

## ANALYSIS OF THE RESULTS OF FAO TRIALS WITH SUNFLOWER HYBRIDS IN THE ČSFR

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### SUMMARY

In the paper results of trials with sunflower hybrids organized in sunflower growing areas by the Research Institute for Plant Production Praha-Ruzyne in the years 1984-1989 are summarized. In small-scale trials 92 hybrids from 12 countries were tested, in mid-scale trials 59 hybrids from 5 countries.

In small-scale trials yield differences between the years (always of a two-year experimental cycle), between localities (when the assortment in the ČSFR and Austria was identical) and between hybrids themselves were compared.

Hybrids were compared within the framework of each two-year cycle and in transformed yields also for the whole six-year period.

In mid-scale trials yield analysis of the hybrids in the course of six years at three localities (at a various number of years at a locality) has been performed. As result, hybrids were assorted into yielding categories.

Comparison of the success of single countries and firms according to the ranking in small scale trials prefers Hungary and GKI Szeged, in mid-scale trials the USA (firms Pioneer and Northrup King), Rumania and Yugoslavia were the most successful ones.

**Key words: sunflower hybrids, analysis, FAO trials**

### INTRODUCTION

The aim of this paper is an analysis of small-scale and mid-scale trials with sunflower hybrids from a 6-year period. The small scale-trials were a part of international trials with sunflower hybrids organized by FAO. The locality in the ČSFR (Horné Chlebany) is the northernmost in the whole FAO experimental network. It is situated 170 m above the sea level.

### MATERIAL AND METHOD

In the FAO trials 92 hybrids and one varietal population (Peredovik) were tested in the course of the 6-year experimental period. Proportion of the hybrids according to their origin is following:

Rumania	17 hybrids	Argentina	7 hybrids
Hungary	13 hybrids	Bulgaria	7 hybrids
Yugoslavia	11 hybrids	Australia	6 hybrids
USA	10 hybrids	France	2 hybrids
FRG	9 hybrids	Turkey	2 hybrids
Spain	8 hybrids	USSR	1 variety

The FAO trials in Horné Chlebany were organized in 3 replications. The area of one plot was 15.2 m<sup>2</sup>. Number of plants per plot varied between 80 and 90, which corresponds to the stand density of 53–59 000 individuals per hectare. The basic crop management consists of fertilization with 40–50 kg N, 50 kg P<sub>2</sub>O<sub>5</sub> and 120 kg K<sub>2</sub>O per hectare.

The mid-scale trials at agricultural enterprises were organized at three localities in the ČSFR. Each hybrid was grown at the area of 1 hectare without replications. The distance between plants was 70 x 25 cm, i.e., 57 000 individuals per hectare.

The FAO trials were evaluated by comparing the hybrids in separate two-year periods. Then by comparing the two-year periods and finally by comparing our locality Horné Chlebany with the Austrian Fuchsenbühl and with the world average for the same set of hybrids. The mid-scale trials were evaluated by comparing the hybrids in single years. Then by comparing the years when identical hybrids that were included more frequently and also by comparing the results from 3 localities for the years when identical hybrids were included.

The continuous cycle of FAO trials was started in 1984 and it included three two-year periods (1984/85, 1986/87 and 1988/89, Tab.10, 11, 12). Comparison of the results at the Slovak locality Horné Chlebany and the Austrian locality Fuchsenbühl was possible in the years 1985 and 1986/87. Fuchsenbühl is located north of Vienna and closest to the ČSFR border of all localities, because in Horné Chlebany only the group of medium-early hybrids was tested in both years and in Fuchsenbühl in 1984 only the group of early hybrids, whereas in 1985 already the identical group of medium-early hybrids was tested. Due to a limited accessibility of the data comparison of the average from Horné Chlebany with the world average was possible only in the period 1986/87. The summarized results, comparison of the years, localities and world average are given in the following tables.

## RESULTS AND DISCUSSION

The highest stability in the achene yield was registered in four Rumanian hybrids (Select and Ro-961, 66, 158) further on in Yugoslav hybrids NS-H-87 and NS Condor. Of the other hybrids, a high yield stability was found in Hungarian hybrids from Szeged, Barbara, Blumx and Koflor 3.

Table 1. Minimum hybrid differences between years

Hybrid	Year	Difference (t/ha)
Select	84/85	0.01
RO-961	88/89	0.01
Barbara	88/89,86/87	0.02 and 0.11
RO-66	86/87	0.02
Pacific 308	84/85	0.03
RO-158	86/87	0.04
NS-H-87	86/87	0.04
Cargill 207	84/85	0.05
Koflor 3	84/85	0.05
II-1414/79	84/85	0.05
Mikaflor	88/89	0.06
NS Condor	84/85	0.08
Blumix	86/87	0.08

Comparison between the localities Horné Chlebany and Fuchsenbigl is shown in Table 2.

Table 2

Year	Average difference	Significance of differences (t-value)	Correlation
1985	0.48 t	5.267 <sup>x</sup>	0.398
1986/87	0.66 t	11.250 <sup>x</sup>	0.786

Differences at both localities were highly significant in 1985, as well as on the average for 1986/87. In 1985, the average yield achieved in Fuchsenbigl was higher by 0.48 t/ha than that achieved in Horné Chlebany. On the contrary the average of the years 1986/87 was by 0.66 t/ha higher in Horné Chlebany than in Fuchsenbigl.

The coincidence of yield relations of the hybrids between the two localities was acceptable. In 1985 the correlation coefficient reached the medium value of 0.4 and was very high almost 0.8 on the average for 1986/87.

The locality Fuchsenbigl is located more to the south in a warmer area in comparison with Horné Chlebany. Higher yields are usually achieved at this locality (except in 1986) but in the ranking of the productivity of the hybrids they did not differ markedly.

Individual distinct differences can indicate a higher or lower suitability of the hybrid to relatively cooler conditions. Contrasting cases are presented in Table 3.

Table 3. Expressive differences in yield of the hybrids at the localities Horné Chlebany and Fuchsenbigl.

Hybrid	Year	Difference in yield (t/ha)
HNK 173	1985	1.40
Monroe 45	1987	1.16
Arbung 363	1985	1.14
NS-Flower	1985	1.13
Adalid 8	1985	1.06
IBH 166	1987	1.01
NS-H-87	1987	-0.92
Florom 305	1985	-0.49

Significantly higher yield at the Austrian locality was obtained with three Spanish hybrids (Monroe 45, Arbung 363 and Adalid 8) in which a negative reaction to climatic conditions of the Slovak locality, located more to the north, can be presumed. There are only two cases of significantly higher yields at the locality more to the north, namely the Yugoslav hybrid NS-H-87 and Rumanian Florom 305. Their suitability for areas more to the north cannot be directly derived, however, the growing practice shows that some hybrids show a high adaptability and offer good yields also in northern areas. Correlation between the yield of hybrids in the world and in the ČSFR is rather high, it achieves the value of 0.689. Substantial differences from the world average are presented in Table 4.

Table 4

Hybrid	Origin	Difference t/ha
RO-66	Rumania	1.06
Blumix	Hungary	0.85
NS-II-86	Yuglosavia	0.84
IBH 166	Hungary	0.83
Türk Ay-1	Turkey	0.82
Barbara	Hungary	0.77

American hybrids Cargill 208 and Dahlgren 730 showed the minimum difference from the world average.

Data on the ten best hybrids (1986/87) are presented in Table 5.

Table 5

Hybrid	Yield t/ha		Plant hight cm	Disease incidence	Oil content %
	1986	1987			
RO 66	4.02	4.04	170	13.7	50.0
GT 788	3.77	—	157	16.4	48.9
RO 85	3.73	—	180	16.8	50.5
Blumix	3.71	3.63	145	13.2	52.8
IBH 166	4.09	3.19	168	16.0	51.9
Dobric	3.63	—	154	13.2	50.8
Multibest I.	3.43	3.62	162	24.6	50.7
Barbara	3.45	3.56	150	31.2	48.5
Türk Ay-1	3.50	3.39	167	21.8	48.7
GT 832	3.42	—	151	11.3	49.2

Data on the ten best hybrids (1988/89) are presented in Table 6.

Table 6

Hybrid	Yield t/ha		Plant hight cm	Disease incidence	Oil content %
	1986	1987			
Albena	3.62	3.32	166	23.0	48.7
NK 281	3.80	2.84	179	21.5	52.1
VrGG 9159/86	3.50	3.10	163	25.0	48.4
Ivena	3.42	3.18	150	19.8	48.2
Ro 160	3.01	3.53	173	20.6	50.4
HNK 81	3.19	3.34	161	19.7	47.2
Superstart	3.39	3.03	163	27.3	48.7
IBH 166	3.31	3.03	175	23.5	49.4
M 701	3.34	—	164	18.8	47.6
AS-545-63	3.23	—	163	21.6	48.8

The ranking of the best hybrids according to yield in the course of the entire six-year period is shown in Table 7.

Table 7

Hybrid	Origin	Yield t/ha
Ro-66	Rumania	3.63
Triumph	USA	3.62
Albena	Bulgaria	3.59
Florum 305	Rumania	3.55
Cargill 207	USA	3.53
Pacific 308	Australia	3.52
M-701	Argentine	3.46 <sup>x</sup>
NK-281	USA	3.44
P-80	Argentine	3.44 <sup>x</sup>
Ivena	FRG	3.42
H 219/79	FRG	3.42
VrGG 9159/86	FRG	3.42
NS-Condor	Yugoslavia	3.41
GT-788	Bulgaria	3.40 <sup>x</sup>

The hybrids marked "x" were tested in only one year. Among 14 hybrids that reached the transformed yield of 3.4 t/ha and more, USA and FRG were represented most frequently having three hybrids each, Rumania, Bulgaria, Argentine two hybrids each and Yugoslavia and Australia one hybrid each.

In the following table, review above average and average hybrids according to country are listed.

Table 8

Country	Rumania	Hungary	Yugoslavia	USA
category 1	Florum 328	Heliapex		Sunbred 285
	Fundulea 53			
category 2	Felix	Viki	NS-H-52	Davil
	Fundulea 206	Citosol 3	NS-H-45	IS 7001
	Select			IS 7116
category 3	Festiv	Antlia	NS-H-26	Sunbred 254
		Jackies 550		IS 7000
		HNK 81		IS 7111
		IBH 166		IS 907
		Multibest I		

Category 4 includes below-average yield e.g., Rumanian hybrids Fundulea 59 and Super. Of Hungarian hybrids there are HNK 173, Citosol 4, Barbara, Rempol 7, Irampol 6, Florakis and Blumix. From the comparison of the mid-scale trials with the FAO trials we can conclude that in some cases coincidence exists in other cases it does not. The ranking after the yield of Rumanian hybrids Select, Felix, Super is corresponding with the FAO results. In the FAO trials the hybrid Florum 328 had not such a good position as in the mid-scale trials. A more conflicting ranking after yield can be seen in some Hungarian hybrids. Citosol 3 has a better position in the mid-scale trials than in the FAO

trials, whereas the position of Citosol 4 was vice versa. In the case of the hybrids Rempol 7, Florakis, HNK 173, Barbara and Multibest I, the results are basically equal in spite of the fact that some of them yielded better in the FAO trials than in the mid-scale trials.

A completely different situation exist in the hybrids IBH 166, HNK 81 and Blumix that occupied much better positions in the FAO trials than in the mid-scale trials.

Success of single countries or breeding centers and firms can be approximately estimated from the results of the trials with hybrids. In the FAO trials the selection of hybrids depends directly on the producer, in the mid-scale trials it is influenced by accessibility of the seed, hence the choice is much narrower.

Evaluation of the success of single countries in both types of trials is summarized in Table 9.

Table 9

Country	FAO trials	mid-scale trials
Hungary	0.45	0.55
USA	0.48	0.43
Rumania	0.50	0.52
FRG	0.52	—
Bulgaria	0.56	—
Australia	0.56	—
Turkey	0.57	—
Yugoslavia	0.58	0.59
France	0.61	—
Spain	0.74	—

From Table 9 the priority of three countries—Hungary, Rumania and USA is obvious, relatively good positions were also achieved by hybrids from FRG. In a lower number, hybrids from Yugoslavia are also presented. In the mid-scale trials Hungarian hybrids have worse positions and American hybrids better positions than in the FAO trials. In Hungary two competitive plant breeding centers were active, their hybrids had distinctly different positions in the the FAO trials and particularly in the mid-scale trials. Whereas the hybrids from GKI Szeged achieved an average ranking 0.40, the hybrids from TAKI Iregszemcze ranked much lower, as indicated by the value of 0.65. From the 5 USA firms, Triumph, Northrup King and Cargill were very successful, their value did not exceed 0.2. On the contrary firms Interstate and Sigco showed a very high value of the average relative ranking over 0.7. In the mid-scale trials hybrids of individual firms were ranked as follows: Pioneer 0.39, Northrup King 0.40 and Interstate 0.55.

Unlike in ČSFR, in the trials of the Austrian Federal Institute there was a high representation of American and French firms that represent 73% of the tested hybrids. Furthermore the trial is characterizd by a broad array of sunflower hybrid producers. Cargill has the leading position, in Austria its hybrid Frankasol is grown at almost 90% of the sunflower growing area.

Rumanian hybrids and Hungarian hybrids from Iregszemcze were not represented at all.

Table 10 FAO trial – period 1984/85

Name	Origin	Yield t/ha
Triumph 570	US	3.35
Florom 305	Rumania	3.28
Cargill 207	USA	3.26
Pacific 308	Australia	3.25
H 219/79	FRG	3.16
NS Condor	Yugoslavia	3.15
NS Helios	Yugoslavia	3.06
Select	Rumania	3.04
IBh 166	Hungary	3.03
NS Flower	Yugoslavia	2.95
Citosol 4	Hungary	2.93
Felix	Rumania	2.80
Koflor 3	Hungary	2.75
Pieredovik	USSR population	2.69
Citosol 3	Hungary	2.68
Arbung 353	Spain	2.60
NS Shine	Yugoslavia	2.59
Super	Rumania	2.59
H-1414/79	FRG	2.53
IH-51	Hungary	2.53
Interstate 7111	USA	2.52
Hysun 32	Australia	2.49
Sigco 448	USA	2.47
Adalit 8	Spain	2.36
IH-173	Hungary	2.33
Fundulea 55	Rumania	2.30
H 617	Bulgaria	2.28
Fundulea 56	Rumania	2.13
One-year results		
P-80	Argentina	3.18
P-75	Argentina	2.81
G-90	Argentina	1.89
P-78	Argentina	1.88
G-100	Argentina	1.81

Table 11 FAO trial – period 1986/87

Name	Origin	Yield t/ha
RO-66	Rumania	4.03
Blumix	Hungary	3.67
IBH 166	Hungary	3.64
Multibest I	Hungary	3.52
Barbara	Hungary	3.51
Türk Ay-1	Turkey	3.44
Multibest II	Hungary	3.31
NS-H-86	Yugoslavia	3.27
Florida 2000	Spain	3.26
3340/81	FRG	3.11
RO-15	Rumania	3.07
RO-33	Rumania	3.05
NS-H-91	Yugoslavia	3.01
NS-H-90	Yugoslavia	3.00
NS-H-87	Yugoslavia	2.86
RO-158	Rumania	2.83
Monroe 45	Spain	2.77
Heliandaus	Spain	2.70
136/83	FRG	2.44
One-year results		
GT 788	Bulgaria	3.77
RO-85	Rumania	3.73
Dobric	Bulgaria	3.63
GT-832	Bulgaria	3.42
Izgrej	Bulgaria	3.39
160/83	FRG	3.36
RO-109	Rumania	3.36
Pacific 354	Australia	3.27
131/81	FRG	3.20
Seed Tec 316	USA	3.19
Pacific 336	Australia	3.14
Dahlgren 730	USA	2.67
Cargill 208	USA	2.66

Table 12 FAO trial – period 1988/89

Name	Origin	Yield t/ha
Albena	Bulgaria	3.47
NK 281	USA	3.32
VrGG 9159/86	FRG	3.30
Ivena	FRG	3.30
RO 160	Rumania	3.27
HINK 81	Hungary	3.26
Superstart	Bulgaria	3.21
IBH 166	Hungary	3.17
NS-H-97	Yugoslavia	3.17
Florom 328	Rumania	3.13
Hysun 24	Australia	3.11
RO 1227	Rumania	3.08
RO 961	Rumania	3.04
Rempol 7	Hungary	3.03
Euflo	France	2.97
HNK 173	Hungary	2.96
RO 1213	Rumania	2.94
Mikaflor	France	2.91
Edirne 87	Turkey	2.90
Interstate isomax	USA	2.89
Sigco 465	USA	2.89
VrGG 9160/86	FRG	2.88
Florakisz	Hungary	2.88
Hysun 44	Australia	2.84
NS-H-94	Yugoslavia	2.83
NS-H-95	Yugoslavia	2.70
Barbara	Hungary	2.65
One-year results		
M 701	Argentina	3.34
AS-545-63	Argentina	3.23
Toledo 55	Spain	3.14
Vip	Spain	2.83
Giraflor SH-222	Spain	2.78

## CONCLUSION

The paper summarizes the results of trials with sunflower hybrids organized in sunflower growing areas by the Research Institute for Plant Production Praha-Ruzyne in the years 1984-1989. In small-scale trials 92 hybrids from 12 countries were tested, in mid-scale trials 59 hybrids from 5 countries.

In the small-scale trials, yield differences between the years (always of a two-year experimental cycle), between localities (when the assortment in the ČSFR and Austria was identical) and between hybrids themselves were compared.

Hybrids were compared within the framework of each two-year cycle and in transformed yields also for the whole six-year period.

In the mid-scale trials, yield analysis of the hybrids in the course of six years at three localities (various number of years per locality) has been performed. As a result, hybrids were classified into yield categories.

Comparison of the success of individual countries and firms according to the ranking in the small-scale trials prefers Hungary and GKI Szeged, in the mid-scale trials the USA (firms Pioneer and Northrup King), Rumania and Yugoslavia were the most successful ones.

## REFERENCE

1. Kováčik, A., Škaloud, V., Vrabec, J., 1989: Vysledky odrudovych pokusu se slunečnicí (Results of varietal Trials with Sunflower). VÚRV.Sborník-Pohorelice 30.8., p.p.19-40
2. Kováčik, A., Škaloud, V., 1990: The Yield Results of Pilot Trials with Sunflower Hybrids. Rostl.vyroba, 36 (3):263-269

## ANÁLISIS DE LOS RESULTADOS DE ENSAYOS CON HÍBRIDOS FAU DE GIRASOL EN ČSFR

## RESUMEN

En esta publicación se resumen los resultados de ensayos con híbridos de girasol organizados en áreas de cultivos de girasol por el Instituto de Producción de Plantas de Praga-Ruzyne en los años 1984-1989. En pequeña escala los ensayos de 92 híbridos de 12 países fueron ensayados, y a media escala se ensayaron 59 híbridos de 5 países.

En los ensayos a pequeña escala las diferencias en rendimiento entre los años (siempre de un ciclo experimental de dos años) entre localidades (cuando la agrupación en ČSFR y Austria fué idéntica) y entre los mismos híbridos fueron comparados.

Los híbridos fueron comparados dentro de la estructura del ciclo de cada dos años y en rendimientos transformados también para el periodo entero de seis años.

A media escala el análisis del rendimiento de los híbridos en curso durante seis años en tres localidades (varios números de años en una localidad) fueron llevados a cabo. Como resultado los híbridos fueron agrupados dentro de categorías de rendimiento.

La comparación del éxito de híbridos simples y firmas de acuerdo a la ordenación en ensayos en pequeña escala estuvieron en primer lugar Hungría y GKI Szeged, en media escala ensayos de USA (firmas Pioner y North Rup King), Rumania y Yugoslavia fueron los de más éxito.

**ANALYSES DES RÉSULTATS D'ESSAIS FAO EN TCHÉCOSLOVAQUIE CONCERNANT  
DES HYBRIDES DE TOURNESOL.**

**RÉSUMÉ:**

Dans cet article, nous présentons un résumé des résultats d'essais 1984-1989 concernant le comportement d'hybrides de tournesol implantés à l'Institut de Recherche pour la Production des Plantes - Praha Ruzyně. 92 hybrides provenant de 12 pays ont été testés en micro-parcelles et 59 hybrides provenant de 5 pays l'ont été en macro-parcelles.

Dans les micro-parcelles, les différences de rendement ont été comparées entre les années ( toujours calculées sur un cycle expérimental de deux ans), entre les lieux d'implantation (lorsque les assortiments entre la Tchécoslovaquie et l'Autriche étaient identiques) et entre les hybrides eux-mêmes.

Les hybrides ont été comparés pour chaque cycle expérimental de deux ans et les rendements indexés ont été calculés sur une période de six ans.

Pour les macro-parcelles, l'analyse du rendement des hybrides a été effectuée sur une période de six ans et à partir des résultats de trois localités. Les hybrides ont été regroupés en catégories définies à partir du rendement.

Dans les micro-essais, les hybrides hongrois et ceux issus du SKI Szeged se sont révélés les plus intéressants. Pour les macro-parcelles, se sont les hybrides américains (Pionner et Northrup King), roumains et yougoslaves qui ont obtenus les meilleurs résultats.