

## INTERACTIONS BETWEEN THE SOWING DATES, PLANT DENSITY AND THE YIELD FOR THE SUNFLOWER AND CORN CROPS

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### ABSTRACT

*Within the ADER 1.2.1. project's multifactorial trials established at A.R.D.S. Simnic – Craiova for the sunflower and corn crops, there were studied the yield's interrelations between three hybrids for each one of the cultivars (Sandrina, Fundulea 911 and Fundulea 708 for the sunflower crop and Mostistea, lezer and F 475 M for the corn crop), three different sowing periods (early period - 31.03.2014, optimum - 15.04.2014 and late period - 08.05.2014) and three plant densities (30.000; 50.000 and 70.000 plants/ha).*

### INTRODUCTION

Sunflower and corn are grown in Romania under different climatic conditions. As a result, there is a wide range of sunflower and corn cultivars present in Romania, their production behavior research under various conditions being very necessary.

### MATERIALS AND METHODS

The multifactorial trials were established in 2014 for the sunflower and corn crops and there were observed within the vegetation period three hybrids for each one of the cultivars, three different sowing periods and three plant densities for each one of the hybrids. The trials were established at the Agricultural and Development Research Station Simnic - Craiova in 2014 on a reddish preluvosoil, pseudogleic in its depth, low in humus (only in the first 25 cm the humus percentage is 2, 35), medium supplied with phosphorus and potassium, with a moderate calcium and sodium content, without being endangered by alkalization or salinization (C.V. Popescu., C. Bora, 2009).

### RESULTS AND DISCUSSIONS

The cultivars and the technologies used for the establishment of these experimental fields were those recommended within the frame of the ADER 1.2.1. project. The climatic data registered in 2014 are presented in table 1.

**Table 1**

**Climatic data 2013 - 2014**

Month	Temperatures (�C)			Rainfall (mm)		
	Monthly average	Monthly multiannual average	Difference	Monthly sum	Monthly multiannual sum	Difference
October	12.1	11.8	0.30	47.1	44.5	2.6
November	8.0	5.5	2.50	51.2	44.9	6.3
December	0.1	0.4	-0.30	0	45.1	-45.1
January	0.7	-1.4	2.10	52.1	32.7	19.4
February	2.2	1.0	1.20	10.3	30.6	-20.3
March	9.4	5.6	3.80	92.5	33.7	58.8
April	12.3	11.8	0.50	136.1	46.0	90.1
May	15.9	16.9	-1.00	124.2	66.9	57.3
June	19.6	20.4	-0.80	120.4	67.9	52.5
July	22.8	22.6	0.20	138.2	61.5	76.7
August	22.2	22.1	0.10	64.9	48.9	16.0
September	17.9	17.5	0.40	138.6	42.4	96.2
<b>Total/average</b>	<b>11.9</b>	<b>11.2</b>	<b>0.70</b>	<b>975.6</b>	<b>565.1</b>	<b>410.5</b>

**For the sunflower crop**, the studied hybrids were: Sandrina, Fundulea 911 and Fundulea 708, established as follows: early period - 31.03.2014, optimum - 15.04.2014 and late period - 08.05.2014. The plant densities were: 30.000; 50.000 and 70.000 plants/ha.

There were used as fertilizers NPK (20.20.0) - 250 kg/ha and, as herbicide after the establishment of the crop - Dual Gold 1.2 l/ha.

In the tables below (table 2 and table 3) there are presented the results of the trials for the conditions registered in 2014:

A – Sowing period (A1 – early, A2 – optimum, A3 – late);

B – Plant density (B1 – 30.000 plants/ha, B2 – 50.000 plants/ha, B3 – 70.000 plants/ha);

C – Hybrid (C1 – Sandrina, C2 – F 911, C3 – F708) Harvest date: 25.09.2014.

As observed, by analyzing the behavior of the hybrid x density x sowing period, none of the hybrids performed, differences in yields not being statistically assured.

The analysis of the results considering each one of the involved factors is showing that the early sowing determined a yield increase of de 826 kg/ha related to the second sowing period, not statistically assured.

When the sunflower was established within the third period, the yield was distinctly statistically lower compared to the crop established within the early period and significantly reduced compared to the crop established within the second period (optimum).

The plant densities 50.000 and 70.000 plants/ha were net superior to the 30.000 plants/ha density, but the yield differences between 50.000 and 70.000 plants/ha were practically inexistent.

For the 2014 conditions, the most productive hybrid was F708, but there were not registered statistically assured differences according to the hybrids.

**Table 2**

**Sunflower crop yield results**

A	Density B	Hybrid C	Yield (kg/ha) U % STAS	Difference + significance (AxBxC)	U% harvest	HLM (kg/ha)	TGW (g)
A I	30.000	SANDRINA	3083	standard	8.3	41.5	73.7
		F 911	2879	-204	8.7	43.0	68.6
		F708	2752	-331	8.4	41.2	53.8
	50.000	SANDRINA	3285	standard	8.2	43.5	62.6
		F 911	3577	292	8.5	42.0	63.1
		F708	3687	402	8.0	45.0	62.2
	70.000	SANDRINA	2855	standard	8.4	44.7	57.8
		F 911	2931	76	8.5	45.0	61.3
		F708	3157	302	8.0	43.5	60.4
A II	30.000	SANDRINA	1682	standard	8.8	41.0	62.7
		F 911	1547	-135	8.9	41.2	66.5
		F708	2128	446	8.6	40.5	61.1
	50.000	SANDRINA	2340	standard	8.5	42.0	54.2
		F 911	2125	-215	8.9	41.0	52.8
		F708	2381	41	8.5	44.0	62.2
	70.000	SANDRINA	2407	standard	8.5	42.0	54.2
		F 911	3013	606	8.8	43.2	68.8
		F708	3149	742	8.3	43.2	58.9
A III	30.000	SANDRINA	957	standard	8.6	40.4	47.8
		F 911	834	-123	8.7	40.8	46.9
		F708	1024	67	8.5	39.5	51.8
	50.000	SANDRINA	1124	standard	8.6	40.1	51.2
		F 911	1066	-58	8.8	40.7	52.8
		F708	1163	39	8.9	40.6	51.9
	70.000	SANDRINA	1016	standard	9.0	41.1	52.8
		F 911	938	-78	8.9	40.9	50.6
		F708	1218	202	8.7	40.3	53.1

DL 5 % =931 kg, DL 1% =1246 kg, DL 0.1% =1654 kg

**Table 3**

**Yield vs. sowing period (A), yield vs. density (B) and yield vs. hybrid (C)  
without considering the other factors**

Factor (A)	Yield (kg/ha)	Difference and signification			
A I	3134	standard	826	2096**	
A II	2308	-826	standard	1270*	
A III	1038	-2069**	-1270*	standard	
DL 5%=849, DL 1%=1405, DL 0.1% = 2630					
Factor (B)	Yield (kg/ha)	Difference and signification			
30.000	1876	standard1	-429***	-422***	
<b>50.000</b>	2305	429***	<b>standard2</b>	7	
70.000	2298	422***	-7	standard	
DL 5%=160, DL 1%=225, DL 0.1% = 317					
Factor (C)	Yield (kg/ha)	Difference and signification			Difference to the average C
SANDRINA	2083	standard	-18	-212	-77
F 911	2101	18	standard	-194	-59
<b>F 708</b>	2295	212	194	<b>standard</b>	135
DL 5%=310, DL 1%=415, DL 0.1% = 548 kg					

**For the corn crop**, the studied hybrids were: Mostistea, lezer, F 475 M, established as follows: 31.03.2014, optimum - 15.04.2014 and late period - 08.05.2014. The plant densities were: 30.000; 50.000 and 70.000 plants/ha.

There were used as fertilizers NPK (20.20.0) - 250 kg/ha and, as herbicide after the establishment of the crop - Dual Gold 1.2 l/ha.

In the tables below (tables 4 to 7), there are presented the results of the trials for the conditions registered in 2014:

A – Sowing period (A1 – early, A2 – optimum, A3 – late);

B – Plant density (B1 – 30.000 plants/ha, B2 – 50.000 plants/ha, B3 – 70.000 plants/ha);

C – Hybrid (C1 – Mostistea, C2 – lezer, C3 – F 475 M)

**Table 4**

**Corn crop yield results**

A	Density B	Hybrid C	Yield (kg/ha) U % STAS	Difference + signification (AxBxC)	U% harvest	HLM (kg/ha)	TGW (g)
<b>A I</b>	30.000	Mostistea	2345	standard	19.5	77.0	330.6
		lezer	3890	1545**	25.1	67.8	363.0
		F 475 M	<b>3959</b>	1614**	23.2	70.9	318.5
	50.000	Mostistea	2368	standard	20.7	76.7	238.1
		lezer	<b>3856</b>	1488*	26.3	69.5	327.4
		F 475 M	3428	1060	24.4	68.8	300.6
	70.000	Mostistea	3685	standard	20.8	77.3	236.3
		lezer	<b>4586</b>	901	26.9	68.5	330.5
		F 475 M	4112	427	25.5	70.5	300.5
<b>A II</b>	30.000	Mostistea	3692	standard	19.7	76.3	274.8
		lezer	<b>4902</b>	1210*	25.7	68.8	341.0
		F 475 M	4651	959	23.1	67.1	300.8
	50.000	Mostistea	3339	standard	20.7	76.1	255.5
		lezer	4697	1358*	27.5	68.7	318.1
		F 475 M	<b>4857</b>	1518**	26.7	67.9	295.5
	70.000	Mostistea	3576	standard	21.5	74.9	243.7
		lezer	<b>5989</b>	2413***	21.1	67.7	327.3
		F 475 M	5032	1456*	29.1	66.9	291.3

<b>A III</b>	30.000	Mostistea	1634	standard	22.4	61.7	224.5
		lezer	<b>1855</b>	221	24.6	63.4	237.4
		F 475 M	1716	82	25.3	60.8	251.3
	50.000	Mostistea	1708	standard	20.9	61.7	241.8
		lezer	<b>1894</b>	186	22.8	63.7	249.6
		F 475 M	1812	104	25.1	61.9	245.5
	70.000	Mostistea	1769	standard	24.3	62.8	229.4
		lezer	<b>1967</b>	198	21.5	65.4	236.7
		F 475 M	1732	-37	22.4	63.8	227.1

DL 5%= 1114 kg, DL 1%= 1493, DL 0.1%= 1971 kg

The lezer hybrid registered statistically assured increase in production for the 30.000 and 50.000 plants/ha densities within limits of 1210-1545 kg/ha compared to Mostistea hybrid. In addition, for the second sowing period the same hybrid registered a very significant yield increase of 2413 kg/ha at 70.000 plants/ha compared to Mostistea hybrid. The F 475 M hybrid registered statistically assured yield increase compared to Mostistea for all the plant densities but for different periods – for the early period, at 30.000 plants/ha (+1614 kg/ha), second period, at 50.000 plants/ha (+1518 kg/ha) and at 70.000 plants/ha (+1456 kg/ha).

For the third sowing period, there were not registered statistically assured results between hybrids and densities, which suggest that delaying the sowing date uniformed the yield capacity in the climatic conditions of 2014.

**Table 5**

**Yields vs. sowing period (A)**

Factor A	Average yield	Difference and significance		
A I	3581	standard	-945***	1794***
A II	4526	945***	<b>standard</b>	2739***
A III	1787	-1794***	-2739***	standard

DL 5%=124 kg, DL 1%=205, DL 0.1%=384 kg

The best results were registered when corn was established at the middle of the month of April. At the second sowing date, the yield was significantly higher than the other two sowing dates - 945 and respectively 2739 kg/ha. Seeding at the early period determined a very significant yield increase (1794 kg/ha) related to the third period.

**Table 6**

**Yield vs. density (B)**

FACTOR B Plants/ha	Average yield	Difference and significance		
30.000	3183	standard1	76	-423
50.000	3107	-76	standard2	-499°
<b>70.000</b>	3605	423	499*	<b>standard3</b>

DL 5%=477 kg, DL 1%=669, DL 0.1%=945 kg

The yield for the crop established at 70.000 de plants/ha was superior to the yields registered at the other densities, but only the difference between 70.000 and 50.000 plants/ha was statistically assured, the decrease of 499 kg/ha being significant.

**Table 7**

**Yield vs. hybrid (C)**

FACTOR C	Average yield (kg/ha)	Difference to the standard1	Difference to the standard2	Difference to the standard3	Difference to the average of the factor C
MOSTISTEA	2680	standard	-1057***	-798***	-618**
IEZER	3737	1057***	standard	259	439*
F 475	3478	798***	-259	standard	180
Average	3298				standard

DL 5%=372 kg, DL 1%=498, DL 0.1%=657 kg

The Mostistea hybrid registered inferior results then the other hybrids and the average. The lezer hybrid was superior to the Mostistea hybrid and to the average with a statistically assured increase, while the F475 M hybrid was superior only to the Mostistea hybrid.

**CONCLUSIONS**

**For the sunflower crop**, by analyzing the behavior of the hybrid x density x sowing period, none of the hybrids performed, differences in yields not being statistically assured. The analysis of the results considering each one of the involved factors is showing that the early sowing determined a yield increase of de 826 kg/ha related to the second sowing period, not statistically assured.

When the sunflower was established within the third period, the yield was distinctly statistically lower compared to the crop established within the early period and significantly reduced compared to the crop established within the second period (optimum).

The plant densities 50.000 and 70.000 plants/ha were net superior to the 30.000 plants/ha density, but the yield differences between 50.000 and 70.000 plants/ha were practically inexistent.

For the 2014 conditions, the most productive hybrid was F708, but there were not registered statistically assured differences according to the hybrids.

**For the corn crop**, the lezer hybrid registered statistically assured increase in production for the 30.000 and 50.000 plants/ha densities within limits of 1210-1545 kg/ha compared to Mostistea hybrid. In addition, for the second sowing period the same hybrid registered a very significant yield increase of 2413 kg/ha at 70.000 plants/ha compared to Mostistea hybrid.

The F 475 M hybrid registered statistically assured yield increase compared to Mostistea for all the plant densities but for different periods – for the early period, at 30.000 plants/ha (+1614 kg/ha), second period, at 50.000 plants/ha (+1518 kg/ha) and at 70.000 plants/ha (+1456 kg/ha).

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