

STUDY REGARDING THE WEEDS INFLUENCE ON WATER USE EFFICIENCY IN MAIZE CROP FROM CRIȘURILOR PLAIN

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Abstract.

The paper is based on the researches carried out during 2005-2007 on the preluvosoil from Agricultural Research and Development Station Oradea. The weeds determined the yield losses between 43,1% and 85,8% in unirrigated conditions and between 45,2% and 79% in irrigated conditions. The weeds determined the decrease of the water use efficiency with 42-86,3% in unirrigated conditions and with 44-79,3% in irrigated conditions. All the years the weeds determined the decrease of the irrigation water use efficiency; the biggest difference between the weeding variant and the variant without weeds was registered in 2007, -70,4%.

Key words: maize, weeds, water consumption, yield, water use efficiency, irrigation water use efficiency

INTRODUCTION

Now, but especially in the future, the agriculture gives the big importance all of the factors with contributions in the yield increase: dynamics factors – hybrid, fertilizers, water etc. – and in the same time and so much for factors of the crop protection against the pathogens, pests and weed, because these factors can produce large damage and decrease of the yield quality.

The researches data emphasized that in the maize crop from Crisurilor Plain, the weeds can produce the yield losses of 30 – 80% or more and a decrease of the yield quality (Ciobanu Cornelia, 2007). One of consequence of these losses is very big water consumption of the weeds due the roots system more profound and developed.(Domuța C., 2005) and the paper studied the influence of the weeds on water use efficiency in unirrigated and irrigated maize.

MATERIALS AND METHODS

The experiment was placed on the preluvosoil from Agricultural Research and Development Station Oradea during 2005-2007. The surface of the experiment block = 30 m²; number of repetition = 4. Placed method = plot subdivided.

The preluvosoil from research field is low acid, the humus content is low, too, and the phosphorus content is moderate. The bulk density on the ploughing land indicates a low settled soil land strong settled on the

irrigation depth (0-75 cm). Wilting point and field capacity have the median values on the irrigation depth.

Plants water consumption was determined directly, based on the method of the water balance in the soil on 0-150 cm, In the irrigated variant, the moisture control ten to ten days assured to maintain the soil water reserve on 0-75 cm between easily available water content and field capacity.

Water use efficiency was calculated like ratio between yield and water consumption and irrigation water use efficiency was calculated like ratio between yield gain obtained using the irrigation and irrigation rate used for maintaining the soil water reserve on irrigation depth between easily available water content and field capacity.

The main weeds from maize crop from research field were: *Amaranthus retroflexus*, *Chenopodium album*, *Setaria glauca*, *Echinichloa crus-galli*, *Digitaria sanguinalis*, *Cirsium arvense*, *Galinsoga parviflora*.

RESULTS AND DISCUSSIONS

The influence of the weeds on maize yield

In the year 2005, in unirrigated conditions, the weeds determined a yield loss of 54% (52,26 q/ha vs 113,6 q/ha). The yield losses from the irrigated variant were 49% (63,8 q/ha vs 130,2 q/ha). Irrigation determined a yield gain very significant statistically. (table 1)

Table 1

The influence of the weeds on yield in unirrigated and irrigated maize, Oradea 2005

Water regime	Variant				Average on the regime
	Herbicide, without weeds		With weeds, Without herbicides		
	q/ha	%	q/ha	%	
Unirrigated	113,6	100	52,26	46,0	82,93 ^{Mt}
Irrigated	130,2	100	63,80	49,0	97,00 ^{ooo}
Average on the variant with and without weeds	121,9 ^{Mt}	100	58,03 ^{ooo}	47,6	-

Water regime		with and without weeds	With and without weeds x Water regime	Water regime x With and without weeds
DL _{5%}	3,6	1,9	3,1	2,9
DL _{1%}	5,2	3,2	4,9	3,7
DL _{0,1%}	7,9	5,1	6,8	5,8

The yield losses determined by the weeds in 2006 in the unirrigated variant were 46,9% (49,22 q/ha vs. 114,2 q/ha) and 44,8% (62,64 q/ha vs. 138,6 q/ha) in the irrigated variant. The yield gains determined by the irrigation use were very significant statistically. (table 2.)

Table 2

The influence of the weeds on yield in unirrigated and irrigated maize, Oradea 2006

Water regime	Variant				Average on the regim
	Herbiced, without weeds		With weeds, Without herbicides		
	q/ha	%	q/ha	%	
Unirrigated	114,2	100	49,22	43,1	81,71 ^{Mt}
Irrigated	138,6	100	62,64	45,2	100,62 ^{***}
Average on the variant with and without weeds	126,4 ^{Mt}	100	55,93 ^{ooo}		-

Water regime		with and without weeds	With and without weeds x Water regime	Water regime x With and without weeds
DL _{5%}	4,1	2,7	3,9	3,8
DL _{1%}	5,9	4,2	5,2	4,6
DL _{0,1%}	9,8	6,8	7,9	6,4

The biggest yield losses from the studied period were registered in 2007, 85,8% (9,6 q/ha vs. 67,2 q/ha) in unirrigated conditions and 79% (25,4 q/ha vs. 120,8 q/ha) in irrigated variant. Irrigation determined yields gains very significant statistically, too. (table 3)

Table 3

The influence of the weeds on yield in unirrigated and irrigated maize, Oradea 2007

Water regime	Variant				Average on the regim
	Herbiced, without weeds		With weeds, Without herbicides		
	q/ha	%	q/ha	%	
Unirrigated	67,2	100	9,6	14,2	38,4
Irrigated	120,8	100	25,4	21,0	73,1
Average on the variant with and without weeds	94,0	100	17,5	18,6	-

Water regime		with and without weeds	With and without weeds x Water regime	Water regime x With and without weeds
DL _{5%}	3,1	2,1	2,9	2,4
DL _{1%}	5,3	3,3	4,8	3,9
DL _{0,1%}	7,9	5,8	6,7	5,6

The influence of the weeds on total water consumption

In the unirrigated variant with weeds, total water consumption had bigger values than in the variant without weeds, 6073 m³/ha vs 5983 m³/ha in 2005, 5490 m³/ha vs. 5372 m³/ha in 2006 and 4502 m³/ha vs. 4402 m³/ha in 2007. The same situation were registered in irrigated variant. The explanation consists of the bigger water quantity used from soil water reserve (table 4)

Irrigation determined the increase of the total water consumption both in the variant with weeds and without weeds; the differences registered

in comparison with unirrigated variant were of 10 and 11% in 2005, 23% in 2006, 65 and 67% in 2007. The participation of the irrigation in the covering sources of the optimum total water consumption was of 11% and 12% in 2005, of 17% in 2006 and of 40% in 2007. (table 4)

Table 4

Total water consumption and covering sources in the variant with and without weeds in the maize crop, Oradea 2005-2007

Variant	Water regime	$\Sigma (e + t)$		Covering sources					
		m ³ /ha	%	R _i -R _f		P _v		Σm	
				m ³ /ha	%	m ³ /ha	%	m ³ /ha	%
2005									
With weeds	Unirrigated	6073	100	1880	31	4193	69	-	-
	Irrigated	6703	110	1760	26	4193	63	750	11
Without weeds	Unirrigated	5983	100	1790	30	4193	70	-	-
	Irrigated	6613	111	1670	25	4193	63	750	12
2006									
With weeds	Unirrigated	5490	100	1940	35	3550	65	-	-
	Irrigated	6760	123	2050	30	3550	53	1160	17
Without weeds	Unirrigated	5372	100	1822	34	3550	66	-	-
	Irrigated	6615	123	1905	29	3550	54	1160	17
2007									
With weeds	Unirrigated	4502	100	690	15	3812	85	-	-
	Irrigated	7442	165	680	9	3812	51	2950	40
Without weeds	Unirrigated	4402	100	590	13	3812	87	-	-
	Irrigated	7342	167	580	8	3812	52	2950	40

$\Sigma (e + t)$ = total water consumption

R_i-R_f = soil reserve (initial reserve – final reserve)

P_v = rainfall during the maize vegetation period

Σm = irrigation rate

The influence of the weeds on water use efficiency (WUE)

The weeds determined a very big decrease of the water use efficiency both in unirrigated and in irrigated conditions.

In the year 2005, the weeds determined a decrease of the water use efficiency with 55% (0,86 kg/m³ vs. 1,90 kg/m³) in unirrigated conditions and with 52% (0,95 kg/m³ vs. 1,97 kg/m³) in irrigated conditions. (table 5).

The values of the decreases registered in the year 2006 are bigger than the values registered in 2005: -58% (0,90 kg/m³ vs. 2,13 kg/m³) in unirrigated conditions and -56% (0,93 kg/m³ vs. 2,09 kg/m³) in irrigated conditions.

The biggest differences between water use efficiency in the variant with and without weed were registered in 2007. In irrigated conditions, the difference was of -86,3% (0,21 kg/m³ vs. 1,53 kg/m³) and in irrigated

conditions the difference was of -79,3% (0,34 kg/m³ vs. 1,64 kg/m³). (table 5)

Table 5

The influence of the weeds on water use efficiency (WUE) in maize, Oradea 2005-2007

Water regime	Variant	WUE		Difference
		Kg/m ³	%	%
2005				
Unirrigated	Without weeds	1,90	100	-
	With weeds	0,86	45	-55
Irrigated	Without weeds	1,97	100	-
	With weeds	0,95	48	-52
2006				
Unirrigated	Without weeds	2,13	100	-
	With weeds	0,90	42	-58
Irrigated	Without weeds	2,09	100	-
	With weeds	0,93	44	-56
2007				
Unirrigated	Without weeds	1,53	100	-
	With weeds	0,21	13,7	-86,3
Irrigated	Without weeds	1,64	100	-
	With weeds	0,34	20,7	-79,3

The influence of the weeds on irrigation water use efficiency (IWUE)

The weeds determined to obtain the smaller values of the irrigation water use efficiency, the yield gain obtained for every 1 m³ of irrigation water was smaller in the variant with weeds in comparison with the value obtained in the variant without weeds. The differences between the irrigation water use efficiency in the variant with weeds and without weeds were of -30,3% (1,54 kg yield gain/m³ vs. 2,21 kg yield gain/m³) in 2005, of -49,1% (1,07 kg yield gain/m³ vs. 2,10 kg yield gain/m³) in 2006 and of -70,4% (0,54 kg yield gain/m³ vs 1,82 kg yield gain/m³) in 2007. (table 6)

Table 6

The influence of the weeds on irrigation water use efficiency (IWUE) in maize, Oradea

2005-2007

Variant	IWUE		Difference	
	Kg yield gain/m ³	%	Kg yield gain/m ³	%
2005				
Without weeds	2,21	100	-	-
With weeds	1,54	69,7	-0,67	-30,3
2006				
Without weeds	2,10	100	-	-
With weeds	1,07	50,9	-1,03	- 49,1
2007				
Without weeds	1,82	100	-	-
With weeds	0,54	29,6	-1,28	- 70,4

CONCLUSIONS

The influence of the weeds on water use efficiency in maize crop was studied in an experiment carried out in Oradea during 2005-2007 on a preluvosoil and the following conclusions were formulated:

- the weeds (*Amaranthus retroflexus*, *Chenopodium album*, *Setaria glauca*, *Echinichloa crus-galli*, *Digitaria sanguinalis*, *Cirsium arvense*, *Galinsoga parviflora*) determined the yield losses between 43,1% (2006) and 85,8% (2007) in unirrigated conditions and between 45,2% (2006) and 79% (2007) in irrigated conditions; all the losses were very significant statistically;
- the presence of the weeds in the maize crop determined to use a bigger quantity of water from soil water reserve and the increase of the total water consumption in comparison with the variant without weeds;
- the weeds determined the decrease of the water use efficiency both in unirrigated conditions (variation interval 42-86,3%) and in irrigated conditions (variation interval 44-79,3%);
- irrigation water use efficiency had smaller values in the variant with weeds in all three years studied; the differences in comparison with the variant without weeds were of -30,3% in 2005, of -49,1% in 2006 and of -70,4% in 2007.

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