

# ACHIEVEMENTS IN SUNFLOWER BREEDING IN YUGOSLAVIA

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## INTRODUCTION

First domestic hybrids contributed significantly to the promotion of sunflower production in Yugoslavia. Sunflower hybrids based on cytoplasmic male sterility are superior over sunflower varieties in genetic potentials for seed yield, genetic resistance to downy mildew, and uniformity in plant height and time of maturation. The hybrids increased the production of sunflower as illustrated by the average yields obtained in Vojvodina, the principal sunflower-growing region of the country—in 1977, the first year of growing, sunflower hybrids were grown on 143,000 ha. and the average yield was 26.3 q/ha. In 1978, the hectareage under sunflowers was 183,000 ha. and the average yield was 24.3 q/ha. In 1979, which was highly unfavorable for sunflower production, the average yield was 22 q/ha. on 190,000 ha, as opposed to the average yield of Soviet varieties which was 18 q/ha.

To stabilize the yields in commercial production above 30 q/ha, it is necessary to develop hybrids which should be more resistant to various stresses, primarily to certain diseases. It is possible to induce a higher adaptability of SC hybrids through an increased divergence of parental lines. Stoenescu (1975) found that a high variability of the main parameters of productivity of sunflower hybrids depends on the locality and year of growing. Fick and Zimmer (1976) arrived at similar conclusions.

The establishment of a wider spectrum of disease resistance should be associated with the determination of genetic sources of resistance. The results of Vranceanu et al. (1974) and Fick and

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Zimmer (1976) illustrate the increase and stabilization of sunflower yields achieved through the incorporation of downy mildew resistance alone.

The most difficult feature in the realization of a hybrid model with high and stable yields is the incorporation of a high degree of disease resistance (Skorić, 1978).

The objective of this investigation was to estimate the possibilities of developing high-yielding hybrids using the available genetically divergent breeding material.

## **MATERIAL AND METHOD**

We used genetically divergent material from the second cycle of breeding which includes a number of cms and restorer lines. The breeding material was evaluated on the basis of a large number of F<sub>1</sub> combinations. Their number was 1730 in 1978 and 2506 in 1979. The new hybrid combinations were comparatively tested against the hybrids from the first cycle of breeding and the variety VNIIMK 8931. The hybrid combinations were tested for a number of characters. Their disease resistance was estimated by inoculation methods and observations in field.

The adaptability of sunflower hybrids already included into the commercial production was examined in a network of large-plot trials. The size of basic plots was 1 ha.

This paper deals only with the hybrids combinations which bettered the most widely grown sunflower hybrid NS-H-26-RM.

## **RESULTS AND DISCUSSION**

To make a realistic evaluation of the new hybrid combinations, it is necessary to review the productional potentials of the hybrids already included into the commercial production. The results from the commercial production and large-plot trials showed that the hybrids brought significantly higher yields than the varieties, in spite of a high variability of the former. The hybrids from the first cycle of breeding brought average yield increases of 6-8 q/ha (Graph 1).

With the hybrids, as compared with the variety VNIIMK 8931, the distribution of seed yield in dependence of the locality and year of growing is realized on a higher scale of yield. The hybrids realize a higher degree of genetic potentials for seed yield on account of the

manifestation of the effect of heterosis and the genetic resistance to downy mildew.

The results of the tests which included a large number of new hybrid combinations indicated that the available breeding material is capable of rendering still more productive hybrids. For a better comparison of the new combinations, it should be pointed out that NS-H-26-RM is grown on more than 100,000 ha, frequently yielding over 30 q/ha. The record yield of this hybrid was 46 q/ha. on a 40 hectare plot.

In 1978, 14% (248) of the new hybrid combinations had higher seed yields and 11% (198) had higher oil yields than NS-H-26-RM. In 1979, 24% (615) of the new combinations had higher seed yields and 22% (537) had higher oil yields.

It is important to mention that some of the new hybrid combinations reached their maximum potentials in seed yield, oil yield, and oil content in seed. The highest seed yield was almost 70 q/ha, the oil content in absolutely dry seed exceeded 55%, while the highest oil yields were more than 2600 kg/ha. in both test years (Table 1).

Tab. 1. - *Maximum values obtained in small-plot trials*

Character	Year	
	1978	1979
Seed yield - q/ha.	59.8	69.4
Oil content in seed - %	55.9	55.6
Oil yield - kg/ha.	2690	2628

It should be added that the degree of resistance of the new hybrid combinations to major diseases approaches that of the hybrids in the commercial production.

A large number of hybrid combinations should be selected on the basis of their seed yields, oil yields, and disease resistance, multiplied, and tested in a network of small- and large-plot trials to find those which are least susceptible to various stresses. It is reasonable to expect that the resulting hybrids will bring higher and more stable yields than the presently grown ones.

The obtained results indicate the existence of high genetic potentials for important agronomic characters. A practical utilization of

these potentials requires increases in genetic variability and the development of a new hybrid model. Increases in genetic variability may be achieved by including wild sunflower species into the breeding program. A new hybrid model should secure an increased harvest index and a more intensive utilization of nutrients and solar energy. To secure these characters, it is necessary to develop a more efficient root system, a new architecture of leaves which should enable a higher density (over 80,000 plants/ha), a more efficient and longer photosynthetic activity, and a larger spectrum of disease resistance based on new genetic sources of resistance.

## ABSTRACT

First domestic SC hybrids increased and stabilized the yields of sunflower in Yugoslavia. Three-year average increases were 6-8 q/ha, as compared with the previously grown Soviet varieties.

A number of hybrid combinations from the second cycle of breeding were found to be superior in seed and oil yields over the standard hybrid, NS-H-26-RM.

Out of 1730 Hybrid combinations examined in 1978, 14% of them had significantly higher seed yields and 11% had significantly higher oil yields than the standard. Out of 2506 combinations examined in 1979, 24% were better than the standard in seed yield and 22% in oil yield.

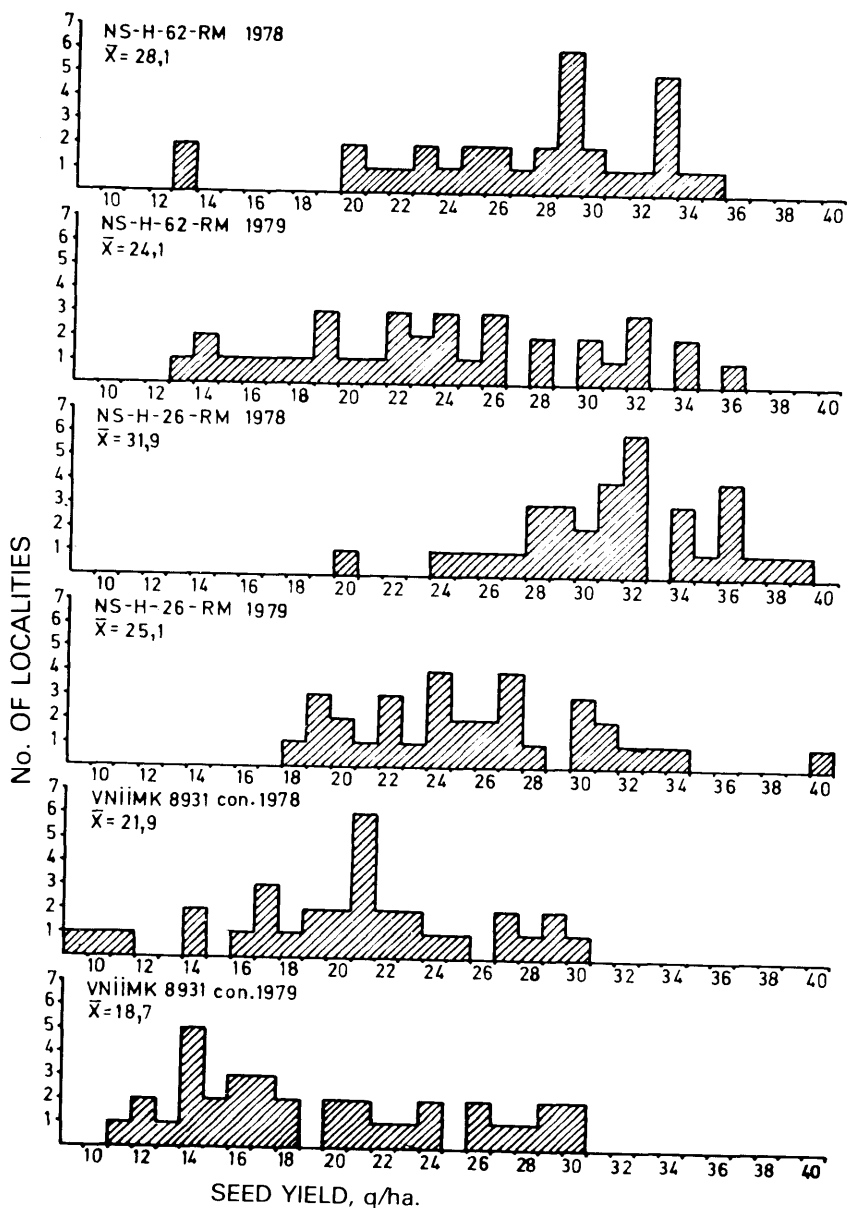
The maximum seed yields obtained in small-plot trials exceeded 60 q/ha, the oil content in seed reached 55%, and the yield of oil was 2600 kg/ha. The hybrid combinations better than the standard (NS-H-26-RM) should be tested further to find those which are most resistant to different stresses.

To obtain significantly higher yields than the present ones, it is necessary to increase the genetic variability of the available breeding material by including a number of wild sunflower species into the breeding program. These wild species should also increase the disease resistance of a new hybrid model that has to be developed.

## REFERENCES

- FICK, G. N., ZIMMER, D. E., 1976. Yield stability of sunflower hybrids and open-pollinated varieties. Proc. 7th Int. Sunfl. Con., 253-259, Krasnodar.
- STOENESCU, F., 1975. *Influenta mediului asupra caracterelor cantitative. Probleme de genetica teoretica si aplicata*, Vol. VII, Nr. 5.
- ŠKORIĆ, D., 1978: Desired model of sunflower hybrid and newly-developed NS sunflower hybrids. EUCARPIA Meeting, Uppsala.
- VRANCEANU, A. V., STOENESCU, F., ILIESCU, H., PIRVU, N., 1974. Sunflower hybrids resistant to downy mildew (*Plasmopara helianthi* Novot.) developed on cytoplasmic male sterility basis. Proc. 6th Int. Sunfl. Con., Bucharest.

Graph 1 - VARIABILITY OF SEED YIELDS IN LARGE-PLOT TRIALS



Graph 2 - DISTRIBUTION OF HYBRID COMBINATIONS BETTER THAN THE CONTROL, NS-H-26-RM, REGARDING SEED AND OIL YIELDS (small-plot trials 1978, 1979)

