

## INFLUENCE OF SOIL AND CLIMATE CONDITIONS AND TECHNOLOGICAL CHAINS ON SOME QUALITY INDICATORS AND PROFITABILITY IN PREMIUM WHEAT VARIETIES

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### Abstract

*Wheat is the most important cereal plant cultivated on largest surfaces due to its importance as a human food and also for animal feeding. Wheat has a high content of carbohydrates and proteins and a balanced the ratio between these items. Wheat quality is determined by the qualities of gluten such as: viscosity, elasticity, extensibility, resistance to action of the proteolytic ferments in the fermentation process, etc.. Besides production, which is the quantitative indicator, the protein content of the grains is the most important qualitative factor which gives the value of the utilized output. For this reason, this paper aimed to study the behaviour of six Premium Wheat varieties with early precocity in the soil and climate conditions of Calarasi area, Romania, during 2016. The analysis was focused on some qualitative indicators as follows: the content of protein and gluten, the hectolitre weight and the mass of 1,000 grains. All the determinations proved a high quality of grains and also the production performance of all the six Wheat varieties used in this study.*

**Key words:** quality, gluten, protein, produce, variety

### INTRODUCTION

Wheat is the most important grown plant with a high food proportion [3]. The large areas on which it is sown, as well as the attention that the plant enjoys, is due to the high content of grains in carbonated carbohydrates and proteins and the ratio of these substances to the requirements of the human body; long consistency of grains and the fact that they can be transported without difficulty [7]. Agronomically speaking, wheat crop offers the advantage that it is fully mechanized [8]. At the same time, wheat is a very good precursor for most crops, because it leaves the field early and allows ploughing to be done even during summer [9].

Wheat quality is due to the quality of gluten (viscosity, elasticity, extensibility, resistance to proteolytic fermentation in the fermentation process, etc.) [10]. After production, which is the quantitative indicator, the protein content of the grain is the most important quality factor that gives the harvesting value [1].

The content in wet gluten is dependent on the protein content of the grains, being an indicator of particularly important quality, which determines the quality class of the harvest obtained [4].

Premium grains are known in Germany as "E" type grains. Various varieties are produced and originally produced in Eastern Austria in the Pannonian Plain, in climatic conditions very similar to those in South-East and West Romania, multi-annual average rainfall of 450-500 mm and multiannual average temperatures exceeding 22°C in July and -2 ... -3°C in January (the average of 1971-2000). The multiannual average temperature in the Eastern area, where varieties have been improved, is +11°C. Thus, the identity of the climatic conditions in the area of improvement with those in the grown areas in Romania [6] is observed.

Premium wheat varieties have a number of features based on which they are included in this class [5]. The most important parameter is their quality, they all have a high protein

content, they have a profound and bulky radicular system, a good water and nutrient utilization capacity, and very good twinning and require a small amount of seed (150 Kg/ha), plant height is high; they are varieties particularly resistant to drought and they are recommended to grow in dry areas, they are particularly resistant to frost (-30°C); they have high resistance to rust and flour; they shows high resistance to fall [2].

## MATERIALS AND METHODS

The researches focused on the study of the behavior in the crop (profitability) in soil and climate conditions in Călărași area, during 2016, six wheat varieties of Premium group, as well as the analysis of some qualitative indicators (the content in protein and gluten, hectoliter weight and meal of ,000 grains). The researches were carried out on three variants, each variant having three repetitions, the surface of the experimental plots being 150 square meters.

Six wheat varieties with early precociousness were studied, as shown in Table 1, Josef variety being chosen as control, for the results comparison.

Table 1. Experimental variants

Variant	Variety
V1	MIDAS
V2	BITOP
V3	FULVIO
V4	ATRIUM
V5	ARNOLD
V6	JOSEF-Mt

Source: Own experiment.

The type of soil encountered in Calarasi county is chernozem. The climate regime is characterized by very hot summers and relatively cold winters with snow storm periods. During the year 2016, the recorded precipitations were 811.6 mm, the largest quantities being recorded during the months of May, June and August, exceeding the monthly multiannual averages (Table 2). Also, the annual average of temperatures was higher compared to the multi-annual average of 1981-2010.

The technology used was in the scarification work followed by a disk work simultaneously with the DAP fertilizer work. Sowing took place on October 10th. Chemical fertilizers NH<sub>4</sub>NO<sub>3</sub> were also administered at a dose of 200 kg in March and 200 kg DAP in April. Phyto-sanitary treatments were performed with Biscaya insecticide, Menara fungicide and Floramix herbicide.

Table 2. Temperatures and precipitations recorded during the year 2016

month		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Precip.
2016	P mm	62.6	35.6	67.8	64.6	71.0	114.8	4.2	88.8	83.2	164.2	51.8	3.0	<b>811.6</b>
	T °C	-5.6	3.2	7.6	14.3	15.9	22.4	24.2	23.1	18.9	9.7	5.3	-2.1	10.7
Average	P mm	33.6	31.6	38.3	51.3	66.5	84.5	77.8	64.7	55.0	43.5	41.5	44.8	<b>633.1</b>
	T °C	-2.1	-1.0	3.5	9.3	14.9	18.3	20.2	19.7	14.8	9.6	3.8	-0.8	9.8

Source: Calarasi Meteorological Station.

## RESULTS AND DISCUSSIONS

As shown in the data presented in table 3, protein content ranges between 13.7% and 15.9%. The lowest content was recorded at the 4 - Atrium variant, with a difference of - 1.5% compared to the control and -0.9% compared to the average of the six variants, 14.6%. The

highest value was obtained at the 5- Arnold variant, 15.9%, the only one that exceeded the control value, of 15.2% (Josef variety), recording an increase of 1.3% compared to the average. Except for the Midas and Atrium varieties, all other varieties in the study recorded values of protein content of over 14%.

The gluten content was over 28% for all six variants analyzed, reaching a maximum of 31.8% for variant 2, Bitop variety. The lowest percentage was recorded for variants 4 -

Atrium variety and 6 - Josef, 28.7%, which were also the variants that made a minus compared to the average (-1.2%).

Table 3. Influence of soil and technological chains on the protein and gluten content

No. crt.	Variety	Content in protein	Dif. Compared to Mt %	Dif. Compared to average %	Content in gluten %	Dif. Compared to Mt %	Dif. Compared to average %
1	Midas	13.8	-1.4	-0.8	29.8	+1.1	-0.1
2	Bitop	14.7	-0.5	+0.1	31.8	+3.1	+1.9
3	Fulvio	14.2	-1.0	-0.4	29.7	+1.0	-0.2
4	Atrium	13.7	-1.5	-0.9	28.7	0	-1.2
5	Arnold	15.9	+0.7	+1.3	30.5	+1.8	+0.6
6	Josef-Mt	15.2	-	+0.6	28.7	-	-1.2
7	<b>Average</b>	<b>14.6</b>			<b>29.9</b>		

Source: Own determinations

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Table 4. Influence of soil and technological chains on some quality indices

No. crt.	Variety	Hectoliter weight %	Dif. Compared to Mt %	Dif. Compared to average %	Mass 1000 grains g	Dif. Compared to Mt g	Dif. Compared to average g
1	Midas	78.4	+3.3	-0.2	40.72	+3.82	+1.75
2	Bitop	80.8	+5.7	+2.2	43.06	+6.16	+4.09
3	Fulvio	78.2	+3.1	-0.4	35.44	-1.46	-3.53
4	Atrium	79.7	+4.6	+1.1	40.36	+3.46	+1.39
5	Arnold	79.4	+4.3	+0.8	37.32	+0.42	-1.65
6	Josef-Mt	75.1	-	-3.5	36.90	-	-2.07
7	<b>Average</b>	<b>78.6</b>			<b>38.97</b>		

Source: Own determinations

The data in Table 4 reflects the value of the hectoliter weight and MMB of the experienced varieties. It is remarked that 2-Bitop variant with the highest hectoliter weight, 80.8%, with an increase of 5.7% compared to control and 2.2% compared to the average of the six studied varieties. The lowest value was obtained at variant control - Josef variety, 75.1%. All other varieties recorded values above 78%, their average being above this value (78.6%).

With respect to 1,000 grains, its values ranged between 36.90 grams, in the variant 6 - Josef and 43.06 grams in the variant 2- Bitop, with an average value of 38.97 grams.

As it can be seen from the data presented in table 5, the profitability obtained in soil and climate conditions of the year 2016 recorded values between 6,492 kg/ha, at variant 6-Josef and 8,158 kg/ha, in variant 1-Midas variety. The profitability of the other analyzed varieties exceeded 7,000 kg/ha, the average value being

7,465 kg/ha. The highest crop was recorded in the variant 1- Midas variety, 25.7% compared to control, namely, a very significant crop increase of 1,666 kg/ha. This variety also produced the only significant production difference (693 kg/ha) compared to the average (7,465 kg/ha). On the second place, from this point of view, 2 variant ranged, with a production of 7,673 kg/ha, was 18.2% higher than the control and an addition of 1,181 kg / ha, which was quoted as very significant. Compared to the average, the increase

achieved by this variety was distinctly significant with a value of 208 kg/ha. Compared to control, all studied varieties recorded very significant crop increases. Compared to the production average, variant Fulvio 3 variant and Atrium 4 did not get any significant differences. Compared to the production average of the six varieties, 7,465 kg/ha, variant 5 - Arnold and 6 - Josef made very significant harvest minuses, resulting in production differences of 973 kg/ha and 405 kg/ha, which in relative values materializes in a minus production of 5.4 until 13%.

Table 5. Influence of soil on Premium wheat production in the year 2016

No. crt.	Variety	Production kg/ha	Difference compared to Mt %	Difference compared to Mt kg	Significance	Difference compared to average %	Difference compared to average kg	Significance
1	Midas	8,158	+25.7	+1,666	***	+9.3	+693	***
2	Bitop	7,673	+18.2	+1,181	***	+2.8	+208	**
3	Fulvio	7,537	+16.1	+1,045	***	+1.0	+72	-
4	Atrium	7,476	+15.2	+984	***	+0.1	+11	-
5	Arnold	7,060	+8.7	+568	***	-5.4	-405	000
6	Josef-Mt	6,492	Mt	Mt		-13.0	-973	000
7	<b>Average</b>	<b>7,465</b>				Mt	Mt	

D15%=106.61 kg/ha

D11%=151.56 kg/ha

D10.1%=219.45 kg/ha

Source: Own determinations

## CONCLUSIONS

Under soil, but especially climate conditions of the year 2016 and the technology used, Premium wheat varieties tested had values of protein content between 13.7% and 15.9%. The average value of the six analyzed varieties was 14.6%. The lowest protein content was recorded in the 4- Atrium variant, 13.7% and the highest in 5 Arnold variant, 15.9%. Arnold variety was the only one to exceed the protein content of control (15.2%). Variants 2-Bitop, 5- Arnold and 6-Joseph obtained protein content values that exceeded the calculated average value of the varieties. Concerning gluten content of varieties, the average value was 29.9%, surpassed only by the variant 2-Bitop and the Arnold variety. Bitop variety was the variety that also recorded the highest content in gluten, 31.8%. As a witness, all varieties studied added a gluten content of between 1 and 3.1%.

In terms of hectoliter weight values, the highest value, 80.8%, was recorded in the 2- Bitop variant. All the studied varieties exceeded the value of hectoliter weight recorded by control, (75.1%), the recorded increase being between 3.3 and 5.7%. All recorded values were over 78%.

The mass of one thousand grains had the lowest value, 35.44 g, for Fulvio 3-variant and the highest, 43.06 g, for 2- Bitop variant.

Regarding the profitability obtained by the studied varieties, it overcome in all variants the production of control, the differences being very significant and consisted in crop profitability ranging from 568 to 1,666 kg/ha. The highest production was recorded in Midas 1 variant, 8,158 kg/ha and the lowest at Arnold 5 variant, 7,060 kg/ha. As compared to average production, the 1 variant Midas obtained the highest crop profitability, 693 kg/ha, a very significant increase.

Compared to the production average, Fulvio 3 variant and Atrium 4 variant did not show any

significant differences. Compared to the production average of the six varieties (7,465 kg/ha), 5 variant Arnold and 6 variant Josef made very significant harvest minuses, resulting in production differences of 973 kg/ha and 405 kg/ha, which means, in relative values, a minus production of 5.4 to 13%.

All the studied variants have confirmed the excellent value of the varieties regarding some qualitative indices but also regarding the recorded productions.

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