

RESEARCHES REGARDING THE INFLUENCE OF CROP ROTATION AND IRRIGATION ON SOME INDICATORS OF THE WHEAT YIELD QUALITY IN THE CONDITIONS OF THE CRIȘURILOR PLAIN

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Abstract

The paper sustain the importance of the crop rotation on quality of the wheat yield and is based on the results carried out during 2009-2010 in a long term trial out placed on the preluvosoil from Oradea in 1990. Both in nonirrigated and irrigated conditions the smallest values of the protein, wet gluten and dry gluten were obtained in wheat monocrop; the values increased in the crop rotation wheat maize and the biggest values were registered bin the crop rotation wheat –maize-soybean.

Key words: crop rotation, irrigated, nonirrigated, water regime, protein, wet gluten, dry gluten.

INTRODUCTION

The quality of the yield is influenced by many factors. Protein accumulation in the grains is influenced by wheat variety, cultivar, climate conditions, natural fertility of the soil, the used nitrogen doses, and irrigation (Oproiu, Cernescu, 1970; Dincă, 1971; Hera, 1986; Muntean et al, 2008; Ardelean, 2006). Gluten content of the wheat grain is influenced first of all by climate conditions (Bandici,1997; Bandici, Domuța, Ardelean, 2003).

The influence of the crop rotation and irrigation on the protein and gluten content is presented in the paper (Austin 1978; Bingham, 1980; Hera, 1986a,b; Zăhan, Zăhan, 1989; Domuța, 2005, Domuța et al., 2007, 2008, 2009).

MATERIAL AND METHODS

The paper is based on the research obtained in the long term trial with crop rotation on preluvosoil conducted at the Agricultural Researches and Development Station (A.R.D.S.) Oradea, Romania in 1990. On ploughing depth, the soil is low acid (pH=6.8), the humus content is low (1.75 %), phosphorus (22.0 ppm) and potassium (845.4 ppm) have medium values; the macroagregates hydrostability is high and bulk density (1.44 g/cm³) is high, too. The experiment device includes:

FACTOR A: crop rotation

a₁ = wheat, monocrop;

a₂ = wheat – maize;

a₃ = wheat – maize - soybean;

FACTOR B : water regime

b₁ = nonirrigated;

b₂ = irrigated

The surface of the experimental plot = 50 m². Number of repetition = 4, Place methods = blocks method. Cultivar used: *Dropia*.

In the irrigated variant, the soil water reserve on 0-50 cm was maintained between easily available water content and field capacity determining the soil moisture every fifteen days and using irrigation when the situation required it (Domuța, 2005).

Wet gluten and dry gluten were determined by usual methods.

Gross protein was determined using the following formula: Nt x 5.7; when Nt = total nitrogen.

RESULTS AND DISCUSSION

Both nonirrigated conditions and crop rotations influenced the protein content of the wheat yield. There were specific situations for every year studied.

The protein content of the wheat grains determined in the wheat – monocrop in 2009 was of 9.1 % in nonirrigated conditions and of 9.0 % in irrigated conditions. The values determined in the wheat–maize crop rotation, 11.0 % and 10.9 %, were significant statistically, being bigger than values from wheat monocrop. The highest values of protein content were registered in the wheat– maize– soybean crop rotation, i.e. 3.8 % and 13.7 %; the differences in comparison with monocrop, 4.7 % both in nonirrigated and irrigated conditions, are very significant statistically.

In the year 2010, the lowest values of protein content were also registered in the wheat monocrop: 7.1 % in nonirrigated and 6.9 % in irrigated conditions. In the wheat-maize crop rotation the values increased by 45 % and 46 % and in the wheat-maize-soybean crop rotation by 73 % in nonirrigated and, respectively, 77 % in irrigated conditions.

On average in the researched period, the lowest values of the protein content in the wheat grains were registered in monocrop, 7.98 % in nonirrigated and 7.73 % in irrigated conditions. The values of the protein content (10.7 % and 10.45 %) significantly increased in the wheat-maize crop rotation in comparison with the monocrop. The highest values of the protein content were obtained in the wheat-maize-soybean crop rotation, 13.02 % in nonirrigated and 12.93 % in irrigated conditions (table 1).

Table 1

Influence of crop rotation and irrigation on protein content of the wheat grains,
Oradea 2009-2010

Crop rotation	Water regim				Average on the crop rotation
	Nonirrigated		Irrigated		
	Protein				
	%	%	%	%	
1.Wheat - monocrop	7.98	100	7.73	100	7.86 ^{Mt}
2.Wheat – maize	10.7	135	10.45	135	10.56 ^{**}
3.Wheat-maize - soybean	13.02	164	12.93	167	12.98 ^{***}
4.Average on the water regim	10.27 ^{Mt}	100	9.73	98.1	-
	Crop rotation	Water regim	Water regim x Crop rotation	Crop rotation x Water regim	
LSD 5 %	1.17	0.73	1.4	1.43	
LSD 1 %	2.16	1.46	2.6	2.73	
LSD 0,1 %	3.96	2.96	4.8	4.43	

Crop rotation strongly influenced the wet gluten content of the wheat grain. Every year the lowest contents were obtained in wheat monocrop, both in nonirrigated and irrigated conditions.

The year 2009 was the year with the biggest drought and, consequently, the values of the gluten were the highest. In wheat monocrop, the values of the gluten were of 22.6 % in nonirrigated conditions and 21.9 % in irrigated conditions. The values registered in the wheat-maize crop rotation (29.9 % and 29.0%) and in the wheat-maize-soybean crop rotation (36.1 % and 33.8%) were very significant statistically, higher than the values registered in the wheat – monocrop (table 1).

The values of wet gluten content registered in 2009 in wheat monocrop were of 20.4 % in nonirrigated conditions and 19.6 % in irrigated conditions. There were very significant differences in the wheat-maize and wheat-maize-soybean crop rotation; the relative differences were of 36% and 61 % in nonirrigated conditions and 38 % and 63 % in irrigated conditions. The highest values of wet gluten were registered this year of all the studied period.

In 2010 in wheat-monocrop, the wet gluten content in grains was of 21.3 % in nonirrigated conditions and 21 % in irrigated conditions. The differences registered in the wheat-maize and wheat-maize-soybean crop rotation were very significant statistically, 31 % and 61 % in nonirrigated conditions, 30 % and 57 % in irrigated conditions, respectively.

In the year 2010, the lowest values of the wet gluten were registered in the wheat monocrop, 19.9 % in nonirrigated conditions and 19.5 % in irrigated ones; in the wheat-maize crop rotation the values increased by 36 % and 37 % while in the wheat-maize-soybean crop rotation by 59 % and 62 %.

The average data of the period 2009-2010 show that the lowest content of the grain wet gluten was registered in monocrop. Very statistically significant differences were registered in wheat-maize and

wheat-maize-soybean crop rotation in comparison with wheat-monocrop: 34% and 60 % in nonirrigated conditions, 34 % and 55 % in irrigated conditions, respectively (table 2).

Table 2

Influence of crop rotation and irrigation on wet gluten content of the wheat grains, Oradea 2009-2010

Crop rotation	Water regim				Average on the crop rotation
	Nonirrigated		Irrigated		
	Wet gluten				
	%	%	%	%	
1.Wheat - monocrop	21.1	100	20.5	100	20.8 ^{Mt}
2.Wheat – maize	28.2	134	27.5	134	27.85 ^{***}
3.Wheat-maize - soybean	33.7	160	32.6	159	33.15 ^{***}
4.Average on the water regim	27.7 ^{Mt}	100	26.9	96.9	-
	Crop rotation	Water regim	Water regim x Crop rotation	Crop rotation x Water regim	
LSD 5 %	1.42	0.75	1.70	1.63	
LSD 1 %	2.40	1.45	3.03	2.96	
LSD 0,1 %	4.46	3.41	5.24	5.05	

In 2009 the values of the dry gluten content in wheat grains for monocrop were of 10.8% in nonirrigated and 10.3% in irrigated conditions. The differences registered in wheat-maize crop rotation were significant statistically, 19% in nonirrigated conditions and 17.0% in irrigated ones. Significant values were distinguished in the wheat-maize-soybean crop rotation: 35% in nonirrigated and 39 % in irrigated conditions (table 2).

The dry gluten content of the wheat grains in 2010 in the monocrop was of 9.8% in nonirrigated conditions and 9.3% in irrigated conditions. The differences registered in wheat-monocrop and in the wheat-maize-soybean crop rotation have similar statistical significance with the differences registered in 2009: the highest values, 13.7% in nonirrigated conditions and 13.0% in irrigated conditions, were registered in wheat-maize-soybean crop rotation (table 3).

In 2010, the smallest values of the dry gluten were registered in wheat-monocrop, as well: 10.2 % in irrigated conditions and 9.4 % in irrigated conditions. A similar situation with 2009 regarding statistically significant differences in comparison with wheat monocrop was also registered in 2010. The highest values of the dry gluten, 14.0 % in nonirrigated conditions and 13.3 % in irrigated conditions, were registered in the wheat-maize-soybean crop rotation.

In the year 2010, the lowest values of the dry gluten were registered in the wheat – monocrop, 9.5 % in nonirrigated conditions and 9.3 % in irrigated conditions. In the wheat-maize crop rotation the values of the dry gluten increased by 23.0 % both in irrigated and nonirrigated conditions while in the wheat-maize-soybean crop rotation they increased by 38.0 % and 39.0 %, respectively.

On average, in the studied period, the values of the dry gluten content of the wheat grains from monocrop were of 10.01 % in nonirrigated conditions and 9.58 % in irrigated conditions. The values registered both in wheat-maize crop rotation (12.20 % and 11.53 %) and in the wheat-maize-soybean crop rotation (13.88 % and 13.38 %) were statistically higher in comparison with the values registered in wheat-monocrop. (table 3).

Table 3

Influence of crop rotation and irrigation on dry gluten content of the wheat grains, Oradea 2009-2010

Crop rotation	Water regim				Average on the crop rotation
	Nonirrigated		Irrigated		
	Protein				
	%	%	%	%	
1.Wheat - monocrop	10.01	100	9.58	100	9.80 ^{Mt}
2.Wheat – maize	12.20	122	11.53	120	11.87
3.Wheat-maize - soybean	13.88	139	13.38	140	13.59
4.Average on the water regim	12.03 ^{Mt}	100	11.49	95.6	-
	Crop rotation	Water regim	Water regim x Crop rotation	Crop rotation x Water regim	
LSD 5 %	0,91	0.65	1.18	1.14	
LSD 1 %	1.56	1.16	2.12	1.90	
LSD 0,1 %	2.49	2.14	3.95	3.48	

CONCLUSIONS

- The results obtained in a long term trial (1990-2010) emphasized the importance of the crop rotation in the protein, wet gluten and dry gluten of the yield wheat;

- During 2009-2010 the lowest values of the protein, wet gluten and dry gluten were obtained in wheat monocrop, both in nonirrigated and irrigated conditions;

- In comparison with wheat monocrop, in the wheat-maize crop rotation the differences very significant statistically in comparison with the wheat monocrop were registered every year in the wheat-maize-soybean crop rotation in all three parameters of the wheat yield quality analysed;

- Irrigation determined to obtain smaller values of the protein, wet and dry gluten in the wheat grains in comparison with nonirrigated variants from all the croprotations.

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