

GRAIN PRODUCTIVITY AND QUALITY OF THE WINTER BARLEY VARIETY ZIMOVYI IN MULTIFACTORIAL FIELD EXPERIMENTS

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Abstract

The paper presents the results of 3 year research studies on the productivity, content and amount of crude protein recorded by the winter barley variety Zimovyi in multifactorial field experiments. It has been established the effect of forerunner plants on the productivity of winter barley crops which was of 72.37%. On average, over 2 years of research, it was recorded the yield of 3609 kg/ha after the forerunner grain peas, while after the forerunner vetch-oat it was of 2507 kg/ha. The effect of planting dates constituted 24.55%. The highest grain yield was obtained on the optimal planting dates - 3750 kg/ha after the forerunner grain peas and 2631 kg/ha on the admissible planting dates after the forerunner vetch-oats. The amount of crude protein in the winter barley grains is higher after the forerunner vetch-oats – 12.13%, exceeding the value of 0.16% obtained after the forerunner grain peas.

Key words: winter barley, forerunner plant, planting dates, productivity, crude protein.

Documentul de față este aranjat astfel încât să poată fi utilizat ca model. De asemenea, el este un șablon pe care se poate lucra în mod direct prin înlocuirea paragrafelor corespunzătoare.

Winter barley is a traditional grain crop cultivated in the Republic of Moldova since the end of the XVIIIth century (Labcenco V.N., Niscii I.A., 1965; Voizian V.N., Jurat V.F., 2016). Recently, the winter barley varieties with a semi-winter type of development, i.e. cultivated both in spring and in autumn, have been identified as the most suitable for the soil and climatic conditions of the country. They are tolerant to a low soil fertility, because of the high cost of mineral fertilizers and longer periods of sowing (Voizian V.N., Jurat V.F., 2016).

The cultivation technology of the above mentioned varieties is quite thoroughly studied but only in simple experiments. The aim of our work was to study the productivity and quality of grains of winter barley variety *Zimovyi* in a multifactorial field experiments.

MATERIAL AND METHOD

The experiments were conducted in the central agro-climatic zone of the Republic of Moldova at the Didactic Experimental Station "Chetrosu" in the period 2015-2017. During the

multifactorial experiments, the following factors were studied:

Factor A: two forerunner plants (grain peas and vetch-oats); Factor B: three planting dates - optimal (19-24.X-control), admissible (19-30.X) and late (29.X-21.XI); Factor C: three seeding rates: 4.0, 5.0 (control) and 6.0 mln/ha.

The sowing of winter barley was carried out with the seeder CH-16A according to the research program. The experiment was designed with 3 replicates on a plot area of 40 m².

Total nitrogen was determined by the Kjeldahl ultra-method. Mineral fertilizers were applied in spring after the emergence of plants at the dose of 100 kg/ha of ammonium nitrate.

RESULTS AND DISCUSSIONS

In conditions of the Republic of Moldova, the main factor determining the yield of field crops, including winter barley is soil moisture availability index, which depends on the amount of precipitation during the vegetative phase of plant development.

Over the years of research, the average grain yield after the forerunner grain peas varied from 2210 kg/ha in 2015 to 4647 kg/ha in 2017. After the second studied forerunner plant, vetch-oats, the yield varied from 1838 kg/ha in 2017 to 3791 kg/ha in 2016. On average, over the years of research, after the

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forerunner grain peas, the yield of winter barley grains was of 3609 kg/ha (figure 1, table 1). This forerunner plant ensured the maximum productivity of winter barley of 3888 kg/ha on the optimal planting dates and at the seeding rate of 4.0 mln/ha. The average grain yield after the forerunner vetch-oats is significantly lower than after grain peas

amounting to 2507 kg/ha. This is by 1102 kg/ha lower than the yield obtained after grain peas and this difference is significant since the LD₀₅ value is of 78 kg/ha. In terms of planting dates, after the forerunner grain peas, the maximum grain yield was obtained on the optimal planting dates, which amounted to 3750 kg/ha.

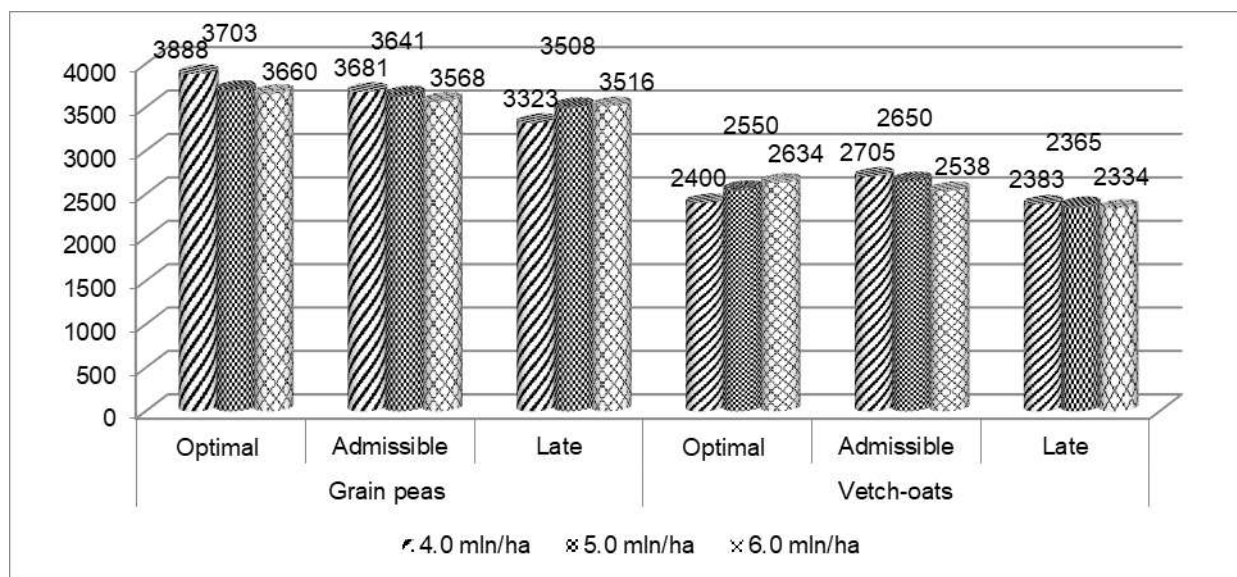


Figure 1 Productivity (kg / ha) of Zimovyi autumn barley variety depending on density, sowing time and forerunner plants.

Table 1

Productivity (kg/ha) of winter barley variety Zimovyi in multifactorial field experiments, 2015-2017

Seeding rates, mln/ha (factor C)	Forerunner plants (factor A)						Average according to factor LD ₀₅ C-90, kg/ha	± reported to the control 5.0 mln/ha
	Grain peas (control A)			Vetch-oats				
	Planting dates (factor B)							
	Optimal (control B)	Admissible	Late	Optimal (control B)	Admissible	Late		
4.0	3888	3681	3323	2400	2705	2383	3063	-7
5.0 (control C)	3703	3641	3508	2550	2650	2365	3070	-
6.0	3660	3568	3516	2634	2538	2334	3042	-28
Average according to factor A	3609			2507				
± reported to grain peas	-1102							
HCP ₀₅ A	78							
Average according to factor B	3750	3629	3449	2528	2631	2361		
± reported to planting dates	-	-121	-301	-	+103	-167		
LD ₀₅ B, kg/ha	90							
LD ₀₅ of the experiment, kg/ha	235							

On admissible planting dates, the grain yield was 3629 kg/ha, which is by 121 kg/ha less than the optimal period. On late planting dates, there is a further decrease in the grain yield down to 3449 kg/ha, which is by 301

kg/ha less than on the optimal period. It was noticed a significant decrease in the productivity level of winter barley grains going beyond LD₀₅ - 90 kg/ha

After the second forerunner vetch-oats, the average grain yield of the Zimovyi variety was of 2507 kg/ha. This forerunner plant ensured the maximum grain yield of 2705 kg/ha on admissible planting dates at the seeding rate of 4.0 mln/ha.

On average, over the years of research, on admissible planting dates, the highest grain yield amounted to 2631 kg/ha, which is by 103 kg/ha significantly higher than on the optimal planting dates.

The minimum grain yield of 2361 kg/ha, after the forerunner vetch-oats, was obtained on the late planting dates, which is significantly lower than on the optimal

planting dates by 167 kg/ha and lower than on the admissible planting dates by 270 kg/ha.

According to the seeding rate options, the grain yield did not change significantly and it amounted to 3042 kg/ha at the seeding rate of 6.0 mln/ha and 3070 kg/ha at the seeding rate variant of 5.0 mln/ha. The marked decrease in productivity (7-28 kg/ha) was insignificant, within the range of LD₀₅ - 90 kg/ha.

The analysis of variance of the multifactorial field experiments allowed us to determine the influence degree of each of the studied technology elements and their interaction on the grain yield of winter barley variety Zimovyi (table 2).

Table 2

The influence degree of factors on the productivity of winter barley

№	Factors	Influence degree, %
1	Forerunner plant	72.37
2	Planting dates	24.55
3	Seeding rate	0.49
4	Interaction: forerunner plant - planting dates	1.47
5	Interaction: forerunner plant - seeding rate	0.45
6	Interaction: planting dates - seeding rate	0
7	Interaction: forerunner plant - planting dates - seeding rate	0.81
	Total	100

The forerunner plants had the most significant impact on grain productivity – 72.37%, the influence degree of the planting dates was 24.55%. Changes in the seeding rates and possible interactions of the studied factors influenced by 1.47 – 0.49%.

The determination of the crude protein content was carried out at the seeding rate option of 5.0 mln/ha. On average, over two years, the crude protein content in the grains of winter barley grown after the forerunner grain peas was 11.97%, which is by 0.16% less than

after the forerunner vetch-oats - 12.13% (figure 2, table 3).

The planting dates had a significant impact on the dynamics of the crude protein accumulation in the winter barley grains. After the forerunner grain peas, the highest content of the main component highlighting grain quality was recorded on the late planting dates, amounting to 12.54%, which is by 0.46% higher than on the optimal planting dates and by 1.24% higher than on the admissible planting dates.

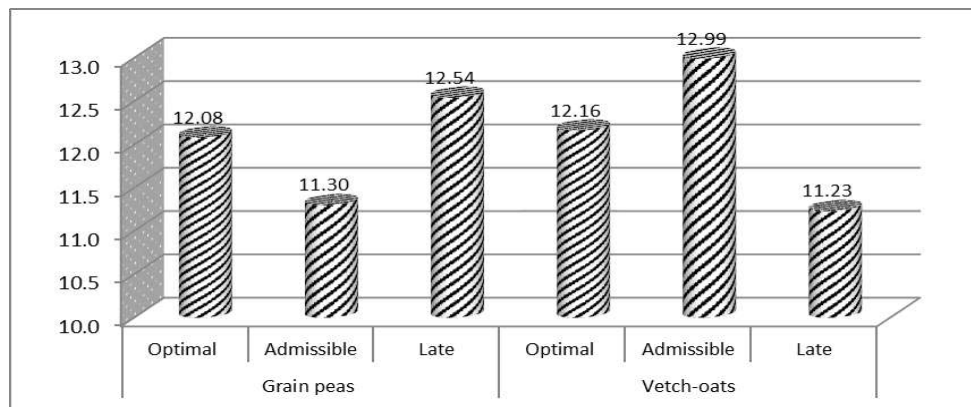


Figure 2 The protein (%) in the grains of winter barley variety Zimovyi.

Table 3

Content (%) and amount of crude protein (kg/ha) in the grains of winter barley variety Zimovyi, 2016-2017

Seeding rate, mln/ha (factor C)	Forerunner plant						Average of the experim ent
	grain peas			vetch-oats			
	planting dates						
	optimal	admissible	late	optimal	admissible	late	
% protein	12.08	11.30	12.54	12.16	12.99	11.23	12.06
Average reported to the forerunner plant	11.97			12.13			
± reported to grain peas	+0.16						
± reported to the 1 st planting dates	-	-0.78	+0.46	-	+0.83	-0.93	
Amount of protein, kg/ha	458.7	415.1	454.2	297.0	342.4	247.0	367.4
Average reported to the forerunner plant	439.2			295.5			
± reported to grain peas	-193.7						
± reported to the 1 st planting dates	-	-43.6	-4.5	-	+45.5	-50.0	

After the forerunner vetch-oats, the maximum crude protein content of 12.99% was recorded on the admissible planting dates significantly exceeding the optimal planting dates by 0.87% and the late planting dates by 1.76%.

On average, according to the experiment, the content of raw protein in winter barley grains was of 12.06%, which is a very good indicator of their quality.

The amount of crude protein extracted from the grain yield after the forerunner grain peas averaged 439.2 kg/ha. According to the planting dates options, the values of this indicator amounted to 458.7 kg/ha on the optimal and 415.1 kg/ha on the admissible planting dates.

After the forerunner vetch-oats, the amount of crude protein extracted from the grain yield averaged 295.5 kg/ha, which is significantly lower than after the forerunner grain peas by 193.7 kg/ha. The maximum amount of crude protein of 342.4 kg/ha, extracted from the grain yield, was obtained on admissible planting dates. On average, according to the experiment, the amount of crude protein extracted from the grain yield was of 367.4 kg/ha.

CONCLUSIONS

As a result of performed studies on grain productivity and quality of the winter barley variety Zimovyi in multifactorial field

experiments, the following conclusions could be drawn:

1. Out of the studied forerunner plants, the most effective was grain peas as the grain yield was of 3690 kg/ha, the influence degree of the forerunner plants on the grain yield amount was of 72.37%;
2. It was determined a selective reaction of the Zimovyi variety to the planting dates after various forerunner plants. After the forerunner grain peas, the greatest effect was obtained on the optimal planting dates - 3750 kg/ha, and after the forerunner vetch-oats on admissible planting dates - 2631 kg/ha. The influence degree of the planting dates on the total yield of Zimovyi variety was of 24.55%;
3. The influence of the seeding rate on the winter barley yield was not detected – 0.49%;
4. The forerunner grain peas contributed to the creation of more favorable conditions for the accumulation of nitrogen compounds in the winter barley grains, which resulted in a higher crude protein content in the grains and its extracted amount from the grain yield.

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