

PRECIPITATION INFLUENCE ON EDIBLE OIL PRODUCTION FROM SUNFLOWER CROP IN CROATIA

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Introduction

Sunflower (*Helianthus annuus* L.) is the most important field crop for edible oil production in Croatia. However, growing area of sunflower (2.6% of arable land capacities in 2003) is inadequate for national need of consume oil. Significant increase of sunflower yields as well as harvested areas is connected with hybrid introducing in production 80's of the last century (Krizmanić *et al.*, 2004). Sunflower growing area in Croatia is mostly distributed in the eastern part of the Pannonian region (the eastern Croatia) mainly because of more favorable precipitation regime in comparison with the remaining part of the country. Sunflower is suitable crop for a semiarid climate considering crop yield and water-use efficiency (Anderson *et al.*, 2003), which has ability to deplete water from deeper soil depths (Stone *et al.*, 2002). Aim of this study was elaboration of precipitation influence on sunflower yields in Croatia.

Methods

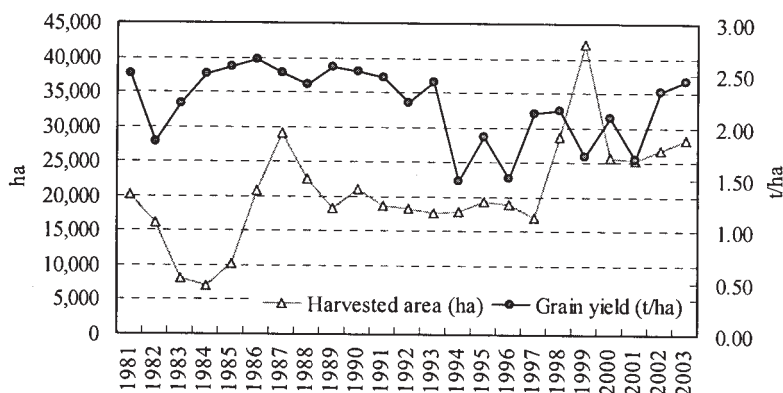
In this study, data of the State Bureau for Statistics (1981-2003) and internal data of the state farms "Belje" d.d. and "Hana" Našice were used as the source of harvested areas and grain yields data. Later data were not available due to restructure of state farms. The precipitation data for Beli Manastir were provided from the meteorological station Brestovac ("Belje" d.d.), and for Našice from the meteorological station Koška (1981-1990), and Lila (1996-2003).

Until end of 1992 the eastern Croatia region was territorially divided in 14 municipalities of total area 11090 km². Since 1992, according to the new territorial division, the eastern Croatia includes five counties (c) of total area 12452 km²: Virovitica-Podravina (VPc), Požega-Slavonia (PSc), Brod-Posavina (BPc), Osijek-Baranya (OBc) and Vukovar-Sirmium (VSc).

Results and discussion

Eastern Croatia has very favorable agroecological conditions for sunflower growing, where is placed over 99% of sunflower production in the Republic Croatia. Sunflower harvested areas as well as grain yields had a large variation during the analyzed years (Figure 1).

Figure 1. Sunflower harvested areas and grain yields in the Republic of Croatia



By comparison of 5-year data, sunflower areas increasing continually (Table 1 and 2). In the municipality Beli Manastir are sown the largest areas of sunflower: 18.8% (1981-85), and 16.4% (1986-90). After forming of counties, the largest areas under sunflower were in Osijek-Baranya county: 56.9% (1996-00), and 53.5% (2001-03).

Table 1. Sunflower harvested areas and grain yields, 1981-1990

Sunflower harvested areas (SHA in ha) and yields (t/ha) in the region eastern Croatia, four municipalities of the region (Beli Manastir =BM, Osijek =OS, Đakovo =ĐA and Našice =NA: % = share of SHA in the region) and two state farms (Belje in BM and Hana in NA: % = share of SHA in municipality)														
Year	Eastern Croatia		Municipality of the eastern Croatia								State farm			
			BM		OS		ĐA		NA		Belje		Hana	
	ha	t/ha	%	t/h a	%	t/h a	%	t/h a	%	t/ha	%	t/h a		
1981	19962	2.5	17.0	3.0	13.1	2.8	18.8	2.1	14.5	2.5	76.1	3.1	37.8	3.1
1982	15795	1.9	16.7	2.5	15.2	2.3	16.2	1.5	14.6	1.7	71.1	2.5	36.5	1.7
1983	8108	2.2	19.4	2.7	19.6	2.8	11.8	1.9	16.2	1.7	92.9	2.7	45.8	1.8
1984	6982	2.5	22.1	3.0	21.6	2.7	11.3	2.3	16.7	2.3	99.0	3.1	43.6	2.7
1985	10162	2.6	22.7	3.1	18.0	2.8	10.2	2.5	14.7	2.2	75.7	3.2	47.2	2.3
Mean	12202	2.3	18.8	2.9	16.3	2.6	14.9	2.0	15.0	2.1	80.8	2.9	40.9	2.4
1986	20718	2.7	19.2	2.9	14.4	3.1	14.7	2.8	10.2	2.6	57.0	3.0	25.4	2.7
1987	28934	2.5	17.5	1.8	13.3	3.0	14.2	2.8	9.1	2.5	58.8	2.0	23.3	2.8
1988	22119	2.4	13.8	2.6	15.6	2.7	13.0	2.7	9.3	2.2	71.9	2.9	39.6	2.6
1989	18143	2.6	15.3	2.6	14.5	2.8	14.0	2.6	6.4	2.3	58.5	2.4	44.8	2.4
1990	20588	2.6	15.9	2.5	9.9	2.8	15.6	2.1	7.7	2.8	55.7	2.7	33.4	3.1
Mean	22100	2.5	16.4	2.4	13.5	2.9	14.3	2.6	8.6	2.5	60.0	2.6	31.6	2.7

Table 2. Sunflower harvested areas and grain yields, 1996-2003

Sunflower harvested areas (SHA in ha) and grain yields (t/ha) in Croatia and five counties* of the eastern Croatia (% = share of SHA in Croatia)												
Year	Croatia		VPc		PSc		BPc		OBc		VSc	
	ha	t/ha	%	t/ha	%	t/ha	%	t/ha	%	t/ha	%	t/ha
1996	18849	1.5	11.3	1.3	2.6	1.8	3.4	1.7	57.7	1.5	24.9	1.6
1997	16946	2.1	9.4	2.1	0.1	1.3	7.8	2.2	60.9	2.1	21.6	2.2
1998	28642	2.2	6.8	2.0	0.4	2.2	4.2	2.4	58.6	2.2	29.4	2.2
1999	41996	1.7	6.9	1.3	0.3	1.5	5.3	1.9	53.9	1.7	33.1	1.9
2000	25715	2.1	5.2	1.3	0.5	2.6	6.7	1.9	56.9	2.1	30.1	2.3
Mean	26430	1.9	7.5	1.6	0.6	1.9	5.4	2.0	56.9	1.9	29.1	2.0
2001	25336	1.7	5.2	1.3	0.3	1.9	6.4	1.8	55.2	1.7	32.3	1.7
2002	26835	2.4	4.8	1.9	0.4	2.3	4.7	2.2	54.0	2.4	35.5	2.3
2003	28211	2.5	5.3	1.5	0.8	2.0	4.7	2.0	51.6	2.5	36.8	2.6
Mean	26794	2.2	5.1	1.6	0.5	2.1	5.3	1.9	53.5	2.2	35.0	2.2

* the counties: VP (Virovitica-Podravina), PS (Požega-Slavonia), BP (Brod-Posavina), OB (Osijek-Baranya) and VS (Vukovar-Sirmium)

The largest grain yields were recorded in the period 1986-90 (2.55 t/ha), then 1981-85 (2.31 t/ha), and the smallest 1996-2000 (1.91 t/ha). Certainly, reasons for this were level of investment in sunflower production and crop management, which were in last years on significantly lower level in comparison with the period 1981-1990. Soil fertility decreasing from east to west (Janeković, 1971), and therefore greater grain yields 1981-90 were realized in the eastern part (Osijek 2.77, Beli Manastir 2.64 t/ha) than in the west part (Đakovo 2.26, Našice 2.28 t/ha). In favorable years for sunflower production (1985, 1986 and 1989), average grain yield was 2.60 t/ha, while in unfavorable years (1996, 1999 and 2001) 1.64 t/ha or 37% less.

Table 3. Precipitations in Beli Manastir and Našice

Beli Manastir								Našice							
Year	VI	VII	VIII	Year	VI	VII	VIII	Year	VI	VII	VIII	Year	VI	VII	VIII
1981	165	33	41	1996	23	84	47	1981	131	41	53	1996	33	80	128
1982	109	62	60	1997	107	101	43	1982	95	98	97	1997	149	142	52
1983	68	40	32	1998	32	94	65	1983	71	20	66	1998	66	74	106
1984	64	27	48	1999	155	92	33	1984	83	43	48	1999	182	113	69
1985	102	59	50	2000	66	41	6	1985	136	35	94	2000	44	64	10
Mean	102	44	46	Mean	77	82	39	Mean	103	47	71	Mean	95	95	73
1986	77	42	63	2001	184	88	18	1986	69	125	74	2001	308	62	25
1987	72	43	47	2002	49	61	111	1987	98	35	29	2002	43	62	122
1988	60	36	12	2003	19	60	23	1988	58	50	35	2003	38	57	39
1989	90	35	73	Mean	84	70	51	1989	92	51	100	Mean	130	60	62
1990	50	45	54					1990	52	76	21				
Mean	70	40	50					Mean	74	67	52				

On sunflower production a great influence have climatic factors, and specially amount and distribution of precipitation during the vegetation period (Borbely *et al.*, 2005; Krausko and Krauskova, 1995).

In the analyzed period, on the level of Croatia, lower grain yields were realized 2001, 1999 and 1982 (1.70, 1.72 and 1.85 t/ha). In these years for VI-VIII month (Table 3), were recorded

the largest amounts of precipitation for Beli Manastir (290, 280 and 231 mm) and Našice (395, 364 and 289 mm). This is confirmation that wet years have unfavorable influence on sunflower production. Namely, wet years are favorable for diseases development, that can significantly reduce sunflower grain yields and quality (Szabo and Pepo, 2005; Mercau *et al.*, 2001; Chuprina *et al.*, 1998).

Negative influence of precipitation surplus on sunflower yields also confirm data of some state farms. Low grain yields were recorded at "Belje" d.d. 1982, 1989 and 1987, by precipitation amounts of 231, 198 and 162 mm for VI-VIII month, and in "Hana" Našice 1982, 1985 and 1989, by precipitation of 289, 264 and 243 mm.

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