STUDIES REGARDING THE INFLUENCE OF CROP ROTATION AND WATER REGIM ON PROTEIN, WET GLUTEN UND DRY GLUTEN CONTENT OF THE WHEAT GRAINS CULTIVATED ON LUVOSOILS

Ardelean Ileana, Bandici Gheorghe*

* University of Oradea, Faculty of Environmental Protection, 26 General Magheru St., 410048 Oradea,Romania, e-mail: ardeleanileana@gmail.com

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 2009-2011 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, water regime, monocrop, wheat grains, 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 type, cultivar, climate conditions, natural fertility of the soil, nitrogen doses used, irrigation (Oproiu, Cernescu, 1970; Dincă, 1971; Hera, 1986; Ardelean, 2006). Gluten content of the wheat grain is influenced first of all bz climate conditions (Bandici,1997; Bandici, Domuţa, Ardelean, 2003).

Usually, the level of protein from wheat grains is very important parameter of the yield, the protein content of the wheat grain can be 10-16% (Muntean L.S. et. all, 2008) but can have the limits of 4-25% (Hera Cr., 1986, Bandici Gh., 1997, Bandici et. all., 2003). Protein acumulation in the grains is influenced by wheat type, cultivar, climate conditions, natural fertility of the soil, nitrogen doses used, irrigatoin (Domuta C., 2005, Domuţa and all., 2007, 2008).

The paper analyses the crop rotation and irrigation influence on protein content of the wheat grain in the conditions of the moderate wet area of the Crisurilor Plain (Domuta C., et. All, 2009)

The production quality is a property connected to several physical and chemical characteristics of plants and confers a positive note to the applied agrotechnical measures, having in view the correlation of quality with the obtained production on a surface unit (Austin R.B., 1978,. Soltner D., 1990, Salisbury F.B., C.W. Ross., 1995).

The influence of the crop rotation and irrigation on the protein and gluten content is presented in the paper (Bingham 1980, Zăhan, Zăhan, 1989; Domuța, 2005).

MATERIAL AND METHODS

The paper is based on the research obtained in the long term trial with crop rotation placed in 1990 at Researche and Development Station (S.C.D.A.) Oradea, on luvosoil, during in period of years 2008-2011. On ploughing deth, the soil is low acid (pH=6.8), humus content s low (1.75 %), phosphorus (22.0 ppm) and potassium (845.4 ppm) have medium values; macroagregates hydrostability is high and bulk density (1.44 g/cm^3) is high, too. The experiment dispositive includes:

Factor A: crop rotation

a_1 = wheat, monocrop;

a_2 = wheat – maize;

a_3 = wheat – maize - soybean;

Factor B : water regime

b_1 = nonirrigated;

b_2 = irrigated

The surface of the experiment parcele = 50 m^2. Number of repetition = 4, Place methods = blocks method. Cultivar used: Dropia.

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

Dry gluten and wet gluten were determined by usually methods.

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

RESULTS AND DISCUSSION

Influence of crop rotation on protein content of the wheat grains. Both nonirrigated condotions, crop rotations influenced the protein content of the wheat yield. There were specifical situation for every year studied.

Protein content of the wheat grains determined in the wheat – monocrop in 2008 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 ststististically bigger than values from wheat monocrop. The biggest values of the protein content were registered in the wheat – maize- soybean crop rotation, 13.8 % and 13.7 %; the differences in comparison with monocrop, 4.7 % doth in nonirrigated and irrigated conditions is very significant statistically.

In the year 2011, the smallest values of the protein content were registered in the monocrop of wheat, too: 71 % in nonirrigated and 6.9 % in irrigated conditions. In the wheat-maize crop rotation the values increased with 45 % and 46 % and in the wheat-maize-soybean crop rotation with 73 % in nonirrigated and 77 % respectively.

In average on the researched period, the smallest values of the protein content of the wheat grains were registered in monocrop, 7.98 % in nonirrigated and 7.73 % in irrigated conditions. In the wheat-maize crop rotation the values of the protein content (10.7 % and 10.45 %) increased distingue significant in comparison with monocrop. The biggest values of the protein content was obtained in the wheat-maize-soybean crop rotation, 13.02 % in nonirrigated and 12.93 % in irrigated (table 1).

Table 1

Influence of crop rotation and irrigation on protein content of the wheat grains, Oradea 2008-2011

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	

Influence of crop rotation on wet gluet content of the wheat grains.

Crop rotation influenced very strong the wet gluten content of the wheat grain. Every year the smallest contents were obtained in wheat monocrop both nonirrigated and irrigated conditions.

The year 2008 was the year with thew biggest drught and values of the gluten were the biggest too. 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 bigger 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; relative differences were of 36% and 61 % in nonirrgated conditions and 38 % and 63 % in irrigated conditions. This

year were registered the biggest values of the wet gluten of the studied period.

In 2010 in wheat-monocrop, the content of the wet gluten fromgrains were of 21.3 % in nonirrigated conditions and 21 % in irrigated conditions. 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 2011, the smallest values of the wet gluten were registered in the wheat monocrop, 19.9 % in nonirrigated conditions and 19.5 % in irrigated conditions; in the wheat-maize crop rotation the values increased with 36 % and 37 % in the wheat-maize-soybean crop rotation with 59 % and 62 %.

The average data of the period 2008-2011 show that the smallest content of the grain wet gluten was registered in monocrop. In wheat-maize and wheat-maize-soybean crop rotation were registered the differences very significant statistically 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 2008-2011

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	

Influence of crop rotation and irrigation on dry gluten content of the wheat grains.

In 2008 the values of the dry gluten content from 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 nonirrigatedconditions and 17.0 % in irrigated conditions. In the wheat-maize-soybean crop rotation were distingue significant: 35 % in nonirrigated conditions and 39 % in irrigated conditions (table 2).

The dry gluten content of the wheat grains in 2009 in the monocrop were of 9.8 % in nonirrigated conditions and 9.3 % in irrigated conditions.

The statistically significant of the differences vs. wheat-monocrop registered in the wheat-maize-soybean crop rotation have similar statistically significant with the differences registered in 2003: significant and distingue significant; the biggest 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, too: 10.2 % in irrigated conditions and 9.4 % in irrigated conditions. A similar situation with 2003 regarding statistically significant of the differences in comparison wheat monocrop was registered in 2005, too. The biggest 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 2011, the smallest 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 increase with 23.0 % both irrigated and nonirrigated conditions and in the wheat-maize-soybean crop rotation with 38.0 % and 39.0 % respectively. In average on the studied period, the values of the dry gluten content of the grains wheat from monocrop were of 10.01 % in nonirrigated conditions and 9.58 % in irrigated conditions.The values, registered in wheat-maize crop rotation were significant statistically bigger: (12.20 % and 11.53 %) and in the wheat-maize-soybean crop rotation were registered the biggest values (13.88 % and 13.38 %) and differences distingue significant in comparison with wheat-monocrop. (table 3).

Table 3

Influence of crop rotation and irrigation on dry gluten content of the wheat grains, Oradea 2008-2011

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 (1990-2011) emphasized the importance of the crop rotation in the protein, wet gluten and dry gluten of the yield wheat.

During 2008-2011 both nonirrigated and irrigated conditions the smallest values of the protein, wet gluten and dry gluten were obtained in wheat monocrop.

In comparisonwith wheat monocrop, in the wheat-maize crop rotation the vahe 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 crop rotations.

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