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

АГРО-БИОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ СОИ В ЗАВИСИМОСТИ ОТ ПРИЕМА ОСНОВНОЙ ОБРАБОТКИ ПОЧВЫ И НОРМЫ УДОБРЕНИЯ

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В работе описаны наши достижения научных исследований по анализу агро-биологических показателей сои сорта СК Веда в динамике на фоне различных обработки почвы и нормы удобрения. Севооборот зерно-пропашной (одиннадцать полей). Рассматривали 2 фактора: прием основной обработки почвы (вспашка на 25-27 см и чизелевание на 25-27 см) и норма удобрения (без удобрений, рекомендуемая ($N_{45}P_{60}$) и интенсивная ($N_{90}P_{120}$)). Установлено, что различные приемы обработки почвы и нормы удобрений практически не влияли на даты наступления фенологических фаз. Способ обработки почвы повлиял только на появление всходов. На варианте с чизелеванием всходы фиксировали на 1 сутки позже, чем на контроле. С увеличением нормы удобрений, изменялась и дата наступления любой из фазы вегетации. Внесение рекомендованной нормы удобрения ($N_{45}P_{60}$) приводило позднему (на 2 дня) наступлению ветвления, цветения и полной спелости по сравнению с контролем. Внесение интенсивной нормы удобрения ($N_{90}P_{120}$) приводило к позднему (на 4 дня) наступлению ветвления, цветения и полной спелости по сравнению с контролем. Изучаемые элементы технологии возделывания сои оказывали положительное действие на высоту растений сои. Проведение вспашки в основную обработку почвы обеспечивало формирование более высокорослых растений сои по сравнению с чизелеванием в течение всего вегетационного периода. В фазу ветвления на неудобреном варианте разница составила 3,2 см, в фазу цветения 2,4 см, а в фазу полной спелости 2,9 см, в пользу вспашки. Увеличение нормы минеральных удобрений прямым образом сказывалось на высоте растений. Так, внесение $N_{45}P_{60}$, увеличивало в среднем

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

AGRO-BIOLOGICAL INDICATORS OF SOYBEAN DEPENDING ON BASIC SOIL TILLAGE AND FERTILIZER RATE

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The article shows the results of field experiments to study the agro-biological parameters of soybean variety called SK Veda, depending on the method of basic soil treatment and fertilizer rates. As part of an experiment conducted in an 11-field grain-row crop rotation, two factors were studied: the use of basic soil tillage (moldboard at 25-27 cm (ploughing) and non-moldboard at 25-27 cm (chiselling) and the fertilizer rate (without fertilizers, recommended (N45P60) and intensive (N90P120)).Research has established that various soil cultivation methods and fertilizer rates had virtually no effect on the dates of the onset of phenological phases. The method of tillage affected only the emergence of seedlings. In the variant with chiselization, seedlings were recorded 1 day later than in the control. With an increase in the rate of fertilizers, the date of onset of any phase of the growing season also changed. Application of the recommended rate of fertilizer (N45P60) contributed to a later (by 2 days) onset of branching, flowering and full ripeness compared to the control. The application of an intensive fertilizer rate (N90P120) contributed to an even later (by 4 days) onset of branching, flowering and full ripeness compared to the control. The studied elements of soybean cultivation technology had a positive effect on the height of soybean plants. Plowing during the main tillage ensured the formation of taller soybean plants compared to chiselling throughout the entire growing season. In the branching phase on the unfertilized version, the difference was 3.2 cm, in the flowering phase 2.4 cm, and in the full ripeness phase 2.9 cm, in favor of plowing. An increase in the rate of mineral fertilizers directly affected the height of plants. Thus, the application of N45P60 increased the plant height by an average of 3.2 cm. And when N90P120 was added, the plant height increased by an average of 7 cm

высоту растений на 3,2 см. А при внесении $N_{90}P_{120}$, высота растений увеличивалась в среднем на 7 см

Ключевые слова: СОЯ, СК ВЕДА, ФЕНОЛОГИЯ, ВЫСОТА РАСТЕНИЙ

Keywords: SOYA, SK VEDA, PHENOLOGY, PLANT HEIGHT

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Introduction

The strategy of adaptive crop production has been implemented in the agricultural production of the Krasnodar region, which includes an anti-monopoly varietal policy, based on their targeted use, which has made it possible to stabilize grain production. Due to climate change and in populations of pathogens and pests, energy saturation of agricultural production and associated changes in technology, it is necessary to periodically change adapted varieties. The study of the biological characteristics of a large number of varieties should cover the most significant agrotechnical factors for field crops: sowing dates, predecessors, main and pre-sowing fertilizer, nitrogen fertilizing and chemical plant protection. The results obtained will allow us to develop the features of the technology for growing each variety, forming rich material for the further development of agricultural technology [1-3].

Soybean has recently become one of the main grain legume crops in our country. This is the most common annual herbaceous plant from the Legume family. This crop has a multifaceted use - both grain and oilseed, food (sauces, soups, cereals, milk, cheese and margarine), feed (cake, silage) and technical (cosmetics, medicine). In its composition it contains 36-43% protein, 18-23% oil and 28-31% carbohydrates. Over the past 10 years, global soybean production and trade have grown by 2.7% and 5.1%, respectively. In 2020/21, the world produced about 342 million tons of soybeans (+31% on 2010/11), and global soybean trade was about 152 million tons (+65%). The growth in soybean production in the world is explained by an increase in planted area and higher yields. Over the past 10 years, the average annual growth rate of soybean

planting area was 1.7%, and yield growth was 1.0%. This led to an increase in soybean area in the world to more than 122 million hectares (+19% compared to 2009/10) and an increase in average yield to 28 centners per hectare (+10%) [7].

Different tillage methods and dosages of mineral fertilizers have different effects on the condition of the soil cover of leached black soil, and there is no general agreement on which agricultural technology is the best. Cost-effectiveness is also important. In light of the ever-increasing cost of fertilizers, the feasibility of using high doses must be carefully assessed [4-6].

Soybean is a plant that can respond positively to the use of fertilizers, especially on leached black soils. Phosphorus and potassium fertilizers added to the soil along with basic tillage can significantly increase yields. However, nitrogen fertilizers can suppress the process of nitrogen fixation, so they are not used under optimal conditions for the symbiosis of nitrogen with soybeans. To obtain high and stable soybean yields, it is necessary to carry out timely and high-quality tillage, including deep moldboard fall plowing, but the constant use of moldboard tillage negatively affects the condition of the soil. So it is necessary to consider other methods [8].

The best soybean yields can be achieved by using rotational plowing or deep, non-moldboard loosening. On the other hand, the path of minimizing tillage leads to a decrease in soybean productivity due to soil compaction and an increase in the number of weeds in crops [9].

According to some researchers, different tillage methods and dosages of mineral fertilizers have different effects on the condition of the soil cover of leached black soil, and there is no general agreement on which agricultural technology is the best. Cost-effectiveness is also important. In light of the constant increase in the cost of fertilizers, it is necessary to carefully evaluate the feasibility of using high doses [10-12].

Material and object of research

The experiments took place in 2021-2022 on an experimental field located in the Kuban educational and experimental farm. The experimental plot is represented predominantly by leached chernozem. In general, both years of the experiment were favorable in terms of weather conditions for growing soybeans.

As part of an experiment conducted in an 11-field grain-row crop rotation, two factors were studied: the use of basic soil tillage (moldboard at 25-27 cm (ploughing) and non-moldboard at 25-27 cm (chiselling) and the fertilizer rate (without fertilizers, recommended (N45P60) and intensive (N90P120)).

Soybeans were studied in the experiment (early ripening variety SK Veda).For ripening, it requires 2300-2400 °C of the sum of active temperatures. High tech. This variety has been developed to withstand abiotic stresses and is recommended for cultivation in dry conditions, without the use of irrigation, due to its high drought tolerance. SK VEDA has a tall stem (122 cm) and a powerful root system, which allows it to extend deeper into the soil and extract moisture from lower layers.

Research results

The growing season is the time required to complete the entire cycle of growth and development of a plant. Its duration is determined by varietal characteristics and conditions of the growing season. For soybeans, the dates of the onset of such phases as: germination, branching, flowering and full ripeness were noted (Table 1).

Table 1 - Phenological observations (2021-2022)

Option		Sowing	Vegetation phases			
tillage	fertilizer rate		shoots	branching	bloom	full ripeness
Plowing (k)	without fertilizers (k)	09.05	17.05	25.06	03.07	06.09
	N45P60	09.05	17.05	27.06	05.07	08.09
	N90P120	09.05	17.05	28.06	06.07	10.09
Chiseling	no fertilizers	09.05	18.05	25.06	03.07	06.09
	N45P60	09.05	18.05	27.06	05.07	08.09
	N90P120	09.05	18.05	28.06	06.07	10.09

In the variant with plowing, soybeans begin to germinate a day earlier (17.05) than in chiselling (18.05). Mineral fertilizers did not affect the date of soybean emergence.

In the variants where fertilizers were applied, the branching phase occurred later. Without fertilizers, this phase began on June 25, with an average dose of fertilizers on June 27, and with a high dose on June 28. Branching of soybean plants did not depend on soil treatment.

The flowering phase with the N90P120 fertilizer rate was recorded the latest (06.07), and the earliest in the variant without fertilizers (03.07). In the variant with a dose of fertilizer N45P60, flowering of soybean plants was recorded on 07/05. The flowering phase was not influenced by soil treatment.

Full ripeness was also not influenced by tillage, but depended on the rate of fertilizer applied. First of all, this phase occurred in the variant without applying fertilizers on 09/06; with the recommended dose of fertilizers, this phase began on 09/08; and last of all, it occurred when applying a high rate of fertilizers on 10/09.

Observing the dates of the onset of phenological phases of soybeans, one can notice that tillage had virtually no significant effect, and the use of different rates of fertilizers had a minor effect.

The height of soybean plants is one of the indicators by which future yields can be judged. We have identified a pattern that with increasing plant height, the number of beans on one plant, the number of seeds in a bean and the weight of 1000 seeds increase, which ensured an increase in yield. According to our data on chiselization during the branching phase of soybean plants, the intensive rate of fertilizers ensured maximum plant growth. The usual rate of fertilizers also gave an increase in plant height compared to options without fertilizers, 27.0 and 24.2 cm, respectively. (Table 2).

Table 2 - Height of soybean plants, cm (average for 2021-2022)

Option		Vegetation phase		
tillage	fertilizer rate	branching	bloom	full ripeness
Plowing (k)	without fertilizers (k)	27.4	65.8	88.7
	N45P60	30.2	69.5	93.9
	N90P120	31.9	73.4	99.1
Chiseling	no fertilizers	24.2	63.4	85.8
	N45P60	27.0	65.6	88.3
	N90P120	29.8	69.3	93.6

At the same time, during the branching phase in the variant with plowing, the greatest increase was also noted when a high rate of fertilizer was applied (31.9 cm), which is 4.5 cm more than the unfertilized variant.

The N45P60 fertilizer rate contributed to the growth of soybean plants in height by 2.8 cm and reached 30.2 cm.

By analyzing the data obtained during the flowering phase, one can observe a direct dependence of plant height on the applied fertilizer rate. When plowing on an unfertilized background, the height was 65.8 cm. The use of the recommended fertilizer rate increased this figure by 3.7 cm, and the height was

69.5 cm. When using the N90P120 fertilizer rate, plant height increased relative to the control by 7.6 cm and amounted to 73.4 cm.

Considering the option with chiseling, you can see the same pattern. As the fertilizer rate increases, the height of the plants also increases. In the flowering phase, without fertilizers, the height was 63.4 cm; with the recommended fertilizer rate, the height was 65.6 cm, which is 2.2 cm more than the control; with a double rate, the height was 69.3 cm, which is 5.9 cm more than the control. .

An important agro-biological parameter is the height of plants at the onset of full ripeness. According to plowing on an unfertilized background, the plant height was 88.7 cm. Soybean plants were the tallest (99.1 cm) according to the intensive fertilizer rate. Here the growth was indicated at the level of 10.4 cm in relation to the control. Application of fertilizers according to the recommended rate contributed to an increase in plant height to 93.9 cm, which exceeds the control values by 5.2 cm.

When chiselling was carried out in the absence of fertilizers, the limit for the height of soybean plants was 85.8 cm. According to the recommended fertilizer rate (N45P60), the limit for the height of soybean plants was 88.3 cm, which is 2.5 cm more. According to the intensive norm in N90P120, the height limit of soybean plants was 93.6 cm, which is already 7.8 cm.

In the variant with plowing, the height of soybean plants was greater compared to chisel cultivation on all fertilization backgrounds. In the unfertilized version, the difference was 2.9 cm, when applying fertilizers according to the recommended norm (N45P60) the difference was 5.6 cm, and when applying fertilizers according to the intensive norm (N90P120) - 5.5 cm.

Conclusion

Various soil tillage methods and fertilizer rates had virtually no effect on the dates of the onset of phenological phases. The method of tillage affected

only the emergence of seedlings. In the variant with chiseling, seedlings were recorded one day later than the control indicators. With an increase in the rate of fertilizers, the date of onset of any phase of the growing season also changed. Application of the recommended rate of fertilizer (N45P60) contributed to a later (by 2 days) onset of branching, flowering and full ripeness compared to the control. The application of an intensive fertilizer rate (N90P120) contributed to an even later (by 4 days) onset of branching, flowering and full ripeness compared to the control. The studied elements of soybean cultivation technology had a positive effect on the height of soybean plants. Plowing during the main tillage ensured the formation of taller soybean plants compared to chiselling throughout the entire growing season. In the branching phase on the unfertilized version, the difference was 3.2 cm, in the flowering phase 2.4 cm, and in the full ripeness phase 2.9 cm, in favor of plowing. An increase in the rate of mineral fertilizers directly affected the height of plants. Thus, the application of N45P60 increased the plant height by an average of 3.2 cm. And when N90P120 was added, the plant height increased by an average of 7 cm.

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