УДК 633.152(470.630)

4.1.1. Общее земледелие и растениеводство (биологические науки, сельскохозяйственные науки)

АГРОБИОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ ОЗИМОЙ ПШЕНИЦЫ, ВОЗДЕЛЫВАЕМОЙ ПО ПРЕДШЕСТВЕННИКУ СОЯ В УСЛОВИЯХ ЗАПАДНОГО ПРЕДКАВКАЗЬЯ

Кравченко Роман Викторович
д. с.-х. н., доцент
РИНЦ SPIN-код: 3648-2228
roma-kravchenko@yandex.ru

Амзаева Яна Борисовна
Аспирант

Тымчик Денис Евгеньевич
студент
Кубанский государственный аграрный университет, Россия, 350044, Краснодар, Калинина, 13

В статье описаны итоги научных исследований вариабельности агробиологических показателей озимой пшеницы, возделываемой по предшественнику соя в условиях Западного Предкавказья. Опытное поле, где выполняли исследования в 2022-23 с.-х. годах, размещено в УОХ «Кубань» Кубгау. В опыте изучались агробиологические показатели озимой пшеницы, возделываемой по предшественнику соя, в стационарном опыте на черноземе выщелоченном. Сорт – Тимирязевка 150. Среднепоздний сорт с посевом в конце оптимальных сроков для зон, имеет массу 1000 семян 36-42 грамм и высоту растения 73-95см. Высокоурожайный сорт, имеет потенциальную урожайность 120 ц/га, с качеством зерна хорошим и отличным на уровне «сильных» пшениц. Данный сорт рекомендован для выращивания по всем предшественникам на высоком агрофоне. Опыт двухфакторный. Первый фактор – прием основной обработки почвы (вспашка на 20-22 см и no-till). Второй фактор – норма минудобрения (контроль без внесения удобрений, рекомендованная норма минерального удобрения (под основную обработку почвы $N_{20}P_{80}$ + ранневесенняя подкормка N_{20}), тнтенсивная норма минерального удобрения (под основную обработку почвы $N_{40}P_{160}$ + ранневесенняя подкормка N_{40}). Предшественник – соя. Выявлено, что на вариантах, где была проведен прямой посев культуры по нулевой обработке почвы, начиная с фазы колошения отмечалось более раннее развитие растений озимой пшеницы – на 3–6 дней. Влияния минеральных удобрений в этом плане не выявлено. Вспашка на глубину 20-22 см на фоне внесения интенсивной нормы минерального удобрения

UDC 633.152(470.630)

4.1.1. General agriculture and crop production (biological sciences, agricultural sciences)

AGROBIOLOGICAL INDICATORS OF WINTER WHEAT CULTIVATED AFTER SOYBEAN AS A PREDECESSOR IN THE WESTERN CAUCAUSIA

Kravchenko Roman Viktorovich
Doctor of Agricultural Sciences, Associate Professor
RSCI SPIN code: 3648-2228
roma-kravchenko@yandex.ru

Amzaeva Yana Borisovna
graduate student

Tymchik Denis Evgenievich
student
Kuban State Agrarian University, Russia, 350044, Krasnodar, Kalinina, 13

The article describes the results of scientific studies of the variability of agrobiological parameters of winter wheat grown after soybean as a predecessor in the conditions of the Western Ciscaucasia. The experimental field, where the studies were carried out in 2022-23 agricultural years, is located in the Kuban UOH of Kubgau. The experiment studied the agrobiological parameters of winter wheat grown after soybean as a predecessor in a stationary experiment on leached chernozem. Variety - Timiryazevka 150. Mid-late variety with sowing at the end of the optimal terms for the zones, has a 1000 seed weight of 36-42 grams and a plant height of 73-95 cm. High-yielding variety, has a potential yield of 120 c/ha, with good and excellent grain quality at the level of "strong" wheat. This variety is recommended for growing after all predecessors on a high agricultural background. The experiment is two-factorial. The first factor is the method of primary tillage (plowing to 20-22 cm and no-till). The second factor is the rate of mineral fertilizer (control without fertilizer application, recommended rate of mineral fertilizer (for primary tillage N20P80 + early spring fertilizing N20), intensive rate of mineral fertilizer (for primary tillage N40P160 + early spring fertilizing N40). The predecessor is soybean. It was found that nIn the variants where direct seeding of the crop was carried out using zero tillage, earlier development of winter wheat plants was noted starting from the earing phase – by 3–6 days. No effect of mineral fertilizers was revealed in this regard. Plowing to a depth of 20–22 cm against the background of the application of an intensive rate of mineral fertilizer (N40P160 + N40) contributed to the maximum growth of winter wheat plants, reaching a limit of 83.2 cm. Leaving the soil

($N_{40}P_{160}$ + N_{40}) способствовала максимальному росту растений озимой пшеницы, достигнув предела в 83,2 см. Оставление почвы без обработки (нулевая обработка) при прямом посеве культуры приводило к угнетению культуры и ограничению высоты растений озимой пшеницы на уровне 74,9–81,2 см в зависимости от фона удобренности

without processing (zero tillage) during direct seeding of the crop led to the suppression of the crop and limitation of the height of winter wheat plants at a level of 74.9–81.2 cm, depending on the fertilization background

Ключевые слова: ПШЕНИЦА ОЗИМАЯ, ТИМИРЯЗЕНВКА 150, ФЕНОЛОГИЯ, ВЫСОТА РАСТЕНИЙ

Keywords: WINTER WHEAT, TIMIRYAZENKA 150, PHENOLOGY, PLANT HEIGHT

http://dx.doi.org/10.21515/1990-4665-209-023

Introduction

The main supplier of wheat grain in Russia and the North Caucasus region as a whole is the Krasnodar Territory. The main crop grown in the Territory is winter wheat. The annual area of its cultivation is 1.2-1.3 million hectares. In the 90s of the twentieth century and the beginning of the XXI century, the grain yield reached 24-30 c/ha, in some years - 34 c/ha. At the same time, the soil and climatic conditions of the Territory allow obtaining high yields of the crop and high-quality grain of strong and valuable varieties of wheat [1-5].

Winter wheat in Kuban is grown using intensive technology. Intensive technology includes high-quality primary soil cultivation, providing plants with balanced nutrition taking into account the content of the main elements in the soil, sowing should be carried out at the optimal time, and correct application of fertilizers during the growing season of winter wheat. In this case, it is necessary to take into account the prevailing conditions in each specific field [10].

An important element of technology used in the cultivation of any crop is mineral fertilizers, without which it is impossible to imagine the intensification of agriculture. Fertilizer application is a powerful tool for controlling plant productivity and reducing nutrient losses in the soil. One of the main points in agrosystems is considered to be the optimization of crop nutrition. About 50% of the increase in crop yield comes from the use of mineral fertilizers. [6-9, 11].

All this requires further study and improvement of individual techniques, which form the technologies. Improvement of soil cultivation techniques,

fertilization of grain crops, where the reserves for obtaining high yields are mainly hidden, are becoming relevant. Therefore, the purpose of our research was to study the production indicators of winter wheat of the Bezostaya 100 variety, cultivated after the predecessor corn, in a stationary experiment on leached chernozem.

Material and object of research

The experimental field, where the research was carried out in 2022-23 agricultural years, is located in the UOH "Kuban" Kubgau. The experiment studied the agrobiological parameters of winter wheat grown after soybeans as a predecessor, in a stationary experiment on leached chernozem. Variety - Timiryazevka 150. Mid-late variety with sowing at the end of the optimal terms for the zones, has a 1000 seed weight of 36-42 grams and a plant height of 73-95 cm. High-yielding variety, has a potential yield of 120 c / ha, with good and excellent grain quality at the level of "strong" wheat. This variety is recommended for growing after all predecessors on a high agricultural background. The experiment is two-factor. The first factor is the method of primary soil cultivation (plowing to 20-22 cm and no-till). The second factor is the rate of mineral fertilizer (control without fertilizer application, recommended rate of mineral fertilizer (for primary soil tillage N20P80 + early spring top dressing N20), intensive rate of mineral fertilizer (for primary soil tillage N40P160 + early spring top dressing N40). Predecessor – soybean.

Research results

Plant vegetation phases are conditionally divided periods of organogenesis, characterized by the formation of plant organs and requiring certain conditions for plant development at different times, which will affect productivity. In order to properly carry out plant care work, it is important to know the vegetation phases of agricultural crops.

Data characterizing the growth and development of winter wheat plants in the 2021-2022 agricultural year are presented in Table 1.

Table 1 – Phenological observations (2021-2022 agricultural year)

Option		Sowing	Shoots	Tillering	Exit to the tube	Earing	Bloom	Full ripeness of grain
soil cultivation	fertilizer rate							
Plowing	B0 (k)	10/12/21	24.10.21	11/12/21	12.04.22	7.05.22	16.05.22	25.06.22
	B1	10/12/21	24.10.21	11/12/21	12.04.22	7.05.22	16.05.22	25.06.22
	B2	10/12/21	24.10.21	11/12/21	12.04.22	7.05.22	16.05.22	25.06.22
Zero tillage (direct seeding)	B0	10/12/21	21.10.21	9.11.21	12.04.22	4.05.22	12.05.22	19.06.22
	B1	10/12/21	21.10.21	9.11.21	12.04.22	4.05.22	12.05.22	19.06.22
	B2	10/12/21	21.10.21	9.11.21	12.04.22	4.05.22	12.05.22	19.06.22

B0 – without fertilizers.
B1 – recommended rate of mineral fertilizer (N20P80 + N20).
B2 – intensive rate of mineral fertilizer (N40P160 + N40).

The sowing time determines the necessary conditions for the development and favorable conditions for overwintering of winter wheat varieties. The optimal sowing time is considered to be the one at which winter wheat has well-branched and formed a good root system by the end of autumn. The Timiryazevka winter wheat variety is characterized by high tillering; by autumn, the plants have formed from 2 to 4 shoots. Sowing of the original seeds of the studied variety was carried out in the second ten-day period of October (12.10.2021). Due to the excellent reserves of productive moisture and precipitation that fell in September and early October, seedlings appeared on the 9th day after sowing using the no-till technology, regardless of the fertilization option, which is 3 days earlier than the control.

Favorable development conditions ensured tillering of winter wheat plants of the Timiryazevka 150 variety on November 9 in all fertilization variants of the experiment, which is 3 days earlier than the control.

In the first ten days of December, with the air temperature dropping to zero degrees, the vegetation of winter wheat ceased. The conditions for overwintering plants were favorable, with minor frosts alternating with thaws.

Winter wheat vegetation resumption was noted at the beginning of the first ten-day period of March (06.03). Tube emergence was observed on April 12, almost a month after vegetation resumption simultaneously in all variants. May 4–7 is the beginning of the earing phase and 9 days later the flowering phase was noted – from May 12 to 16. And the last phase is considered to be full grain ripeness, which occurred from June 19 to 25.

In the variants where direct sowing of the crop was carried out using zero tillage, starting from the earing phase, an acceleration of the development of winter wheat plants was noted - by 3 days before the ear ejection, by 4 days before the beginning of flowering of the plants and by 6 days at the onset of full physiological maturity.

The dates of the onset of growth and development phases of winter wheat plants for the 2022-2023 agricultural year are given in Table 2.

Sowing of original seeds of the studied variety was carried out in the second ten days of October (10/19/2021). Thanks to excellent reserves of productive moisture and precipitation that fell in September and early October, seedlings appeared on the 7th day after sowing using the no-till technology, regardless of the fertilization option, which is 5 days earlier than the control.

Favorable development conditions ensured tillering of winter wheat plants of the Timiryazevka 150 variety on November 16th in all fertilization variants of the experiment, which is 4 days earlier than the control.

Table 2 – Phenological observations (2022-2023 agricultural year)

Option		Sowing	Shoots	Tillering	Exit to the tube	Earing	Bloom	Full ripeness of grain
soil cultivation	fertilizer rate							
Plowing	B0 (k)	10/19/22	10/31/22	20.11.22	14.04.23	8.05.23	18.05.23	26.06.23
	B1	10/19/22	10/31/22	20.11.22	14.04.23	8.05.23	18.05.23	26.06.23
	B2	10/19/22	10/31/22	20.11.22	14.04.23	8.05.23	18.05.23	26.06.23
Zero tillage (direct seeding)	B0	10/19/22	26.10.22	11/16/22	14.04.23	5.05.23	14.05.23	20.06.23
	B1	10/19/22	26.10.22	11/16/22	14.04.23	5.05.23	14.05.23	20.06.23
	B2	10/19/22	26.10.22	11/16/22	14.04.23	5.05.23	14.05.23	20.06.23

B0 – without fertilizers.
B1 – recommended rate of mineral fertilizer (N20P80 + N20).
B2 – intensive rate of mineral fertilizer (N40P160 + N40).

In the first ten days of December, with the air temperature dropping to zero degrees, the vegetation of winter wheat ceased. The conditions for overwintering plants were favorable, with minor frosts alternating with thaws.

Winter wheat vegetation resumption was noted at the beginning of the first ten-day period of March (09.03). Tube emergence was observed on April 14, almost a month after vegetation resumption simultaneously in all variants. May 5–8 is the beginning of the earing phase and after 9–10 days the flowering phase was noted – from May 14 to 18. And the last phase is considered to be full grain ripeness, which occurred from June 20 to 26.

In the variants where direct sowing of the crop was carried out, starting from the earing phase, an acceleration of the development of winter wheat plants was noted - by 3 days in the earing phase, by 4 days in the flowering phase and by 6 days in the phase of full maturity.

Thus, it can be said that with direct seeding, the vegetation phases occur faster, unlike plowing, which allows harvesting to begin much earlier and the

difference will be 6 days. The influence of mineral fertilizers in this regard has not been identified.

The aboveground mass of plants is one of the main components of sowing, which significantly affects the productivity of winter wheat plants, namely the grain yield. In many cases, there is a relationship between the size of the aboveground mass and the grain yield - the greater the mass, the higher the grain yield. Therefore, in the conditions of the Steppe, it is important to achieve the formation of not excessive aboveground mass, but to focus on the moisture reserves in the soil, the characteristics of the variety.

The results of agro-biological measurements in dynamics are presented in Table 3.

Table 3 – Dynamics of winter wheat plant height, cm

Option		Growth and development phase		
soil cultivation	fertilizer rate	tillering	exit to the tube	earing
Plowing	b/fertilizer (k)	23.1	51.6	79.3
	N20P80 + N20	23.8	52.9	81.6
	N40P160 + N40	24.7	54.7	83.2
Zero tillage (direct seeding)	b/fertilizers	22.0	50.6	74.9
	N20P80 + N20	23.6	51.5	77.0
	N40P160 + N40	24.4	52.4	81.2

According to our data, during the control (plowing without fertilizing), the plant height in the tillering phase was 23.1 cm. Against the background of the recommended rate of mineral fertilizer (N20P80 + N20), an increase in plant height by 0.8 cm was noted, and against the background of the intensive rate of mineral fertilizer (N40P160 + N40) - by 1.6 cm. In the tube emergence phase, the plant height increased to 51.6 cm. Against the background of the recommended rate of mineral fertilizer (N20P80 + N20), an increase in plant

height by 1.3 cm was noted, and against the background of the intensive rate of mineral fertilizer (N40P160 + N40) - by 3.1 cm.

In the "earing" phase, the height of winter wheat plants reached its maximum and amounted to 79.3 cm. Against the background of the recommended rate of mineral fertilizer (N20P80 + N20), an increase in plant height by 2.3 cm was noted, and against the background of the intensive rate of mineral fertilizer (N40P160 + N40) - by 3.9 cm.

With direct sowing on an unfertilized background in the tillering phase of the crop, the height of the winter wheat plant was 22.0 cm, which is 1.1 cm lower than the control. Against the background of the recommended rate of mineral fertilizer (N20P80 + N20), an increase in plant height by 1.6 cm was noted, and against the background of the intensive rate of mineral fertilizer (N40P160 + N40) - by 2.4 cm. In the "tube emergence" phase, the plant height increased to 50.6 cm, which is 1.0 cm lower than the control. Against the background of the recommended rate of mineral fertilizer (N20P80 + N20), an increase in plant height by 0.9 cm was noted, and against the background of the intensive rate of mineral fertilizer (N40P160 + N40) - by 1.8 cm. In the "earing" phase, the height of winter wheat plants reached a maximum and was 74.9, which is 4.4 cm lower than the control. see. Against the background of the recommended rate of mineral fertilizer (N20P80 + N20), an increase in plant height by 2.1 cm was noted, and against the background of the intensive rate of mineral fertilizer (N40P160 + N40) - by 6.3 cm. At the same time, in all phases of growth and development of the crop, inhibition of winter wheat plants was noted against the background of zero tillage with direct sowing of the crop by 0.3-1.1 cm in the tillering phase, by 1.0-2.3 cm in the tube emergence phase and by 2.0-4.4 cm in the earing phase.

Thus, plowing to a depth of 20-22 cm against the background of the application of an intensive rate of mineral fertilizer (N40P160 + N40) contributed to the maximum growth of winter wheat plants, reaching a limit of

83.2 cm. Leaving the soil without cultivation (zero tillage) with direct sowing of the crop led to the suppression of the crop and limitation of the height of winter wheat plants at a level of 74.9–81.2 cm, depending on the fertilization background.

Conclusion

In the variants where direct seeding of the crop was carried out using zero tillage, earlier development of winter wheat plants was noted starting from the earing phase - by 3-6 days. The effect of mineral fertilizers in this regard was not revealed. Plowing to a depth of 20-22 cm against the background of the application of an intensive rate of mineral fertilizer (N40P160 + N40) contributed to the maximum growth of winter wheat plants, reaching a limit of 83.2 cm. Leaving the soil without processing (zero tillage) during direct seeding of the crop led to the suppression of the crop and limitation of the height of winter wheat plants at a level of 74.9-81.2 cm, depending on the fertilization background.

Bibliographic list

1. Arkhipenko, A. A. The role of mineral fertilizers and primary tillage for winter wheat crops in the formation of its productivity / A. A. Arkhipenko, R. V. Kravchenko // Scientific journal of KubSAU, 2021. - No. 171. - P. 335-347. - DOI 10.21515/1990-4665-171-023.

2. Kravchenko, R. V. Realization of the productive potential of corn hybrids using technologies of different intensity / R. V. Kravchenko // Bulletin of the BSHA, 2009. - No. 2. - P. 56-60.

3. Kravchenko, R. V. Optimization of mineral nutrition with minimization of primary soil cultivation in winter wheat cultivation technology / R. V. Kravchenko, A. A. Arkhipenko // Proceedings of KubSAU, 2019. - No. 80. - P.150-155. - DOI 10.21515/1999-1703-80-150-155.

4. Kravchenko, R. V. The influence of primary tillage for winter wheat on the formation of its productivity elements / R. V. Kravchenko, S. I. Luchinsky, A. A. Arkhipenko, A. E. Semenov // Proceedings of KubSAU, 2021. - No. 90. - P. 64-70. - DOI 10.21515/1999-1703-90-64-70.

5. Kravchenko, R. V. Influence of primary tillage for winter wheat on the formation of its productivity / R. V. Kravchenko, V. I. Prokhoda, S. I. Luchinsky, A. A. Arkhipenko // Scientific journal of KubSAU, 2021. - No. 169. - P. 124-132. - DOI 10.21515/1990-4665-169-011.

6. Kravchenko, R. V. Dynamics of agro-physical parameters of soil depending on its cultivation and mineral fertilizers in winter wheat technology / R. V. Kravchenko, A. A. Arkhipenko / Scientific journal of KubSAU, 2022. - No. 178. - P.283-292. - DOI 10.21515/1990-4665-178-024.

7. Kravchenko, R. V. Efficiency of mineral fertilizers against the background of no-till soil cultivation in the technology of winter wheat cultivation / R. V. Kravchenko, V. I. Prokhoda, U. B. Asrorov / Scientific journal of KubSAU, 2022. - No. 182. - P. 99-111. - DOI 10.21515/1990-4665-182-009.

8. Bardak, N. I. Influence of the method of processing leached chernozem and its agrophytic parameters and agrobiological indicators of winter wheat / N. I. Bardak, R. V. Kravchenko, S. A. Dmitriev / Scientific journal of KubSAU, 2023. - No. 188. - P. 56-66. - DOI 10.21515/1990-4665-188-006.

9. Kravchenko, R. V. Formation of agrobiological indicators of winter wheat depending on mineral fertilizers against the background of minimization of primary tillage / R. V. Kravchenko, S. I. Luchinsky, A. E. Semenov / Proceedings of KubSAU, 2023. - No. 108. - P. 71-76. - DOI 10.21515/1999-1703-108-71-76.

10. Kravchenko, RV Dynamics of agrophysical indicators of the soil under winter wheat crops while minimizing the main tillage / Kravchenko RV, Luchinskiy SI, Amzaeva Ya.B. // Polythematic Online Scientific Journal of Kuban State Agrarian University. 2024. No. 199. pp. 61-68. – DOI 10.21515/1990-4665-199-007.

11. Kravchenko, R. V. Formation of production indicators of winter wheat depending on mineral fertilizers against the background of minimization of primary tillage / R. V. Kravchenko, S. I. Luchinsky, A. E. Semenov / Proceedings of KubSAU, 2024. - No. 112. - P. 125-131. - DOI 10.21515/1999-1703-112-125-131.