THE INFLUENCES OF CROP ROTATION AND IRRIGATION ON PROTEIN CONTENT OF WHEAT GRAINS IN THE WEST OF ROMANIA

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Abstract

The paper based on the researches carried out during 2008-2010 in the long term trial placed in 1990 on the preluvosoil from Oradea. Three kind of crop rotation (wheat – monocrop; wheat – maize; wheat – maize – soybean) were studied in unirrigated and irrigated conditions. The smallest content of the protein from wheat grains were registered in the wheat monocrop both nonirrigated and irrigated variant. In the wheat-maize and wheat-maize-soybean crop rotation the values registered were significant statistically bigger than in wheat monocrop. Irrigation determined the decrease of the protein content.

Key words: wheat, crop rotation, protein, yield, irrigated, nonirrigated

INTRODUCTION

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., 1979, 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 (Domuţa C., 2005, Ardelean I., 2006, 2007,).

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 Crişurilor Plain (Domuţa C., et. all)

The production quality is a property connected to several physical and chemical characteristics of plants and confers a positive note to the aplied 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).

MATERIAL AND METHODS

The researches were carried out during 2008-2010 at Agricultural Researches and Development Station (A.R.D.S.) Oradea, Romania, in a long term trial placed in 1990 on preluvosoil. On ploughing depth the soil is low acid (pH= 6.8), humus content is low (1.75%), phosphorus (22.0 ppm) and potassium (845.4 ppm) have medium values; macroagregates hydrostability (47.5%) 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.

Gross protein was determined using the folowing formula = $Nt \times 5.7$; when Nt = total nitrogen.

RESULTS AND DISCUSSIONS

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 statistically 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% both in nonirrigated and irrigated conditions is very significant statistically. (Table 1).

Table 1

Crop rotation and irrigation influence on protein content of the wheat grain, Oradea 2008

Crop rotation	Water regime				Average on the crop rotation
	Nonirrigated		Irrigated		
	Protein				
	%	%	%	%	
1. Wheat- monocrop	9.1	100	9.0	100	9.05^{Mt}
2. Wheat-maize	11.1	121	10.9	121	10.95^{*}
3. Wheat-maize-soybean	13.8	152	13.7	152	13.75^{***}
Average on the water regime	11.3^{Mt}	100	11.2^{-}	99	-

	Crop rotation	Water regime	Water regime x Crop rotation	Crop rotation x Water regime
LSD 5%	1.2	0.6	1.3	1.4
LDS 1%	2.3	1.2	2.6	2.7
LSD 0,1%	4.2	3.1	4.7	4.3

In the year 2009, protein content of the wheat yield was smaller than in 2008 in the all crop rotation; the smallest values were registered in the monocrop, 7.3% in nonirrigated variant and 7.0% in irrigated variant. Both in nonirrigated conditions and irrigated conditions, the differences registered incomparison with monocrop (45% and 75%, respectivelly 46% and 83%) are distingue significant statistically. (Table 2).

Table 2

Crop rotation and irrigation influence on protein content of the wheat grain, Oradea 2009

Crop rotation	Water regime				Average on the crop rotation
	Nonirrigated		Irrigated		
	Protein				
	%	%	%	%	
1. Wheat- monocrop	7.3	100	7.0	100	7.15 Mt
2. Wheat-maize	10.6	145	10.2	146	10.4 **
3. Wheat-maize-soybean	12.8	175	12.8	183	12.8 ***
Average on the water regime	10.23 Mt	100	10.0 -	97.8	-

	Crop rotation	Water regime	Water regime x Crop rotation	Crop rotation x Water regime
LSD 5%	1.4	1.0	1.7	1.6
LSD 1%	2.8	1.9	3.1	2.9
LSD 0,1%	5.2	3.7	5.9	4.8

In 2010 the smallest values of the protein content were registered in the monocrop, too both in nonirrigated conditions (8.2%) and irrigated conditions (8.0%). In the wheat-maize cro rotation the values of the protein content increased, and the differences in comparison with monocrop (2.7% in nonirrigated variant and 2.6% in irrigated variant) were distingue significant statistically. The differences registered in the wheat-maize-soybean crop rotation (5% both in nonirrigated and irrigated conditions) were very significant statistically. (table 3).

In average on the researched period, the smallest values of the protein content of the wheat grains were registered in monocrop, 8.2% in nonirrigated conditions and 8.0% in irrigated conditions. In the maize-wheat crop rotation the values of the protein content (10.8% and 10.6%) increased distingue significant in comparison with monocrop.

Table 3

Crop rotation and irrigation influence on protein content of the wheat grain, Oradea 2010

Crop rotation	Water regime				Average on the crop rotation
	Nonirrigated		Irrigated		
	Protein				
	%	%	%	%	
1. Wheat- monocrop	8.2	100	8.0	100	8,1 Mt
2. Wheat-maize	10.9	133	10.6	133	10,75 ***
3. Wheat-maize-soybean	13.2	161	13.0	163	13,1 ***
Average on the water regime	10.8 Mt	100	10.5 -	97.5	-

	Crop rotation	Water regime	Water regime x Crop rotation	Crop rotation x Water regime
LSD 5%	0.9	0.6	1.2	1.3
LSD 1%	1.4	1.3	2.1	2.6
LSD 0,1%	2.5	2.1	3.8	4.2

The biggest values of the protein content was obtained in the wheat-maize-soybean crop rotation, 13.3% in nonirrigated and 13.2% in irrigated conditions (table 4).

Table 4

Crop rotation and irrigation influence on protein content of the wheat grain, Oradea 2008 – 2010

Crop rotation	Water regime				Average on the crop rotation
	Nonirrigated		Irrigated		
	Protein				
	%	%	%	%	
1. Wheat- monocrop	8.2	100	8.0	100	8.1^{Mt}
2. Wheat-maize	10.8	132	10.6	133	10.7**
3. Wheat-maize-soybean	13.3	162	13.2	165	13.25***
Average on the water regime	10.76^{Mt}	100	10.6^{-}	98.5^{-}	-

	Crop rotation	Water regime	Water regime x Crop rotation	Crop rotation x Water regime
LSD 5%	1.17	0.73	1.4	1.43
LDS 1%	2.16	1.46	2.6	2.73
LSD 0,1%	3.96	2.96	4.8	4.43

In average on the nonirrigated and irrigated crop rotation, the smallest values of the protein content were registered in monocrop. In the wheat-maize crop rotation, the differences in comparison with monocrop were significant statistically in 2008, distingue significant statistically in 2009 and very significant statistically in 2010. All the three years, the differences vs. monocrop registered in the wheat-maize-soybean are very significant statistically.

In all the 3 years and crop rotations studied the values of the protein content of the wheat grains determined in the irrigated variants were smaller than values registered in the nonirrigated variants but the differences are without statistically significant both every crop rotation and in average on the all crop rotations.

Irrigation determined the increase of the protein quantity from wheat yield increased with 96.0 kg/ha (35.3%) in monocrop, with 141.7 kg/ha (25.6%) in maize-wheat crop rotation and with 213.8 kg/ha (27.0%) in wheat-maize-soybean crop rotation (table 5).

Table 5

Influence of crop rotation and irrigation on protein wheat production, Oradea 2008- 2010

Crop rotation	Water regime				Average on the crop rotation
	Nonirrigated		Irrigated		
	Kg/ha	%	Kg/ha	%	
1. Wheat- monocrop	271.7	100	367.7	135.3	319.7
2. Wheat-maize	553.2	100	694.9	125.6	624.1
3. Wheat-maize-soybean	789.5	100	1003.3	127.0	896.4
Average on the water regime	538.1	100	688.6	127.9	-

CONCLUSIONS

Wheat-maize crop rotation determined a statistically significant increase of the protein content from yield gain in comparison with wheat-monocrop. In the wheat-maize-soybean the differences in comparison with monocrop were significant statistically every year both in nonirrigated and irrigated conditions

In the irrigated conditions the values of the protein content from yield grain were smaller than values registered in nonirrigated conditions but the difference were unsignificant statistically. In the all crop rotation the quantities of protein/hectare at the irrigated variant were bigger than the values obtained in nonirrigated conditions.

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