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ВПЛИВ АГРОЗАХОДІВ НА ПІДВИЩЕННЯ ПРОДУКТИВНОСТІ ПШЕНИЦІ ЯРОЇ

Анотація. *Метою досліджень було оцінити реакцію сортів пшениці ярої на норми мінеральних добрив і строки сівби в умовах нестійкого зволоження центральної частини Правобережного Лісостепу. Польовий, лабораторний і статистичний методи досліджень. Вперше в умовах нестійкого зволоження правобережного Лісостепу України встановлено залежність формування агрофітоценозу та продуктивності пшениці ярої від норми внесених добрив та строку сівби, а також визначено вплив досліджуваних чинників на формування якості зерна. Перевагу слід надавати середньостиглим сортам пшениці ярої, вирощуючи їх на високих фонах мінерального живлення з сівбою в третій декаді березня. З перенесенням строку сівби від оптимально раннього (27 березня) до пізнього (27 квітня) ріст і розвиток рослин усіх досліджуваних сортів, а також оптимальне використання запасів ґрунтової вологи погіршуються. Зменшення такої негативної дії можливе за рахунок оптимізації умов мінерального живлення.*

Ключові слова: *пшениця яра, строк сівби, норма добрива, врожайність, якість зерна.*

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ВЛИЯНИЕ АГРОПРИЁМОВ НА ПОВЫШЕНИЕ ПРОДУКТИВНОСТИ ПШЕНИЦЫ ЯРОВОЙ

Аннотация. *Целью исследований была оценка реакции сортов пшеницы яровой на нормы минеральных удобрений и сроки сева в условиях неустойчивого увлажнения центральной части Правобережной Лесостепи. Полевой, лабораторный и статистический методы исследований. Впервые в условиях неустойчивого увлажнения правобережной Лесостепи Украины установлена зависимость формирования агрофитоценозов и производительности пшеницы яровой нормы вносимых удобрений и срока сева, а также определено влияние исследуемых факторов на формирование качества зерна. Предпочтение следует отдавать среднеспелых сортов пшеницы яровой, выращивая их на высоких*

фонах минерального питания с посевом в третьей декаде марта. С переносом срока сева от оптимально раннего (27 марта) до позднего (27 апреля) рост и развитие растений всех изучаемых сортов, а также оптимальное использование запасов почвенной влаги ухудшаются. Уменьшение такой негативного воздействия возможно за счёт оптимизации условий минерального питания.
Ключевые слова: *пшеница яровая, срок сева, норма удобрения, урожайность, качество зерна.*

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THE IMPACT OF AGRICULTURAL PRACTICES ON THE PRODUCTIVITY OF SPRING WHEAT

Abstract. *Purpose is to evaluate the response of spring wheat varieties to norms of mineral fertilizers and the timing of sowing under the conditions of unstable moisture of the central part of the Right Bank Forest-Steppe. Methods are field, laboratory and statistical. For the first time under the conditions of unstable moisture of Right Bank Forest-Steppe of Ukraine the dependence of agrophytocenoses and spring wheat yield on the norm of applied fertilizers and the time of sowing is determined and the influence of studied factors on the formation of grain quality is shown. The advantage should be given to mid ripening varieties of spring wheat, growing them on high background mineral nutrition with sowing in the third decade of March. With postponing the sowing date from the optimally early date (March 27) to late one (April 27), the growth and development of plants of all studied varieties, as well as the optimal use of soil moisture reserves deteriorate. Reduction of such negative action is possible due to the optimization of mineral nutrition conditions.*
Keywords: *spring wheat, sowing date, fertilizer norm, yield, grain quality.*

The importance of grain production is determined by its special role in the formation of food resources of the country. The volumes of grain production determine the degree of food security of the country [1].

Under the ecological conditions, the territory of Ukraine is favorable for the cultivation of wheat grain. More than 98% of the area of wheat agrocenoses is occupied by winter wheat which is quite understandable because this crop is 5–10 c/ha more productive in the territory of Ukraine, compared with spring wheat. However, it is obvious that the comparison of winter wheat yield and spring wheat one is incorrect, since the winter form has, firstly, a twice longer active vegetation period (about 200 days, whereas spring wheat has only 100 days) and, therefore, is biologically more productive. Secondly, as a rule, winter wheat is more optimally provided in agrotechnological terms, in particular by better precursors and fertilizer standards [2]. However, in recent years, winter wheat crops, due to unfavorable hydrothermal conditions of the autumn–winter period, often thin out or completely die. Therefore, in order not to reduce gross harvesting of food grain, it is necessary to pay attention to the expansion of the sown areas of spring wheat [3–6].

Thanks to works of the domestic scientists V. M. Remeslo, V. F. Saiko, V. A. Vlasenko, V. V. Lykhochvor, A. M. Izotov, I. M. Svydyniuk, D. M. Alimov, V. M. Yula, V.S. Golik, A. P. Bilitiuk, L. V. Andriychenko, A. O. Rozhkov and many others, a significant progress has been made on solving a number of technological problems. At the same time, the average yield of spring wheat in Ukraine for many years suggests that the potential of varieties is still realized by only 37% [4]. The stability of new varieties to stress factors is determined by the degree of their adaptability and stability to certain conditions. It should be noted that modern varieties of spring wheat with different morphological characteristics and genetic potential of productivity, reactions of which on the requirements of conditions of the growing environment, impact of mineral fertilizers and the timing of sowing under the conditions of unstable moisture of Right Bank Forest-Steppe are still insufficiently investigated and therefore relevant.

The research purpose is to evaluate the influence of mineral fertilizers and the timing of sowing on the productivity of spring wheat varieties under the conditions of unstable moisture of Right Bank Forest-Steppe.

The research materials and methods. The experimental work was carried out at Cherkasy State Agricultural Research Station NSC "Institute of Agriculture of NAAN of Ukraine" in the fields of State Experimental Agricultural Enterprise "Cherkaske" in 2014 and 2015.

The experiment is based on the split plot method. Experiment replication is three-time and the placement of plots is consistent. The total area of the plot is 75 m^2 and the registration plot is 50 m^2.

The system of spring wheat fertilization included the following variants: 1. without fertilizers *(check variant)*; $N_{65}P_{65}K_{65}$, 3.$N_{80}P_{80}K_{80}$; 4.$N_{120}P_{120}K_{120}$.

In the experiment such spring wheat varieties as Nedra (Institute of Agriculture of the National Academy of Sciences of Ukraine), Elegia Myronivska and Struna Myronivska (Myroniv Institute of Wheat named after VM Remeslo NAAS of Ukraine) were studied. The timing of sowing is I – March 27; II – April 10; III – April 27. As a rule, the first time of sowing annually coincide with the soil physical maturity. The determining factor for defining the following periods of sowing was a gradual increase in soil temperature at the depth of seeding by 1–2 °C. Phenological monitoring of plants was carried out in accordance with "Methods of state variety testing of agricultural crops" [7]. The analysis of the yield structure included the determination of a number

of plants per unit area, density of productive stalk, plant height, ear length, amount of grain in the ear and thousand-kernel weight.

Harvest recording was carried out using the continuous threshing of each plot, followed by revaluation for 100% purity and 14% humidity [8]. It was monitored by test sheaves which were taken before collecting from two non-adjoining repetitions in two places of a plot of 1 m^2. The quality indicators of soft wheat grain were determined according to the national standard of Ukraine DSTU 3768-2010 "Wheat. Specifications" [9] by the method of infrared spectrometry, on the infrared analyzer NIP Scanner 4250 with computer software ADIDM 3114.

Research results. The crop formation is a complex prophylactic process which is determined by the genetic program of a plant and the environmental conditions [5, 10–15].

The yield level varied during research years and it was caused by weather factors, namely precipitation. The most important thing in the preparation and sowing of spring wheat is to retain soil moisture, the significant losses of which delay the emergence of simultaneous seedlings and, therefore, the initial growth and development which in the future leads to a sharp decline in the productivity, since in the initial period of growth, before the stem elongation spring wheat consumes moisture from upper layers of the soil no deeper than 50 cm. Wheat can use water from the depth of 50–100 cm only after the stem elongation and after the ear formation it uses moisture from the depth of more than 100 cm [15]. Over the years of research, reserves of

Таблиця

Yield and quality of grain of spring wheat varieties depending on the time of sowing and conditions of mineral nutrition in 2014 and 2015

№	Variant	Yield, t/ha		Σ, t/ha	Increase		Protein, %		Σ, %
		2014	2015		t/ha	%	2014	2015	
1	Nedra (I*) – check variant	2.51	2.77	2.64	–	–	11.7	11.0	11.3
2	Nedra (II)	2.43	2.54	2.48	-0.16	-6	11.3	10.4	10.8
3	Nedra (III)	2.40	2.48	2.44	-0.20	-8	11.1	10.0	10.5
4	Nedra (I) + $N_{65}P_{65}K_{65}$	3.53	3.57	3.55	0.91	34	13.1	12.7	12.9
5	Nedra (II) + $N_{65}P_{65}K_{65}$	3.40	3.42	3.41	0.77	29	12.8	11.8	12.3
6	Nedra (III) + $N_{65}P_{65}K_{65}$	3.33	3.37	3.35	0.71	27	12.5	11.5	12.0
7	Nedra (I) + $N_{80}P_{80}K_{80}$	3.97	3.88	3.92	1.28	48	14.5	13.3	13.9
8	Nedra (II) + $N_{80}P_{80}K_{80}$	3.82	3.71	3.76	1.12	42	14.2	12.8	13.5
9	Nedra (III) + $N_{80}P_{80}K_{80}$	3.75	3.58	3.67	1.03	39	14.1	12.3	13.2
10	Nedra (I) + $N_{120}P_{120}K_{120}$	4.23	4.24	4.24	1.60	60	15.5	14.4	14.9
11	Nedra (II) + $N_{120}P_{120}K_{120}$	4.10	4.01	4.05	1.41	53	15.2	13.8	14.5
12	Nedra (III) + $N_{120}P_{120}K_{120}$	4.00	3.95	3.97	1.33	50	15.0	13.1	14.0
13	Struna (I) – контроль	2.73	2.81	2.77	–	–	10.8	10.4	10.6
14	Struna (II)	2.63	2.59	2.61	-0.16	-6	10.5	9.8	10.1
15	Struna (III)	2.50	2.50	2.50	-0.27	-10	10.1	9.5	9.8
16	Struna (I) + $N_{65}P_{65}K_{65}$	3.80	3.77	3.78	1.01	36	12.4	12.1	12.2
17	Struna (II) + $N_{65}P_{65}K_{65}$	3.71	3.58	3.64	0.87	31	12.2	11.2	11.7
18	Struna (III) + $N_{65}P_{65}K_{65}$	3.63	3.50	3.57	0.80	29	11.9	10.5	11.2
19	Struna (I) + $N_{80}P_{80}K_{80}$	4.12	4.01	4.07	1.30	47	13.3	13.0	13.1
20	Struna (II) + $N_{80}P_{80}K_{80}$	4.00	3.85	3.92	1.15	41	13.4	12.1	12.7
21	Struna (III) + $N_{80}P_{80}K_{80}$	3.93	3.72	3.82	1.05	38	12.8	11.3	12.0
22	Struna (I) + $N_{120}P_{120}K_{120}$	4.53	4.43	4.48	1.71	62	14.5	13.4	13.9
23	Struna (II) + $N_{120}P_{120}K_{120}$	4.32	4.21	4.27	1.50	54	14.3	12.7	13.5
24	Struna (III) + $N_{120}P_{120}K_{120}$	4.20	4.07	4.13	1.36	49	14.1	12.0	13.0
25	Elegia (I) – контроль	2.58	2.57	2.58	–	–	11.0	11.2	11.1
26	Elegia (II)	2.48	2.33	2.40	-0.18	-7	11.2	10.5	10.8
27	Elegia (III)	2.41	2.25	2.33	-0.25	-10	11.3	10.1	10.7
28	Elegia (I) + $N_{65}P_{65}K_{65}$	3.77	3.50	3.63	1.05	41	12.7	12.5	12.6
29	Elegia (II) + $N_{65}P_{65}K_{65}$	3.70	3.22	3.46	0.88	34	12.5	11.7	12.1
30	Elegia (III) + $N_{65}P_{65}K_{65}$	3.63	3.12	3.37	0.79	31	12.4	11.4	11.9
31	Elegia (I) + $N_{80}P_{80}K_{80}$	4.00	3.77	3.88	1.30	50	13.5	13.2	13.3
32	Elegia (II) + $N_{80}P_{80K80}$	3.91	3.45	3.68	1.10	43	13.4	12.9	13.1
33	Elegia (III) + $N_{80}P_{80}K_{80}$	3.85	3.38	3.61	1.03	40	13.2	12.5	12.8
34	Elegia (I) + $N_{120}P_{120}K_{120}$	4.35	4.12	4.23	1.65	64	14.7	14.7	14.7
35	Elegia (II) + $N_{120}P_{120}K_{120}$	4.20	3.97	4.08	1.50	58	14.5	13.7	14.1
36	Elegia (III) + $N_{120}P_{120}K_{120}$	4.15	3.88	4.01	1.43	55	14.3	13.3	13.8
37	HIP_{05}, t/ha	0.09	0.11	–					

**Note: Timing of sowing: I – March 27; II – April 10; III – April 27*

productive moisture were at the level of 23.0–29.0 mm in the soil layer of 0–20 cm; in the layer of soil of 0–10 cm they were 7–12 mm and in the meter layer of soil they were 152–176 mm (depending on the time of sowing). In the process of growth and development of spring wheat plants there was an intensive use of productive moisture reserves from the soil layer. During the harvest period of spring wheat, reserves of productive moisture in the meter layer of soil were 34 mm and in the soil layer of 0–20 cm they were 13 mm. In the soil depth of 40–60 cm there were no reserves of productive moisture.

During two years of research, Struna Myronivska and Nedra varieties had the highest yields (4.24–4.48 tons/ha) in the first timing of sowing with mineral fertilizers ($N_{120}P_{120}K_{120}$) (Table). At the same time, wheat grain is characterized by high protein content which varies considerably depending on the weather conditions of the growing season and norms of mineral fertilizers. The highest protein content (13.9–14.9%) was noted in variants with the application of the highest fertilizer norms.

During the observation of the level of structural indicators of spring wheat, the positive influence of mineral fertilizers on the number of grains in the ear was noted. Using a high norm of mineral nutrition ($N_{120}P_{120}K_{120}$) the number of grains in the ear was 31.3–34 depending on the time of sowing and spring wheat variety, while without fertilizers (check variant) Nadra variety had 29.4–30.4 grains. Also, the influence of sowing dates on the number of grains in the ear was analyzed. In variants with the first sowing time in all wheat varieties, the number of grains exceeded other two times by 0.1–1.3 grains depending on the variety and mineral nutrition. However, the largest number of grains was of Struna Myronivska with the application of $N_{120}P_{120}K_{120}$. So, for the first time of sowing there were 34.0 grains in one ear. The ear length reached 11.3 cm and the average height of plants in this variant was 99.4 cm. Elegia Myronivska and Nedra had the highest plant height (100 cm) in the variant with the application of $N_{120}P_{120}K_{120}$ for the first sowing time. The ear length of spring wheat varieties varied from 8.7 to 11.3 cm. However, it was the smallest in plants sown during the third sowing time (April 27) – from 8.7 to 10.2 cm in all varieties within the studied levels of mineral nutrition.

Based on the research, there are the following conclusions:

1. Before sowing mid-ripening varieties of spring wheat, it is best to start it in the third decade of March with the complete mineral nutrition. Under such conditions, Struna Myronivska has a significantly higher yield (4.48 t/ha).

2. For all sowing times and optimal conditions of mineral nutrition ($N_{120}P_{120}K_{120}$) the highest content of protein in the grain is formed by plants of Nedra variety (14.0–14.9%).

3. After postponing the sowing date from the optimum early time (March 27) to late (April 27) the individual productivity of plants of all studied varieties, their biometric parameters, as well as the optimal use of soil moisture reserves deteriorate. Reduction of such negative action is possible due to the optimization of mineral nutrition conditions ($N_{120}P_{120}K_{120}$).

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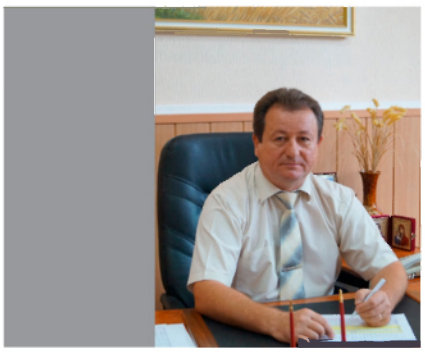

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ФОРМУВАННЯ ПАРАМЕТРІВ ПОСІВІВ РОСЛИН КОНОПЕЛЬ СОРТУ ГЛЯНА ЗАЛЕЖНО ВІД ТЕХНОЛОГІЧНИХ ЗАХОДІВ

Анотація. *В статті представлено результати вивчення реакції рослин конопель посівних сорту Гляна на умови вегетації в посівах, формування стеблостою і забезпечення його найбільшого збереження до кінця вегетаційного періоду рослин. Встановлено рівень густоти стеблостою від норм висіву насіння та фону мінерального живлення. Визначено реакцію рослин конопель на різні рівні мінерального добрива; внесення високих доз у дослідах сприяло подовженню вегетаційного періоду конопель в середньому на 3-6 діб за три роки досліджень. Проаналізовані показники оптичної щільності і густоти стояння у посівах рослин конопель посівних, за якими встановлено, що кількість рослин культури, які випали в процесі вегетації, збільшувалась з підвищенням норм висіву насіння на ділянках.*

Ключові слова: *мінеральне живлення, норма висіву, польова схожість, міжфазні періоди, густота стеблостою.*