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4.1.1. Общее земледелие и растениеводство

ФОРМИРОВАНИЕ АГРОБИОЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ ОЗИМОЙ ПШЕНИЦЫ ТИМИРЯЗЕВКА 150 НА ФОНЕ ДИФФЕРЕНЦИРОВАННОЙ ОСНОВОЙ ОБРАБОТКЕ ПОЧВЫ В УСЛОВИЯХ ЗАПАДНОГО ПРЕДКАВКАЗЬЯ

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В работе показаны итоги полевых опытов по изучению формирования агробиологических показателей озимой пшеницы Тимирязевка 150 на фоне дифференцированной основой обработке почвы в условиях Западного Предкавказья (УОХ «Кубань» Кубгау). Годы исследований – 2023-24. В соответствии с экспериментальной схемой исследовались три варианта основной обработки почвы (вспашка на 20-22 см, чизелевание на 20-22 см и нулевая обработка (no-till). Контрольным вариантом служило дисковое лущение на 10-12 см. В качестве объекта исследования использовался сорт озимой пшеницы Тимирязевка 150. Было изучено формирование его агробиологических показателей по предшественнику соя. Система удобрений включала в себя внесение интенсивной нормы минерального удобрения под основную обработку почвы (аммофос ($N_{40}P_{160}$) + ранневесенняя подкормка аммиачной селитрой (N_{40})). Было выявлено, что различия в сроках наступления фенологических фаз отражают адаптивные реакции растений озимой пшеницы на изменение агрофизических условий почвы под влиянием различных приемов ее обработки. Наиболее раннее появление всходов отмечается при нулевой обработке, что на 1-3 дня опережает другие варианты. Наиболее короткий вегетационный период характерен для нулевой обработки (232 дня), тогда как при чизелевании 233 дня, по дисковом лущении и вспашке он составляет 234 и 235 дней, соответственно. Традиционная вспашка обеспечивает наиболее благоприятные условия для роста растений озимой пшеницы (79,4

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4.1.1. General agriculture and crop production

FORMATION OF AGROBIOLOGICAL INDICATORS OF WINTER WHEAT TIMIRYAZEVKA 150 AGAINST THE BACKGROUND OF DIFFERENTIATED BASIS OF SOIL CULTIVATION IN THE CONDITIONS OF THE WESTERN CAUCAUSIA

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The study presents the results of field experiments on studying the formation of agrobiological indicators of winter wheat Timiryazevka 150 against the background of differentiated soil cultivation in the conditions of the Western Ciscaucasia (UOKh "Kuban" Kubgau). Research years - 2023-24. In accordance with the experimental design, three variants of primary soil cultivation were studied (plowing to 20-22 cm, chisel tillage to 20-22 cm and zero tillage (no-till). The control variant was disk stubble cultivation to 10-12 cm. The Timiryazevka 150 winter wheat variety was used as the object of the study. The formation of its agrobiological indicators was studied according to the soybean predecessor. The fertilization system included the application of an intensive rate of mineral fertilizer under primary soil cultivation (ammophos (N40P160) + early spring fertilization with ammonium nitrate (N40)). It was found that the differences in the timing of the onset of phenological phases reflect the adaptive responses of winter wheat plants to changes in the agrophysical conditions of the soil under the influence of various methods of its cultivation. The earliest emergence of seedlings is noted with no-tillage, which is 1-3 days ahead of other options. The shortest The vegetation period is typical for zero tillage (232 days), while with chisel plowing it is 233 days, for disk stubble cultivation and plowing it is 234 and 235 days, respectively. Traditional plowing provides the most favorable conditions for the growth of winter wheat plants (79.4 cm). Chisel plowing shows comparable results, which makes it a promising alternative to plowing (74.3 cm). Zero tillage and disk stubble

см). Чизелевание показывает сопоставимые результаты, что делает его перспективной альтернативой вспашке (74,3 см). Нулевая обработка и дисковое лущение (как контрольный вариант) показывают наименьшие значения высоты растений (69,2 и 68,2 см, соответственно), что может негативно сказываться на продуктивности посевов. Чизелевание и вспашка способствуют максимальному развитию ассимиляционного аппарата растений озимой пшеницы (46,1 и 47,2 тыс.м2/га) , в то время как минимальные и нулевые обработки почвы ограничивают этот показатель (38,4 и 35,1 тыс.м2/га, соответственно), что может сказываться на конечной урожайности культуры

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

cultivation (as a control option) show the lowest values of plant height (69.2 and 68.2 cm, respectively), which can negatively affect the productivity of crops. Chisel plowing and plowing contribute to the maximum development of the assimilation apparatus of winter wheat plants (46.1 and 47.2 thousand m2 / ha), while minimum and zero tillage limit this indicator (38.4 and 35.1 thousand m2 / ha, respectively), which may affect the final yield of the crop

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

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Introduction

Winter wheat is one of the key grain crops in global agriculture and plays a strategic role in the agricultural sector of Russia, providing a significant share of the country's food security. Its life cycle, including autumn sowing, germination before winter, and resumption of vegetation in the spring, allows it to ripen earlier than spring crops and effectively use soil moisture. Successful cultivation of winter wheat and obtaining high, stable yields directly depend on a set of agricultural measures, among which the soil cultivation system occupies a central place. [1-5].

Research conducted on leached chernozems showed that the highest yield of winter wheat grain (7.84 t/ha) is achieved with plowing. This method also ensures high grain quality, including natural grain, optimal vitreousness and high gluten quality (group 1). At the same time, from the point of view of profitability, the most profitable options were winter wheat cultivation after grain-legume predecessors against the background of plowing (143.0%), as well as against the background of surface treatment[10].

A loose, lumpy surface has a negative effect on seedlings. In conditions where moisture is a determining factor for the harvest, it is recommended to

avoid multiple treatments, which dry out the soil and are costly. When sowing on occupied fallows and leguminous crops, it is advisable to use surface treatment to a depth of 10-12 cm, which allows reducing energy costs for soil treatment by up to 43%.[6-9, 11].

Increasing the yield of grain crops is a key task of modern agriculture. Despite the existing technologies, there are significant reserves for increasing productivity, in particular by improving soil cultivation techniques and optimizing fertilizer application systems. In particular, the effect of minimum soil cultivation in combination with various schemes of nitrogen fertilizer application on the productivity of winter wheat after soybeans has not been sufficiently studied. Therefore, the aim of our research was to study the production indicators of winter wheat of the Timiryazevka 150 variety, grown after soybeans, in a stationary experiment on leached chernozem. The study plans to assess the effect of various soil cultivation techniques against the background of the application of an intensive rate of mineral fertilizer (N40P160 + N40) on yield, crop structure and grain quality. The results of the work will allow developing more effective and environmentally friendly technologies for growing winter wheat in the conditions of the central zone of the Western Ciscaucasia.

Material and object of research

The climatic conditions of the Central Region, where the experimental field of the UOH "Kuban" Kubgau is located, located on the southern periphery of temperate latitudes, are defined as transitional from the moderate continental type to the subtropical, combining features of both humid and arid subtropical climate. They are characterized by the dominance of a long hot summer period and mild, moderately warm winter. Transitional seasons (spring, autumn) are weakly expressed. In general, the climatic conditions during the field experiments in the 2023-2024 agricultural year were characterized by a stable

tendency towards an increase in temperature and a decrease in the amount of precipitation relative to the long-term norm, especially pronounced in the winter and summer months. In general, these conditions were favorable for the cultivation of winter wheat.

Based on the presented agrochemical and physicochemical parameters, the studied leached chernozem of the experimental field, classified as low-humus, super-powerful and light clayey according to granulometric composition, has favorable properties for the cultivation of winter wheat.

In accordance with the experimental design, three variants of primary soil cultivation were studied (plowing at 20-22 cm, chisel tillage at 20-22 cm and zero tillage (no-till). The control variant was disk stubble cultivation at 10-12 cm. The Timiryazevka 150 winter wheat variety was used as the object of study. The formation of its agrobiological indicators was studied according to the soybean predecessor. The fertilization system included the application of an intensive rate of mineral fertilizer under primary soil cultivation (ammophos (N40P160) + early spring fertilization with ammonium nitrate (N40)).

Research results

Vegetation phases are key periods of plant development, characterized by the formation of new organs. In different phases, plants require different conditions for optimal growth and development. For example, tillering requires sufficient moisture and nitrogen, and heading requires optimal temperature. Knowledge of vegetation phases allows an agronomist to plan and carry out plant care work (fertilizing, disease and pest control, watering) at the most appropriate time, which helps to increase yields and reduce costs.

All treatment options are characterized by the same sowing date (10/25/23), but differences in the timing of emergence indicate the influence of the treatment method on the conditions for seed germination. The earliest

emergence of seedlings is observed with zero tillage (11/5/23), which is 3-6 days ahead of other options (Table 1).

Table 1 – Phenology of winter wheat plants, 2023-2024 agricultural year.

Soil cultivation	Sowing	Shoots	Tillering	Exit to the tube	Earing	Bloom	Full ripeness of grain
Disc peeling(k)	25.10.23	7.11.23	27.11.23	14.04.24	9.05.24	21.05.24	27.06.24
Plowing	25.10.23	8.11.23	28.11.23	14.04.24	11.05.24	22.05.24	29.06.24
Chiseling	25.10.23	6.11.23	26.11.23	14.04.24	9.05.24	20.05.24	26.06.24
No-till	25.10.23	5.11.23	25.11.23	14.04.24	8.05.24	19.05.24	25.06.24

During the spring regrowth, differences in the timing of the tillering phase are observed. With chisel tillering, tillering occurs 1-2 days earlier (26.11.23) compared to other treatment options. The tube emergence and earing phases in all options occur almost simultaneously (14.04.24 and 8-11.05.24, respectively), indicating that the development conditions have leveled off by the spring-summer period.

The most significant differences are seen during the grain ripening period. The flowering phase occurs earliest with zero tillage (19.05.24), ahead of other options by 1-3 days. Full grain ripeness is also achieved earliest with zero tillage (25.06.24), which is 1-4 days ahead of traditional methods of cultivation.

An analysis of the total duration of the period from germination to full maturity shows that the shortest vegetation period is typical for zero tillage (232 days), while with plowing and disc stubble cultivation it is 235-238 days. This may have practical significance for planning harvesting and crop rotation.

Differences in the timing of the onset of phenological phases reflect the adaptive reactions of winter wheat plants to changes in the agrophysical conditions of the soil under the influence of various methods of cultivation.

Acceleration of development with zero tillage may be associated with the characteristics of the water-thermal regime of untreated soil.

The obtained data indicate that the method of primary tillage affects the rhythm of winter wheat development, especially in critical periods - emergence and grain ripening. Zero tillage promotes earlier passage of the main phenological phases, which can have both positive (early harvesting, avoidance of unfavorable weather conditions) and potentially negative consequences (incomplete use of the vegetation period).

Table 2 – Dynamics of winter wheat plant height, cm

Option	Growth and development phase		
	tillering	exit to the tube	earing
Disc peeling (k)	23.6	43.6	68.2
Plowing	27.6	52.4	79.4
Chiseling	24.1	50.6	74.3
No-till	23.8	43.5	69.2

In all treatment options, a regular increase in plant height is observed from the tillering to earing phase. During the tillering period, the plant height is 23.6-27.6 cm, by the time the stem is formed it increases to 43.6-73.5 cm, and by earing it reaches 68.2-79.4 cm. The most intensive growth occurs in the period from tillering to stem formation, which corresponds to the biological characteristics of winter wheat development.

Maximum plant heights in all development phases are observed with plowing: 27.6 cm in the tillering phase, 52.4 cm when the tube is formed, and 79.4 cm during the earing period. This exceeds the control variant (disk stubble cultivation) by 4.0 cm during tillering, by 8.8 cm when the tube is formed, and by 11.2 cm during earing.

Chisel tillage demonstrates high plant growth rates, especially in the tube (50.6 cm) and earing (74.3 cm) phases, which is only slightly inferior to plowing. Zero tillage shows contradictory results: with low rates in tillering

(23.8 cm) and the tube (43.5 cm) phase, the height of plants is maximum in earing (69.2 cm).

The greatest differences between treatments occur during the critical tube emergence phase, with values varying by almost 30 cm (from 43.6 cm for disc plowing to 73.5 cm for no-till).

The obtained data confirm that traditional plowing provides the most favorable conditions for the growth of winter wheat plants. Chisel plowing shows comparable results, which makes it a promising alternative to plowing. Zero tillage demonstrates an uneven effect on plant growth by development phases. Disk stubble plowing as a control option shows the lowest plant height values, which can negatively affect crop productivity.

Table 3 – Dynamics of leaf surface area of winter wheat, (thousand m2/ha)

Option	Growth and development phase		
	tillering	exit to the tube	earing
Disc peeling (k)	14.7	22.0	38.4
Plowing	15.6	29.6	47.2
Chiseling	15.6	26.6	46.1
No-till	13.5	24.5	35.1

In all treatment options, a regular increase in the leaf surface area is observed from the tillering to heading phase. In the tillering phase, the area is 13.5-15.7 thousand m²/ha, when the tube is formed, it increases to 22.0-29.6 thousand m²/ha, and by heading it reaches its maximum values - 35.1-46.1 thousand m²/ha.

The largest leaf surface area values at all stages of development are observed with chisel plowing and plowing. By the earing stage, the area reaches 46.1 thousand m²/ha with chisel plowing and 41.2 thousand m²/ha with plowing, which is 7.3-11.0 thousand m²/ha higher than with disc stubble plowing and zero tillage. This indicates more favorable conditions for plant growth and

development with deep and combined tillage methods, which is associated with better moisture and nutrient supply.

Disc peeling and zero tillage provide a smaller leaf surface area, especially towards the earing stage (38.4 and 35.1 thousand m²/ha, respectively).

The leaf surface area directly affects the photosynthetic activity of crops and, as a consequence, the formation of yield. A higher leaf area during chisel cutting and plowing creates the prerequisites for increasing the productivity of winter wheat.

Chisel tillage and plowing promote maximum development of the assimilation apparatus of plants, while minimum and zero tillage limit this indicator, which can affect the final yield of the crop.

Conclusion

In the conditions of the Central zone of the Krasnodar Territory, an urgent task of modern agriculture is to increase the productivity of winter wheat on leached chernozem while maintaining soil fertility. The study allowed us to obtain a detailed picture of the effect of primary cultivation methods on the growth and development of winter wheat plants of the Timiryazevka 150 variety. Differences in the timing of the onset of phenological phases reflect the adaptive reactions of winter wheat plants to changes in agrophysical soil conditions under the influence of various cultivation methods. The earliest emergence of seedlings is observed with zero cultivation, which is 1-3 days ahead of other options. The shortest growing season is characteristic of zero cultivation (232 days), while with chisel tillage it is 233 days, with disk stubble cultivation and plowing it is 234 and 235 days, respectively. Traditional plowing provides the most favorable conditions for the growth of winter wheat plants (79.4 cm). Chisel tillage shows comparable results, which makes it a promising alternative to plowing (74.3 cm). Zero tillage and disc stubble cultivation (as a control option) show the lowest plant height values (69.2 and 68.2 cm,

respectively), which may negatively affect crop productivity. Chisel tillage and plowing contribute to the maximum development of the assimilation apparatus of winter wheat plants (46.1 and 47.2 thousand m2/ha), while minimum and zero tillage limit this indicator (38.4 and 35.1 thousand m2/ha, respectively), which may affect the final crop yield.

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