THE INFLUENCE OF TECHNOLOGICAL ELEMENTS ON THE WINTER TRITICALE YIELD

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ABSTRACT

The paper presents the 4-year data on the behaviour of local winter triticale varieties Ingen 35 and Ingen 93 in multifactorial field experiments. The highest yields of winter triticale varieties were recorded after the forerunner grain peas: Ingen 35 - 3632 kg/ha and Ingen 93 - 3744 kg/ha. Referring to the planting dates, the highest yields were recorded on the optimal planting dates. Ingen 35 variety provided yields at the level of 4265 kg/ha after the forerunner grain peas, 3448 kg/ha after the forerunner vetch-oat and 2770 kg/ha after the forerunner sunflower. The Ingen 93 variety recorded yields of 4176 kg/ha after the forerunner grain peas, 3778 kg/ha after vetch-oat and 2929 kg/ha after the forerunner sunflower. In the case of the seeding rate, the highest yields were obtained for the variant 5.0 mln/ha, which ensured 3161 kg/ha for the Ingen 93 variety and 3077 kg/ha for the Ingen 35 variety. The dominant influence degree on the grain production belongs to the forerunner crop: 67.11% for Ingen 35 and 73.16% for Ingen 93. The influence of the planting dates was of 31.92% and 25.56% respectively for the varieties. The highest percentage of protein content was recorded after the forerunner grain peas – 14.11% for the Ingen 93 variety. It was established the tendency to increase the protein content from the optimal to the late planting dates for both varieties and after all forerunner crops.

The highest protein yield was recorded after the forerunner grain peas in both varieties: 426.1 kg/ha for Ingen 35 and 435.5 kg/ha for Ingen 93.

INTRODUCTION

From an evolutionary point of view, winter triticale is a relatively young crop, which was created by scientists, a crop that has long become one of the most productive in the group of straw cereals.

In the conditions of the Republic of Moldova, the cultivation technology of this crop is little studied, which requires from the beginning scientific research with the approved local varieties.

MATERIAL AND METHOD

The researches regarding the study of the productivity and quality of the grains of winter triticale varieties were carried out in the period 2015-2018 at the Didactic-Experimental Station „Chetrosu", located in the central region of the Republic of Moldova.

The winter triticale varieties Ingen 35 and Ingen 93, created within the Institute of Genetics and Plant Physiology of the ASM, served as biological material. The following technological elements were studied in the multifactorial field experiments: three forerunner crops: grain peas (Control A), vetch-oat and sunflower; three planting dates: optimal (Control B), admissible and late and three seeding rates: 4.0, 5.0 (Control C) and 6.0 mln/ha of germinating seeds.

The experiment was performed in 3 replications on the surface of a plot of 40 m^2.

Data obtained on the production of winter triticale varieties were statistically processed by the method of dispersion

analysis of the multifactorial field experiment according to the algorithms described by B.A. Dospekhov.

The soil on which the research was performed was carbonated chernozem, with the humus content of 3.6%, nitrogen content - 0.22%, phosphorus content - 0.14-0.16% and potassium content 1.4-1.6 %. The reaction of soil solution was neutral (pH - 6.9%).

Over the years of experiments the climatic conditions were favourable for the studied crop. Thermal conditions ranged from 11.0°C (2017) up to 12.6°C (2015). The average air temperature per years was 11.8°C exceeding the norm (9.9°C) by 1.9°C.

The amount of precipitation varied from 475.8 mm (2016) up to 554.2 mm (2017). The average per years was of 532.2 mm, exceeding the norm (492 mm) by 40.2 mm.

RESULTS AND DISCUSSIONS

Over the research years (2015-2018), the winter triticale variety Ingen 35 ensured the highest yield, being sown after the forerunner grain peas, which constituted 3632 kg/ha. The grain harvest after this forerunner crop significantly exceeded (LD_{05} 81 kg/ha) the one obtained after the forerunner vetch-oat by 543 kg/ha and the yield obtained after the forerunner sunflower by 1221 kg/ha. The lowest yield of the winter triticale grains Ingen 35 was obtained after the forerunner sunflower amounting to 2411 kg/ha, which is by 1221 kg/ha lower than the control variant – grain peas.

In the case of the planting dates we can mention that after all the studied forerunner crops, the most successful results were obtained on the first (optimal) planting dates. After the forerunner grain peas, the grain yield constituted 4265 kg/ha on the first (optimal) planting dates, significantly exceeding (LD_{05} 89 kg/ha) the second (admissible) planting dates by 583 kg/ha and the third (late) planting dates by 1306 kg/ha. The dynamics of grain production is similar according to the other studied forerunner crops.

If we refer to the seeding rate, the best results were obtained for the variants 5.0 mln/ha - 3077 kg/ha and 6.0 mln/ha - 3072 kg/ha (fig.1).

The influence degree of the forerunner crops on the grain harvest was of 67.11%, while the one of the planting dates constituted 31.92%. The influence of the seeding rate and the interaction of the studied factors was less than 1%.

The Ingen 93 winter triticale variety after the forerunner grain peas recorded a production level of 3744 kg/ha. This forerunner crop was significantly positive (LD_{05}-75 kg/ha) compared to other forerunners studied by 505 kg/ha after the vetch-oat and by 1261 kg/ha after the forerunner sunflower.

As to the planting dates, the Ingen 93 variety, after all the studied forerunner crops recorded the highest yields on the first (optimal) planting dates. After the forerunner grain peas, the yield of this variety was of 4126 kg/ha, which significantly exceeded the second (admissible) and the third (late) planting dates by 356 and 790 kg/ha respectively. The second place by productivity is occupied by the forerunner vetch-oat. After this forerunner crop, the harvest of winter triticale grains on the first (optimal) planting dates was of 3738 kg/ha, significantly exceeding the admissible and late planting dates by 519 and 977 kg/ha respectively. The lowest results were obtained after the forerunner sunflower. On average, the grain yield after the forerunner cops was of 2483 kg/ha. The sowing density did not significantly influence the production of the Ingen 93 variety, the production varying from 3099 kg/ha to 3205 kg/ha (fig. 2).

The dispersion analysis of the multifactorial field experiment did not allow to establish the influence degree of the studied factors on the yield of the Ingen 93 variety.

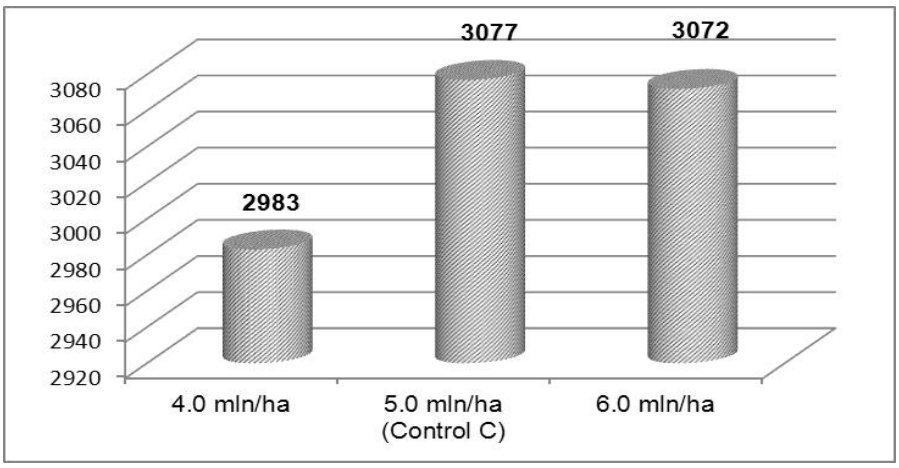

Figure 1. The yield (kg/ha) of the winter triticale Ingen 35 depending on sowing density in multifactorial field experiments, 2015-2018.

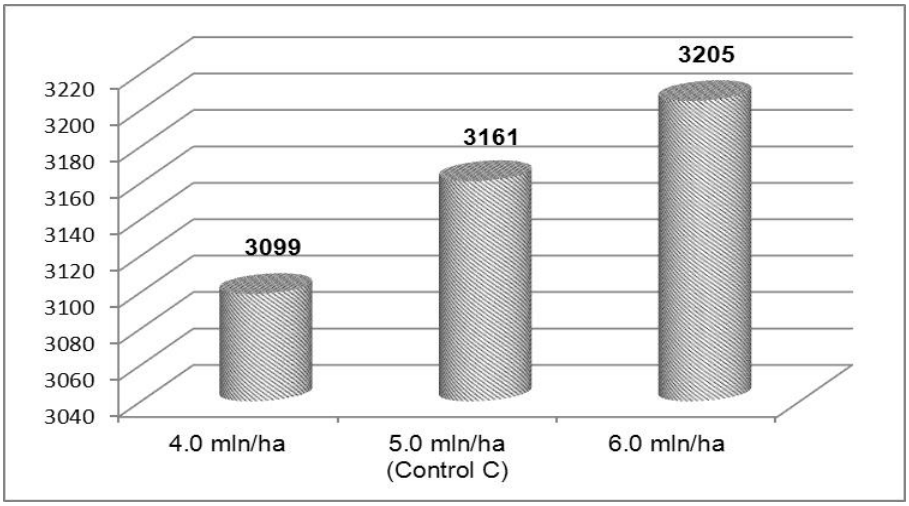

Figure 2. The yield (kg/ha) of the winter triticale Ingen 93 depending on sowing density in multifactorial field experiments, 2015-2018.

Data presented in Table 1 show that the highest influence degree of the factors on the total production belonged to the forerunner crop, which constituted 73.16%, being followed by the factor planting dates with 25.56%. The interaction of the forerunner crop and the planting dates was equal to 1.0%. The other factors and their interaction recorded a share of less than one percent.

Table 1

The influence degree of the studied factors on the production of winter triticale (%), years 2015-2018

Factors	Technological elements	Ingen 35	Ingen 93
A	Forerunner crop	67.11	73.16
B	Planting dates	31.92	25.56
C	Seeding rate	0.47	0.30
AB	Forerunner crop + Planting dates	0.43	1.0
AC	Forerunner crop + Seeding rate	0.02	0
BC	Planting dates + Seeding rate	0.02	0
ABC	Forerunner crop + Planting dates + Seeding rate	0	0
	Total	100	100

The assessment of the protein content in the grains showed that in the

case of Ingen 35 variety, after the forerunner grain peas, the values of this indicator oscillate between 13.17% on the optimal planting dates and 13.91% on the late planting dates (*tab. 2*).

Table 2

Protein content and yield in the winter triticale Ingen 35 production, 2015-2018.

Indicators	Forerunner crops					
	Grain peas (control A)			Vetch-oat		
	Planting dates					
	optimal (control B)	admissible	late	optimal (control B)	admissible	late
5.0 mln/ha	13.17	13.54	13.91	13.91	13.53	14.47
Average per factor A	13.54			13.73		
±compared to the control A, %	-			+ 0.19		
± compared to the control B, %	-	+0.37	+0.74	-	+0.34	+1.28
Protein yield, kg/ha	488.2	438.2	351.9	390.8	373.6	339.9
Average per factor A		426.1			368.1	
± compared to the control A		-			-58.0	
± compared to the control B	-	-50.0	-136.3	-	-17.2	-50.9

On average, after the forerunner grain peas, the protein content constituted 13.54%. After the forerunner vetch-oat, the protein content varied from 13.19% on the optimal planting dates to 14.47% on the late planting dates. On average per forerunner crop, the accumulation of protein in the winter triticale grains of the Ingen 35 variety constituted 13.73%, exceeding the control variant by 0.19%. In this variety, after both forerunner crops, the protein content increased by 0.34-1.28% from the optimal to late planting dates.

The Ingen 93 variety recorded a protein content of 14.11%, after the forerunner grain peas exceeding the vetch-oat by 0.68% (*tab. 3*).

Table 3

Protein content and yield in the winter triticale Ingen 93 production, 2015-2018.

Indicators	Forerunner crops					
	Grain peas (control A)			Vetch-oat		
	Planting dates					
	optimal (control B)	admissible	late	optimal (control B)	admissible	late
5.0 mln/ha	13.39	14.42	14.52	13.23	13.23	13.82
Average per factor A	14.11			13.43		
±compared to the control A, %	-			- 0.68		
± compared to the control B, %	-	+1.03	+1.13	-	0	+0.59
Protein yield, kg/ha	467.4	440.5	398.7	427.6	370.7	326.7
Average per factor A	435.5	375.0				
± compared to the control A	-	-60.5				
± compared to the control B	-	-26.9	-68.7	-	-57.0	-100.9

The dynamics of the variety of protein content depending on the planting dates is similar to the Ingen 35 variety.

Regarding the interaction of the protein yield with the production of winter triticale varieties, we can mention that the Ingen 35 variety recorded the quantity of protein content of 126.1 kg/ha after the forerunner grain peas, while after the forerunner vetch-oat it was of 368.1 kg/ha being by 58.0 kg/ha lower than after the grain peas.

According to the factor planting dates, it registered the highest protein yield on the optimal planting dates, which was of 488.2 kg/ha, exceeding the

admissible planting dates by 50.0 kg/ha and the late by 136.3 kg/ha. After the forerunner vetch-oat, the average protein yield was of 368.1 kg/ha.

The Ingen 93 variety recorded the protein yield of 435.5%, after the forerunner grain peas exceeding the vetch-oat by 60.5 kg/ha. In both varieties of winter triticale, the protein yield tends to decrease from the optimal to the late planting dates.

CONCLUSIONS

Based on the results of 4 years of research we can make the following conclusions:

1. The Ingen 35 and Ingen 93 winter triticale varieties recorded the highest yields after the forerunner crop grain peas: 3632 and 3744 kg/ha respectively.
2. After all the studied forerunner crops, the highest yield was obtained on the optimal planting dates for both varieties of winter triticale.
3. The higher protein content was registered by the Ingen 35 variety sown after the forerunner vetch-oat -13.73% and by the Ingen 93 variety after the forerunner grain peas – 14.11%.
4. It was established the dynamics of increased protein content from the optimal to the late planting dates for both varieties and after both forerunner crops.
5. The protein yield was higher in the case of Ingen 93 variety after both forerunner crops: 4355 kg/ha after grain peas and 375.0 kg/ha after vetch-oat.
6. The dominant influence degree of technological elements on the production of winter triticale belongs to the forerunner crop 67.11-73.16%, while the influence degree of the planting dates was 2 times lower 31.92 and 25.56%.

BIBLIOGRAPHY

1. **Veveriţă, E., etc.,** 2014 - Triticale - new cereal for Moldovan agriculture, Materials of the Scientific-Practical Conference dedicated to the 70th anniversary of the founding of ICCC "Selection", Results and perspectives of research on field plant cultivation in the Republic of Moldova, Chisinau, pp.182-188.
2. **Belcenso, S.A., Malitev, V.F.,** 2007 - Regulation of the productive process of sowing winter triticale by technological methods. Grain farming in Russia, №5, pp.8-9.
3. **Csnicatchina, A.N., Rogosnica N. V.,** 2007 - Cultivar of winter triticale. Feed production, №10, c.21-22.
4. **Csnicatchina, A.N., Rogosnica N. V.,** 2006 - Agroecological study of triticale varieties. Grain farming,№ 6, c.19.
5. **Dospehov, B. A.,** 1979 - Field experiment technique. Moscow, Kolos, 416 p.