

EXPERIMENTATION OF SUNFLOWER CULTIVARS IN NEAR AND MIDDLE EAST, LATIN AMERICA AND U. S. A. (1978-1979)

A. V. VRANCEANU and
F. M. STOENESCU (Romania)
with the collaboration of
G. S. RYAN (Argentina),
B. A. ELAHMAR (Egypt),
M. A. VAHABIAN (Iran),
KAHTAN KHALAF ALI and S. S. RAJAN
(Iraq),
Z. S. Ghosheh (Jordan),
M. LEYVA ORTIZ (Mexico),
A. R. KHAN (Pakistan),
W. W. ROATH and T. E. THOMPSON (U.S.A.).

INTRODUCTION

Two sunflower trials, one with open pollinated varieties and the other with single and three-way hybrids, were performed in the second biennial cycle (1978-1979) by 35 institutions from 28 countries which co-operate within the F.A.O. Research Network on Sunflower. The results obtained by the European countries were published in the second issue of the Information Bulletin "Helia".

This paper presents the main results obtained by a number of participating countries from outside Europe, the Near and Middle East, Latin America and U.S.A., where a great interest for sunflower introduction and development has been recently shown. The local conditions, differing extremely from one location to the other and from year to year, in some cases completely unfavourable to this crop, have determined a great variation in the behaviour of the investigated cultivars. Unfortunately, analysis of variance for evaluating the effects of the main factors upon seed and oil yields and their interactions could not be computed, because not all participants have sent complete and rigorous experimental data worthy of being included into a synthetic work.

However, we consider the available results as quite valuable, because they provide an information on sunflower seed and oil yield levels which could be attained in the respective countries. In addition to this, the testing of a large number of hybrids and open pollinated varieties belonging to different morpho-physiological types has allowed the establishment of the optimal biological parameters of sunflower adaptability for each environment,

which is of a great importance for those regions where sunflower is a less known oilseed crop.

MATERIALS AND METHODS

In comparison with the first biennial testing cycle, the second one included a greater number of sunflower open pollinated varieties, due to the still actual interest for this type of cultivar, mostly in the developing countries. Trial No. 1 comprised 11 such varieties and one single hybrid, as check (Annex 1). Besides the

Annex 1

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

Entry No.	Cultivars	Genetic type	Origin
1	Peredovik	OPV	U.S.S.R. produced in Bulgaria
2	Hemus	OPV	Bulgaria (General Toshevo)
3	IH-10	OPV	Hungary
4	Iregi 816 B	OPV	Hungary
5	Iregi Csikos	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.S.S.R. produced in Yugoslavia

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

Country and location	Name and address	Trials conducted
Egypt Giza	Dr. Badr A. Elahmar, Institute of Field Crops, Oil Crop Research Section Agricultural Research Center, Orman, Giza (Cairo).	No. 1 1979 No. 2 1979
Jordan Amman	Agronomy Division, Dept. of Agricultural Research and Extension, P.O. Box 2178, Amman.	No. 1 1978
Iraq Nineveh	Kahtan M. Al. Metwalii, Assistant Director, Oil Seed and Cotton Section, Abu-Ghuraib, Baghdad.	No. 1 1978
	Dr. S.S. Rajan, Senior Adviser, F.A.O. Project Manager IRQ/76/006 UNDP, P.O. 2048 (Alwiyah), Baghdad.	No. 1 1978
Iran Tehran	Seed and Plant Improvement Institute, Karaj-Tehran.	No. 1 1978 No. 2 1978
Pakistan Islamabad	Dr. A. Rahman Khan, Agricultural Research Council, F.2-14/78 Coord. Oilseed, Almarkaz, P.O. Box 1031, Islamabad.	No. 2 1978
Argentina Pergamino (Buenos Aires) and Saenz Peña (Chaco)	Dr. Guillermo S. Ryan, Est. Experimental INTA, 5988 Mánfredi (Córdoba).	No. 1 1978/1979 No. 2 1978/1979
Mexico Culiacán	Ing. Mauricio Leyva Ortiz, Instituto Nacional de Investigaciones Agrícolas, CIAPAN, Campo Agrícola Experimental del Valle de Culiacán, km 23 Carr. Culiacán-Eldorado, Apartado Postal 356.	No. 1 1978/1979
U.S.A. Casselton (N. Dakota)	Dr. W. W. Roath, Walster Hall, North Dakota State University, Fargo, North Dakota, 58105.	No. 1 1978 No. 2 1978
U.S.A. Bushland (Texas)	Dr. T. E. Thompson, USDA, ARS Southwestern Great Plains Research Center, Bushland, Texas 79012.	No. 1 1978 No. 2 1978

well known Russian varieties Peredovik and VNIIMK 8931 and 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 was composed of 16 single hybrids (4 from U.S.A., 3 from France, 3 from Yugoslavia, 2 from R. Rep. of Germany, 2 from Spain, 1 from Bulgaria and 1 from Romania), 4 three-way hybrids (from Romania and France) and the open pollinated variety Peredovik (produced in Bulgaria) as check (Annex 2).

Annex 2

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

Entry No.	Hybrids	Genetic type	Origin
1	HB-451	SH	Bulgaria (General Toshevo)
2	Remil	SH	France (Clermont Ferrand)
3	Luciole	TH	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.
16	Sungro 380 A	SH	U.S.A.
17	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

All sunflower hybrids have been obtained on the basis of cytoplasmic male sterility and pollen fertility restoration system and possess the genes Pl_1 or Pl_2 which confer resistance to downy mildew (*Plasmopara helianthi*). The three-way hybrids have been obtained by crossing a single male sterile hybrid to a restorer inbred line.

The countries and locations where the two trials were carried out, as well as the participating institutions and researchers are listed in Annex 3.

The experimental design was the rectangular lattice with four replications and 12 and 20 entries, respectively. Plot size was of a minimum 50 plants, but in most cases 80, after

discarding the borders (the marginal rows and 1—2 first and last plants on each row).

The interpretation of experimental data was performed using the analysis of variance, particularly for seed and oil yields.

Phenological observations and biometrical determinations were carried out on the basis of a common methodology established for the previous research cycle. Resistance to diseases was estimated only in the field, noting the natural infection frequency.

The cultural practices were adapted to the local conditions and technology, some trials being conducted under irrigation, but the most in dryland.

RESULTS AND DISCUSSION

Egypt. The two trials were conducted in good conditions at Giza, in 1979. The highest seed yield was provided by the three-way hybrid Sorem HT-116, the only hybrid that overyielded significantly the check variety Peredovik (Table 1). With the exception of 8 hybrids which are statistically equal to the check, the other 10 hybrids are inferior to Peredovik, proving their more reduced adaptability to the specific environment of Giza-Cairo.

Data obtained with open pollinated varieties confirm these findings (Table 2). Four such

The oil content was not determined locally due to the lack of the adequate facilities.

Jordan. Only Trial No. 1 with open pollinated varieties was conducted adequately in 1978, Trial No. 2 being compromised by the attack of birds. Data from Table 3 point out the outstanding position of the check hybrid Romsun 59 which, with its high seed yield of 38.8 q/ha, was difficult to be approached by the investigated open pollinated varieties. This hybrid has presented a reduced height and a very large head, representing a desirable ideotype for Amman environment. Among the open pollinated varieties, the highest yield was provided by the Romanian cultivar Record. The values for plant height and head diameter indicate a normal growth and development of sunflower plants.

Iraq. The experimentation was carried out at Nineveh with open pollinated varieties. The

Table 1

Trial No. 2 with sunflower hybrids in Egypt (1979)

Hybrids	Seed yield (0 % moisture)		No. of days from seeding to :		Plant height (cm)	Head diameter (cm)	1,000 seed weight (g)
	q/ha	%	flowering	physiological maturity			
HB-451	17.0	78	203	237	150	12	46
Remil	20.9	96	204	244	156	19	59
Luciole	18.8	86	205	244	160	15	56
INRA 7702	20.7	95	204	242	178	18	52
Sorex	23.1	106	204	241	172	22	58
Olga II	20.7	95	206	244	115	11	58
Sorem HT-111	16.1	74	205	241	152	17	61
Sorem HT-116	25.0	115	203	239	168	18	74
Sorem HT-117	21.2	97	203	239	174	16	41
Romsun 90	17.6	81	204	242	160	17	66
HS-1161	15.1	69	202	237	175	16	47
HS-72 M	14.9	68	205	242	154	21	44
P.O.I. 301 A	21.8	100	204	242	152	13	63
H-894	13.8	63	204	241	169	14	56
H-241	17.3	79	202	240	163	16	46
Sungro 380 A	20.3	93	205	243	167	21	54
NS-H-27	16.4	75	203	239	155	16	56
NS-H-34	16.7	77	204	242	145	22	63
NS-H-63 RM	19.5	89	205	245	148	15	65
Peredovik	21.8	100	204	239	191	21	54
L.S.D. 0.05	2.6	12					

cultivars: Hemus, Peredovik, Record and Argentario have seed yields significantly higher than the single hybrid Romsun 59, taken as check.

The maturity was delayed due to the slow plant growth and development during the sowing-flowering period. After flowering, the phenotypic aspect of sunflower plants was however normal.

weather conditions were more favourable for sunflowers in 1979 than in 1978. The two-year average data for seed yield presented in Table 4, show that the majority of the open pollinated varieties are similar to the check hybrid Romsun 59, although a slight superiority of varieties can be noticed in 1979. Taking into consideration the average oil yield, the best

Table 2

Trial No. 1 with open pollinated varieties in Egypt (1979)

Cultivars	Seed yield (0 % moisture)		No. of days from seeding to :		Plant height (cm)	Head diameter (cm)	1,000 seed weight (g)
	q/ha	%	flowering	physiological maturity			
Peredovik	18.1	138	208	242	177	17	60
Hemus	18.4	140	207	243	199	19	64
IH-10	12.2	93	205	241	143	15	57
Iregi 816 B	9.9	76	209	245	121	13	43
Iregi-Csikos	15.4	118	208	246	143	14	67
Argentario	15.9	121	209	245	166	17	63
Record	16.3	124	210	246	192	19	61
Romsun 59	13.1	100	210	247	158	17	58
Sepasol	13.7	105	210	248	178	17	60
Novi Sad 20	13.8	105	211	247	174	15	64
Novi Sad 61	14.0	107	210	248	143	14	58
VNIIMK 8931	14.2	108	211	247	170	15	61
L.S.D. 0.05	2.6	20					

cultivars appear to be Record, Peredovik, Hemus and Novi Sad 20.

The vegetation period of all sunflower cultivars was about three weeks shorter than that registered in most European countries (Table 5). The highest seed oil content (44—45%) was determined to Hemus, Novi Sad 20 and Record. The high percentage of empty seeds (10—15%) seems to be one of the main causes of the low seed yields, particularly in 1978. As a rule, this phenomenon is caused by high temperatures and drought occurring during the flowering and seed filling period.

Iran. Under the soil-climatic conditions of Karaj-Tehran, the open pollinated varieties Argentario, VNIIMK 8931, Novi Sad 20 and Record displayed in 1978 the highest seed yields, producing over 25 q/ha (Table 6). As oil yield concerned, Record occupies the first place, having the highest oil content (48.3%).

Among sunflower hybrids, the Romanian three-way hybrids Sorem HT-116 and Sorem HT-117 ranked the first places both for seed yield (30.5 and 31.3 q/ha respectively) and oil yield (14.8 and 14.6 q/ha respectively). A small group of single hybrids made up of H-241,

Table 3

Trial No. 1 with open pollinated varieties in Jordan (1978)

Cultivars	Seed yield (0 % moisture)		No. of days from seeding to :		Plant height (cm)	Head diameter (cm)
	q/ha	%	flowering	physiological maturity		
Peredovik	15.9	41	54	115	161	18
Hemus	15.5	40	54	103	180	21
IH-10	21.7	56	51	100	133	25
Iregi 816 B	23.3	60	52	105	117	16
Iregi-Csikos	18.6	48	53	104	125	16
Argentario	26.8	69	55	105	165	18
Record	29.5	76	55	121	180	25
Romsun 59	38.8	100	54	100	120	26
Sepasol	21.0	54	53	98	173	18
Novi Sad 20	22.1	57	47	99	203	22
Novi Sad 61	24.8	64		100	200	20
VNIIMK 8931	20.2	52	54	105	192	22
L.S.D. 0.05	6.2	16				
C.V. %						

19.3

Table 4

Trial No. 1 with open pollinated varieties in Iraq. Seed and oil yield (1978—1979)

Cultivars	Seed yield (0 % moisture)						Oil yield					
	1978		1979		mean		1978		1979		mean	
	q/ha	%	q/ha	%	q/ha	%	q/ha	%	q/ha	%	q/ha	%
Peredovik	16.5	95	26.0	107	21.3	102	6.8	103	11.4	101	9.1	101
Hemus	11.3	65	26.7	109	19.0	91	4.8	72	12.9	114	8.9	99
IH-10	7.3	42	26.2	107	16.8	80	3.1	47	11.1	98	7.1	79
Iregi 816 B	6.7	39	20.5	84	13.6	65	2.5	38	9.0	80	5.8	64
Iregi-Csikos	19.7	113	24.9	102	22.3	107	5.9	89	9.0	80	7.5	83
Argentario	16.2	93	24.9	102	20.6	99	6.3	95	9.9	88	8.1	90
Record	11.1	64	29.9	123	20.5	98	4.4	67	14.3	127	9.4	104
Romsun 59	17.4	100	24.4	100	20.9	100	6.6	100	11.3	100	9.0	100
Sepasol	13.8	79	25.3	104	19.6	94	5.4	82	11.3	100	8.4	93
Novi Sad 20	12.9	74	25.4	104	19.2	92	4.8	73	12.8	113	8.8	98
Novi Sad 61	14.3	82	25.9	106	20.1	96	5.3	80	10.7	95	8.0	89
VNIIMK 8931	11.7	67	26.8	110	19.3	92	4.4	67	10.1	89	7.3	81
L.S.D. 0.05	2.4	14	4.7	19	3.6	17	1.4	21	2.6	23	2.0	22
C.V. %			18.2						19.9			

HB-451 and NS-H-27 also overyielded significantly the check variety Peredovik as oil yield concerned (Table 7). These levels of seed and oil yields, as well as the values of the main morpho-physiological characteristics show that sunflower meets quite good growing conditions in Iran.

Pakistan. The only available results come from Trial No. 2 with sunflower hybrids (Table 8) conducted in 1978. The seed and oil yields are very poor, reflecting the unfavourable climate and cropping conditions which have also affected the oil content, plant height and head diameter. A high percentage of unfertilized seeds was noticed. The highest oil yields exhibited the Yugoslav single hybrid NS-H-27 (6.1 q/ha) and the Romanian three-way hybrid Sorem HT-116 (5.8 q/ha).

Argentina. The experimentation was conducted in three localities situated in different regions, during the growing season 1978/1979, but it was concluded only in two localities, Pergamino (Buenos Aires) and Saenz Peña (Chaco); in the third locality, Mánfredi (Córdoba), the two trials were destroyed by downy mildew at the beginning of growth and by hail at the budding stage.

At Pergamino, the seed and oil yield level was quite high, showing that the local conditions are favourable to sunflower cultivation. The best open pollinated variety was Hemus, the only exceeding the check hybrid Romsun 59 with a significant difference of 19% as oil yield concerned (Table 9). In this trial, the majority of cultivars exhibited high values of

Table 5

Trial No. 1 with open pollinated varieties in Iraq. Morpho-physiological characteristics (1978—1979)

Cultivars	Vegetation period (days)	Plant height (cm)	Head diameter (cm)	% oil in dry-matter	1,000 seed weight (g)	% empty seeds
Peredovik	108	187	16	42.8	66	14
Hemus	109	190	16	45.2	65	13
IH-10	104	155	16	42.3	64	15
Iregi 816 B	105	135	14	40.5	68	14
Iregi Csikos	105	152	16	32.5	63	13
Argentario	109	188	16	39.3	63	15
Record	109	195	15	44.1	60	10
Romsun 59	107	186	16	42.8	66	13
Sepasol	111	219	16	41.3	56	13
Novi Sad 20	110	192	15	44.4	56	15
Novi Sad 61	112	210	15	39.2	55	15
VNIIMK 8931	111	210	16	37.7	54	15

Table 6

Trial No. 1 with open pollinated varieties in Iran (1978)

Cultivars	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	% seed husk	Test weight (kg/ha)	1,000 seed weight (g)	No. of days from seeding to :		Plant height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%					flower- ing	physio- logical maturity		
Peredovik	17.6	64	8.6	77	45.8	32.6	38	77	74	109	176	17
Hemus	13.9	51	6.6	59	45.8	31.7	38	82	75	115	174	20
IH-10	15.2	56	7.6	68	45.8	31.8	35	78	65	103	147	19
Iregi 816 B	14.6	54	5.9	53	45.0	30.0	32	62	68	102	141	18
Iregi-Csikos	20.7	76	7.1	64	34.3	30.2	37	70	64	106	147	18
Argentario	28.6	105	11.9	107	42.4	30.3	36	75	73	108	163	18
Record	25.7	94	12.2	110	48.3	31.7	38	78	74	114	180	16
Romsun 59	27.2	100	11.1	100	42.1	28.8	33	63	73	107	147	18
Sepasol	21.2	78	10.0	90	46.4	29.8	37	70	79	115	182	19
Novi Sad 20	25.9	95	11.1	100	46.4	30.0	37	67	74	105	152	17
Novi Sod 61	22.9	84	10.3	93	44.1	29.8	40	80	76	107	174	18
VNIIMK 8931	27.6	101	12.1	103	45.5	29.0	35	75	75	112	176	19
L.S.D. 0.05	6.2	23	3.0	27								
C.V. %	8.7		12.7									

Table 7

Trial No. 2 with sunflower hybrids in Iran (1978)

Hybrids	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	% seed husk	Test weight (kg/ha)	1,000 seed weight (g)	No. of days from seeding to :		height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%					flower- ing	physio- logical maturity		
HB-451	28.1	110	13.4	116	47.9	29.4	39	58	68	116	149	19
Remil	23.0	90	9.0	78	39.1	25.3	38	64	68	122	159	17
Luciole	21.9	86	9.2	79	42.2	28.0	36	64	63	104	127	16
INRA 7702	26.8	105	10.5	91	39.2	29.2	40	60	72	120	160	17
Sorex	24.2	95	8.0	69	33.2	29.8	37	64	71	122	149	16
Olga	24.6	96	9.6	83	39.0	27.0	38	64	67	125	138	17
Sorem HT-111	22.1	86	10.5	91	47.6	30.4	37	67	72	116	156	18
Sorem HT-116	30.5	119	14.8	128	48.6	29.6	38	68	74	121	151	17
Sorem HT-117	31.3	122	14.6	126	46.7	32.8	36	63	75	112	163	16
Romsun 90	22.9	89	10.5	91	45.8	32.1	37	66	69	108	117	18
HS-1161	25.4	99	11.0	95	43.5	27.7	36	69	64	125	127	16
HS-72 M	26.4	103	11.4	98	43.3	30.2	37	62	66	114	133	15
P.O.I. 301 A	24.9	97	12.1	104	48.7	30.4	42	61	74	121	147	16
H-894	22.9	89	9.4	81	41.5	27.8	35	54	71	118	141	17
H-241	29.1	114	13.9	120	47.9	32.2	42	65	74	122	150	18
Sungro 380 A	22.9	89	11.1	96	48.2	23.7	43	58	75	122	154	16
NS-H-27	27.7	108	13.3	115	48.0	28.0	40	54	72	116	150	17
NS-H-34	24.4	95	10.3	89	41.8	29.1	37	50	72	113	147	17
NS-H-63 RM	20.3	79	7.7	66	38.2	26.2	39	48	68	108	151	17
Peredovik	25.6	100	11.6	100	45.3	30.1	35	77	73	119	162	16
L.S.D. 0.05	5.2	20	1.8	16								
CV %	6.3											

Table 8

Trial No. 2 with sunflower hybrids in Pakistan (1978)

Hybrids	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	No. of days from seeding to :		Plant height (cm)	Head diameter (cm)	% male sterile plants
	q/ha	%	q/ha	%		flower- ing	physio- logical maturi- ty			
HB-451	11.1	128	4.2	127	38.0	82	122	134	13	25
Remil	6.2	71	2.1	64	34.4	81	121	141	13	21
Luciole	12.5	144	4.5	136	36.1	74	115	123	14	24
INRA 7702	9.6	110	3.2	97	33.3	81	120	135	13	16
Sorex	6.1	70	1.6	48	26.0	84	125	138	13	20
Olga II	4.3	49	1.4	42	32.4	79	119	122	15	12
Sorem HT-111	11.2	129	4.5	136	39.9	82	121	138	13	28
Sorem HT-116	13.2	152	5.8	178	44.0	91	130	153	13	18
Sorem HT-117	7.2	82	2.4	73	32.7	92	131	156	13	17
Romsun 90	14.1	162	4.8	145	34.1	81	122	123	13	14
HS-1161	12.3	141	4.8	145	39.0	73	118	119	14	33
HS-72 M	9.8	113	3.3	100	33.5	77	120	129	13	11
P.O.I. 301 A	6.8	78	3.0	91	43.6	91	133	134	14	19
H-894	10.4	120	3.6	109	34.7	92	134	138	14	13
H-241	6.4	74	2.2	67	34.8	77	120	133	14	16
Sungro 380 A	8.1	93	3.7	112	45.6	94	138	139	12	15
NS-H-27	15.3	176	6.1	185	39.8	92	135	132	11	12
NS-H-63-RM	10.8	124	3.9	118	36.3	79	128	143	15	14
Peredovik	8.7	100	3.3	100	38.2	82	127	139	13	29
L.S.D. 0.05	3.1	36	1.2	36						

oil percentage, seed weight and head size. Among single and three-way hybrids, the most yielding proved to be NS-H-34, H-894, NS-H-63 RM and Sorem HT-111, which overyielded the check variety Peredovik with significant differences both for seed yield and oil yield (Table

10). A very high oil content, over 55%, displayed the single hybrids HS-H-34 and P.O.I.-301 A. While plant height and head size varied within the normal limits, the growth period was much shorter to all entries of Trial No. 2.

Table 9

Trial No. 1 with open pollinated varieties in Argentina (Pergamino, Buenos Aires), in 1978/1979

Cultivars	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	1,000 seed weight (g)	No. of days from seeding to flower- ing	Plant height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%					
Peredovik	31.5	92	15.3	100	48.6	91	60	170	24
Hemus	35.6	104	18.2	119	51.1	86	62	170	22
IH-10	29.5	86	14.6	95	49.4	80	55	170	19
Iregi 816 B	25.0	73	13.4	88	53.4	64	56	130	19
Iregi-Csikos	37.3	109	15.2	99	40.7	79	55	170	22
Argentario	33.3	97	16.1	105	48.3	87	63	180	22
Record	31.9	93	16.2	106	50.8	86	64	190	20
Romsun 59	34.3	100	15.3	100	44.6	81	56	150	24
Sepasol	29.1	85	11.8	77	40.5	93	64	200	23
Novi Sad 20	31.5	92	15.7	103	49.9	76	61	170	22
Novi Sad 61	24.4	71	11.7	76	48.1	89	62	180	23
VNIIMK 8931	33.9	99	15.4	101	45.5	82	63	180	24
L.S.D. 0.05	3.7	11			2.1	9			
C.V. %	11.2				6	9			

Table 10

Trial No. 2 with sunflower hybrids in Argentina (Pergamino, Buenos Aires), in 1978/1979

Hybrids	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	1,000 seed weight (g)	No. of days from seeding to :		Plant height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%			flower- ing	physio- logical matur- ity		
HB-451	28.9	115	14.8	116	51.1	65	57	107	170	21
Remil	23.1	92	10.2	80	44.2	74	55	102	185	18
Luciole	26.3	105	12.2	96	46.3	76	55	104	170	20
INRA 7702	25.8	103	11.8	93	45.9	71	55	102	180	20
Sorex	25.9	103	9.7	76	37.4	83	57	106	180	19
Olga II	24.3	97	10.4	82	42.6	65	55	105	175	23
Sorem HT-111	31.1	124	14.9	117	47.9	60	57	107	195	22
Sorem HT-116	27.1	108	12.9	102	47.7	66	60	107	190	22
Sorem HT-117	19.3	77	8.8	69	45.8	61	57	105	220	19
Romsun 90	28.1	112	13.2	97	47.1	73	54	103	160	21
HS-1161	23.1	92	11.3	89	48.9	73	55	107	180	20
HS-72 M	26.8	107	12.7	100	47.5	73	55	103	180	19
P.O.I.-301 A	28.3	113	15.6	123	55.3	53	55	103	170	20
H-894	33.6	134	16.7	131	49.8	51	55	103	170	20
H-241	25.6	102	13.6	107	53.2	71	55	102	185	21
Sungro 380 A	28.6	114	14.6	115	51.1	59	57	106	175	20
NS-H-27	27.1	108	13.7	107	50.7	51	58	104	160	22
NS-H-34	33.1	132	18.4	145	55.7	44	58	100	180	25
NS-H-63-RM	34.9	139	16.1	127	46.3	54	55	102	190	24
Peredovik	25.1	100	12.7	100	50.8	75	57	104	180	20
L.S.D. 0.05	4.1	16	2.2	17		6				
C.V. %		13		14		8				

At Saenz Peña, the seed and oil yields were much lower, particularly to the open pollinated varieties. Iregi Csikos, a kind of gray striped low oil variety, was the only cultivar over-

yielding significantly the check hybrid Romsun 59 (Table 11). The unfavourable growth conditions have also affected evidently the oil content, the seed weight and the head size. As

Table 11

Trial No. 1 with open pollinated varieties in Argentina (Saenz Peña, Chaco), in 1978/1979

Cultivars	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	% seed husk	1,000 seed weight (g)	No. of days from seeding to flower- ing	Plant height (cm)	Head diameter (cm)	Resistance to:*	
	q/ha	%	q/ha	%							<i>Pucci- nia he- lianthi</i>	Black rot com- plex
Peredovik	8.6	91	3.0	91	35.0	22	43	72	160	15	2.5	2
Hemus	9.0	95	3.3	100	36.8	23	48	76	175	14	2	2
IH-10	6.0	63	2.3	70	38.6	24	47	64	150	13	2	3.5
Iregi 816 B	7.4	78	2.7	82	36.2	16	35	67	140	13	2	3
Iregi-Csikos	13.4	141	4.2	127	31.0	37	47	66	150	15	2	2
Argentario	8.6	91	2.9	88	34.1	17	43	76	175	15	3	2
Record	7.3	77	2.6	79	35.8	25	41	82	190	14	3	2
Romsun 59	9.5	100	3.3	100	34.9	21	39	77	165	15	2	2
Sepasol	9.8	103	3.4	103	34.6	20	40	88	195	15	2	1.5
Novi Sad 20	7.7	81	2.9	88	38.0	18	39	81	180	13	2	2
Novi Sad 61	8.7	92	3.2	97	36.7	26	44	82	185	14	2	2
VNIIMK 8931	8.7	92	3.2	97	37.2	17	38	83	200	14	2.5	1.5

* Scale : 0-4 (0 = total resistant)

Table 12

Trial No. 2 with sunflower hybrids in Argentina (Saenz Peña, Chaco), in 1978—1979

Hybrids	Seed yield (% moisture)		Oil yield		% oil in dry matter	% seed husk	1,000 seed weight (g)	No. of days from seeding to flo- wing	% sterile plants	Plant height (cm)	Head dia- meter (cm)	Resistance to:*	
	q/ha	%	q/ha	%								<i>Puc- c- inia he- lian- thi</i>	Black rot com- plex
HB-451	13.5	108	4.9	109	36.1	24	42	73	29	147	16	2	2
Remil	18.7	150	7.2	160	38.4	28	64	69	1	165	14	1	1.5
Luciole	19.3	154	8.5	189	44.0	17	64	67	3	140	15	1	2
INRA 7702	19.4	155	7.6	169	39.4	20	58	69	1	160	18	1	1.5
Sorex	9.1	73	2.5	56	28.0	36	51	70	2	140	15	2	3
Olga II	12.7	102	4.4	98	34.4	20	48	68	18	140	15	2	2
Sorem HT-111	13.5	108	4.9	109	36.4	23	42	70	12	140	15	1.5	2
Sorem HT-117	13.1	105	4.5	100	34.5	20	42	60	5	190	15	2	1.5
Sorem HT-116	14.5	116	5.1	113	35.5	16	43	78	0	190	15	2	1.5
Romsun 90	14.7	118	5.8	129	39.7	15	50	66	4	93	15	1.5	2.5
HS-1161	15.4	123	7.0	156	45.5	17	59	63	5	120	15	2	2
HS-72 M	18.5	148	8.0	178	43.2	22	53	66	2	140	15	2	2
P.O.I. 301 A	18.5	148	8.6	191	46.7	29	47	74	0	150	16	1	1.5
H-894	19.3	150	8.5	189	44.0	19	42	75	7	160	16	1	1.5
H-241	14.3	114	6.1	136	42.7	23	48	68	3	110	13	1.5	2
Sungro 380 A	20.7	166	9.1	203	43.4	15	44	76	1	175	15	1.5	1.5
NS-H-27	21.2	170	10.5	233	49.4	22	39	76	15	147	15	1.5	1.5
NS-H-34	22.2	178	10.3	229	46.4	16	39	76	3	170	17	1	1.5
NS-H-63-RM	20.1	161	8.1	180	40.2	26	45	66	2	150	15	1	2
Peredovik	12.5	100	4.5	100	35.8	20	50	76	0	170	16	2.5	

* Scale : 0—4 (0 = total resistant)

concerns sunflower hybrids all but two hybrids, Sorex and Olga II, have given seed and oil yields superior to the check variety Peredovik, with a special mention for NS-H-27, NS-H-34 and Sungro 380 A (Table 12). A higher oil content, over 45%, presented the hybrids NS-

H-27, P.O.I. 301-A, NS-H-34 and HS-1161. The seed weight and head size in this hybrid trial were also seriously affected.

Mexico. The growth conditions at Culiacán, during the 1978/1979 cropping season, were favourable for sunflower cultivation, with the

Table 13

Trial No. 1 with open pollinated varieties in Mexico (1978/1979)

Cultivars	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	Test weight (kg/hl)	1,000 seed weight (g)	No. of days from seeding to :		Plant height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%				flower- ing	physio- logical matu- rity		
Peredovik	21.0	95	8.4	98	43.2	35	53	79	104	178	16
Hemus	20.2	92	8.4	98	44.6	33	53	79	106	190	15
IH-10	16.9	77	7.3	85	46.3	37	61	69	98	163	15
Iregi 816 B	13.1	60	5.3	62	44.0	37	44	70	99	147	14
Iregi-Csikos	19.6	89	6.0	70	33.4	39	57	68	99	156	15
Argentario	20.5	93	7.7	90	41.8	32	52	79	105	188	16
Record	19.4	88	7.7	90	42.6	32	50	79	104	197	16
Romsun 59	22.0	100	8.6	100	42.2	29	44	86	108	205	16
Sepasol	20.6	94	7.8	91	40.9	33	54	84	110	236	16
Novi Sad 20	20.5	93	8.3	97	43.4	31	47	83	109	232	16
Novi Sad 61	17.5	80	6.0	70	37.2	31	47	84	108	187	15
VNIIMK 8931	20.0	91	8.0	93	43.0	33	49	83	107	239	16
L.S.D. 0.05	3.2	15	1.8	21							

exception of seed filling period (February-March 1979) when a severe drought was registered. In comparison with the check hybrid Romsun 59, all the open pollinated varieties included in Trial No. 1 (Table 13) have given inferior seed and oil yields, but significant negative differences were noticed only for Iregi 816 B, Iregi-Csikos, IH-10 and Novi Sad 61. The growth period of all entries is by 2—3 weeks shorter than that registered in many European countries, the plant height is situated within the normal limits, but the head diameter is more reduced (14—16 cm).

such as Remil, Luciole and Sorex have yielded below the check variety Peredovik. In comparison with open pollinated varieties, the most of hybrids have a more reduced plant height and a higher volumetric weight.

At Bushland (Texas), the seed and oil yield level was very low in both trials, mainly due to bird damages and disease losses caused by *Rhizopus*. In trial No. 1 with open pollinated varieties (Table 16), all entries were significantly inferior to the check hybrid Romsun 59, both for seed and oil yields, showing the same reaction as at Casselton.

Table 14

**Trial No. 1 with open pollinated varieties in U.S.A.
(Casselton, N. Dakota), in 1978**

Cultivars	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	Test weight (kg/hl)	1,000 seed weight (g)	No. of days from seeding to :		Plant height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%				flower- ing	physio- logical matur- ity		
Peredovik	22.4	90	11.3	100	50.3	37	64	70	111	203	18
Hemus	14.9	60	7.2	64	48.3	37	63	72	113	203	18
IH-10	14.2	57	6.8	60	48.1	39	68	66	109	173	15
Iregi 816 B	18.3	74	8.9	79	48.8	39	38	64	102	157	17
Iregi-Csikos	19.8	80	7.1	63	35.8	43	58	66	107	160	20
Argentario	19.5	79	9.0	80	46.1	38	57	72	111	221	17
Record	20.2	81	9.4	83	46.7	38	65	67	109	211	18
Romsun 59	24.8	100	11.3	100	45.7	38	60	70	111	196	19
Sepasol	16.7	67	7.6	67	45.5	37	57	73	113	239	17
Novi Sad 20	17.0	69	7.6	67	44.6	37	52	73	111	190	18
Novi Sad 61	12.9	52	5.1	45	39.8	34	59	75	122	206	19
VNIIMK 8931	15.9	64	7.2	64	45.4	37	62	73	111	203	19
L.S.D. 0.05	4.0	16	1.8	16							
C.V. %	14.0										

U.S.A. Sunflower co-operative trials were performed in 1978 in two states with completely different soil and climate conditions: North Dakota and Texas.

At Casselton (N. Dakota), all the open pollinated varieties, except Peredovik, have displayed significant lower seed and oil yields compared to the check hybrid Romsun 59, in some cases going down below 70% (Hemus, IH-10, Sepasol, Novi Sad 20, VNIIMK 8931, Novi Sad 61). In most cases, the plant height exceeded two meters, particularly Sepasol and Argentario (Table 14).

On the other hand, the most of hybrids from Trial No. 2 (Table 15) have shown an evident superiority towards the check variety Peredovik, both for seed and oil yield. Significant positive differences have been registered to the three-way hybrid Sorem HT-116 and to the single hybrids HS-1161, NS-H-27 and HS-72 M for seed yield and to HS-1161, NS-H-27 and Sorem HT-116 for oil yield. Certain hybrids,

In trial No. 2, the surprising very low seed yield of the check variety Peredovik (10.3 q/ha) brought into relief the superiority of most hybrids, especially of NS-H-63 RM, NS-H-34 and NS-H-27 (Table 17). The more reduced height of the plants suggests also the adversity of the environmental conditions. In this trial, the absence of the U.S. hybrids is not explainable.

SUMMARY AND CONCLUSIONS

Twelve open pollinated varieties and 20 single and three-way hybrids were tested in 10 localities from 8 countries outside Europe, as part of the second biennial cycle of network experimentation with sunflower cultivars (1978—1979).

The growing conditions extremely different from one location to the other or from year to year have determined a great variation in

Table 15

Trial No. 2 with sunflower hybrids in U.S.A. (Casselton, N. Dakota), in 1978

Hybrids	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	Test weight (kg/ha)	1,000 seed weight (g)	No. of days from seeding to :		Plant height (cm)	Head diameter (cm)
	q/ha	%	q/ha	%				flower- ing	physio- logical matur- ity		
HB-451	18.1	99	8.3	112	46.2	37	55	69	114	118	18
Remil	11.3	62	4.1	55	36.3	41	58	64	118	190	18
Luciole	14.5	80	5.8	78	39.9	41	70	64	111	163	20
INRA 7702	16.9	93	6.6	89	39.0	43	53	67	115	165	19
Sorex	15.9	87	4.8	65	30.0	41	67	66	111	163	17
Olga	19.4	107	7.4	100	37.9	39	61	67	111	183	21
Sorem HT-111	22.6	124	9.3	126	41.3	38	57	67	109	185	18
Sorem HT-116	25.4	140	10.5	142	41.3	38	65	71	111	178	18
Sorem HT-117	22.1	121	8.9	120	40.2	36	62	72	113	201	18
Romsun 90	21.6	119	8.5	115	39.3	37	57	64	103	155	18
HS-1161	25.0	137	11.8	159	47.0	38	54	64	107	157	19
HS-72 M	24.2	133	10.3	139	42.7	39	59	64	113	160	21
P.O.I. 301 A	22.2	122	10.3	139	46.6	41	44	65	111	160	18
H-894	22.7	125	9.2	124	40.4	41	53	68	108	173	17
H-241	21.8	120	8.7	118	40.1	42	68	64	113	157	18
Sungro 380 A	19.7	108	9.0	122	45.5	39	53	72	111	191	21
NS-H-27	24.7	136	11.1	150	44.9	43	45	69	109	157	20
NS-H-34	22.2	122	9.7	131	43.5	42	48	70	108	168	19
NS-H-63-RM	22.8	125	7.6	103	33.3	39	52	67	102	175	17
Peredovik	18.2	100	7.4	100	40.5	37	68	70	113	188	19
L.S.D. 0.05	5.4	30	2.9	39							
C.V. %		17									

Table 16

Trial No. 1 with open pollinated varieties in U.S.A. (Bushland, Texas), in 1978

Cultivars	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	Test weight (kg/ha)	No. of days from seeding to flo- wering	Plant height (cm)	% heads infected by <i>Rhi- zopus</i>	% bird damage
	q/ha	%	q/ha	%						
Peredovik	8.9	58	3.7	57	42.1	33	72	144	33	9
Hemus	12.9	84	5.7	88	43.8	32	72	142	29	9
IH-10	12.3	80	5.5	85	44.6	35	67	122	24	25
Iregi 816 B	11.1	73	4.5	69	40.6	32	67	121	9	28
Iregi Csikos	13.2	86	4.2	65	32.0	38	67	122	14	13
Argentario	12.7	83	4.8	74	38.0	30	76	149	39	8
Record	10.3	67	4.2	65	41.0	29	78	155	31	7
Romsun 59	15.3	100	6.5	100	42.4	31	74	135	28	5
Sepasol	9.7	63	3.5	54	36.1	25	80	156	38	4
Novi Sad 20	10.5	69	4.1	63	39.1	31	77	157	34	5
Novi Sad 61	10.3	67	3.9	60	37.4	28	80	165	30	4
VNIIMK 8931	12.9	84	5.3	82	41.0	30	80	156	29	6
L.S.D. 0.05	2.2	14	1.2	18						
C.V. %		11.0								

the response of the investigated cultivars. Generally, the yielding level of the open pollinated varieties was inferior to that of the check

hybrid Romsun 59, particularly under less favourable conditions for sunflower cultivation. Among sunflower varieties, the highest seed

Trial No. 2 with sunflower hybrids in U.S.A. (Bushland, Texas), in 1978

Hybrids	Seed yield (0 % moisture)		Oil yield		% oil in dry matter	Test weight (kg/hl)	No. of days from seedling to flo- wering	Plant height (cm)	% heads infected by <i>Rhi- zopus</i>	% bird damage
	q/ha	%	q/ha	%						
HB-451	11.5	112	5.0	116	43.4	35	70	144	24	16
Remil	15.0	146	5.3	123	35.5	38	69	141	17	18
Luciole	15.8	153	5.5	128	34.6	36	67	122	17	10
INRA 7702	17.4	169	6.3	147	36.3	40	70	132	23	16
Sorex	12.4	120	4.0	93	32.0	38	70	144	17	19
Olga II	13.9	135	5.2	121	37.1	36	68	128	23	11
Sorem HT-111	12.8	124	5.5	128	43.1	36	72	150	38	24
Sorem HT-116	11.4	111	4.5	105	39.9	31	74	161	31	14
Sorem HT-117	9.0	87	3.6	84	39.6	32	78	167	33	12
Romsun 90	14.0	135	6.0	140	43.2	36	69	111	29	18
HS-1161	15.2	148	6.5	151	42.7	36	68	120	28	6
HS-72 M	16.2	157	6.9	160	42.7	33	68	125	22	6
NS-H-27	16.5	160	7.2	167	43.8	37	75	143	25	21
NS-H-34	17.2	167	7.2	167	41.7	38	73	138	20	8
NS-H-63-RM	19.0	184	7.1	165	37.3	37	70	129	29	14
Peredovik	10.3	100	4.3	100	41.9	32	71	145	38	19
L.S.D. 0.05	2.6		1.2							
C.V. %	11.1									

and oil yields displayed Record, Sepasol, Hemus and Argentario.

The following hybrids: Sorem HT-116, NS-H-27, NS-H-34, HS-1161, H-894 and Sorem HT-117, have proved to be superior to the check variety Peredovik in most localities, with respect to seed yield, oil content, plant uniformity and disease resistance. As compared to varieties, sunflower hybrids have a shorter vegetation period and a more reduced plant height.

Besides the advantage of a more economic hybrid seed production system, the three-way sunflower hybrids such as the Romanian hybrids Sorem HT-116 and Sorem HT-117 show a higher stability and a better tolerance to adverse environments than the single crosses, due to their broader genetic basis.

EXPÉRIMENTATION DES VARIÉTÉS
ET DES HYBRIDES DE TOURNESOL
AU MOYEN ET PROCHE-ORIENT,
AMÉRIQUE LATINE ET AUX
ÉTATS-UNIS (1978—1979)

Résumé

Dans le cadre du second cycle biennal d'expérimentation des cultivars de tournesol (1978—1979), on a essayé 20 hybrides simples et à trois voies et 12 variétés, en 10 localités de 8 pays situés au dehors de l'Europe.

Les conditions de culture très différentes d'une localité à l'autre et d'une année à l'autre ont déter-

miné une grande variation dans le comportement des cultivars étudiés. En général, le niveau du rendement des variétés a été inférieur à celui mis en évidence par l'hybride témoin Romsun 59, en particulier dans des conditions moins favorables pour la culture du tournesol. Parmi les variétés de tournesol étudiées, Record, Sepasol, Hemus et Argentario ont donné les plus hauts rendements en grains et en huile.

Les hybrides Sorem HT-116, NS-H-27, NS-H-34, H-1161, H-894 et Sorem HT-117 ont été supérieurs au variété témoin Peredovik dans la plupart des localités, en ce qui concerne le rendement en grains, la teneur en huile, l'uniformité des plantes et la résistance aux maladies. Par rapport aux variétés, les hybrides de tournesol ont une période de végétation plus courte et une hauteur plus réduite.

Outre l'avantage d'un système de production de semences hybrides plus économique, les hybrides à trois voies de tournesol, tel que les hybrides roumains Sorem HT-116 et Sorem HT-117, ont montré une stabilité plus grande et une tolérance meilleure aux conditions défavorables de milieu que les hybrides simples, due à leur base génétique plus large.

EXPERIMENTACIÓN DE VARIEDADES
E HÍBRIDOS DE GIRASOL EN EL
ORIENTE MEDIO Y CERCANO,
AMERICA LATINA Y LOS ESTADOS
UNIDOS (1978—1979)

Resúmen

Dentro del segundo ciclo de experimentación en la red de los cultivares de girasol (1978—1979) se han hecho testar 20 híbridos simples y „tres vías“ y 12 variedades, en 10 localidades de 8 países situados fuera de Europa.

Las condiciones de cultura muy variados de una localidad a otra y de un año a otro han determinado gran variación en el comportamiento de los cultivos estudiados.

Generalmente, el nivel de producción de las variedades ha resultado inferior a aquello evidenciado por el híbrido testigo Romsun 59, sobre todo en condiciones menos favorables para el cultivo del girasol. Entre las variedades de girasol, las variedades Record, Sepasol, Hemus y Argentario han dado las mayores producciones de semillas y aceite.

Los siguientes híbridos: Sorem HT-116, NS-H-27, NS-H-34, H-1161, H-894 y Sorem HT-117 han sido superiores a la variedad testigo Peredovik en la

mayoría de las localidades, en lo que concierne la producción de semillas, el contenido de aceite, la uniformidad de las plantas y la resistencia a enfermedades. Frente a las variedades, los híbridos de girasol cuentan con un período de vegetación más corto y una talla más reducida.

Además de la ventaja de un sistema más económico de producción de semillas híbridas, los híbridos „tres vías“ de girasol, como los híbridos rumanos Sorem HT-116 y Sorem HT-117 han mostrado mayor estabilidad y mejor tolerancia a las condiciones nefavorables de medio que los híbridos simples, a consecuencia de su más amplia base genética.