

DOUBLE CROPPING IRRIGATED SUNFLOWER IN THE VOJVODINA PROVINCE

S. Dragović, Livija Maksimović, Ž. Panić, D. Škorić

Faculty of Agriculture, Institute of Field and Vegetable Crops, 21000 Novi Sad, Yugoslavia

Summary

Double cropping of sunflower increases the annual production of sunflower itself as well as the profitability of irrigation systems. In the Vojvodina Province, sunflower may be double cropped after early crops and winter wheat, i.e., in a period of 120-140 days with the temperature sum of 2,000 to 2,500°C.

A three-year trial, conducted on a loamy soil, included six NS sunflower hybrids which were sown at four dates: June 10 and 20 and July 1 and 10. The trial was irrigated.

The vegetation period of the tested hybrids depended on sowing date and weather conditions in the course of the season. The average vegetation periods for the four sowing dates were 126, 124, 121, and 111 days, respectively. The emergence lasted 6-7 days, budding 37-43 days, flowering 13-18 days. Grain filling and maturation lasted from 71 days with the first date to 54 days with the fourth.

Seed yields in the first three dates were high, on the level of average yields obtained when sunflower is grown as the main crop. The highest yield was obtained in the second date, 2.86 t·ha⁻¹. The first and the third date brought similar yields, 2.70 and 2.64 t·ha⁻¹, respectively. An intensive outbreak of diseases lowered the average yield of sunflower sown at the first date in 1986. The average yield obtained in the fourth date, calculated on 13% moisture basis, was 2.34 t·ha⁻¹, but grain moisture was high at the time of harvest (52.9% on average), especially in 1986. Obviously, this sowing date is not safe.

Oil concentration in seed was high but contingent on sowing date and hybrid. The highest concentration was obtained with the second sowing. The average concentrations for the four sowing dates were 44.7%, 45.2%, 42.8%, and 41.9%, respectively.

Introduction

In the Vojvodina Province, after the harvest of early crops and winter wheat, considerable acreage remains fallow from mid-June or early July to mid- or late October. This is a period of 120-140 days with the temperature sum of 2,000 to 2,500°C, depending on sowing date and weather conditions. Since the period is usually dry, double cropping is possible only in irrigation.

Furthermore, double cropping implies the use of early hybrids, with the vegetative period of 100 to 120 days. Such hybrids are available within the assortment of NS hybrids.

Double cropping of sunflower increases the annual production of the crop itself, and it is cheaper than the conventional production on account of lower investments in soil tillage and fertilization. Disease are less of a problem because of high temperature and low relative air humidity which accelerate the initial stages of plant growth and development. However, the period of maturation is longer than that in the conventional production.

Material and Methods

In the period 1986-1988, a field trial was conducted on the loamy soil with favorable water-physical and chemical properties at the experiment field of the Institute of Field and Vegetable Crops in Novi Sad. The trial included four sowing dates and six sunflower hybrids.

A. Sowing dates:

1st date: June 10 2nd date: June 20
3rd date: July 1 4th date: July 10

B. Hybrids:

1. NS-H-52 2. NS-H-56 3. NS-H-60
4. NS-H-61 5. NS-H-68 6. NS-H-27

The cultural practices included the seedbed preparation by disking. Fertilization was omitted. The sowing arrangement was 70 x 23-25 cm. The irrigation was scheduled according to soil moisture, at 65-70% FWC. The number of irrigations and irrigation rates are presented in Table 1.

Results

WEATHER CONDITIONS. Air temperature and rainfall are important for double cropping of sunflowers.

The air temperature, expressed as temperature sums (Table 2) varied with sowing date and weather conditions. The average sums for the four sowing dates ranged between 1,000 and 1,500°C.

The highest daily and 10-day mean temperatures occurred in July and August. The temperatures in September and the first half of October were also favorable, above 10°C, while the temperatures lower than that, which occurred after October 15, were not counted as biologically active.

The total rainfall for the five months (June-October) was 209 mm, on average, with the annual variations from 169 to 237 mm (Table 3). As the sunflowers required more water than that, supplementary irrigation was applied.

VEGETATION PERIOD. Again, the length of vegetation period depended on sowing date and weather conditions. The average period ranged from 111 days with the 4th date to 126 days with the 1st date. The emergence lasted 6-7 days, budding 37-43 days, flowering 13-18 days. These stages were much shorter than those in the conventional growing of sunflower as the main crop. Grain filling and maturation lasted longer from 54 to 71 days (Table 4).

SEED YIELD. The seed yields obtained in the trial were on the level of the average yield for the location. On the three-year average for all hybrids, the yield achieved with the second date was 2.86 t ha⁻¹. The first and the third date brought similar yields, 2.70 and 2.64 t ha⁻¹, respectively (Table 5).

The annual yield variations were high, especially with some of the hybrids tested. In 1986, for example, a severe attack of *Sclerotinia* decimated the yields in the first date, putting them below those obtained in the second date (Table 6). The average yield obtained in the fourth date, calculated on 13% moisture basis, was 2.34 t ha⁻¹, but grain moisture was high at the time of harvest (52.9% on average), especially in 1986. The seed obtained in the fourth date, therefore, could not be considered fully mature.

OIL CONCENTRATION. The oil concentrations obtained were slightly below those obtained in the conventional growing and, therefore, quite satisfactory. The highest concentration was obtained with the second sowing, the lowest with the fourth, 45.2% and 41.9%, respectively (Table 7). The differences between the hybrids were only 1.2%, from 43.0% to 44.2%.

Discussion and Conclusion

It is possible to successfully double crop sunflower in the Vojvodina Province. According to ŠAŠKO (1967), the temperature sum required by early hybrids grown in the Ukraine is 2,050-2,200°C. According to Vučić (1981), the required sum for the Vojvodina Province is 2,050-2,400°C. The temperature regimen of the Vojvodina Province obviously meets the requirement with the first three sowing dates tested, while the fourth date is uncertain.

According to Gett (1980), the sunflower requirement for water is 400-500 mm. It means that a half of the required sum should be supplemented by irrigation.

Tab. 1 - Irrigation scheduling for double cropped sunflower

Sowing date	1986		1987		1988		Average	
	No.	mm	No.	mm	No.	mm	No.	mm
June 10	6	230	9	220	7	185	7	210
June 20	5	200	7	175	7	185	6	185
July 1	3	130	5	140	5	155	4	140
July 10	3	130	4	125	4	140	4	130

Tab. 2 - Temperature sum (°C) for sunflower vegetation period

Sowing date	1986	1987	1988	Average
June 10	2571	2472	2615	2552
June 20	2350	2408	2419	2392
July 1	2216	2257	2256	2243
July 10	2000	2031	2017	2016

Tab. 3 - Monthly rainfall for sunflower vegetation period

Month	1986	1987	1988	Average
Jun	50	62	65	59
July	77	32	20	43
Aug.	40	50	17	37
Sept.	4	6	55	22
Oct.	42	68	12	41
Total	213	218	169	202

Tab. 4 - Phenostages of sunflower plants

Sowing date	Phenostage	Number of days			Average
		1986	1987	1988	
June 10	Emergence	8	7	6	7.0
	Budding	37	38	37	37.3
	Flowering	17	53	83	18.6
	Harvest	79	53	83	71.6
	Emergence - harvest	133	114	146	126.6
June 20	Emergence	7	6	7	6.6
	Budding	48	42	39	43.0
	Flowering	12	17	12	13.6
	Harvest	65	59	78	67.3
	Emergence - harvest	125	118	129	124.0
July 1	Emergence	8	6	5	6.3
	Budding	45	48	35	42.6
	Flowering	14	14	21	16.3
	Harvest	67	48	73	62.6
	Emergence - harvest	126	110	129	121.6
July 10	Emergence	8	5	7	6.6
	Budding	38	44	43	41.6
	Flowering	17	14	15	15.3
	Harvest	62	44	58	54.6
	Emergence - harvest	117	102	116	111.6

Tab. 5 - Yield of the sunflower hybrids per sowing date (tha⁻¹),
on average for 1986-1988

Hybrid	Sowing date				Average
	June 10	June 20	July 1	July 10	
NS-H-52	2.85	3.08	2.95	2.49	2.84
NS-H-56	2.84	3.06	3.16	2.56	2.90
NS-H-60	2.88	3.41	3.02	2.67	3.00
NS-H-61	2.87	2.60	2.49	2.33	2.57
NS-H-68	2.59	2.79	2.01	2.53	2.48
NS-H-27	2.14	2.22	2.19	2.07	2.16
	2.70	2.86	2.64	2.34	

Tab. 6 - Average yield of the sunflower hybrids
per year and sowing date, tha

Sowing date	Year			Average
	1986	1987	1988	
June 10	1.82	3.17	3.18	2.70
June 20	2.67	2.90	3.03	2.86
July 1	2.64	2.54	2.73	2.64
July 10	2.23	2.12	2.66	2.34
Average	2.34	2.68	2.90	2.64

Tab. 7 - Oil concentration in sunflower seed

Hybrid	Sowing date				Average
	June 10	June 20	July 1	July 10	
NS-H-52	45.3	46.3	41.5	42.8	44.0
NS-H-56	45.8	46.6	43.6	40.7	44.2
NS-H-60	43.0	44.2	43.6	41.1	43.0
NS-H-61	43.6	43.8	43.2	42.6	43.2
NS-H-68	45.2	44.6	42.7	41.2	43.4
NS-H-27	45.1	45.6	42.5	43.6	44.2
Average	44.7	45.2	42.8	41.9	43.6

Vegetation period of double cropped sunflower depends on sowing date and temperature conditions in the course of the season, especially on the sum of active temperatures in September and October.

The seed yield obtained indicate that the first three dates are quite acceptable for a successful production of sunflower. These results are in agreement with the earlier results of DRAGOVIĆ ET AL. (1988, 1989), KNEŽEVIĆ ET AL. (1980), VUČIĆ (1980), etc.

The sowing after July 1 (the fourth date) may bring in question the success of seed production. Such production is highly dependent on the weather conditions, especially in September and October.

Oil concentration, on average for the entire trial, was 43.6%. The highest concentration, 45.2%, was obtained with the second date. The latter value is similar to those obtained in the conventional growing of sunflower as the main crops which, according to SPASOJEVIĆ ET AL. (1992), ranges between 40 and 45%.

References

- Dragović, S., Panić, Ž., Maksimović, L. (1988): Sunflower Production for Grain in Double Cropping and Irrigation. Proceeding of 12 th International Sunflower Conference, Novi Sad.
- Dragović, S., Panić, Ž. (1989): Proizvodnja ratarskih kultura za zrno i zelenu masu u postnoj setvi. Zbornik referata Seminara agronoma (520-526), Kupari.
- Gatto, I., Greco, I., Alba, A. (1980): The Effects of Seasonal Irrigation Water Regimes in Sunflower Characters in Southern Italy. 9th Int. Sunflower Conference, Malaga, Spain.
- Vučić, N. (1980): Sunflower Seedlings Transplantation for Double Cropping in Irrigation. Proceedings of 9th Int. Sunflower Conference, Malaga, Spain.
- Vučić, N. (1981): Navodnjavanje i dve žetve godišnje, Novi Sad.
- Knežević, M., Mezei, I., Manojlović, Z., Hertig, E. (1983): Proizvodnja suncokreta u postnoj setvi. Zbornik referata sa savetovanja tehnologa industrije ulja Jugoslavije (173-178), Beograd.
- Stanojević, D., Jovanović, D., Nedeljković, S. (1992): Sunflower assortment and its role in the realization of yield in the production area of the Belgrade oil and protein industry. Zbornik radova Instituta za ratarstvo i povrtarstvo, Novi Sad, Vol. 20.