STUDIES REGARDING THE INFLUENCE OF CCROP ROTATION AND REGIME NUTRITION INTERACTION ON PHYTOMASS ACCUMULATION IN WINTER WHEAT CULTIVATED ON THE PRELUVOSOILS

Bandici Gheorghe, Ardelean Ileana *

*University of Oradea, Faculty of Environment Protection, Department of Agricultural, Oradea, Romania
Corresponding author: University of Oradea, Faculty of Environment Protection, Department of Agricultural, 26 Magheru Str., zip code: 410048, Oradea, Romania, tel.: 004059412550, fax. 0040259416274,
e-mail: gbandici@yahoo.com

Abstract

The crop rotation is a decisive factor influencing growth and development of wheat.

Plant growth is fundamental in obtaining yield and is related vegetation and technological factors, the level of yield being reflected in the intensity of phytomass accumulation.

In the majority of cases, total growth of green mass is considered on the assumption that a maximum yield is obtained by increasing total dry weight phytomass production and by a favourable repartition of it among plant's organs.

Key words: crop rotation,regime nutrition, phenophase, phytomass, preluvosoils, early ripening, incomplete ripening, complete ripening

INTRODUCTION

Crop rotation together with other appropriate agricultural practices contribute to the favourableness of growth and development conditions of wheat root system, to an improved synthesis of specific organic compounds and their improved translocation to plant's organs (*Lazany J., 2000; Bandici Gh., 1997, 2001*) Finally, all the enumerated conditions lead to improved efficiency per area unit.

Zamfirescu, (1977) stressed out that the accumulation process of total green mass relies on the absorption of nutrients from soil through plant's root system. In turn, root system depends on the level of foliar system functioning conditioned by water and nutrients' provision of soil. (*Lazany J., 2003).*

The importance of rationale fertilization and of the crop rotation, on growths and development of plants is stated by many authors: *Austin, 1978, Soltner, 1990, Salisbury andRoss, 1995Domuta and all., 2007,2008).*

Most of the reserches were centred on the influence of crop rotation on the yields, namely on the phytomass accumulation. the crop rotations with regard to wheat was very satisfactory in this order as forerunner plant: pea, beans, winter rape, bots, linseed, soja, red clover, potato, sugar beet, sunflower, corn etc. (*Bandici, Gus, 2001*, *Munteanu L., and all., 2011, Domuta, 2012).*

Bîlteanu Gh., (1993) after long tests demonstrated the importance of crop rotation on wheat yields on brown-red soils in Romanian Plain. On clay-illuvial podzols, the introduction of ameliorative plants such as red clover represented an element of outmost importance for increase of the wheat yield.

Dincă, D., (1982), made some references on the role of crop rotation on wheat yield and on the organic accumulation in whole plant and grains.

It is demonstrated that after 10-year monoculture, wheat yield decreases continously in comparative with rotations. it fluctuates as a consequence of changing climatic conditions. under such circumstances, fertilization does not induce a significant yield increase. a particularly important problem is linked to wheat crop increment, which must fit the rising consumption needs of world population (*Zăhan P. şi Zăhan Rodica, 1989, Bandici and all., 2003, Ardelean, 2013*).

MATERIAL AND METHODS

The research was set at Agrozootechnical Researches Experimental Station (A.R.E.S) Oradea (Romania), between 2012 - 2013. The experimental design was polyfactorial in subdivides stands using as factors interaction: crop rotation x phenophase and regime nutrition x phenophase.

The influence of later factors was studied on the dynamics phytomass accumulation of winter wheat cultivated on preluvosoils. As biological material, the Delia race of wheat was employed.

Experimental results (phytomass accumulation) were analyzed by ANOVA (analysis of variance) and expressed as g of dry weight/10 plants (*Bandici, 2007*).

RESULTS AND DISCUSSIONS

The present paper presents the correlation between phytomass accumulation and crop rotation quality in winter wheat cultivation.

The Table 1 presents the phytomass accumulation during the less favourable year 2012. The results show that the forerunner plant do not influence phytomass accumulation increase as winter wheat advances in vegetation. The increase is dependent on the properties and quality of the crop rotation, the best yields being obtained after the cultivation of pea.

Thus, in wheat monoculture the phytomass accumulation increases from 0.96 g. dry weight/10 plants (at beginning winter) to 45.40 g. dry weight/10 plants at complete ripening. If corn is used as crop rotation, but specially after pea, the increases in yield are superior, varying between 0.87-

60.43 g. dry weight/10 plants after corn and between 1.50-66.97 g. dry weight/10 plants after pea, respectively as winter wheats'forerunner plants.

The phenomenon keeps same pace but at values in 2013, a less favourable year (table 2). The phytomass accumulation varies in wheat monoculture between 0.20-35.60 g. dry weight/10 plants and 0.23-42.83 g. dry weight/10 plants after corn and between 0.20-47.10 g. dry weight/10 plants after pea. Regardless to climatic conditions, at a different scale, a positive correlation was found between phenophase x regime nutrition: as wheat advances to maturity, there is a progressive accumulation of total phytomass in seeds (table 3 and 4).

Concerning 2012, a less favorable year, results show a very significant increase in phytomass at the beginning of winter in unfertilized alternative (1.00 g dry weight/10 plants). At the complete ripening there is an increase to 49.92 g dry weight/10 plants, in unfertilized alternative *(Zăhan, Rodica Zăhan, 1989).*

In 2013, a less favorable year, phytomass accumulation decreases as compared to a favorable year, taking values in a narrower, range between 0.22 g dry weight/10 plants at beginning of winter and 31.32 g dry weight/10 plants at compared ripening in unfertilized alternative.

It is worth to mention that in 2012 (less favorable year) the quantity of accumulated phytomass was directly proportional with fertilization level as it was rising during study period (49.92 g dry weight/10 plants) in unfertilized alternative and 69.49 g dry weight/10 plants in fertilized alternative, organo-mineral complex was used in all experimental alternative as fertilized.

In a less favorable year, 2013, phytomass accumulation decreased depending on nutrition regime (31.32 g dry weight/10 plants in unfertilized alternative and 51.80 g dry weight/10 plants in fertilized alternative using the same organo-mineral complex as fertilizer).

It is worth to mention that during the two research years, a negative correlation was found between percent participation of compound synthesized before fructification and seeds formation and fertilization level.

This phenomen is more accentuated in unfertilized alternatives as compared with fertilized with organo-mineral complex and is influenced unfavorable climatic conditions.

Thus, in 2012, a favorable year, increasing the fertilization had as result a decrease of participation percentage from 33.7 g dry weight/10 plants in unfertilized alternative to 15.3 g dry weight/10 plants in fertilized with organo-mineral complex alternatives.

In 2013, considered an unfavorable year, the decreases varied between 11.2 g dry weight/10 plants in unfertilized and 7.9 g dry weight/10 plants in fertilized alternatives using organo-mineral complex of fertilizers.

Table 1

The effect of the crop rotation x phenophase on winter wheat phytomass accumulation, on brown luvic soils (Oradea 2012)

Phenophase	Total dry weight phytomass, seeds and straw g./10 plants											
	Crop rotation											
	Wheat monoculture (Mt)			Corn (W-C)			Pea (P-W-C)			Pea (P-W-C-C)		
	Totals d.W.	Seeds	Straw	Totals d.W.	Seeds	Straw	Totals d.W.	Seeds	Straw	Totals d.W.	Seeds	Straw
At winter beginning	0.96	-	0.96	0.87	-	0.87	0.87	-	0.87	1.50	-	1.50
At the end of winter	1.07	-	1.07	1.07	-	1.07	1.57	-	1.57	2.20	-	2.20
The beginning of vegetation	1.93	-	1.93	2.96	-	2.96	4.27	-	4.27	4.07	-	4.07
The formation of first interned	5.27	-	5.27	5.10	-	5.10	7.80	-	7.80	6.27	-	6.27
Straw elongation	13.47	-	13.47	19.17	-	19.17	17.17	-	17.17	14.00	-	14.00
The formation of spike	31.50	-	31.50	29.50	-	29.50	54.60	-	54.60	49.53	-	49.53
Beginning of seeds formation	34.63	-	34.63	42.83	-	42.83	57.90	-	57.90	54.63	-	54.63
Early ripening	39.67	10.00	29.67	52.90	13.33	39.57	59.93	14.33	45.60	56.80	11.00	45.80
Incomplete ripening	45.33	12.53	32.80	57.10	15.93	41.17	62.50	21.67	40.83	62.67	18.67	44.00
Complete ripening	45.40	15.67	29.73	60.43	24.33	36.10	63.60	27.00	36.60	66.97	30.67	36.30
LSD 5% LSD 1 % LSD 0,1 %	For total plant phytomass 0.071 g/10 plants d.w. 0.093 g/10 plants d.w. 0.119 g/10 plants d.w.						For seeds: 2.7 g/10 plants d.w. 3.6 g/10 plants d.w. 4.7 g/10 plants d.w.					

Statistical significations:

- for *Total plant phytomass*: under 0.071 = insignificant (-); 0.071-0.093 = significant (*); 0.093 - 0.119 = distinct significant (**); over 0.119 = very significant (***);
- for *seeds*: under 2.7 = insignificant (-); 2.7-3.6 = significant (*); 3.6 - 4.7 = distinct significant (**); over 4.7 = very significant (***).

Table 2.

The effect of the crop rotation x phenophase on winter wheat phytomass accumulation dynamics. on brown luvic soils (Oradea, 2013)

Phenophase	Total dry weight phytomass. seeds and straw g./10 plants											
	Crop rotation											
	Wheat monoculture (Mt)			Corn (W-C)			Pea (P-W-C)			Pea (P-W-C-C)		
	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw
At winter beginning	0.20	-	0.20	0.23	-	0.23	0.30	-	0.30	0.20	-	0.20
At the end of winter	0.37	-	0.37	0.37	-	0.37	0.40	-	0.40	0.37	-	0.37
The beginning of vegetation	0.47	-	0.47	0.47	-	0.47	0.50	-	0.50	0.47	-	0.47
The formation of first interned	0.80	-	0.80	0.97	-	0.97	1.33	-	1.33	0.93	-	0.93
Straw elongation	3.73	-	3.73	3.43	-	3.43	4.37	-	4.37	4.33	-	4.33
The formation of spike	8.60	-	8.60	9.47	-	9.47	11.0	-	11.00	10.60	-	10.60
Beginning of seeds formation	24.83	-	24.83	25.50	-	25.50	34.03	-	34.03	33.13	-	33.13
Early ripening	33.87	9.83	24.04	36.00	8.50	27.50	35.73	11.33	24.40	41.33	10.83	30.50
Incomplete ripening	35.37	11.70	23.67	41.87	11.00	30.87	40.73	13.90	26.83	45.33	12.17	33.16
Complete ripening	35.60	13.37	22.23	42.83	12.80	30.03	43.43	17.50	25.93	47.10	15.97	31.13
LSD 5% LSD 1 % LSD 0.1 %	.For total plant phytomass: 0.073 g/10 plants d..w. 0.096 g/10 plants d.w. 0.123 g/10 plants d.w.						For seeds: 2.7 g/10 plants d.w. 3.6 g/10 plants d.w. 4.7 g/10 plants d.w.					

Statistical significations:
- for *Total plant phytomass*: under 0.073 = insignificant (-); 0.073-0.096 = significant (*); 0.096-0.123 = distinct significant (**); over 0.123 = very significant (***);
- for *seeds*: under 2.7 = insignificant (-); 2.7-3.6 = significant (*); 3.6-4.7 = distinct significant (**); over 4.7 = very significant (***).

Table 3

The effect of nutrition regime x phenophase interaction on winter wheat dry weight phytomass accumulation dynamics on brown luvic soils. (Oradea 2012)

Phenophase	Total dry weight phytomass, seeds and straw g./10 plants								
	Nutrition regime								
	N_0P_0			$N_{120}P_{80}$			$N_{100}P_{80}$ + 10t/ha manure		
	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw
At winter beginning	1.00	-	1.00	1.17	-	1.17	0.97	-	0.97
At the end of winter	1.22	-	1.22	1.55	-	1.55	1.65	-	1.65
The beginning of vegetation	2.65	-	2.65	2.62	-	2.62	4.65	-	4.65
The formation of first interned	4.77	-	4.77	6.10	-	6.10	7.45	-	7.45
Straw elongation	11.62	-	11.62	16.85	-	16.85	19.37	-	19.37
The formation of spike	36.70	-	36.70	43.05	-	43.05	44.10	-	44.10
Beginning of seeds formation	43.62	-	43.62	49.55	-	49.55	49.31	-	49.31
Early ripening	47.62	9.50	38.12	52.90	13.75	39.15	56.45	13.25	43.20
Incomplete ripening	49.82	15.75	34.07	57.32	18.45	38.87	63.55	17.40	46.15
Complete ripening	49.92	21.00	28.92	57.95	24.50	33.45	69.49	27.75	41.74
DL 5%	0.063 g/10 plants d.w.						2.3 g/10 plants d.w.		
DL 1 %	For total plant phytomass: 0.083 g/10 plants d.w.						For seeds: 3.1 g/10 plants d.w.		
DL 0.1 %	0.106 g/10 plants d.w.						4.0 g/10 plants d.w.		

Statistical significations:

- for *Total plant phytomass*: under 0.063 = insignificant (-); 0.063-0.083 = significant (*); 0.083-0.106 = distinct significant (**); over 0.106 = very significant (***);
- for *seeds*: under 2.3 = insignificant (-); 2.3-3.1= significant (*); 3.1-4.0 = distinct significant (**); over 4.0 = very significant (***).

Table 4

The effect of nutrition regime x phenophase interaction on winter wheat dry weight phytomass accumulation dynamics on brown luvic soils. (Oradea 2013)

Phenophase	Total dry weight phytomass. seeds and straw g./10 plants								
	Nutrition regime								
	N_0P_0			$N_{120}P_{80}$			$N_{100}P_{80}$ + 10t/ha manure		
	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw	Total s d.W.	Seeds	Straw
At winter beginning	0.22	-	0.22	0.22	-	0.22	0.25	-	0.25
At the end of winter	0.35	-	0.35	0.37	-	0.37	0.40	-	0.40
The beginning of vegetation	0.45	-	0.45	0.47	-	0.47	0.50	-	0.50
The formation of first interned	0.90	-	0.90	0.95	-	0.95	1.17	-	1.17
Straw elongation	2.45	-	2.45	4.47	-	4.47	4.97	-	4.97
The formation of spike	5.82	-	5.82	11.30	-	11.30	12.62	-	12.62
Beginning of seeds formation	23.00	-	**23.00**	30.07	-	**30.07**	35.05	-	**35.05**
Early ripening	26.45	6.03	**20.42**	38.97	11.85	**27.12**	44.77	12.50	**32.27**
Incomplete ripening	30.22	7.35	22.87	43.05	14.07	28.98	49.20	15.15	34.05
Complete ripening	31.32	9.72	21.60	43.60	15.70	27.90	51.80	19.30	32.50
DL 5% DL 1 % DL 0.1 %	For total plant phytomass: 0.063 g/10 plants d.w. 0.083 g/10 plants d.w. 0.106 g/10 plants d.w.						For seeds: 2.3 g/10 plants d.w. 3.1 g/10 plants d.w. 4.0 g/10 plants d.w.		

Statistical significations:

- for *Total plant biomass*: under 0.063 = insignificant (-); 0.063-0.083 = significant (*); 0.083-0.106 = distinct significant (**); over 0.106 = very significant (***);
- for *seeds*: under 2.3 = insignificant (-); 2.3-3.1= significant (*); 3.1-4.0 = distinct significant (**); over 4.0 = very significant (***).

CONCLUSIONS

The crop rotation has a positive effect on total phytomass accumulation as compared with wheat monoculture, the obtained values being conditioned by a higher favourableness of climatic factors.

With regard to phytomass accumulation in seeds, it was positively influenced by the quality of the crop rotation, being higher in correlation with the nutrition regime qualities.

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