3	37.7	12.6	8.2	30.8	37.5	16.6	20.9	21.0	11.4	27.9	36.5	25.4
Sorex	15.7	26.1	30.3	25.9	**26.9**	32.6	25.8	28.2	33.0	22.0	6.6	29.6	30.2	15.1	20.9	17.4	15.1	32.4	34.0	24.6
Olga II	17.2	27.7	31.5	23.3	26.1	38.9	22.5	33.7	34.6	22.2	7.8	30.3	33.0	16.2	22.6	16.8	13.4	25.9	33.8	25.1
Sorem HT-111	16.7	29.1	27.3	24.4	28.8	25.8	19.4	24.7	34.4	15.0	8.0	36.0	33.6	14.9	25.7	27.4	12.8	26.0	35.4	24.5
Sorem HT-116	16.6	33.6	34.9	30.0	31.3	40.4	21.7	27.5	36.2	14.4	8.5	37.0	41.6	16.4	24.3	27.7	17.5	27.0	37.5	27.6
Sorem HT-117	15.8	30.5	35.7	28.3	27.5	34.6	22.1	33.5	35.4	12.9	7.1	35.9	46.5	15.5	23.2	24.9	14.1	26.1	35.9	26.6
Romsun 90	17.4	31.2	37.3	27.3	26.5	34.7	21.6	19.4	34.8	12.4	6.0	32.3	37.6	17.1	26.1	27.8	14.7	26.6	38.6	25.8
HS-1161	19.7	29.5	35.4	25.3	27.5	35.6	21.9	20.8	35.7	22.3	8.8	29.0	31.3	17.3	22.0	25.9	14.8	23.9	38.3	25.5
HS-72 M	18.5	29.8	36.4	26.2	29.9	26.3	19.7	27.6	40.2	15.9	9.5	30.7	28.4	16.6	25.7	26.5	13.9	21.9	38.7	25.4
P.O.I. 301 A	17.1	31.7	39.9	31.9	28.9	34.6	21.6	22.3	32.4	21.1	8.1	31.7	37.8	18.1	26.5	27.8	19.9	24.5	34.8	26.9
H-894	15.2	35.0	38.0	29.5	29.6	28.4	22.4	19.3	37.6	12.4	7.8	34.0	36.8	16.4	28.0	30.3	12.6	26.2	36.2	26.1
H-241	18.9	31.4	31.7	28.5	31.1	32.8	22.8	36.0	39.8	20.3	10.2	32.5	29.8	17.2	26.6	29.0	15.4	28.1	35.3	27.2
Sungro 380 A	15.6	35.1	33.3	32.3	31.1	29.7	23.8	34.6	35.4	18.0	8.1	33.7	37.0	16.7	23.5	27.2	15.5	25.5	36.4	27.0
NS-H-27	19.2	32.0	36.4	31.3	29.1	29.9	21.1	30.7	32.0	10.0	7.6	31.8	33.5	17.2	22.0	26.1	18.7	29.4	37.9	26.1
NS-H-34	16.6	32.0	36.9	29.2	30.3	33.3	24.9	21.4	33.5	10.3	8.6	33.0	28.9	16.4	24.0	25.5	16.3	26.7	39.2	25.6
NS-H-63 RM	17.6	26.8	26.1	24.4	26.4	24.2	20.1	26.2	35.9	10.3	8.3	29.7	29.8	15.8	20.1	21.1	16.4	28.1	37.1	23.4
Peredovik	19.3	30.0	31.1	27.2	30.5	35.0	23.4	34.4	34.8	14.3	8.6	29.9	40.3	15.6	17.7	22.3	16.0	28.6	23.9	25.4
L.S.D. 0.05	4.0	2.2	6.0	2.3	3.2	6.7	2.5	4.6	5.6	3.8	2.5	2.4	3.4	1.6	2.6	4.5	1.6	4.0	3.8	2.6

Table 11

Trial No. 2 with single and three-way hybrids (1979). Seed yield test (q/ha, 0% moisture)

Hybrids	Austria	Bulgaria	France		F. Rep. of Germany	Hungary	Italy	Poland	Portugal	Romania		Spain	Turkey			Yugoslavia	Mean of 16 locations
	Vienna	Toshevo	Aude CETIOM	Clermont Ferrand	Giessen	Iregszemcse	Bari	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Edirne	Novi Sad	
HB-451	24.7	30.8	20.7	20.7	33.2	19.4	23.3	25.9	12.8	35.1	38.0	16.7	25.5	28.5	31.0	30.9	26.1
Remil	23.0	—	18.8	22.4	25.1	27.3	20.6	37.4	—	30.6	37.6	17.8	28.0	25.0	—	—	22.3
Luciole	21.5	—	28.4	19.4	26.4	23.8	14.0	25.8	—	30.5	34.2	—	19.4	22.1	—	—	24.1
INRA 7702	23.6	—	17.7	21.7	33.4	27.2	21.5	34.8	—	30.7	35.8	18.3	26.8	24.1	—	—	26.3
Sorex	26.1	35.0	23.9	21.4	36.4	34.0	23.9	38.6	24.0	32.9	40.1	20.0	25.1	31.8	32.9	35.3	30.1
Olga II	25.9	30.5	23.9	19.4	33.4	28.1	23.3	32.1	25.9	34.2	42.8	16.4	22.5	28.2	24.7	33.2	27.8
Sorem HT-111	23.1	34.1	22.2	20.7	25.9	29.6	19.4	29.1	15.3	35.3	39.4	15.9	28.5	24.6	29.7	35.0	26.7
Sorem HT-116	23.1	36.9	22.0	21.4	27.2	37.6	22.0	39.0	19.9	38.8	41.7	16.7	36.4	36.7	34.7	32.8	30.4
Sorem HT-117	23.8	30.9	31.0	23.2	27.9	29.4	23.3	32.4	11.5	37.2	41.3	20.0	34.3	36.3	33.4	30.0	29.1
Romsun 90	22.8	27.2	25.7	21.1	27.8	17.2	22.0	23.7	9.3	31.5	31.2	16.0	31.5	33.9	29.6	34.2	25.3
HS-1161	20.4	28.3	25.3	18.7	29.4	18.9	25.0	23.8	22.9	33.7	38.8	17.4	25.0	28.8	25.6	25.1	25.4
HS-72 RM	24.9	32.4	25.1	19.3	26.7	22.0	20.9	34.0	26.0	35.0	40.0	18.6	25.9	31.7	28.1	33.0	27.7
P.O.I. 301 A	25.9	—	28.2	22.6	30.2	20.5	19.0	33.7	—	28.9	36.6	—	30.1	32.8	—	—	28.0
H-894	24.2	32.5	22.5	22.9	29.4	20.5	23.4	35.0	16.2	31.0	36.9	16.0	36.8	34.6	32.6	33.5	28.0
H-241	22.3	31.2	27.7	24.8	28.0	22.3	25.3	25.1	16.7	28.9	36.4	19.8	32.3	33.4	31.4	24.1	26.9
Sungro 380 A	22.0	27.7	31.6	26.5	22.7	23.1	20.7	34.4	23.6	29.1	35.6	19.6	32.5	31.9	32.6	37.1	28.2
NS-H-27	22.8	27.7	27.0	20.6	29.3	14.2	24.6	26.8	18.6	28.9	36.9	20.8	28.0	34.4	32.9	33.5	26.7
NS-H-34	21.3	28.4	29.0	19.4	27.6	15.5	23.2	30.6	22.1	28.1	36.7	18.6	29.9	32.6	30.7	38.6	27.0
NS-H-63 RM	25.0	31.1	26.7	20.2	28.8	22.8	23.7	28.2	12.3	29.9	35.1	18.0	31.9	34.3	30.3	31.2	26.8
Peredovik	21.3	31.6	24.2	20.4	27.4	21.3	20.7	29.1	20.1	33.0	38.1	18.0	28.6	33.1	32.3	32.7	27.0
L.S.D. 0.05	3.6	3.2	7.5	3.0	2.9	4.1	4.0	5.5	3.9	2.5	2.3	3.0	5.8	6.1	5.8	4.6	3.0

Table 12

Trial No. 2 with single and three-way hybrids. Two-year seed yields test (q/ha, 0% moisture)

Hybrids	Austria	Bulgaria	France		F. Rep. of Germany	Hungary	Poland	Portugal	Romania		Spain	Turkey			Yugoslavia	Mean of 15 locations
	Vienna	Toshevo	Aude CETIOM	Clermont Ferrand	Giessen	Iregszemcse	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Edirne	Novi Sad	
HB-451	21.4	31.9	26.4	23.9	33.3	19.8	20.5	14.8	34.5	39.9	16.1	23.4	25.7	21.6	33.2	25.8
Remil	20.5	—	27.1	22.9	27.7	26.0	26.5	—	30.4	33.4	16.9	23.4	23.7	—	—	25.3
Luciole	19.7	—	28.9	21.2	28.4	24.0	22.7	—	29.0	34.0	—	20.1	21.9	—	—	25.0
INRA 7702	19.8	—	26.6	26.0	30.8	24.7	23.7	—	30.8	36.7	17.5	23.9	22.6	—	—	25.7
Sorex	20.9	30.6	27.1	23.7	34.5	29.9	30.3	15.3	31.3	35.1	17.6	23.0	24.6	24.0	34.7	26.8
Olga II	21.6	29.1	27.7	21.4	36.2	25.3	27.2	16.9	32.2	37.9	16.3	22.6	22.5	19.1	33.5	26.0
Sorem HT-111	19.9	31.6	24.8	22.6	25.9	24.5	22.1	11.7	35.7	36.5	15.4	27.1	26.0	21.3	35.2	25.4
Sorem HT-116	19.9	35.3	28.5	25.7	33.8	29.7	26.7	14.2	37.9	41.7	16.6	30.4	32.2	26.1	35.2	28.9
Sorem HT-117	19.8	30.7	33.4	25.8	31.3	25.8	22.7	9.3	36.6	43.9	17.8	28.8	30.6	23.8	33.0	27.6
Romsun 90	20.1	29.2	31.5	24.2	31.3	19.4	18.1	7.7	31.9	34.4	16.6	28.8	30.9	22.2	36.4	25.5
HS-1161	20.1	28.9	30.4	22.0	32.5	20.4	23.1	15.9	31.4	35.1	17.4	23.5	27.4	20.2	31.7	25.3
HS-72 M	21.7	31.1	30.8	22.8	26.5	20.9	24.9	17.8	32.9	34.2	17.6	25.8	29.1	21.0	35.9	26.2
P.O.I. 301 A	21.5	—	34.1	27.3	32.4	21.1	27.4	—	30.3	37.2	—	28.3	30.3	—	—	29.0
H-894	19.7	33.8	30.3	26.2	28.9	21.5	23.7	12.0	32.5	36.9	16.2	32.4	32.5	22.6	34.9	26.9
H-241	20.9	31.3	29.7	26.7	30.4	22.6	22.7	13.5	30.7	33.1	18.5	29.4	31.2	23.4	29.7	26.3
Sungro 380 A	18.8	31.4	32.5	29.4	26.2	23.5	26.2	15.9	31.4	36.3	18.2	28.0	29.6	24.0	36.8	27.2
NS-H-27	21.0	29.9	31.7	26.0	29.6	17.7	18.4	13.1	30.4	35.2	19.0	25.0	30.3	25.8	35.7	25.9
NS-H-34	19.0	30.2	33.0	24.3	30.5	22.2	20.5	15.4	30.6	32.8	17.5	27.0	29.1	23.5	38.9	26.3
NS-H-63 RM	21.3	29.0	26.4	22.3	26.5	21.4	19.3	10.3	29.8	32.5	19.9	26.0	27.7	23.4	34.2	24.7
Peredovik	20.3	30.8	27.7	23.8	31.2	22.4	21.7	14.4	31.5	39.2	16.3	23.2	27.7	24.1	28.3	25.5
L.S.D. 0.05	3.3	2.7	6.8	2.7	4.8	3.3	4.7	3.2	2.5	2.4	2.3	4.2	5.3	3.7	4.2	2.8

Table 13

Trial No. 2 with single and three-way hybrids (1978). Oil yield test (q/ha)

Hybrids	Austria	Bulgaria	France			F. Rep. of Germany	Hungary		Italy	Poland	Portugal	Fundulea		Spain	Turkey			Yugoslavia	Mean of 18 locations
	Vienna	Toshevo	Aude CETIOM	Clermont Ferrand	Montpellier	Giessen	Iregszemcse	Szeged	Pisa	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Yeşilköy	Novi Sad	
HB-451	8.0	16.6	15.9	13.6	15.2	16.6	9.8	16.5	13.4	7.3	6.3	17.6	21.8	7.3	9.3	9.2	12.5	16.2	13.0
Remil	7.6	12.6	16.9	10.1	13.6	14.7	11.4	9.8	13.8	7.4	—	14.0	14.1	6.9	7.3	8.2	11.8	14.1	11.4
Luciole	7.2	11.7	13.8	10.2	13.1	14.4	11.2	6.3	12.9	8.8	—	13.1	16.5	6.8	8.3	8.0	12.3	14.5	11.1
INRA 7702	6.2	12.7	17.0	12.8	14.9	12.6	10.0	12.1	15.1	5.7	—	14.2	17.6	6.9	7.8	7.8	11.1	15.0	11.7
Sorex	5.0	9.6	13.7	9.5	10.5	11.7	8.9	10.4	12.1	8.1	10.0	11.5	11.8	5.4	6.4	5.5	12.0	10.8	9.6
Olga II	6.4	11.3	15.2	9.6	11.8	15.8	9.3	13.9	12.7	9.6	10.1	13.9	15.0	6.7	8.5	6.8	11.1	12.8	11.1
Sorem HT-111	7.5	14.4	13.6	11.8	15.5	11.4	9.6	12.1	13.1	7.0	7.5	18.4	17.2	6.7	10.7	11.9	12.8	16.2	12.1
Sorem HT-116	7.3	16.0	17.3	14.5	16.6	19.3	11.6	13.5	14.7	6.2	9.9	18.8	20.8	7.4	10.0	12.4	13.8	16.0	13.7
Sorem HT-117	6.9	14.9	17.7	13.3	14.3	16.1	10.8	16.3	13.8	5.6	5.2	18.3	23.4	7.0	9.6	11.1	12.8	15.5	12.9
Romsun 90	7.4	15.4	19.7	13.0	14.8	17.4	10.8	9.8	15.1	6.0	4.3	16.7	19.6	8.3	10.9	12.4	12.5	17.7	12.9
HS-1161	8.7	14.5	17.8	11.5	14.5	17.8	11.2	10.4	14.8	10.8	10.7	15.0	16.2	8.5	9.0	11.0	11.0	17.8	12.8
HS-72 M	8.1	14.2	17.9	11.8	16.5	11.2	9.6	12.5	16.2	7.0	12.0	14.8	13.7	8.2	11.6	11.3	10.3	17.1	12.4
P.O.I. 301 A	8.0	16.0	20.8	15.5	16.0	17.8	10.7	11.2	12.6	10.5	—	16.4	19.3	8.8	11.4	12.6	12.2	16.3	13.8
H-894	6.5	17.0	19.0	13.5	15.5	13.8	11.1	9.0	14.1	5.5	7.8	17.1	18.8	7.1	12.2	12.8	12.3	15.8	12.7
H-241	8.5	15.7	15.5	13.1	16.8	16.0	11.4	17.6	16.0	9.9	8.2	16.1	14.9	8.2	12.1	13.1	13.3	15.7	13.5
Sungro 380 A	7.6	18.1	17.2	15.5	17.2	13.5	11.3	17.3	14.0	8.8	11.7	17.6	19.5	8.4	11.3	12.8	12.9	17.0	14.0
NS-H-27	9.1	16.6	18.2	15.5	16.6	12.7	10.6	15.3	14.0	4.7	9.4	16.8	17.9	8.4	9.8	12.3	14.7	17.6	13.3
NS-H-34	7.3	16.1	18.5	14.2	16.2	16.0	11.9	9.9	13.3	4.8	10.4	17.1	14.8	7.3	10.1	11.1	12.8	17.2	12.7
NS-H-63 RM	6.5	10.8	12.1	9.9	11.8	10.1	8.8	10.7	13.6	4.4	5.0	13.1	13.6	6.3	7.1	7.8	11.6	15.2	9.9
Peredovik	8.7	15.8	15.8	13.4	16.9	17.4	11.2	16.8	14.4	6.7	9.6	15.2	20.8	7.6	7.7	10.3	14.4	10.9	13.0
L.S.D. 0.05	1.8	1.3	3.0	1.3	1.8	4.6	1.6	2.4	2.4	1.8	2.0	1.3	1.8	1.0	1.6	2.1	2.0	1.9	1.6

Table 14

Trial No. 2 with single and three-way hybrids (1979). Oil yield test (q/ha)

Hybrids	France		Hungary	Italy	Poland	Portugal	Romania		Spain	Turkey		Yugoslavia	Mean of 12 locations
	Aude CETIOM	Clermont Ferrand	Iregszemcse	Bari	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Novi Sad	
HB—451	10.0	10.3	9.3	9.8	13.1	6.0	17.5	19.2	8.4	11.3	13.7	13.5	11.8
Remil	8.8	10.5	11.7	8.4	18.1	—	13.8	17.6	8.2	10.9	11.1	—	11.9
Luciole	13.9	9.0	10.1	5.5	12.1	—	14.3	17.8	—	7.2	10.4	—	11.1
INRA 7702	7.4	9.9	11.3	10.2	16.1	—	13.7	16.8	8.5	10.3	9.9	—	11.4
Sorex	10.2	9.3	13.3	9.1	17.1	10.3	14.4	17.4	8.8	8.5	12.6	13.4	12.0
Olga II	10.7	8.4	10.7	9.3	13.8	10.1	14.6	18.7	7.4	8.3	11.2	11.8	11.3
Sorem HT-111	10.9	10.6	13.9	7.8	14.4	7.9	18.1	20.8	7.9	12.8	11.5	15.8	12.7
Sorem HT-116	10.8	10.8	17.2	9.2	19.2	10.1	19.6	21.4	8.2	16.2	17.0	14.3	14.5
Sorem HT-117	16.0	12.9	11.1	10.5	17.6	6.0	19.7	21.7	10.3	16.2	18.3	13.9	14.5
Romsun 90	13.2	11.1	8.3	9.9	12.5	4.6	16.0	16.1	8.2	14.6	15.6	15.5	12.1
HS-1161	12.4	9.1	8.7	10.5	11.6	11.4	16.6	19.7	8.9	10.8	13.5	10.9	12.0
HS-72 M	12.5	9.6	9.4	9.0	16.1	12.9	16.7	15.4	9.5	11.1	14.5	14.0	12.6
P.O.I. 301 A	15.1	12.3	10.0	8.9	17.2	—	14.5	19.4	—	13.9	15.4	—	14.1
H-894	10.6	11.5	9.2	10.9	17.0	8.0	15.0	18.2	8.2	16.7	16.3	15.0	13.1
H-241	13.9	13.1	10.3	11.3	13.1	8.5	14.4	18.9	10.4	15.0	15.6	10.6	12.9
Sungro 380 A	16.1	14.6	11.1	9.7	17.2	12.3	14.9	19.2	10.4	15.2	15.9	16.7	14.4
NS-H-27	13.9	11.0	7.1	11.9	13.7	9.9	14.8	19.7	11.0	12.9	16.5	15.2	13.1
NS-H-34	14.4	9.7	8.4	10.7	14.5	10.4	14.1	18.0	9.5	12.8	15.1	17.0	12.9
NS-H-63 RM	12.5	9.5	9.8	10.2	13.5	5.5	13.8	17.1	8.6	13.3	15.1	12.6	11.8
Peredovik	12.1	10.5	10.4	9.3	14.2	10.0	16.5	19.5	9.6	13.1	15.9	14.4	12.9
L.S.D. 0.05	5.5	1.6	2.3	2.0	2.6	1.9	1.6	1.1	1.6	2.7	3.0	2.6	1.8

Trial No. 2 with single and three-way hybrids. Two-year oil yield test (q/ha)

Hybrids	France		Hungary	Poland	Portugal	Romania		Spain	Turkey		Yugoslavia	Mean of 11 locations
	Aude CETIOM	Clermont Ferrand	Iregszemcse	Poznań	Elvas	Fundulea	Podu Iloaie	Córdoba	Ankara	Luleburgaz	Novi Sad	
HB-451	13.0	12.0	9.6	10.2	6.2	17.6	20.5	7.9	10.3	11.5	14.9	12.2
Remil	12.9	10.3	11.6	12.8	—	13.9	15.9	7.6	9.1	9.7	—	11.5
Luciole	13.9	9.6	10.7	10.5	—	13.7	17.2	—	7.8	9.2	—	11.6
INRA 7702	12.2	11.4	10.7	10.9	—	14.0	17.2	7.7	9.1	8.9	—	11.3
Sorex	12.0	9.4	11.1	12.6	10.2	13.0	14.6	7.1	7.5	9.1	12.1	10.8
Olga II	13.0	9.2	10.0	11.7	10.1	14.3	16.9	7.1	8.4	9.0	12.3	11.1
Sorem HT-111	12.3	11.2	11.8	10.7	7.7	18.3	19.0	7.3	11.8	11.7	15.9	12.5
Sorem HT-116	14.1	12.7	14.4	12.7	10.0	19.2	21.1	7.8	13.1	14.7	15.3	14.1
Sorem HT-117	16.9	13.1	11.0	11.6	5.6	19.0	22.6	8.7	12.9	14.7	14.7	13.7
Romsun 90	16.5	12.1	9.6	9.3	4.5	16.4	17.9	8.3	12.8	14.0	16.6	12.5
HS-1161	15.1	10.3	10.0	11.2	11.1	15.8	18.0	8.7	9.9	12.3	14.4	12.4
HS-72 M	15.2	10.7	9.5	11.6	12.5	15.8	14.6	8.9	11.4	13.0	15.6	12.6
P.O.I. 301 A	18.0	13.9	10.4	13.6	—	15.5	19.4	—	12.7	14.0	—	14.7
H-894	14.8	12.5	10.2	11.3	7.9	16.1	18.5	7.6	14.5	14.6	15.4	13.0
H-241	14.7	13.1	10.9	11.5	8.4	15.3	16.9	9.3	13.5	14.4	13.2	12.8
Sungro 380 A	16.7	15.1	11.2	13.0	12.1	16.3	19.4	9.4	13.3	14.3	16.9	14.3
NS-H-27 – Gloriosol	16.0	13.3	8.9	9.2	9.7	15.8	18.8	9.7	11.4	14.4	16.4	13.1
NS-H-34	16.5	12.0	10.2	9.7	10.4	15.6	16.4	8.4	11.5	13.1	17.1	12.8
NS-H-63 RM	12.3	9.7	9.3	9.0	5.3	13.4	15.4	7.5	10.2	11.5	13.9	10.7
Peredovik	14.0	12.0	10.8	10.5	9.8	15.9	20.2	8.6	10.4	13.1	12.7	12.5
L.S.D. 0.05	4.3	1.5	2.0	2.2	2.0	1.5	1.5	1.3	2.2	2.6	2.3	1.1

Table 16

Trial No. 2 — Analysis of variance for seed and oil yields in single and three-way hybrid test, evaluated for 15—11 locations and 2 years

Source	Seed yield			Oil yield		
	df	mean square	F	df	mean square	F
Cultivars (C)	19	40.65	85.8 **	19	27.78	15.2 **
Locations (L)	14	1604.42	3385.0 **	10	329.72	180.6 **
Years (Y)	1	228.99	483.1 **	1	55.56	30.4 **
C × L	266	17.38	36.7 **	190	4.49	2.5 **
C × Y	19	51.38	108.4 **	19	4.47	2.5 **
L × Y	13	47.64	100.5 **	10	57.79	31.7 **
Pooled error	267	0.47		190	1.83	

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

European countries : Romania, Yugoslavia and Bulgaria, and in some zones of Western Europe, as Aude (France) and Giessen (F. Rep. of Germany). Under ecological conditions favourable to sunflower, most of hybrids overyielded significantly the check cultivar Peredovik.

Oil yields (Tables 13, 14, 15) also presented a sinuous curve of variation, being very much affected by the environmental conditions, genrally in the same manner as seed yields.

The analysis of variance (Table 16) indicates that location and year effects on the variability of both seed and oil yields had the

greatest magnitude. In comparison with the open pollinated varieties (Trial No. 1), the differences among hybrids are more consistent. The interactions of hybrids with locations and years have shown higher and more significant values than those obtained in the case of varieties, which underline once more the lower ecological plasticity of sunflower hybrids. The high significant location x year interaction shows that the year influence varies considerably from one location to the other.

The highest and most constant seed and oil yields have been achieved by the three-way hybrid Sorem HT-116 and the single hybrids P.O.I. 301 A and Sungro 380 A (Figure 2). The hybrids Sorem HT-117, H-894 and H-241 require certain favourable conditions for manifesting good performances.

Examining the morpho-phisiological characteristics of sunflower hybrids (Table 17), in comparison with those of the open pollinated varieties, it is obvious that hybrids have a shorter vegetation period and plant height,

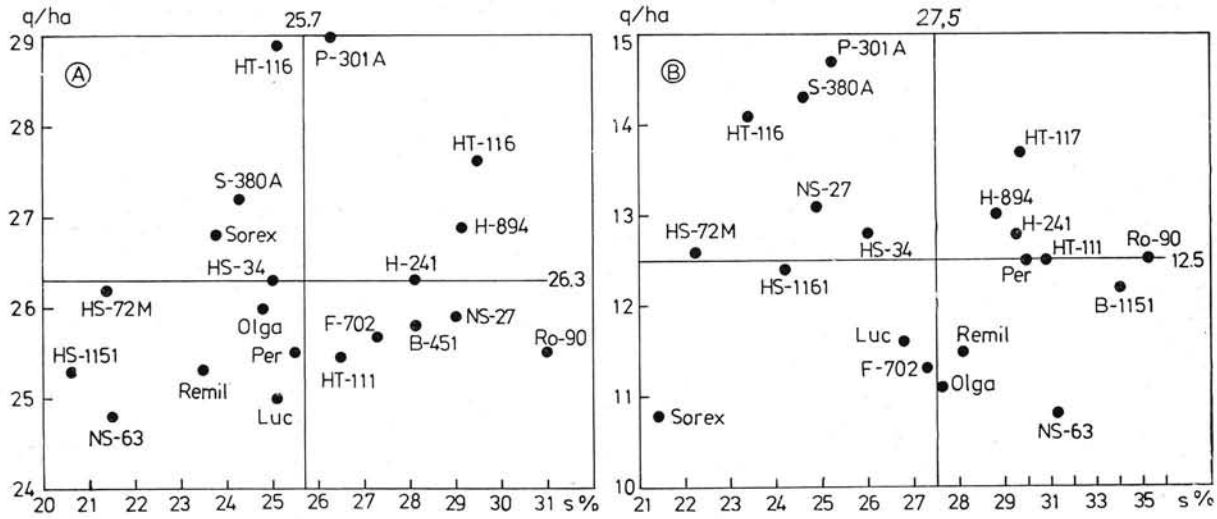

Fig. 2 — Distribution of sunflower single and three-way hybrids in terms of yielding capacity and coefficient of variation (A = seed yield, B = oil yield)

Table 17

Trial No. 2 with single and three-way hybrids (1978—1979). Morpho-physiological characteristics (means for 16—21 locations)

Hybrids	Vegetation period (days)		Plant height (cm)		Head diameter (cm)		% oil in dry matter		Test weight (kg/hl)		1,000 seed weight (g)	
	limits	mean	limits	mean	limits	mean	limits	mean	limits	mean	limits	mean
HB-451	103—136	122	85—188	158	10—30	19	40—53	49.6	32—44	38	42—73	56
Remil	107—138	124	93—220	178	11—25	18	37—49	44.7	32—47	39	45—79	62
Luciole	102—130	117	78—187	152	10—27	19	37—50	45.1	32—45	40	52—75	64
INRA 7702	108—134	125	88—215	168	10—28	17	37—48	44.2	36—48	40	46—69	55
Sorex	103—142	125	98—213	172	10—27	18	30—45	39.8	36—44	39	49—90	70
Olga II	102—137	124	86—207	159	11—32	20	37—48	42.2	35—45	40	52—83	68
Sorem HT-111	104—130	124	94—224	180	10—28	19	38—54	49.8	35—44	39	42—70	57
Sorem HT-116	106—136	126	85—236	186	10—31	21	41—53	49.2	32—44	38	45—78	61
Sorem HT-117	105—138	125	95—221	165	9—32	19	41—56	50.9	32—44	39	45—64	57
Romsun 90	103—129	121	72—187	138	9—31	20	42—53	49.6	32—44	38	46—73	58
HS-1161	101—141	123	80—177	148	10—30	18	41—53	48.3	32—44	38	50—72	62
HS-72 M	105—144	124	84—186	152	10—30	19	40—54	47.9	33—42	37	42—67	59
P.O.I. 301 A	108—142	128	88—197	160	10—30	18	39—53	50.4	32—50	41	40—64	49
H-894	108—137	126	93—192	163	10—31	17	37—53	47.2	36—46	40	34—65	46
H-241	110—138	127	86—192	161	11—32	19	40—54	48.4	35—47	40	46—80	59
Sungro 380 A	110—143	130	98—219	182	10—28	17	40—55	50.9	35—49	41	38—73	50
NS-H-27	109—143	127	92—192	163	11—31	18	42—57	50.5	36—49	41	33—57	45
NS-H-34	109—138	124	95—183	166	11—29	19	40—53	48.1	36—48	40	33—57	44
NS-H-63 RM	102—131	122	91—181	156	10—30	19	35—47	44.2	36—47	41	37—53	45
Peredovik	110—137	127	102—223	188	10—29	19	41—56	48.8	33—47	39	52—85	66

some hybrids possess a higher seed oil content and test weight, but all of them produce smaller seeds then varieties, except the striped seed hybrids Sorex and Olga II.

The oil content of sunflower hybrids has been greatly affected by the environmental conditions, being generally higher in areas where sunflower crops give good seed yields. Nevertheless, genetic differences can be easily detected and the following categories of hybrids can be established : hybrids with low oil content (Sorex and Olga II), hybrids with medium oil content (INRA 7702, NS-H-63 RM, Remil and Luciole), hybrids with high oil content (H-894, HS-72 M, NS-H-34, HS-1161, H-241) and hybrids with very high oil content (HB-451, Sorem HT-111, Sorem HT-116, Sorem HT-117, Romsun 90, P.O.I. 301 A, Sungro 380 A, NS-H-27).

In contrast with the open pollinated varieties, sunflower hybrids offer a better resistance to the attack of the most important pathogens (Tables 18 a and 18 b). Thus, all hybrids, excepting HB-451, Sorex and Olga II, manifest a good or very good resistance to the European race of *Plasmopara helianthi,* as proved by the artificial inoculations carried out at Fundulea, Romania and Novi Sad, Yugoslavia. At least half of the hybrids present a light better resistance to *Sclerotinia sclerotiorum* and *Botrytis cinerea* then the check cultivar Peredovik.

Artificial inoculations with a mixture of *Orobanche cumana* races, occurring in South-Eastern part of Romania, showed that all the experimentated cultivars are high susceptible to the new pathogen race spread in this region in the last 10—15 years. A lower intensity of the attcak presented the hybrids Sorem HT-111, Olga II, Sungro 380 A, Sorem HT-117 and Luciole.

In Novi Sad testing nursery, a better resistance to *Sclerotinia bataticola (Macrophomina phaseoli)* manifested the check cultivar Peredovik and the hybrids Sungro 380 A, NS-H-34, Sorem HT-116, H-241 and INRA 7702.

SUMMARY AND CONCLUSIONS

The second biennial cycle of experimentation with sunflower cultivars (1978—1979) included two competitive trials, one with open pollinated varieties and the other with single and three-way hybrids. These trials were con-

Table 18 a

Trial No. 2 with single and three-way hybrids (1978—1979). Percentage of diseased plants

Hybrids	*Plasmopara helianthi*					*Sclerotinia sclerotiorum*											
	Iregszemcse	Fundulea		Novi-Sad	Szeged	Iregszemcse			Fundulea				Novi Sad				Edirne
	1978	1978	1979	1978	1978	1978		1979	1978			1979	1978			1979	1978
	nat.	art.	art.	art.	nat.	head nat.	stem nat.	nat.	head art.	stem art.	base art.	nat.	head nat.	nat.	base nat.	nat.	nat.
HB-451	9	56	29	100	4	19	78	19	90	100	14	3	9	11	5	36	1
Remil	3	2	2	3	0	7	73	2	100	100	19	1	2	10	1	—	2
Luciole	4	0	1	0	0	10	67	7	100	100	10	1	0	11	2	—	1
INRA 7702	2	3	1	—	0	19	67	10	90	100	8	2	2	12	1	—	3
Sorex	2	95	98	7	0	13	58	24	90	100	23	1	2	9	3	12	0
Olga II	17	63	100	100	0	13	70	9	88	100	23	5	6	9	3	46	2
Sorem HT-111	11	3	5	8	4	7	85	19	90	100	14	3	4	8	4	34	0
Sorem HT-116	2	4	5	7	5	10	91	12	95	100	9	1	3	19	12	31	1
Sorem HT-117	2	2	16	0	2	6	78	6	95	100	15	6	3	20	9	36	1
Romsun 90	1	12	9	7	0	14	75	12	100	100	16	5	2	24	6	23	1
HS-1161	0	5	6	2	0	16	83	5	90	100	14	4	6	5	3	50	1
HS-72 M	0	16	10	0	0	15	80	7	95	100	14	1	5	6	4	13	2
P.O.I. 301 A	3	2	1	0	0	22	62	5	90	100	9	5	7	4	0	—	1
H-894	4	2	1	2	0	16	77	6	82	55	5	2	2	7	2	6	0
H-241	4	21	3	13	0	20	75	6	90	100	10	4	14	7	1	53	0
Sungro 380 A	3	9	1	0	6	22	74	3	100	100	12	3	4	6	1	29	1
NS-H-27	2	10	1	1	8	19	73	4	95	100	8	6	3	5	2	29	0
NS-H-34	2	2	7	2	6	16	78	8	86	100	14	1	1	7	2	8	3
NS-H-63 RM		1	0	—	6	10	89	18	90	100	12	1	0	6	5	4	1
Peredovik	13	100	100	98	0	13	71	23	100	100	16	4	16	9	3	29	1

Table 18 b

Trial No. 2 with single and three-way hybrids (1978—1979). Percentage of diseased plants

Cultivar	*Botrytis cinerea*							*Orobanche cumana*			*Sclerotium bataticola*	
	Szeged	Iregszemcse		Poznań		Clermont Ferrand		Fundulea			Novi Sad	
	1978	1978	1979	1978	1979	1978	1979	1978		1979	1978	1979
	nat.	nat.	nat.	nat.	nat.	nat.	nat.	art. F % *	art. I % **	art.	nat.	nat.
HB-451	10	2	30	100	77	1	9	100	69	100	21	28
Remil	8	0	15	100	37	0	4	100	163	100	24	—
Luciole	2	3	11	100	77	1	3	82	33	70	26	—
INRA 7702	3	5	18	99	25	1	7	100	160	100	8	—
Sorex	9	6	8	99	65	1	4	100	73	100	31	27
Olga II	12	4	38	100	55	1	6	100	26	100	36	9
Sorem HT-111	14	2	14	100	65	3	27	96	24	100	35	10
Sorem HT-116	10	2	8	100	52	5	19	100	67	100	12	7
Sorem HT-117	8	2	55	100	66	5	20	92	32	100	20	12
Romsun 90	9	3	69	100	82	1	18	100	126	100	29	9
HS-1161	12	6	58	100	50	2	36	100	67	—	22	22
HS-72 M	10	3	41	100	75	3	11	100	67	100	25	20
P.O.I. 301 A	15	1	58	100	45	3	5	100	58	100	21	—
H-894	8	1	30	100	48	1	17	—	—	90	27	26
H-241	6	1	47	100	58	1	12	100	68	100	11	8
Sungro 380 A	14	4	40	100	53	4	3	100	27	100	4	3
NS-H-27	3	3	46	100	62	2	15	100	67	100	12	8
NS-H-34	2	0	36	100	53	0	20	100	67	100	7	9
NS-H-63 RM	7	3	10	100	68	1	10	100	68	100	39	11
Peredovik	12	7	22	100	77	9	13	95	28	100	4	7

* F % = frequency ;
** I % = intensity.

ducted co-operatively by 35 research institutions, in 28 countries.

The results presented in this paper refer to the European countries and may be considered as an useful guide for sunflower growers interested in the identification of the best cultivars for their specific environment.

Most of the open-pollinated varieties tested couldn't keep up with the check hybrid Romsun 59 as seed and oil yield concerned, particularly in areas with favourable soil and climate conditions for sunflower crops. High and constant yields have been obtained however with Record, VNIIMK 8931, Sepasol and Argentario.

More than half of the examined sunflower hybrids have overyielded the check cultivar Peredovik, the highest performances being achieved by the three-way hybrid Sorem HT-116 and the single hybrids P.O.I. 301 A and Sungro 380 A.

Environmental influences (locations and years) contributed much more then cultivars to the variability of both seed and oil yields. Year influence was quite different from one location to the other.

In comparison with varieties, hybrids have a shorter vegetation period and plant height and a better uniformity. They are also downy mildew resistant, in contrast with the open pollinated varieties which are very susceptible.

ESSAIS COMPARATIFS EUROPÉENS AVEC VARIÉTÉS ET HYBRIDES DE TOURNESOL

Résumé

Le second cycle biennal d'expérimentation des variétés et des hybrides de tournesol (1978—1979) a compris deux essais comparatifs, l'un avec des variétés à pollinisation libre et l'autre avec des hybrides simples et à trois voies. Ces essais comparatifs ont été exécutés par 35 instituts de recherches de 28 pays. Les résultats décrits dans le présent article se réfèrent aux pays européens et peuvent être considérés comme un guide utile aux cultivateurs de tournesol intéressés à l'identification des meilleures variétés et hybrides de tournesol qui conviennent à certaines conditions spécifiques de milieu.

La plupart des variétés essayées ont été inférieures à l'hybride témoin Romsun 59 quant au rendement en grains et en huile, surtout dans les zones ayant des conditions de sol et de climat favorables à la cultivation du tournesol. Cependant les rendements

des variétés Record, VNIIMK 8931, Sepasol et Argentario ont été elevés et constants.

Les rendements de la plupart des hybrides essayés ont été supérieurs à celui de la variété témoin Peredovik, les meilleures performances étant celles réalisées par l'hybride à trois voies Sorem HT-116 et par les hybrides simples P.O.I. 301 A et Sungro 380 A.

L'influence du milieu (localités et ans) sur la variation du rendement en grains et huile a été plus importante que celle de la variété ou de l'hybride. L'influence des années a été assez différente d'une localité à l'autre.

Par rapport aux variétés, les hybrides ont une période de végétation plus courte, une hauteur moindre et une meilleure uniformité. Ils sont aussi résistants au mildiou, à la différence des variétés de tournesol qui sont très sensibles.

CULTIVOS COMPARATIVOS EUROPEOS CON VARIEDADES E HIBRIDOS DE GIRASOL

Resúmen

El segundo ciclo bienal de experimentación de las variedades e híbridos de girasol (1978—1979) comprendió dos cultivos comparativos, el uno con variedades de polinización libre, el otro con híbridos simples y "tres vías".

Estos cultivos comparativos fueron efectuados por 35 instituciones de investigación de 28 países. Los resultados que presentamos en este artículo se refieren a los países europeos y pueden considerarse como un guía útil para los cultivadores de girasol que estan interesados en identificar las mejores variedades e híbridos de girasol bajo ciertas condiciones específicas de medio.

La majoría de las variedades probadas fueron inferiores al híbrido testigo Romsun 59 en cuanto a la producción de semilla y aceite, en particular en las zonas de condiciones de suelo y clima favorables al cultivo del girasol. No obstante, las variedades RECord, VNIIMK 8931, Sepasol y Argentario dieron producciones elevadas y contantes.

La mayoría de los híbridos experimentados dieron producciones superiores a la variedad testigo Peredovik, las mayores performancias siendo realizadas por el híbrido "tres vías", Sorem HT-116 y por los híbridos simples P.O.I. 301 A y Sungro 380 A.

La influencia del ambiente (localidades y años) contribuyó más que la variedad o el híbrido a la variación de la producción de semillas y aceite.

La influencia de los años fue bastante distinta de una localidad a otra.

En comparación con las variedades, los híbridos tienen el período vegetativo más corto, menor altura y mayor uniformidad. Al mismo tiempo, éstos son resistentes al mildiu, a diferencia de aquellas que son muy sensibles.