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YIELDS AND QUALITY OF WINTER WHEAT VARIETIES DEPENDING ON PRECEDING CROPS AND SEEDING RATES IN THE RIGHT-BANK FOREST STEPPE OF UKRAINE

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The results of research on the impact of different preceding crops, varieties and seed rates on yield and grain quality of winter wheat.

It was found that the worst predecessors for winter wheat is corn silage and soybeans, which later dismissed the field, leading to a substantial 18.3 and 13.7 % reduction in yield crops. The most fruitful was the Smuglyanka variety with a seeding rate of 5 million pcs. /ha after peas and buckwheat.

Key words: *winter wheat,* preceding crops, *varieties, yield,* seeding rates *protein content, gluten content.*

Sown area of winter wheat, as the main food crops of Ukraine, during the last years, the range of 6.5 million hectares. Under the 2015 harvest was planted 6.8 million hectares, which is 12 % more than in the previous year. But along with increasing the share of culture in the structure of sown areas, winter wheat grown increasingly after nonfallow predecessors. This determines their significant role in shaping yields that adequate of bioclimatic potential [9].

The research of many scientists found that the rate of seeding of winter wheat has a significant impact on its yield and grain quality. Because it affects the area of plant nutrition, growth, leaf apparatus and the content of chlorophyll, temperature conditions, light intensity, availability of CO_2, photosynthesis, respiration, and other physiological and biochemical processes. From seeding rates also depends on the effectiveness of certain farming practices – predecessors, soil tillage, fertilization and others [5, 10].

It is proved that under the same conditions of growing different varieties manifest themselves in different ways, so the realization of potential productivity are significantly different. The share of influence of varieties on the yield of the winter wheat, according to most researchers is 25–30 %. Therefore, the selection of

modern intensive varieties some extent eliminates the negative impact of shortcomings admitted during the growing culture [1, 2, 4, 5, 7].

The goal of research was determination of the regularities of formation crop of different varieties of winter wheat depending on predecessors and seeding rates of culture in Right-Bank Forest-Steppe zone of Ukraine.

The materials and methods of research. The research was conducted during 2012–2014, in the science lab SOOO «Rasava» Skvira district Kyiv region.

Soil on field – typical black soil on loess. Humus content (by Turin) in the topsoil – 4.0–4.2 %, available nitrogen (N-NO3 + N-NH4) – 22.3 mg / 1000 g soil, mobile phosphorus (by Machihin) – 18 mg / 1000 g of soil, rolling potassium (by Machihin) – 203 mg / 1000 g soil, pH saline – 6.5–7.0.

In the three factor field experiment investigated such predecessors of winter wheat (factor A), peas (control), corn on a silage, soybean (early ripening), buckwheat, winter rape; varieties of winter wheat (factor B): Poliska 90 (control); Podolanka; Myronivsky 65; Smuglyanka and seeding rate of germinating seeds (factor C): 4; 4.5 (control); 5 and 5.5 million pcs./ha.

The Area of sown plots – 60 m^2, the accounting area – 50 m^2, repetition – three times. Split plots laid the experiment. The technology of growing of winter wheat – common for the zone (ISO 3768: 2010) [8].

Accounting for grain yield were carried out in the phase of full ripeness of winter wheat by method of a full harvesting of accounting plots. The grain of each variant in all repetitions separately adjusted to 100 % purity and moisture standard [6]. The protein content in grain was determined on the device NEOTEC – 4250 using infrared spectroscopy, the amount of gluten by a manual laundering in water (GOST 13586.1-68) [3]. Statistical analysis of data was performed using the «Statistica 10».

The results of research. Place of winter wheat in the rotation affects on providing the culture of moisture and nutrients regimes. In addition, preceding crops affects on the physical condition of the soil that affect the level of absorption of precipitation and nitrification process. Accordingly, the intensity of plant growth

and development of winter wheat, and with it the formation of the crop and its quality will be determined by the abovementioned indicators, which to some extent depend on the predecessor.

Absolute numbers of wheat yield varied within 4–7.4 t / ha, depending on the interaction between factors studied (Tab. 1). Analyzing the impact of predecessors on winter wheat yield, we can state that the determining factors here were the timing of their harvesting and their impact on the stocks of available moisture in the soil weediness and phytosanitary status field.

1. The yield of winter wheat depending on the precursors, the varietal characteristics and seeding rates (average for 3 years).

Predecessors (A)	**Varieties (B)**	**Seeding rate of germinating seeds, million pcs./ha. (C)**				**Average A**	**Interaction effects, AB**
		4	**4,5 (St)**	**5**	**5,5**		
Peas (St)	Poliska 90 (St)	4,7	5,3	5,6	4,5	6,0	5,0
	Podolanka	5,2	5,9	6,4	5,1		5,7
	Myronivsky 65	5,6	6,2	6,6	5,4		6,0
	Smuglyanka	6,4	7,0	7,4	6,7		6,9
Corn on silage	Poliska 90 (St)	3,9	4,5	4,9	4	4,9	4,3
	Podolanka	4,1	5,2	5,5	4,6		4,9
	Myronivsky 65	4,7	5	5,3	4,4		4,9
	Smuglyanka	5,7	6,5	6,5	6,2		6,2
Soybean (early ripening)	Poliska 90 (St)	4	4,6	4,7	4,2	5,2	4,4
	Podolanka	4,4	5,3	5,6	4,1		4,9
	Myronivsky 65	4,6	5,6	5,7	4,6		5,1
	Smuglyanka	6,3	6,6	6,9	6,0		6,5
Buckwheat	Poliska 90 (St)	4,5	5,6	5,8	4,8	5,7	5,2
	Podolanka	5,6	6,5	6,7	5,9		6,2
	Myronivsky 65	5,5	6	6,4	5,3		5,8
	Smuglyanka	6,1	7,0	7,2	6,2		6,6
Winter rape	Poliska 90 (St)	4,5	5	5,4	4,3	5,5	4,8
	Podolanka	4,9	5,7	6,1	4,8		5,4
	Myronivsky 65	5,3	5,8	6,2	5,3		5,7
	Smuglyanka	6	6,4	6,7	6,1		6,3
Average C		5,1	5,8	6,1	5,1	**Average B**	$LSD_{05}A(\%)=6,3$ $LSD_{05}B(\%)=7.1$ $LSD_{05}C(\%)=3,3$
Interaction effects, BC	Poliska 90 (St)	4,3	5,0	5,3	4,4	4,7	
	Podolanka	4,8	5,7	6,1	4,9	5,4	
	Myronivsky 65	5,1	5,7	6,0	5,0	5,5	
	Smuglyanka	6,1	6,7	6,9	6,2	6,5	

The yield of winter wheat ranged 5.1–18.3 %, depending on the predecessor. Based on the conducted ANOVA, we can conclude that the odds in favor of the null hypothesis that the yield of winter wheat does not depend on the studied factors range from 0 to 1.0. Thus 100 % against this hypothesis. Therefore, the factors of predecessor, varieties and seeding rates statistically significantly influenced the yield of culture (Tab. 2).

2. ANOVA of field experiment (on average 3 years)

Effect	SS	Degr. of Freedom	MS	F	p
A	40,905	4	10,226	705,3	0,0000
B	127,169	3	42,39	2923,4	0,0000
C	59,416	3	19,805	1365,9	0,0000
A*B	8,386	12	0,699	48,2	0,0000
A*C	0,889	12	0,074	5,1	0,0000
B*C	1,774	9	0,197	13,6	0,0000
A*B*C	3,198	36	0,089	6,1	0,0000
Error	3,48	240	0,015		

In determining the reliability of differences between specific variants found that precursors which later harvested significantly reduced the yield of wheat. The lowest yield observed after corn silage (-18.3 %) and soybeans (-13.7 %). After the crops that are harvested early yield of wheat have received at the level of control. In particular, after buckwheat yield was at 5.7 t / ha, which is within LSD_{05}. Related values were after winter rape.

Also winter wheat crop significantly depended on its varietal characteristics. So, on average, 37 % higher than in the control (Poliska 90) yields formed a Smuglyanka due to resistance to moisture deficit during the critical periods of development, and varieties Podolanka and Myronivsky 65 showed by 13.5 and 15.5% higher crop yields compared to the control.

The ontogenesis of plants is constantly under the influence of their density in the population. When optimal placement with necessary area of nutrition, intraspecific competition in crops of cultivated plants is low. The highest yield on average in varieties was for plant density of wheat 5 million pieces germinating

seeds/ha. Increasing the seeding rate to 5.5 million pieces/ha resulted in a significant decrease in yield – from 10 to 27 % depending on the predecessor. This is due to enhanced competition for factors of life in densely planted crops. Reduction of the seed rate to 4 million pieces/ha resulted in a significant (-11.8) reduction in yield due to deterioration of the phytosanitary condition of crops, due to increased plants competition from weeds. The slightest fluctuations in the level of yields depending on the seeding rates were observed when grown variety Smuglyanka, that is, this variety was best suited to sparse and dense crops.

Varieties had the greatest impact on yield of winter wheat – 51.9 %, seeding rate – 24.2, the predecessors of – 16.7 % as evidenced calculations in Figure 1.

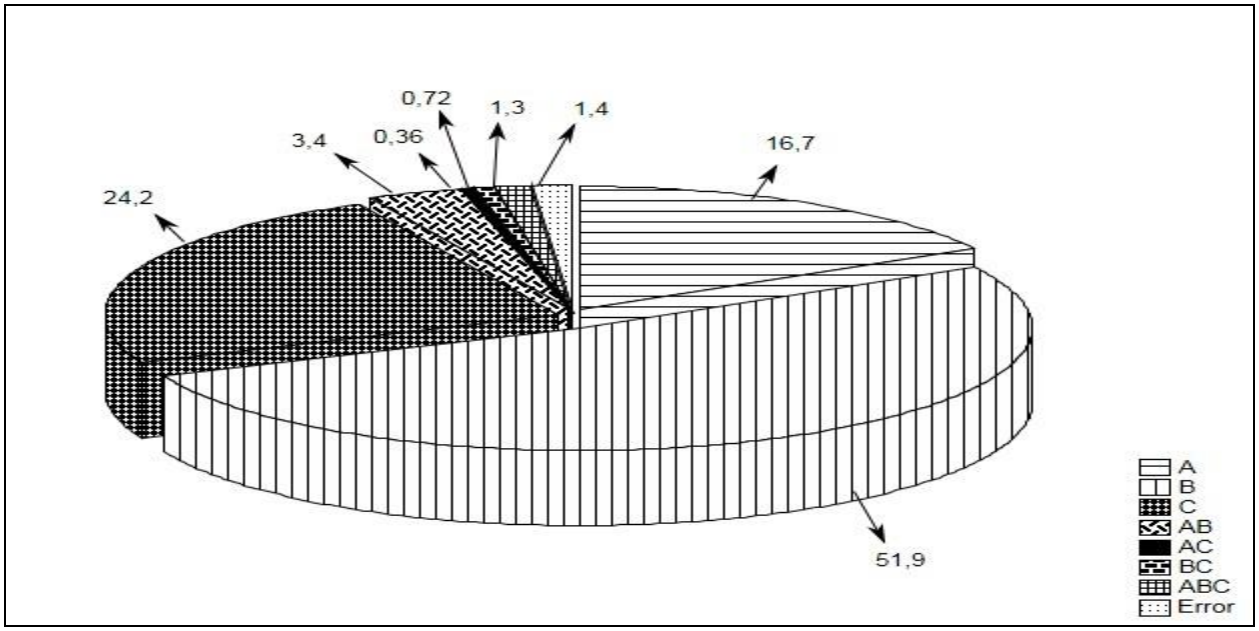

Fig. 1. The share of influence factors on winter wheat yield, % (average 3 years).

The interaction of factors in percentage terms, had less impact than the effect of each factor separately.

In total in the experiment higher winter wheat yield (7.4 t/ha) was obtained from the variety Smuglyanka with a seeding rate of 5 million seeds/ha on predecessor peas that by 39.7 % more control. Similar results were in the same variety at the same seeding rate after sowing buckwheat predecessor.

The formation of grain quality indicators significantly influenced predecessors and varieties of winter wheat. The content of protein and gluten are crucial indicators of quality grain. Under current standards for wheat (ISO-3768: 2009) in Ukraine to food grain class III include grain protein content of at least 11 %, and gluten – 18 %.

The table 3 data strongly suggest that the quality of winter wheat grown after soybeans, buckwheat and winter rape were not significantly different from controls, although the tendency to reduce it, and after corn silage - significantly inferior control.

3. The quality of winter wheat depending on the varietal characteristics and predecessors (average 3 years)

Попередник	Protein, %	Interaction effects, ± %	Gluten, %	Interaction effects, ± %
Poliska 90 (St)				
Peas (St)	11,3	0	22,9	0
Corn on silage	10,8	-4,4	20,2	-11,8
Soybean (early ripening)	11,2	-0,9	21,6	-5,7
Buckwheat	11	-2,7	21	-8,3
Winter rape	11,1	-1,8	21,1	-7,9
LSD_{05}(%)	-	3,54	-	2,3
Podolanka				
Peas (St)	10,8	0	20,5	0
Corn on silage	10	-7,4	19,4	-5,4
Soybean (early ripening)	10,7	-0,9	20	-2,4
Buckwheat	10,3	-4,6	19,8	-3,4
Winter rape	10,2	-5,6	19,9	-2,9
LSD_{05}(%)	-	6,7	-	2,52
Myronivsky 65				
Peas (St)	12,5	0	24,4	0
Corn on silage	11,1	-11,2	21,3	-12,7
Soybean (early ripening)	12,2	-2,4	21,9	-10,2
Buckwheat	11,9	-4,8	21,7	-11,1
Winter rape	11,8	-5,6	21,7	-11,1
LSD_{05}(%)	-	7,2	-	3,45
Smuglyanka				
Peas (St)	12,7	0	25	0
Corn on silage	11	-13,4	21,1	-15,6
Soybean (early ripening)	12,9	1,6	22	-12,0
Buckwheat	12,3	-3,1	21,6	-13,6
Winter rape	12	-5,5	21,3	-14,8
LSD_{05}(%)	-	7,8	-	3,78

Lower grain quality parameters when growing winter wheat after silage maize are explained worst moisture and nutritional regimes after this culture.

Best quality grains formed in plots where were grown variety Smuglyanka, whose protein content increased by 9.9 %, and gluten – by 3.9 % compared to the control variant Poliska 90.

Conclusions. In the conditions Right-Bank Forest-Steppe Ukraine for more complete realization of the genetic potential of winter wheat yield and receiving culture at 7.2–7.4 t/ha with the highest quality indicators advisable to grow Smuglyanka sort of seeding rate of 5 million seeds/ha after predecessors buckwheat and peas that 35.8–39.6 % more control.

The list of used literature resources

1. Бутенко А. О. Вплив строків сівби та сортових особливостей на продуктивність і якість зерна озимої пшениці / А. О. Бутенко, О. М. Бакуменко // Вісник сумського національного аграрного університету серія «агрономія і біологія». – 2011. – № 4. – С. 88–91.

2. Жемела Г. П. Якість зерна озимої пшениці / Г. П. Жемела – К.: Урожай, 1973. – 183 с.

3. Зерно. Методы определения количества и качества клейковины в пшенице : Гост 13586.1–68. – [от 2009.01.01]. – М. : Стандартинформ, 2009. – 6 с. – (Межгосударственный стандарт).

4. Кудря С. І. Вологозабезпеченість і урожайність пшениці озимої залежно від попередника. / С. І. Кудря, М. К. Клочко, Н. А. Кудря // Вісник аграрної науки. – 2007. – №11. – С. 23–26.

5. Лихочвор В. В., Озима пшениця. / В. В. Лихочвор, Р. Р. Грець – Львів: Українські технології, 2002. – 88 с.

6. Мойсейченко В. Ф. Основи наукових досліджень в агрономії / В. Ф. Мойсейченко, В. О. Єщенко. – К. : Вища школа, 1994. – 334 с.

7. Невмивако Т. В. Вплив попередників на врожайність і якість зерна пшениці озимої / Т. В. Невмивако // Вісник аграрної науки. – 2008.– №4. – С. 74–76.

8. Пшениця. Технічні умови : ДСТУ 3768-2010. – [Чинний від 2010-01-04]. – К. : Держспоживстандарт України, 2010. – 14 с. – (Національний стандарт України).

9. Рослинництво України 2014. Статистичний збірник – К. : Державна служба статистики України, 2015. – 180 с.

10. Русанов В. Технології вирощування озимої пшениці та їх оцінка / В. Русинов // Агроном. – 2008. – №4. – С. 84 – 88.