

THE INFLUENCE OF CROP ROTATION OVER THE YIELD AND THE QUALITY OF THE SEEDS FOR THE DROPIA AUTUMN WHEAT CULTIVAR

Popovici Mariana*, Eva Bucurean

**University of Oradea, Faculty of Environmental Protection,
26 Gen. Magheru St., 410048 Oradea; Romania, e-mail; mariana_mediu@yahoo.com*

Abstract

The crop rotation has slow effects, which show their results in time, influencing the fertility through their structure and the alternant crops, mainly due to the effect of the precursory plant. Its action has a biological nature, which manifests itself in the quantity of the organic remains left in the soil, the root secretions, biological processes of decomposition and synthesis, all finally reflected over the yield.

The work presents the yield from the quantity and quality aspect, yields that were obtained for the Drobia autumn wheat cultivar, at Leș, Bihor, during the years 2004 and 2006, in the conditions of monoculture, crop rotation of wheat-corn and crop rotation of wheat-corn-pea rotation. The highest yield growth was obtained in the case of the wheat-corn-beans crop rotation with the percentage of 58%.

In the aspect of the quality of the wheat, the protein and gluten content is higher in average with 10,2% in the case of protein and with 6,3% in the case if the wheat-corn-pea crop rotation.

Key words: crop rotation, precursory plants, monoculture, proteins, gluten.

INTRODUCTION

In order to find the rotation place for the autumn wheat, there have to be taken into account at least four elements from the plant's biology, that are, the high requirements of the soil preparations and sowing period, their sensibility to weeds, their low capacity of valuing the natural fertility of the soil, their sensibility to diseases and pests.

The sowing of the wheat in the monoculture. The wheat is considered to be a mediocre precursory, but in certain occasions it reaches this kind of situation due to some advantages: the soil can be very well prepared starting with the summer period, the weeds can be eliminated until sowing, the fertilizers can be administered, the nitrates accumulate in the soil from the decomposition of organic substance and the water accumulates from precipitations.

The sowing of the wheat in rotation with the corn brings yield increases in comparison with the monoculture. The corn is considered to be a good precursory plant for the autumn wheat if a few steps are followed: the cultivation of the corn hybrids with a shorter vegetation period, the appliance on the corn of high quantities of chemical fertilizers, the sowing of the corn in deep autumn soil, the execution of the care work of the corn in optimum conditions, the clearing of the area cultivated with corn in the shortest period possible, the preparation of the soil immediately after the harvest of the corn.

The sowing of the wheat in crop rotation, through the introduction in the rotation besides corn, of pea, determines a growth in the soil fertility through the organic substance left in the soil. After the pea, the soil remains structured, with a higher content of water and air.

The sowing of wheat in the following rotation: wheat – corn – pea is considered to be the best option to obtain high quality wheat yields, efficient at the same time under the economical aspect.

MATERIAL AND METHODS

The experiment was realized at S.C.A. Leş, Bihor, during the period 2004 – 2006, where the Dropia autumn wheat cultivar was used, in which three crop rotation types were used: the monoculture, wheat – corn, wheat – corn – pea.

The unilateral study on the influence of crop rotation, reflects the way of response of the autumn wheat yield, conditioned by the structure of the rotation.

From the quality indicators of the Dropia autumn wheat cultivar, the content of proteins and wet gluten were analysed, during the 2004 – 2006 period.

RESULTS AND DISCUSSIONS

1. The influence of the crop rotation upon the yield.

The unilateral study of the crop rotation emphasizes the importance of the precursory plant upon the yield of the Dropia autumn wheat cultivar. In the soil – climate conditions from S.C.A Leş, the effect of the precursory plant on the yield is much limited (table 1).

Table 1

The unilateral comparison of the R factor- crop rotation - on the seed yield of the “Dropia” winter wheat cultivar, Leş-Bihor (2004-2006)

Nr. crt.	Crop rotation	Average yield (q/ha)	Relative yield (%)	Difference to the ctrl (q/ha)	Significance
1	R ₁ – monoculture	30,7	100,0	-	-
2	R ₂ – wheat-corn	45,5	148,2	+15,2	xxx
3	R ₃ – wheat-corn-pea	52,8	158,0	+27,0	xxx

LSD 5% = 4,52 q/ha

LSD 1% = 9,32 q/ha

LSD 0,1% = 14,2 q/ha

The obtained results emphasize especially the favorable effect of the rotation, which leads to yield increases of 15,2-27,1 q/ha in comparison with the wheat monoculture.

The monoculture, in the case of the wheat, shows that the wheat cannot be harvested after itself for a number of years without registering important diminishes of the yield. The most obvious diminish of the wheat yield is determined by: the increasing number of weeds in the area, the spread of diseases and pests, the accumulation in the soil of bacterian rhizospherical flora, which affects the proper growing and functioning conditions of the wheat roots.

From the above shown information it can be observed that the rotation of two, three years has an extremely beneficial effect on the wheat yield, leading to positive yields very well assured, in comparison with the ones obtained as a result of the monoculture. The introduction of a rotation, besides the positive influence it has on the yield, has a favorable action on the structure and fertilization of the soil as well.

The wheat – corn rotation determines high increases of the yield in the case of the two and especially three years crop rotation.

The use of the rotation corn – wheat leads to the diminish of the resources of nitrogen and phosphorus from the soil, so, while using this kind of rotation, it is also necessary to use mineral fertilizers.

In the wheat – corn rotation the fito-sanitary state can be worsen, because the wheat and the corn have over 10 common diseases, and some of them are very serious.

Due to these unfavorable effects, it is required to interrupt the succession cereals – cereals and the introduction in the yield of the leguminous plants for the grains. In the case of the analysed experiment it was the pea, which due to its nodosities present on its roots has the capacity of fixing the atmosheprical nitrogen and at the same time determine yield increases.

2.The influence of the crop rotation over the protein and wet gluten content.

The quality aspect of the grain yield, under the influence of the crop rotation appears to be very interesting. A clear lighten reflects the protein content of the wheat grains, at the level of all experimental years. Under this aspect, it is emphasized the fact that the introduction in the rotation of one, two or more plants, lifts the protein content in comparison with the single yield. It can be observed that the wheat – corn rotation determines an increase in the protein quantity in two consecutive years, with statistically assured differences. In the case of a three years rotation, the influence of a leguminous plant, the pea, a plant with the capacity to enrich the quantity of nitrogen in the soil, leads to significant increases in the protein content for the wheat grains. (table 2)

During all experimental years the quantity differences in the protein content, in comparison with the control option, are statistically assured.

Table 2

The influence of the crop rotation on the protein content of the wheat grains in the “Dropia” cultivar, Leş-Bihor (2004-2006)

Nr. Crt.	Crop rotation	2004		2005		2006		2004-2006	
		Protein	%	Protein	%	Protein	%	Protein	%
1	R ₁ – monoculture	13,6	100,0	13,8	100,0	13,6	100,0	13,7	100,0
2	R ₂ - wheat-corn	14,6	107,4 [*]	14,5	105,1 [*]	14,3	105,1 [*]	14,5	105,8
3	R ₃ - wheat-corn-pea	15,4	113,3 [*]	14,9	107,9 [*]	15,1	111,0 [*]	15,1	110,2
LSD 5%		5,1		6,0		7,3			

The gluten has some properties that confer the bread elasticity and extensibility in a hydrated state, a reason why it is required that the wheat should have a high content of gluten.

The wet gluten follows a similar pattern with the protein content analysed in the yield rotation for the Dropia autumn wheat cultivar. (table 3)

Table 3

The influence of the crop rotation on the wet gluten content of the wheat grains in the “Dropia” cultivar, Leş-Bihor (2004-2006)

Nr. Crt.	Crop rotation	2004		2005		2006		2004-2006	
		Wet gluten	%	Wet gluten	%	Wet gluten	%	Wet gluten	%
1	R ₁ – monoculture	26,9	100,0	26,5	100,0	27,0	100,0	26,8	100,0
2	R ₂ - wheat-corn	27,9	103,7	27,7	104,5	28,1	104,6	27,9	105,2
3	R ₃ - wheat-corn-pea	28,4	105,6 [*]	28,5	107,6 [*]	28,5	105,6 [*]	28,5	106,3
LSD 5%		5,6		5,5		5,3			

In this case the difference from the control factor is statistically relevant, not only in the case of wheat – corn – pea variant. The shown results emphasize the necessity of a proper crop rotation for the crops that are seed productive, that should play the role of stimulus on the yield capacity and the quality of the harvest.

CONCLUSIONS

In the yield conditions from SCA Leș, Bihor, the introduction of crop rotation in the process of seed yield in the case of the Dropia autumn wheat cultivar, states the following:

The action of the crop rotation has a biological nature which manifests itself in the quantity of the organic remains left in the soil, the root secretions, the biological processes of discomposure and synthesis, that are reflected finally over the yield.

The influence of the crop rotation is reflected as an answer to the autumn wheat yield, conditioned by the structure of the rotation. In comparison with the wheat monoculture, the simple introduction in the rotation of the corn assures a production increase of 15,2 q and the improved effect of the fertility, through the introduction in the rotation of the pea, makes that the difference in the production to reach a number of 27,1 q/ha.

The quality aspect of the wheat grains, influenced by the rotation is clear, especially in the case of protein content and the introduction in the rotation of a leguminous plant determines an increase in the content of the wet gluten.

If the wheat – corn rotation determines a clear quantitative increase of the protein (statistically assured), in the case of the three year rotation, the influence of a leguminous plant, the pea, leads to a significant increase of it in the case of wheat grains.

REFERENCES:

1. Bandici GH., P.Zăhan, I.Bronț 1997, Influența intercondiționării plantei premergătoare și a agrofondului creat asupra calității producției de grâu, în condițiile solurilor brune luvice din Câmpia de Vest, Analele Univ. Oradea, Tom III
2. Bilteanu GH., 1984, Rotația culturilor, (In: Grâul, sub red. N.Ceapoiu), Ed.Acad.R.S.R., București
3. Bilteanu GH., V Bîrnaure, 1989, Fitotehnie, Editura Ceres, București
4. Fasoulas A.C.1993, Principles of crop breeding, Aristotelian Univ. of Tessaloniki, Greece
5. Haș I. 2006, Producerea semințelor la plantele agricole, Ed. AcademicPres, Cluj-Napoca
6. Păcurar, I., 1988, Tehnologia producerii de sămânță la grâul de toamnă și grâul de primăvară, In: Producerea semințelor de cereale, leguminoase, plante tehnice și furajere, Red. de propagandă tehnică-agricolă, București
7. Savatti M., G. Nedelea, M. Ardelean, 2004, Tratat de ameliorarea plantelor, Ed. Marineasa, Timișoara
8. Săulescu, N.N., 1984, Producerea de sămânță, In: Grâul, sub red.N.Ceapoiu, Ed.Acad.R.S.R., București