THE ROTATION AND FERTILISATION – IMPORTANT SHACKLE INTO INCREASE THE YIELD AT THE WINTER WHEAT CULTIVATED ON THE LUVOSOIL FROM SCDA ŞIMNIC CRAIOVA

ROTAŢIA ŞI FERTILIZAREA – VERIGI TEHNOLOGICE IMPORTANTE ÎN SPORIREA PRODUCŢIEI LA GRÂUL DE TOAMNĂ CULTIVAT PE LUVOSOLUL DE LA SCDA ŞIMNIC CRAIOVA

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Abstract: *In this paper, we present the yields obtained at the winter wheat cultivated in different rotation systems under the influence of the mineral and organic fertilizers. From all the variants, the most valuable proved to be $N_{100}P_{60}$. Also very good productions were obtained at the variant with 20 t/ha manure.*

Rezumat: *În această lucrare prezentăm producţiile obţinute la grâul de toamnă cultivat în diferite asolamente sub influenţa fertilizării minerale şi organice. Din variantele experimentate cea mai performantă s-a dovedit a fi $N_{100}P_{60}$. De asemenea, foarte bune producţii de boabe au fost obţinute şi la varianta cu 20 t/ha gunoi de grajd.*

Key words: *rotation, fertilization, yields*
Cuvinte cheie: *rotaţie, fertilizare, producţii.*

INTRODUCTION

Due to the increase of the world population, one of the problems of the humanity is how to ensure the daily necessary of foods. As the winter wheat is used for sustenance for almost 50% of the world population, it is quite necessary to find new methods to increase the yields obtained at this culture.

MATERIALS AND METHODS

The experience was carried out at the Agricultural Research and Development Station Şimnic Craiova during the 2006 and 2007 years. The experience has two factors:

- **A factor** - represented by the different rotation systems;
- **B factor** – represented by the different levels of fertilization.

As experimented variety, we use Flamura 85 sowing in every year in optimal epoch at the density of plants of 500 seed per square meter. As standard we use the unfertilized variant (St1) and as general standard for each rotation we use the most used rotation for Romania: wheat – corn (St2). The collected data were processed using the variance analysis.

RESULTS AND DISCUSSIONS

From a climatic point of view, the two yeas were different as favourability for winter wheat culture: 2006 was considered as favourable and 2007 was considered as less favourable than the previous year. From the point of view of precipitations, in the period September 2005 – July 2006 637 mm were recorded, in the period September 2006 – July 2007 only 368,5 mm were recorded, 286,6 mm less (table no. 1). The multi annual average for this period was 494.9 mm.

The temperatures for the two autumns (2005 and 2006) were considered as normal, being closely that the multi annual average. The 2007 winter was warmer than the previous one with 4.2 to 8°C related to the average/60 years. The lack of rain in the 2007 spring made the plants to be stressed and the yields obtained to be smaller than the ones realized on the 2006.

Table 1

Climatic conditions in the period 2005-2006 and 2006-2007

Month	Temperature °C		Precipitations mm	
	Month average	Multi-annual average	Month amount	Multi-annual average
2005-2006				
October	11.3	11.4	23.0	39.2
November	4.4	5.6	33.6	47.0
December	1.2	0.2	41.8	45.0
January	-6.3	-2.6	42.0	36.4
February	3.1	-0.2	26.0	31.4
March	5.7	4.8	70.5	35.0
April	13.7	11.4	68.0	42.8
May	19.8	16.8	38.0	61.7
June	20.0	20.9	128.0	63.8
July	23.1	22.1	66.0	54.6
August	22.2	22.0	130.0	43.6
September	17.7	17.5	52.0	38.0
Total/average	11.3	13.5	718.9	538.5
2006-2007				
October	12.4	11.4	13.0	39.2
November	7.4	5.6	7.0	47.0
December	1.6	0.2	32.0	45.0
January	5.5	-2.6	16.5	36.4
February	4.0	-0.2	31.0	31.4
March	5.5	4.8	54.0	35.0
April	12.7	11.4	0	42.8
May	19.6	16.8	121.0	61.7
June	23.6	20.9	36.0	63.8
July	26.5	22.1	6.0	54.6
August	25.3	22.0	171.0	43.6
September	17.4	17.5	73.0	38.0
Total/average	13.5	13.5	560.5	538.5

The plant density at the harvest time (table no. 2) was influenced by both studied factors and varied between 360 plants/m^2 at monoculture in unfertilized variant to 700 plant/m^2 in 4-year rotation in the $N_{100}P_{60}$ variant. High values of the plant density were observed at 3 years rotation at the same level of fertilization of $N_{100}P_{60}$ variant and to the 20 t/ha manure in 4 and 3 years rotation (700 pl./m^2 respectively 683 pl./m^2).

The height of the plants in all the four rotations has varied between 50.2 cm at the monoculture system to 78.7 cm at the 4 years rotation when the winter wheat was cultivated after sunflower. The smallest plants were observed in monoculture on all agro founds used and the tallest plants has been determinate in the 4 yeas rotations at the $N_{100}P_{60}$ variants.

The number of seeds/ear has low values in monoculture at all the experimented variants comparative with the other rotations systems, especially at the $N_{100}P_{60}$ variants.

The hectolitre weight – MH – was influenced with preponderance by the levels of the fertilizers applied (B factor) and less by the rotation systems (A factor). At the unfertilized variants the values of MH were balanced between 72 to 76 kg/hl. At once with the applied fertilizers the vales of the MH grows from 75 kg/hl at the P_{60} variant in monoculture to 77.5 kg/hl at the $N_{100}P_{60}$ variant in the four years rotation system (table no. 2).

Table 2

Biometric measures determinate at winter wheat from SCDA Simnic Craiova in average 2006-2007

Rotation	Agro fond	Nr.pl/m^2	Height - cm -	No. of seeds/ear	MH - kg/hl -
Monoculture wheat	Unfertilized	360	50.2	21.2	72.0
	N100	496	59.9	31.4	75.2
	P60	608	59.3	22.5	75.0
	N100 P60	640	59.6	33.0	76.2
	20t/ha manure	540	67.8	29.4	76.5
2 years wheat - corn	Unfertilized	488	65.9	38.8	74.0
	N100	552	69.0	40.8	76.0
	P60	624	69.7	38.5	75.0
	N100 P60	688	71.7	41.8	76.8
	20t/ha manure	635	69.0	37.8	77.0
3 years pea- wheat - corn	Unfertilized	525	62.8	39.6	74.0
	N100	576	70.0	41.5	76.5
	P60	645	66.9	39.5	75.0
	N100 P60	704	71.3	42.8	76.5
	20t/ha manure	683	70.2	38.6	77.0
4 years sun flower – wheat – corn - wheat	Unfertilized	562	68.1	38.9	76.0
	N100	590	73.3	40.5	78.0
	P60	663	70.8	39.8	76.2
	N100 P60	715	78.7	42.8	76.8
	20t/ha manure	700	72.4	39.1	77.5

The statistical analysis of the production data for each kind of rotation systems put into the light the favourable effect of the mineral and organic fertilization of the winter wheat crop (table no. 3). It is obviously the smaller yields levels for the 2006 year that the productions obtained in 2007. Both monoculture and rotation systems (3 and 4 years) registered high differences between the levels of productions at all experimented variants in 2006 related 2007 year.

The decrements of productions varied between 14.5 q/ha and 29.4 q/ha at the $N_{100}P_{60}$ variant and 9.9 q/ha to 26.9 q/ha at the 20 t/ha manure variant. In monoculture, in average on the two experimented years where the single experimented factor was different levels of fertilizers, the obtained yields were influenced only by this factor and has values that varied between 7.7 q/ha at P_{60} variant and 24.3 q/ha variant at the $N_{100}P_{60}$ variant.

In the most used rotation of 2 years for our country – **winter wheat – corn** – the yield at the unfertilized variant was higher with 2.5 q/ha related the same variant on the previous

rotation system (monoculture). The yields at the fertilized variants varied between 22.1 q/ha at the P_{60} variant and 36.7 q/ha at the $N_{100}P_{60}$ variant, with 74.0% to 189% more that the standard (St1).

Table 3

The influence of the rotation and fertilization to the yields obtained at winter wheat cultivated at SCDA Simnic Craiova

Rotation	Agro fond	2006 Yields q/ha	2007 Yields q/ha	Average 2006-2007			
				Yields q/ha	Diff.	%	Signif.
Monoculture wheat	Unfertilized – St1.	10.3	10.1	10.2	St1.	100	St1.
	N100	29.8	25.3	27.5	17.3	270	***
	P60	23.1	12.7	17.9	7.7	175	**
	N100 P60	41.7	27.2	34.5	24.3	338	***
	20t/ha manure	36.1	26.2	31.2	21.0	306	***
Average/agro fund		28.2	20.3	24.3	-2.7	90	O
2 years wheat - corn	Unfertilized – St1.	12.3	13.2	12.7	St1.	100	St1.
	N100	34.4	25.6	30.0	17.3	236	***
	P60	25.8	18.4	22.1	9.4	174	**
	N100 P60	44.4	29.1	36.7	24.0	289	***
	20t/ha manure	39.2	27.6	33.4	20.7	263	***
Average/agro fund - St. 2		31.2	22.8	27.0	St 2.	100	St2.
3 years pea- wheat - corn	Unfertilized – St1.	18.3	16.2	17.3	St1.	100	St1.
	N100	47.2	29.6	38.4	21.1	222	***
	P60	39.2	23.3	31.3	14.0	181	***
	N100 P60	58.9	31.1	45.0	27.7	260	***
	20t/ha manure	55.5	30.2	42.8	25.5	247	***
Average/agro fund		43.8	26.1	35.0	8.0	130	XXX
4 years sun flower – wheat – corn - wheat	Unfertilized – St1.	19.8	17.3	18.5	St1.	100	St1.
	N100	50.3	31.6	41.0	22.5	222	***
	P60	40.1	25.6	32.8	14.3	177	***
	N100 P60	62.7	33.4	48.1	29.6	260	***
	20t/ha manure	58.6	32.2	45.4	26.9	245	***
Average/agro fund		46.3	28.0	37.2	10.2	138	XXX
DL 5%		= 8.01 q/ha		= 4.56 q/ha		=5.52 q/ha	
DL 1%		= 9.66 q/ha		= 5.50 q/ha		=8.04 q/ha	
DL 0.1%		=12.67q/ha		= 7.20 q/ha		=9.92 q/ha	

DL for the averages /agro founds used: DL 5% =2.51 q/ha; DL 1% =3.53 q/ha; DL 0.1% =4.60 q/ha

On the three years rotation where the winter wheat had as previous culture crop the pea, the mineral and organic fertilizers applied determined significant increase in productions comparative with the result obtained in monoculture and two years rotation systems. On the agro funds of the $N_{100}P_{60}$ and 20 t/ha manure the obtained yields have high values and they are bigger than the standard with 27.7 q/ha and respectively 25.5 q/ha. Those increases in productions were considered statistically as very significant.

The cultivation of the wheat into a four year rotation, where it has as previous culture crops the sunflower and corn, the obtained yields were bigger than the all the experimented rotation systems. All the variants from these rotation systems gave very good productions and those increases in production were from a statistical point of view considered as very significant.

Related to the classic rotation –***wheat-corn***- considered as general standard (St2) the 3 years and 4 years rotation proved to be most valuable with high production at all the experimented variants (table no. 3).

CONCLUSIONS

From all the experimented rotation systems the best proved to be the 4 years rotation (sun flower – wheat – corn – wheat);

The most valuable variants on each rotation were the $N_{100}P_{60}$ variants and the 20 t/ha manure variants, which have registered very significant increases in productions;

The monoculture systems have registered the lowest values at all variants, with 24.3 q/ha as average/variants.

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